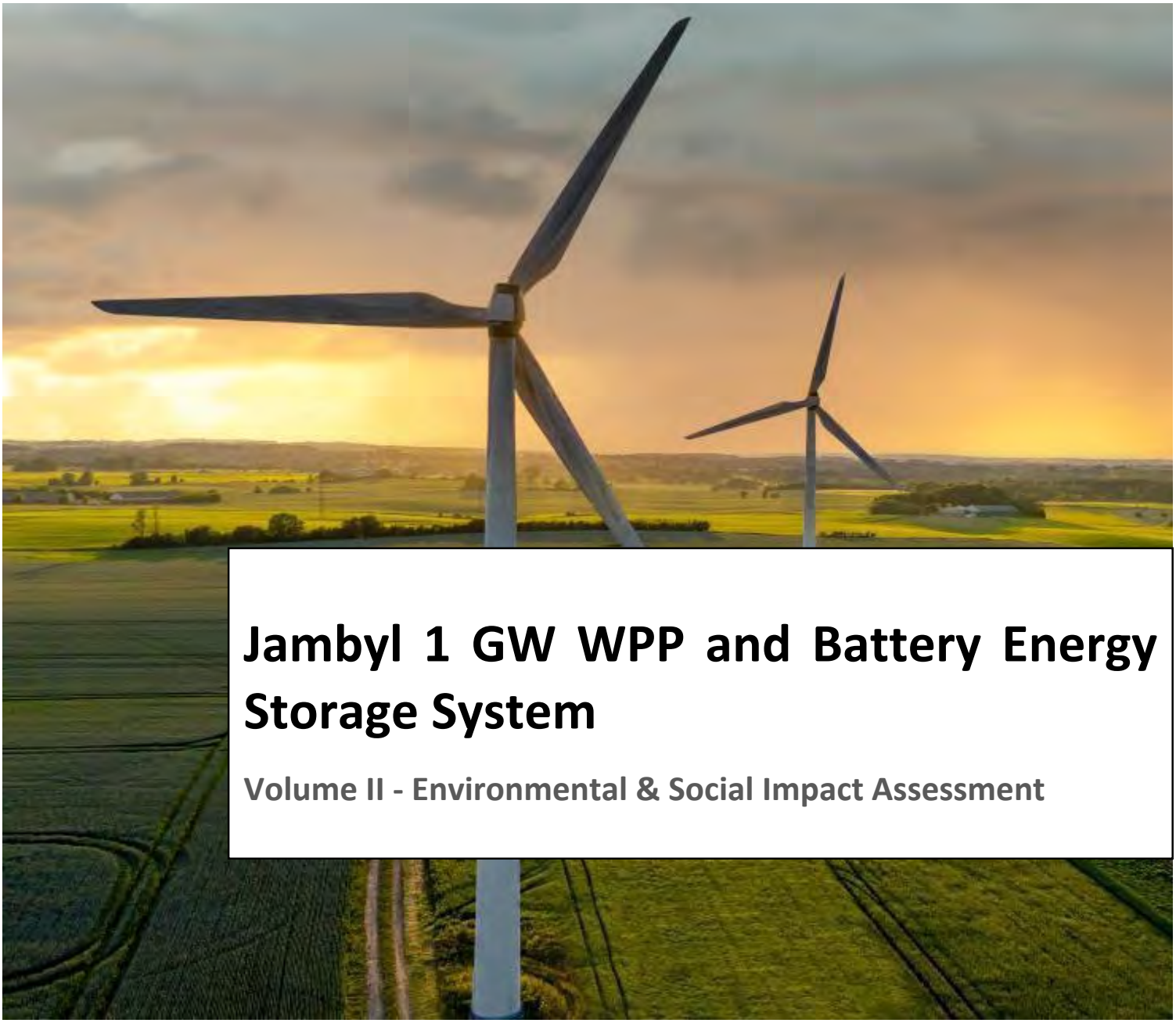


Jambyl 1 GW WPP and Battery Energy Storage System

Volume II - Environmental & Social Impact Assessment

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Acronyms

Acronym	Definition
AC	Alternating Current
ADB	Asian Development Bank
AFOLU	Agriculture, Forestry and Other Land Use
AoA	Analysis of Alternatives
AoI	Area of Influence
AP	Action Plan
BESS	Battery energy storage system
CBD	Convention on Biological Diversity
CBO	Community Based Organisations
CCTV	Closed circuit television
CHA	Critical Habitat Assessment
CHS	Community Health and Safety
CLO	Community liaison officer
CSR	Corporate Social Responsibility
DC	Direct Current
EBRD	European Bank of Reconstruction and Development
EHS	Environment, Health and Safety
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPC	Engineering, Procurement, and Construction
EPRP	Emergency Preparedness and Response Plan
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
FAO	Food and Agriculture Organisation
GHG	Greenhouse Gas
GIIP	Good International Industry Practice
GIS	Geographical Information System
HSSE-MS	Health Safety Social Environmental Management System
HMWMP	Hazardous Material and Waste Management Plan
HR	Human resources
IFC	International Finance Corporation
ILO	International Labour Organisation
IP	Indigenous peoples
IUCN	International Union for Conservation of Nature
LLA	Land lease agreement
LRP	Livelihood Restoration Plan
MAWR	Ministry of Agriculture and Water Resources
MPC	Maximum permitted concentration
MSK-64	Medvedev–Sponheuer–Karnik scale
ML	Local Magnitude

NCR	Non-compliance report
NTS	Non-Technical Summary
O&M	Operation and Maintenance
OESMP	Operational environmental and social management plan
OHTL	Overhead transmission line
OHS	Occupational Health and Safety
OPEX	Operating Expenditures
PM	Particulate Matter
POPs	Persistent organic Pollutants
PPA	Power Purchase Agreement
PPE	Personal Protective Equipment
PPP	Public private partnership
PRs	Performance Requirements
PS	Performance Standards
PV	Photovoltaic
RoW	Rights of Way
SEP	Stakeholder Engagement Plan
SWID	Sericulture and Wool Industry Development
SWMP	Site Waste Management Plan
TTMP	Traffic and Transportation Management Plan
ToR	Terms of Reference
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
USTDA	United States Trade and Development Agency
WBG	World Bank Group
WHO	World Health Organisation
WPZ	Water Protection Zone

Glossary

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

Term	Definitions
Assessment (ESIA)	Impacts may be positive or negative and may affect the environment, communities, human health and well-being, desired sustainability objectives, or a combination of these
Environmental and Social Management Plan (ESMP)	Summarises the company's commitments to address and mitigate risks and impacts identified as part of the ESIA, through avoidance, minimization, and compensation/offset, and monitor these mitigation measures
Health Safety Social Environmental Management System (HSSE-MS)	A part of the Project's overall management system that includes the organizational structure, responsibilities, practices, and resources necessary for implementing the project-specific management program. This program is developed through the environmental and social assessment of the Project and is aimed at ensuring quality, occupational health and safety, and environmental protection.
Good International Industry Practice (GIIP)	Exercise of professional skill, diligence, prudence, and foresight that would reasonably be expected from skilled and experienced professionals engaged in the same type of undertaking under the same or similar circumstances globally or regionally. The outcome of such exercise should be that the project employs the most appropriate technologies in the project-specific circumstances
Grievance mechanism	Procedure provided by a project to receive and facilitate resolution of affected communities' concerns and grievances about the project's environmental and social performance
Habitat	Terrestrial, freshwater, or marine geographical unit or airway that supports assemblages of living organisms and their interactions with the non-living environment
Hazardous waste	By-products of society that can pose a substantial or potential hazard to human health or the environment when improperly managed. Substances classified as hazardous wastes possess at least one of four characteristics— ignitability, corrosivity, reactivity, or toxicity— or appear on special lists
Indigenous peoples	Defined by the World Bank E&S Framework as a distinct social and cultural group possessing the following characteristics in varying degrees: (a) Self-identification as members of a distinct indigenous social and cultural group and recognition of this identity by others; (b) Collective attachment to geographically distinct habitats, ancestral territories, or areas of seasonal use or occupation, as well as to the natural resources in these areas; (c) Customary cultural, economic, social, or political institutions that are distinct or separate from those of the mainstream society or culture; and (d) A distinct language or dialect, often different from the official language or languages of the country or region in which they reside
Indirect area of	Includes area which may experience project related changes in combination

Term	Definitions
influence	with activities not under the direct control of the project
Information disclosure	Disclosure means making information accessible to interested and affected parties (stakeholders). Communicating information in a manner that is understandable to stakeholders is an important first and ongoing step in the process of SE. Information should be disclosed in advance of all other engagement activities, from consultation and informed participation to negotiation and resolution of grievances. This will make engagement more constructive
Intangible cultural heritage	According to the 2003 UNESCO convention for the safeguarding of intangible cultural heritage, manifestations of intangible cultural heritage include: Oral traditions and expressions, including language; Performing arts; Social practices, rituals and festive events; Knowledge and practices concerning nature and the universe
Land acquisition	All methods of obtaining land for project purposes, which may include outright purchase, expropriation of property and acquisition of access rights, such as easements or rights of way
Livelihood	Full range of means that individuals, families, and communities utilize to make a living, such as wage-based income, agriculture, fishing, foraging, other natural resource-based livelihoods, petty trade, and bartering
Magnitude	The assessment of magnitude is undertaken in two steps. Firstly, the magnitude of potential impacts associated with the Project are categorized as beneficial or adverse. Secondly, the beneficial or adverse impacts are categorized as major, moderate, minor or negligible based on consideration of several parameters
Modified habitat	Land and water areas where there has been apparent alteration of the natural habitat, often with the introduction of alien species of plants and animals, such as agricultural areas
Natural habitat	Land and water areas where the biological communities are formed largely by native plant and animal species, and where human activity has not essentially modified the area's primary ecological functions
Occupational health and safety	The range of endeavours aimed at protecting workers from injury or illness associated with exposure to hazards in the workplace or while working
Project affected people	Individuals, workers, groups or local communities which are or could be affected by the project, directly or indirectly, including through cumulative impacts
Renewable energy	Energy sources derived from solar power, hydro, wind, certain types of geothermal, and biomass

Term	Definitions
Sensitivity	The sensitivity of a receptor is determined based on the review of the population (including proximity/numbers/vulnerability), presence of biological features of the site and the surrounding area, soil, agricultural suitability, geology and geomorphology, proximity of aquifers and watercourses, existing air quality, presence of any archaeological features etc
Significance	Significance of impact considers the interaction between the magnitude and sensitivity criteria
Solid waste	Material with low liquid content, sometimes hazardous. Include municipal garbage, industrial and commercial waste, sewage sludge, wastes resulting from agricultural and animal husbandry operations and other connected activities, demolition wastes and mining residues
Stakeholders	Stakeholders are persons or groups who are directly or indirectly affected by a project, as well as those who may have interests in a project or the ability to influence its outcome, either positively or negatively
World Bank Group EHS Guidelines	Technical reference documents for environmental protection and set out industry-specific examples of 'international good practice'. Projects are expected to comply with the levels and measures identified in the General EHS Guidelines where host country requirements are less stringent or do not exist

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1 Introduction

1.1 Project Background and Overview

Abu Dhabi Future Energy Company PJSC ("Masdar") has established the Qazaq Wind Power LLP as the dedicated project company for the development, construction and operation of a 1GW Wind Power Project (WPP), including a Battery Energy Storage System ("BESS") (the "Project"), in the Jambyl region of the Republic of Kazakhstan.

On 12 November 2024 Qazaq Wind Power LLP signed an Investment Agreement with the Government of the Republic of Kazakhstan represented by the Ministry of Energy in relation to developing the Project.

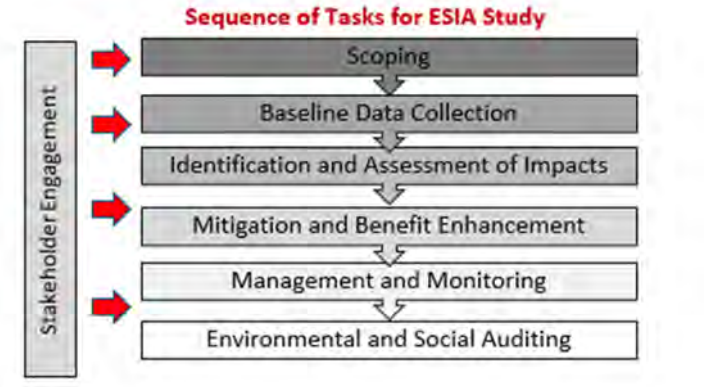
The Project consists of 140 Wind Turbine Generators (WTGs), each with a capacity of 8 - 11 MW, as well as a BESS with 300 MW of power capacity/600 MWh, within a total site development area of approximately 14,000 ha. The Project also includes the construction of two 220 kV Overhead Transmission Lines (OHTL), as follows:

- 130 km OHTL connecting the WPP site to the existing 220/500 kV Jambyl substation, crossing Sarysu, Talas, Zhualy and Jambyl districts of Jambyl region.
- 162 km OHTL connecting the WPP site to the existing Opornaya 220 kV substation, and then onto to existing Kentau 220 kV substation, crossing Sarysu, Sozak and Kentau districts.

The Project will be one of the largest wind power plants in Kazakhstan and will contribute significantly to the national emission reduction targets and grid stability.

Masdar has appointed Juru Ltd. (Juru or the ESIA Consultant) to perform an Environmental and Social Impact Assessment (ESIA) for the Project, and this Report presents the findings of the ESIA process that has been undertaken. A summary of the general overall ESIA process is shown in the Figure 1-1 below.

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



The Project seeks funding from International Funding Institutions (IFIs) and therefore will be developed in compliance with international standards. The ESIA is developed in accordance with International Lenders standards, such as the International Finance Corporation (IFC) Performance Standards (PSs), Asian Infrastructure Investment Bank (AIIB) Environmental and Social Framework (2024) (ESF) and the Equator Principles IV (July 2020), as well as National regulations.

1.2 Need for the Project

Kazakhstan's power sector is currently dominated by fossil fuel-based generation, primarily coal. To diversify

the energy mix, and meet rising electricity demand, the Government has adopted the Green Economy Strategy and updated climate commitments, including targets for renewables to reach 15% by 2030 and 50% by 2050.

The Jambyl 1 GW Wind Power Project directly supports these objectives by supplying up to 1 GW of clean electricity to the national grid, strengthening energy security and reducing greenhouse-gas emissions. The WPP area benefits from strong wind resources (c. 9.6 m/s at 110 m), making it a cost-effective contribution to the National Concept for Transition to a Green Economy up to 2050.

Beyond environmental gains, the Project is expected to deliver socio-economic benefits through job creation, regional investment and local supply-chain development. It aligns with Kazakhstan's commitments under the Paris Agreement and supports the achievement of the UN Sustainable Development Goals (SDGs), particularly SDG 7 (Affordable and Clean Energy) and SDG 13 (Climate Action).

In summary, the Project will:

- Contribute to national and regional energy security;
- Diversify the national energy mix, reducing reliance on fossil fuels;
- Contribute materially to Kazakhstan's 2030 and 2050 renewable-energy targets; and
- Lower national greenhouse-gas emissions while providing long-term economic benefits.

1.3 Key Project Proponents

The Project will be developed by Masdar as the lead developer in partnership with W Solar Investment LLC ("W Solar"), "Kazakhstan Investment Development Fund ("KIDF") Management Company" LTD., and Qazaq Green Power PLC ("QGP"). Masdar has established a dedicated Project Company/Special Purpose Vehicle (SPV), **Qazaq Wind Power LLP** (the "Owner"), that will be responsible for implementing the Project. The project company will oversee all stages of the Project, including development, financing, construction, and operation.

Below is a summary introducing the main parties involved in Qazaq Wind Power:

- **Masdar** is a global leader in renewable energy investment and development. Masdar's mission is to develop, invest in and deliver high-quality, sustainable and economically viable clean energy projects locally and globally, and has over a decade of experience as a renewable energy developer and investor. Masdar invests in and contributes to innovative global projects, including large, utility-scale renewable energy power plants, community grid projects, and individual solar home systems. It is active across 40 countries and has developed some of the world's most significant solar and wind energy projects. Masdar has invested or committed to invest in renewable energy projects with a gross capacity of over 20 GW, with Kazakhstan identified as a key growth market.
- **W Solar Investment** is an Abu Dhabi-based company that develops, owns, and operates renewable energy power plants. As a subsidiary of Alpha Dhabi Holding and a joint venture with Masdar, it forms partnerships with governments and other entities to implement solar power projects in various countries across Africa, Asia, and Europe.
- **Kazakhstan Investment Development Fund (KIDF) Management Company Ltd.** is the management company for the KIDF, a state direct investment fund in Kazakhstan, responsible for developing and executing investment strategies in alignment with Kazakhstan's strategic goals. KIDF was established by the Presidential Decree № 829 dated January 30, 2019 to attract foreign direct investment into Kazakhstan's non-extractive sectors.

- **Qazaq Green Power PLC** is a public company based in Astana, Kazakhstan, focused on developing

green energy projects. Established in 2022, it was created to help modernize Kazakhstan's energy sector by introducing new technologies and increasing the share of renewable energy. The company's work aims to improve energy efficiency, implement investment projects, and ensure the environmental safety of power facilities.

The electricity offtaker is the **Financial Settlement Centre LLP (FSC)**, a Kazakh entity established to centralize the purchase of electricity from renewable energy facilities to encourage investment in that sector. It was set up in 2013 as a subsidiary of KEGOC, Kazakhstan's national power transmission company, and acts as a single buyer in the wholesale electricity market for renewable energy

The Sponsor intends to secure project finance from a group of international financial institutions. At this stage, the indicative lender group comprises the **Asian Infrastructure Investment Bank (AIIB)**, the **Islamic Development Bank (IsDB)**, the **Islamic Corporation for the Development of the Private Sector (ICD)** (Member of the IsDB Group), and selected commercial lenders including Abu Dhabi banks; this composition remains subject to lender due diligence and approvals.

1.4 Purpose and Scope of ESIA Report

The purpose of this ESIA is to identify, evaluate and document the potential environmental and social effects of all Project components, including wind turbine generators (WTGs), BESS, on-site substations, internal access roads, temporary construction areas, and the overhead transmission lines (OHTL) required for grid connection. Associated facilities and cumulative impacts in the wider region are also considered where relevant.

The scope of the ESIA includes assessment of potential impacts during construction and operation, phases of the Project, consideration of alternatives, and identification of appropriate avoidance, mitigation, management and monitoring measures to ensure that adverse impacts are minimised and positive outcomes are enhanced.

The assessment has been undertaken in accordance with international lender standards, including the IFC Performance Standards, the AIIB Environmental and Social Framework (ESF), and the Equator Principles. While the ESIA is primarily designed to meet international lender standards, national environmental and social requirements of the Republic of Kazakhstan have also been considered, with the Project applying whichever standard is more stringent.

It should be noted that, in parallel, a separate Environmental Impact Assessment (EIA) is being prepared to comply with national legislation and to obtain the necessary regulatory permits. Together, the ESIA and EIA processes ensure that the Project satisfies both international lender safeguards and Kazakhstan’s permitting framework.

The ESIA provides an integrated framework to inform decision-making by the Project Proponent, competent authorities and lenders, and to ensure that the Project is designed, constructed and operated in line with good international industry practice. Specifically, the ESIA aims to:

- Describe the Project, supporting infrastructure and associated facilities, together with reasonable alternatives considered;
- Establish the legal, policy and institutional framework relevant to the Project;
- Characterise the baseline environmental and socio-economic conditions within the Project’s Area of Influence;
- Identify and assess the potential positive and adverse impacts of the Project during pre-construction, construction, and operation phases;

- Propose avoidance, minimisation, mitigation and enhancement measures to address identified impacts, and assess the significance of residual impacts;
- Define monitoring and management measures to be implemented through the Project's Environmental and Social Management Plan (ESMP) and associated plans; and
- Provide a basis for meaningful stakeholder engagement, disclosure of information, and incorporation of feedback into Project design and management.

This ESIA builds on the Environmental and Social Scoping Report (Juru, 2025), which identified key environmental and social issues for further study and confirmed the terms of reference for this assessment. It integrates findings from field surveys, desktop studies, and stakeholder consultations carried out during the ESIA process.

1.5 Structure of the ESIA Report

The ESIA Report is structured as follows:

- **Chapter 1** provides the introduction, background and rationale, information on the Project proponent, objectives of the ESIA, and the report structure.
- **Chapter 2** provides a detailed description of the Project, including the location, main components, associated facilities, and project phases.
- **Chapter 3** outlines the legal and institutional framework, covering national environmental legislation, international conventions, and lender standards.
- **Chapter 4** presents the assessment methodology, including criteria for evaluating receptor sensitivity, impact magnitude, significance evaluation, and cumulative impact assessment.
- **Chapter 5** summarises the stakeholder engagement undertaken during the ESIA process.
- **Chapters 6 to 19** address the environmental and social baseline, potential impacts, and mitigation and management measures for key topics, including socio-economics, community health and safety, human rights and labour, biodiversity, noise and vibration, shadow flicker, landscape and visual impacts, hydrology and hydrogeology, geology and soils, waste management, and archaeology and cultural heritage.
- **Chapter 20** addresses cumulative impacts.
- **Chapter 21** provides a summary of the mitigation through design that have been undertaken for the Project.
- **Chapter 22** sets out the environmental and social management and monitoring framework (ESMMF).
- **Chapter 23** provides the conclusions and key recommendations.

The main body of the ESIA is supported by a suite of reports and studies and these are provided in the Annexes as follows:

- Annex A: Project grievance form;
- Annex B: Stakeholder Engagement Plan (SEP);
- Annex C: Cultural Heritage Survey Reports
- Annex D: Information about protected areas (IBAT report).
- Annex D: Biodiversity survey reports, including the Biodiversity Work Plan for the Project;
- Annex E: TBC.

This structure ensures the ESIA comprehensively covers all relevant issues in line with international lender standards, and international best practice. It also provides transparency to stakeholders on the process,

scope and outcomes of the environmental and social assessment.

2 Project Description

2.1 Project Overview and Location

The Project is located in the Jambyl region in the south of Kazakhstan (see Figure 2-1 and Figure 2-2 below). The Project comprises of the following key components:

- A 1GW Wind Power Project (WPP) within approx. 14,000 ha, comprising:
  - 140 WTGs of 8 - 11 MW capacity each (the final number and capacity is to be confirmed once site studies and measurement campaigns are completed);
  - Battery Energy Storage System (BESS) with 300 MW of power capacity/600 MWh; and
  - A Project substation.
- Two associated 220 kV Overhead Transmission Line (OHTL) connecting the Project to the existing substations as follows:
  - 130 km OHTL connecting the WPP site to the existing 220/500 kV Jambyl substation.
  - 162 km OHTL connecting the WPP site to the existing Opornaya 220 kV substation, and then onto to existing Kentau 220 kV substation.

Figure 2-1: Overall Project Location

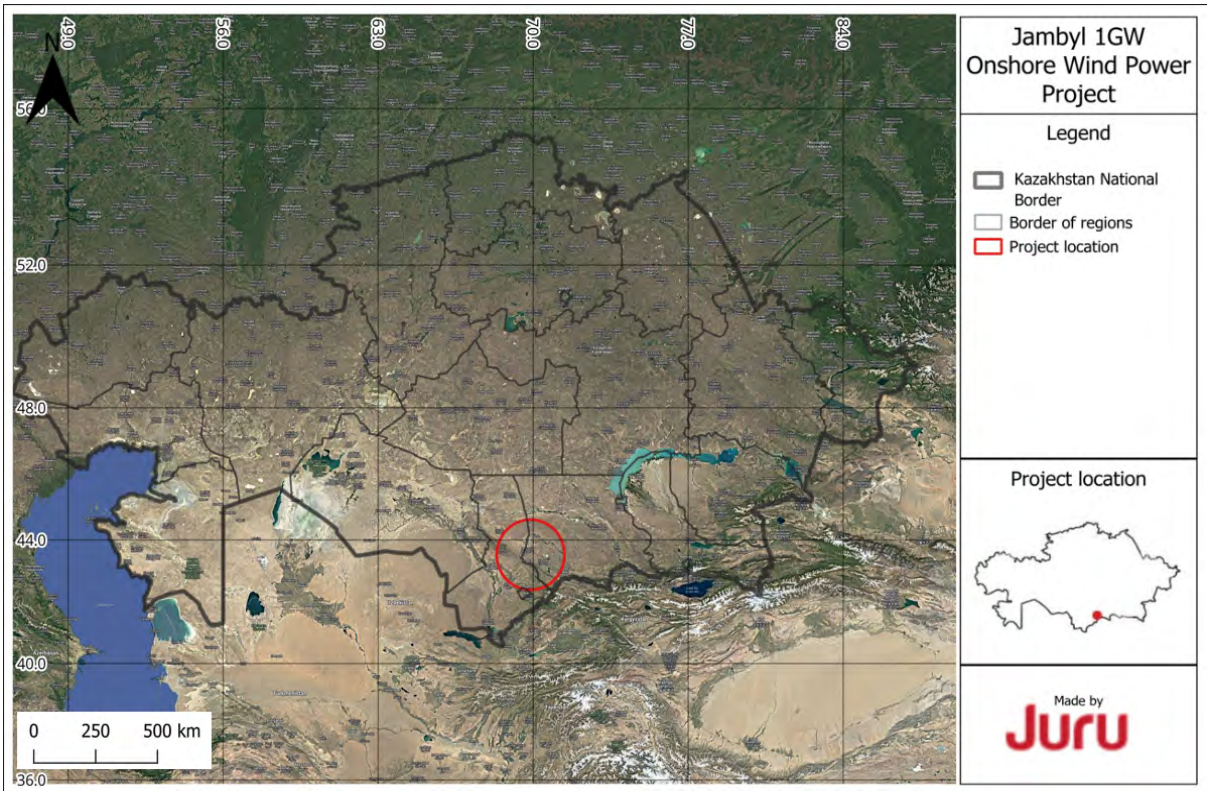
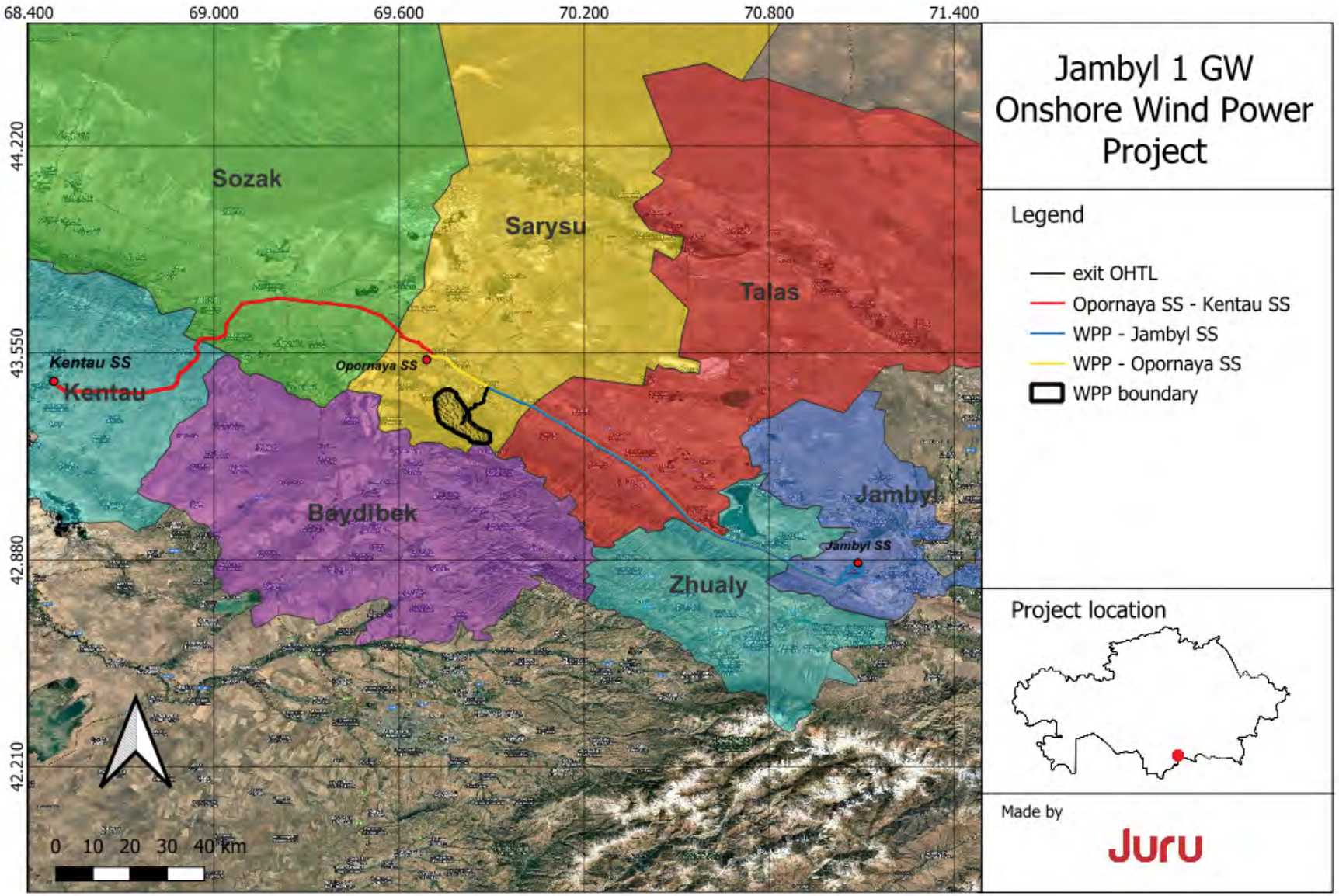


Figure 2-2: Project layout and location



2.1.1 Wind Power Project (WPP) Area

The WPP project site is located in Sarysu district of Jambyl region, south of Kazakhstan, approximately 120 km north-west from Jambyl city and 13.5 km south of Zhanatas town.

The Wind Power Project is situated on an elevated plateau within the low Karatau foothills, characterised by gently undulating topography with localised ridgelines and shallow depressions. The landscape is predominantly open steppe, consisting of semi-arid grassland and sparse shrub cover, with vegetation heavily influenced by long-term grazing. Land use is largely pastoral, with extensive areas of communal rangeland and pockets of agricultural activity in lower-lying zones. The openness of the plateau offers wide visibility and exposes the area to prevailing winds, while the absence of significant tree cover or built infrastructure reinforces its largely natural and rural character.

There are several settlements and two towns (Zhanatas, Karatau) located near the proposed WPP area and these are listed in Table 2-1 below.

Table 2-1: WPP area settlements

	Settlement	Distance from WPP site border (km)
1.	Aktogay	9.2
2.	Ushbas	1.5
3.	Karaoy	14.8
4.	Turkestan	7.8
5.	Uzakbay Syzdykbaev (Zhanaaryk)	8.1
6.	Karatas	11.4
7.	Arystandy	12
8.	Zhanatas (town)	24
9.	Karatau (town)	45.4

The closest settlement to WPP area is Ushbas Village, located 1.5 km from the north-west site boundary. Ushbas is also the closest village to a WTG, lying approximately 2 km east of the nearest WTG. The closest town is Zhanatas North, located approximately 13.5 km to the north of the WPP site boundary.

There is a large open pit phosphate mine operated by EuroChem located close to the northern boundary of the WPP site; the mine was opened in 2014..

2.1.2 Overhead Transmission Line (OHTL) Routes

There are two OHTLs proposed for connecting the Project to the existing substations as follows:

- The 126 km Jambyl OHTL;
- The 160 km Kentau OHTL.

The locations of the existing network substations in relation to the WPP and nearest districts are presented in Figure 2-3 and can be summarised as follows:

- Jambyl 500 kV substation - 24 km west of Jambyl city, and 100 km southeast of the WPP site

boundary;

- Opornaya 220 kV substation - 1.5 Km west of Zhanatas town and 17 km north of the WPP site boundary;
- Kentau 220 kV substation - 6 Km south of Kentau and 100 km west northwest of the WPP site boundary.

It should be noted that the OHTL routes have not yet been finalised but have been optimised to avoid and minimize environmental and social impacts; these routes are still under technical review and therefore may be subject to change.

2.1.2.1 Jambyl OHTL

The 126 km OHTL route from the WPP to the Jambyl substation traverses predominantly open steppe and semi-desert landscapes, running largely across flat to gently undulating terrain aligned with existing roads and powerline corridors. Much of the area comprises heavily grazed pastures and modified shrub-steppe, with sparse low vegetation reflecting long-term livestock use. In the central section, the route passes through shrubby hilly steppe near the Karatau foothills, where rolling slopes and occasional rocky outcrops introduce more varied topography. Approaching the Jambyl substation, the landscape transitions to low-lying agricultural lands interspersed with small streams, reedbeds and patches of riparian vegetation, although the alignment has been selected to avoid sensitive wetland features such as Lake Akkol. Several rural settlements lie close to this southeastern end of the route, including Aulie-Bastau and Auliekol, which are located in the vicinity of the Jambyl substation and represent the main community receptors along this section. Land use throughout the corridor is dominated by livestock grazing and small-scale cultivation, with scattered farms and households situated mainly along the Taraz–Zhanatas road.

There are several settlements located near the proposed OHTL routes and these are listed in Table 2-2 and Table 2-3.

With regards to the Jambyl OHTL, there are several settlements that lie along the main road to Zhanatas and around the Jambyl substation area, as well as the town of Karatau which lies approximately 4.5 km to the east of the proposed OHTL route; these are listed in the table Table 2-2 and shown in Figure 2-7.

Table 2-2: Jambyl OHTL area settlements

	Settlement	Distance to the Jambyl OHTL (m)
1.	Karaoy	4,6
2.	Koktal	5
3.	Koktal (sanatory)	0.3
4.	Esei bi	4.5
5.	Kaskabulak	4.9
6.	Akshukyr	2.2
7.	Karatau (town)	4.45
8.	Tamdy	11.45
9.	Kozhagapper	3.3
10.	Maytobe	2.1
11.	Abdikadir	2
12.	Zhylybulak	8.8
13.	Darbaza	6.3
14.	Karabastau	3.6
15.	Aulie-bastau	1.2
16.	Aulie-kul	0.07
17.	Kyzyltan	1.35

For more details on the above communities and their location in relation to the OHTL please refer to Section 6 (Socio-economic environment).

Figure 2-3 below shows the existing Jambyl substation.

Figure 2-3: Jambyl 500 kV substation



2.1.2.2 Kentau OHTL

The 162 km OHTL from the WPP to the Kentau substation crosses a more varied landscape than the Jambyl route, beginning on open steppe west of the WPP and then running south of Zhanatas toward the Opornaya substation before turning west and entering increasingly rugged terrain. The first sections consist largely of heavily grazed sagebrush semi-desert and low shrub-steppe, with flat plains and degraded vegetation typical of long-term livestock use. West of Opornaya, the alignment traverses the industrialised Kazphosphate mining zone, where open pits, spoil heaps and haul roads dominate the landscape. Beyond this point, the route climbs into the southern flanks of the Greater Karatau range, following rolling ridgelines and dissected terraces with sparse grasses, rocky outcrops and more natural steppe communities in places. Descending from the mountains, the OHTL emerges onto broad alluvial plains characterised by extensive grazing lands, fallow fields and scattered riparian features. Several rural settlements lie in proximity to this alignment, particularly around the Kentau end of the route, including Sholakkorgan, Shoktas, Uyuk and Kotyrbulak, which represent the main community receptors near the substation. Land use along the corridor is dominated by livestock grazing, small-scale farming and, in specific sections, mineral extraction activities.

There are several settlements located in proximity to the proposed Kentau OHTL route. These include rural communities such as Sholakquragan, Ushuk, and Shoktas, as well as the town of Kentau, which lies approximately 6.7 km to the east of the proposed OHTL route. These settlements, situated along and around the Kentau substation area, are listed in the Table 2-3

Table 2-3: Kentau OHTL area settlements

	Settlement	Distance to the Kentau OHTL (m)
1.	Sholakkorgan	1.4

	Settlement	Distance to the Kentau OHTL (m)
2.	Uyuk	1
3.	Ashisay	1.9
4.	Shoktas	0.563
5.	Kotyrbulak	0.6
6.	Kushata	2.8
7.	Kentau (town)	6.7

For more details on the above communities and their location in relation to the OHTL please refer to Section 6 (Socio-economic environment).

Figure 2-4 and Figure 2-5 below shows the existing Opornaya and Kentau substations respectively.

Figure 2-4: Opornaya 220 kV substation



Figure 2-5: Kentau 220 kV substation



Figure 2-6: WPP Area and Surrounding Towns & Villages

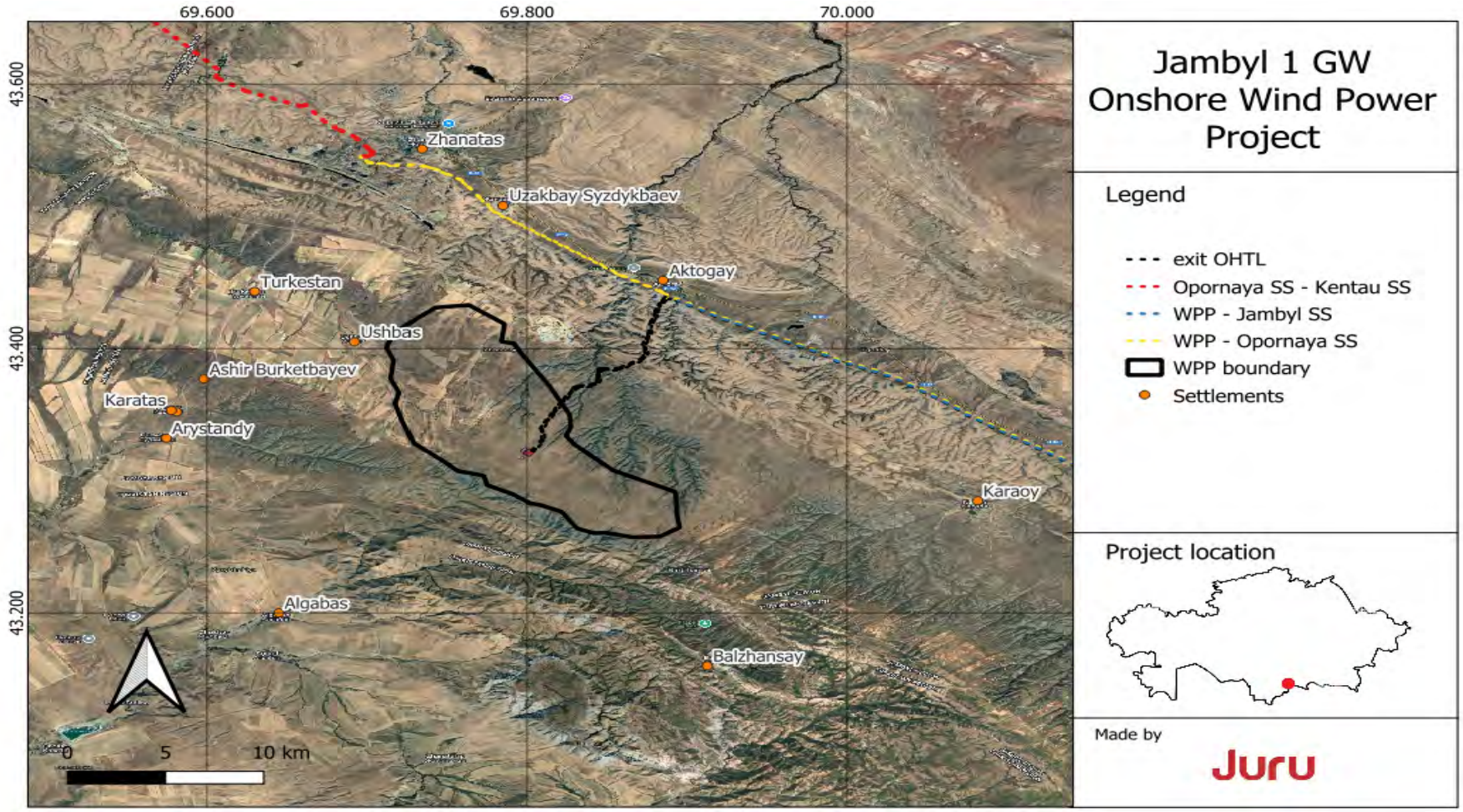


Figure 2-7: WPP- Jambyl SS OHTL Route and Nearby Towns & Villages

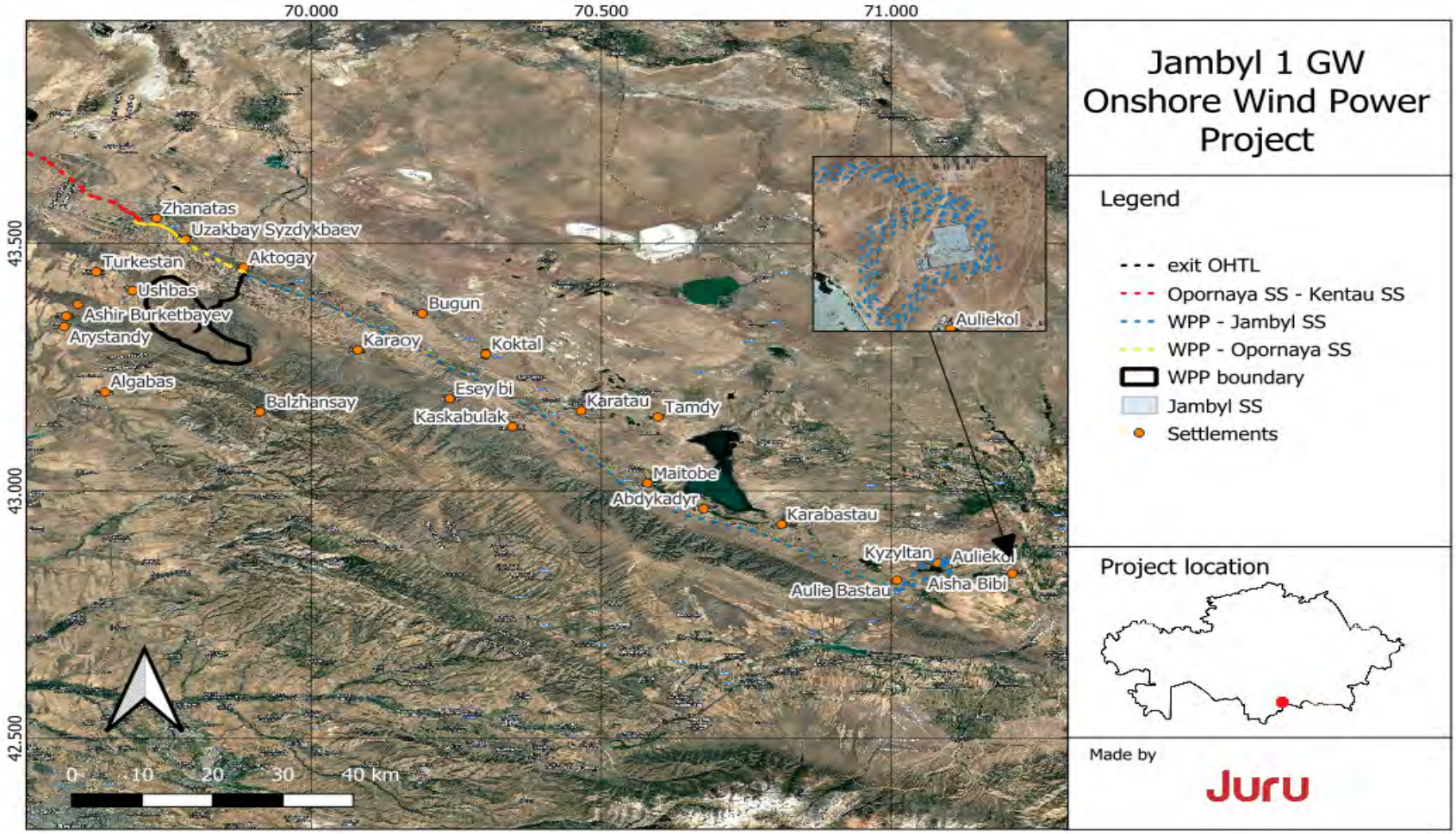
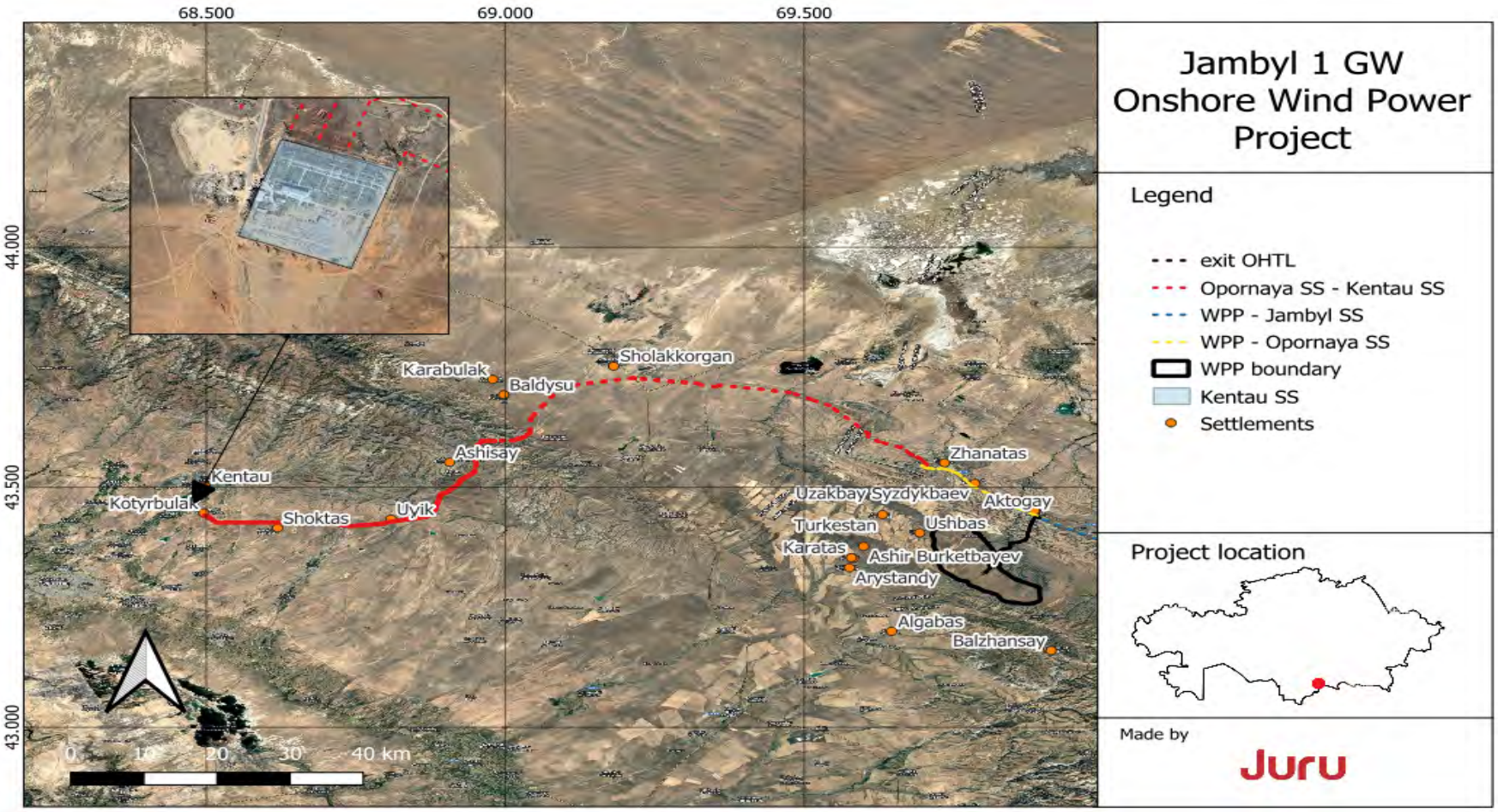


Figure 2-8: WPP- Kentau SS OHTL Route and Nearby Towns & Villages


68.500
69.000
69.500
44.000
43.500
43.000
Jambyl 1 GW Onshore Wind Power Project
Legend
exit OHTL
Opornaya SS - Kentau SS
WPP - Jambyl SS
WPP - Opornaya SS
WPP boundary
Kentau SS
Settlements
Project location
Made by
Juru
Sholakkorgan
Karabulak
Baldysu
Ashisay
Kentau
Kotyrbulak
Shoktas
Uyik
Zhanatas
Uzakbay
Syzdykbaev
Aktogay
Turkestan
Ushbas
Karatas
Ashir
Burketbayev
Arystandy
Algabas
Balzhansay
0
10
20
30
40 km

2.2 Main Project Components

The Project Company (PC) will appoint an EPC contractor to undertake the detailed design of the Project based on the specifications and requirements to be defined in the EPC Contract, and subject to the PC's review and approval. The below description is based on the currently available design information and the general requirements typical of a Project of this nature, based on previous experience.

2.2.1 Introduction

The Project is comprised of the following elements:

1. Wind Turbine Generators;
2. BESS;
3. Project Substation
4. OHTL to the Kentau SS;
5. OHTL to the Jambyl SS;
6. Internal roads;
7. Underground cables.

2.2.2 Wind Turbine Generators (WTGs)

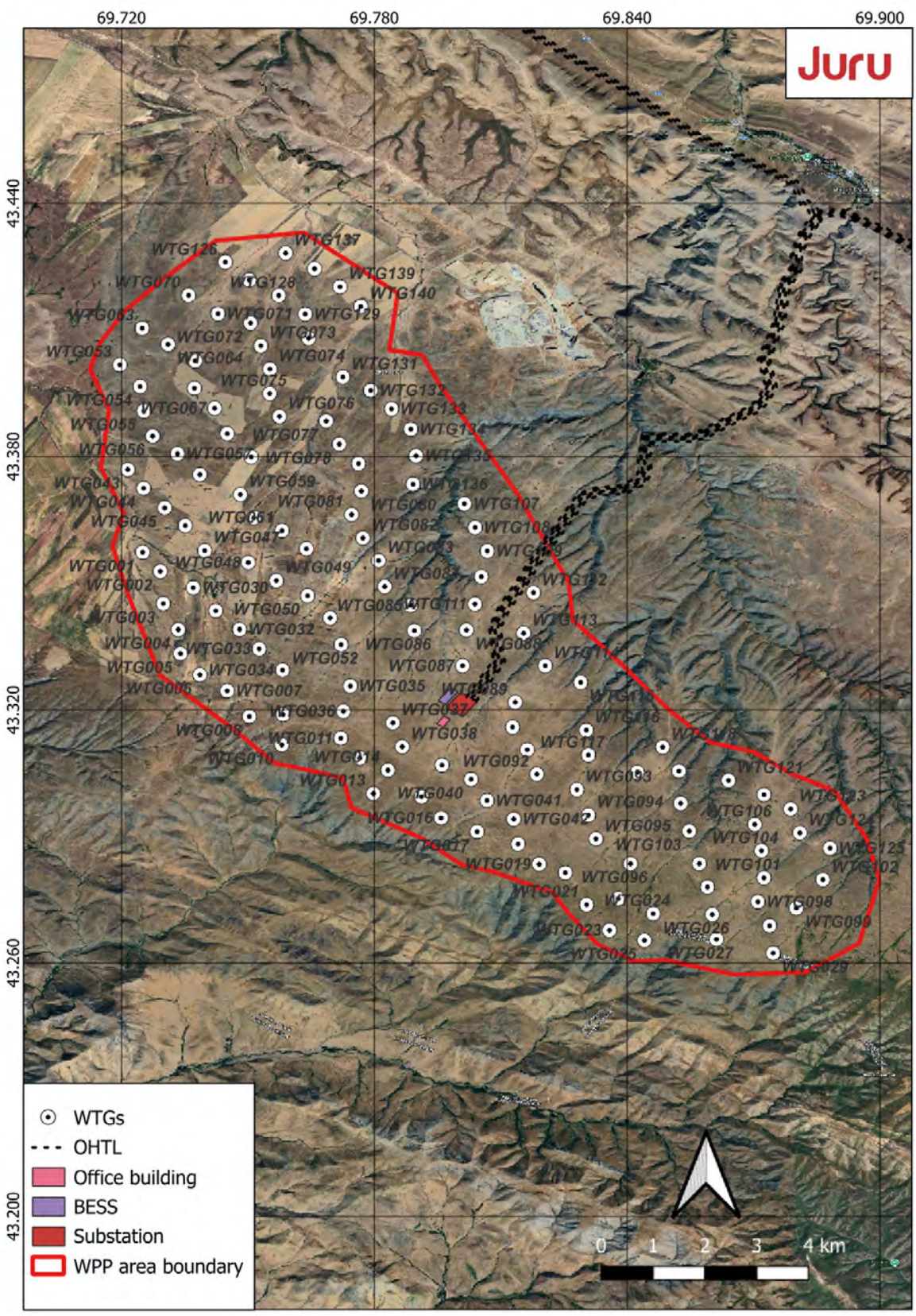
The current proposed WPP design consists of 140 Wind Turbine Generators (WTGs) each with a capacity of between 8 to 11 MW. For the purposes of this ESIA, we have assumed the following options for the WTGs; however, the final WTG selected would be based on the results of the meteorological monitoring campaign and the EPC selected design and configuration which is to be confirmed at a later stage:

Table 2-4: WTG Model Options Considered[1]

Model	Goldwind GW204-10.5MW	Envision EN206-11.0MW	SANY SI-19580
Capacity/rated power (MW)	10.5	11.0	8
Hub Height (m)	148	145	120
Rotor Diameter (m)	204	210	195
Tower design	Steel/concrete		

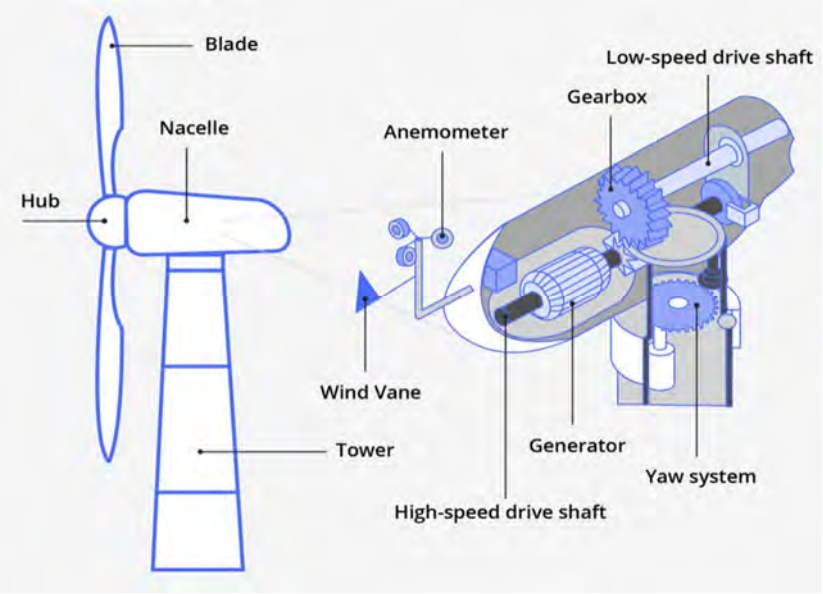
[1] The technical solution is not final and is pending final design and technology selection.

Figure 2-9: Wind Turbine layout and numbering



A WTG consists of rotor blades connected to the hub which is connected to a gearbox and generator as shown in Figure 2-10 below.

Figure 2-10: WTG components



The detailed final layout of the WTGs, BESS, Project sub-station, access roads, internal roads, site offices, accommodation, and other key infrastructure, will be initially developed by Masdar with the detailed design to be provided by the selected EPC Contractor; this will be informed by additional technical studies and considerations. For the purposes of this ESIA Report, we have assumed an initial WTG layout as provided by Masdar, which is presented in Figure 2-9.

In addition to the WTG, the main permanent components of the WPP development include:

- Associated foundations and hardstand areas;
- Transformers, either located in or adjacent to the WTG tower, where the Low Voltage (LV) electricity generated by the WTG is stepped up to Medium Voltage (MV) before being routed to the Project substation;
- Medium Voltage MV *'collector system'* which consists of buried power cables linking the WTGs and connecting them to the on-site electrical control building and sub-station; Fiber-optic cable from the WTG's and earthing is also included in the collector system trenches and routed back to the substation;
- Site access roads to enable WTG delivery and maintenance access from main road;
- On-site Collecting Substation;
- Control Building and Operation & Maintenance (O&M) Building;
- Meteorological masts; and
- Ancillary equipment.

2.2.3 Battery Energy Storage System (BESS)

The Project also includes the development of a Battery Energy Storage System ("BESS") with 300 MW of power capacity of 600 MWh and rated power of 300 MW (Figure 2-12).

A BESS can help address the intermittency of wind power and enable a power system to respond rapidly to large fluctuations in demand, making the grid more responsive and reducing the need to build back up power plants.

The design of the BESS will be initially developed by Masdar with the detailed design to be provided by the selected EPC Contractor. The BESS will be located within the WPP sub-station area and will cover an area of approximately of 20 ha.

A BESS is a set of energy accumulators that, through an electrochemical process, can store electrical energy. The BESS consists mainly of batteries and a battery control and monitoring system (BMS). The BESS typically consists of:

- A Power Conversion System (PCS) suitable for outdoor installation on a concrete pad;
- Lithium-ion battery suitable for outdoor installation, and a Battery Management System (BMS);
- An Energy Storage Unit;
- DC Cables;
- Instrumentation and communication cables;
- Interfacing to meet statutory requirements and comply with Local Grid Code;
- Fire Detection & protection system; and
- Heating, Ventilation, and Air Conditioning (HVAC) system for BESS.

The BESS system will be composed of about 120 containers of around 5MWh each, plus the associated interconnection and management systems. The areas between and around equipment will be finished with gravel and kept free of vegetation or other material that could act to spread a fire.

Table 2-5: BESS parameters[2]

Parameter	Value	Unit
Rated power	300	MW
Rated capacity	600	MWh
Container size	5,0 – 5,5	MW/pc.

The BESS shall be selected from a Bloomberg New Energy Finance (BNEF) Tier 1 manufacturer. Its design shall satisfy all technical requirements for performance, durability, and safety, as well as the specific ambient conditions of the installation site such as temperature, humidity, and any environmental factors that could affect the operation of the BESS. Also, BESS solution will be chosen with the goal of minimizing the overall space requirement, simplifying the infrastructure needs (such as grid connection and cooling systems), and again reducing the impact on the surface area of the site.

2.2.4 Collecting Substation

All power cabling, known as the *collector system*, from and between the WTGs will then connect to the project substation rated at 30/220kV and will be connected to the grid utility via OHTL (Figure 2-11). The cabling will be buried in trenches approximately 1 m wide and 1 m deep, typically following the routing of access tracks wherever possible.

The substation area will cover an area of approx. 7 ha. The substation will collect the generated power from WTGs via 30kV lines and coverts it to 220kV transmission to the national grid through outgoing transmission lines connected to other substations: one will go to Opornaya SS another one to Jambyl SS.

The substation is critical for managing and distributing the electricity generated by the WTGs. It collects the lower voltage electrical power from each WTG and steps it up to a higher voltage (220 kV) suitable for long-distance transmission, which is required for integrating the generated power into the broader electrical grid efficiently. Additionally, the substation maintains the stability and quality of the power with various

[2] Technical solution is not final and is pending final design and technology selection.

components that regulate voltage, manage load, and safeguard against faults.

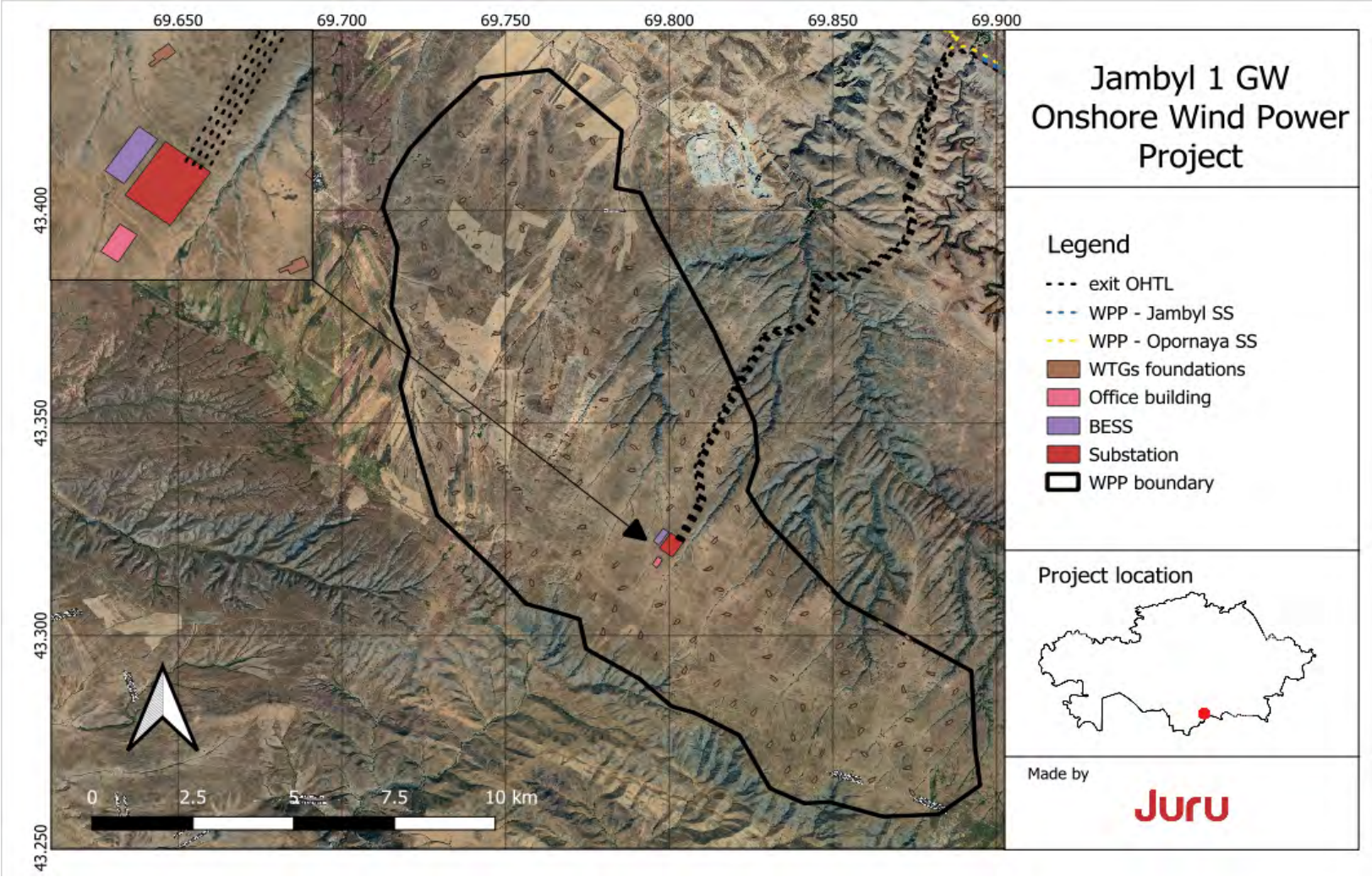
The project substation will comprise one or two concrete structures for housing electrical components such as transformers and MV switchgear, as well as the control building. The control building will include protection and control panels, AC/DC auxiliary power supply panels, DC battery banks with chargers, an MV/LV transformer for supplementary services, telecom panels, and other necessary facilities like offices, a warehouse, and toilets. The substation area, including the control building, will be located within a fenced compound that includes areas for vehicle parking and access.

The substation and associated infrastructure will be situated in the WPP site at a central location within the WTG array. The design of the substation will be initially developed by Masdar, with the detailed design to be provided by the selected EPC Contractor based on detailed site studies and design.

Table 2-6: Technical parameters of Collecting Substation

Parameter	Value	Units
Substation rating	30/220	kV
Substation rating	1,980	MVA
OHTL rating	220	kV

Figure 2-11: Location of SS, BESS and Office building



2.2.5 Supporting Infrastructure and Ancillary Facilities

2.2.5.1 Access road and internal roads

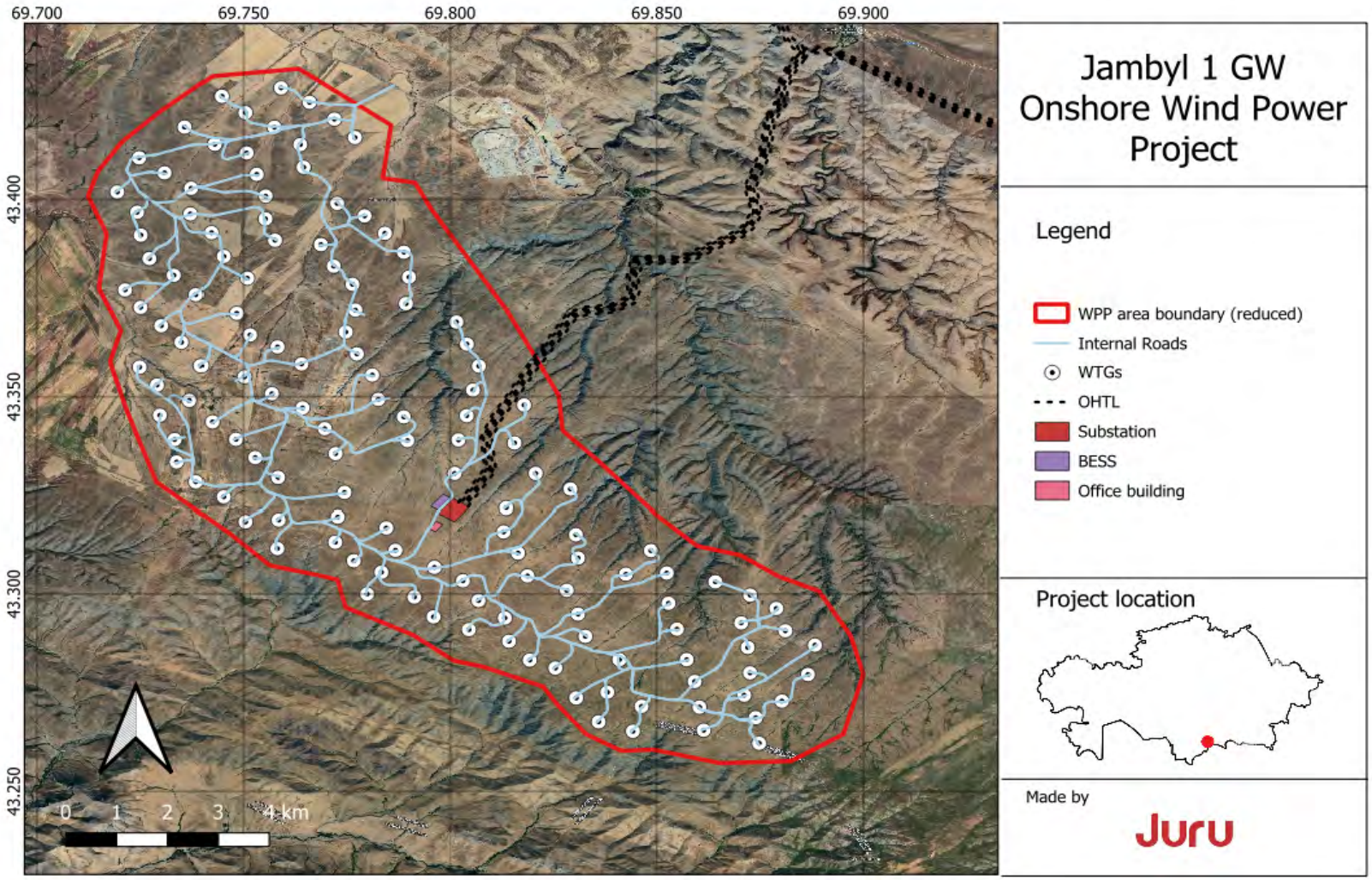
Currently, access to the WPP site is limited to a few single 'tracks' which are inaccessible from November to April, due to weather conditions. The location and routes for access roads to the site from the main roads will be initially developed by Masdar with the detailed design to be provided by the selected EPC Contractor. As the Project covers a large area it may be necessary to have more than one access route to the WPP site.

Smaller internal site access roads will also be required to provide access to each of the proposed WTG locations, hardstanding and substation areas, providing plant and O&M access to the WTG bases and substation buildings. Cable routes are typically buried parallel and alongside the site internal roads, which are typically circa 5-6m wide comprising of compacted stone materials.

Access roads, both internal and external, have been determined on a preliminary basis by the time of undertaking the ESIA.

The total distance of internal roads covering 140 WTGs is approx. 80 km. Given the width of the road is 7 m, total area for internal road should be 56000 ha.

Figure 2-12: Internal roads inside Project WPP area



There are 3 access road options under consideration by the Developer (Figure 2-13).

All access road options use the existing asphalt road constructed by Eurochem LLP. Two of the access road options cross the existing Zhanatas WF area (Figure 2-13).

The proposed access options under consideration are described and discussed in more detail in Section 18 (Traffic and Transportation).

Figure 2-13: Access roads

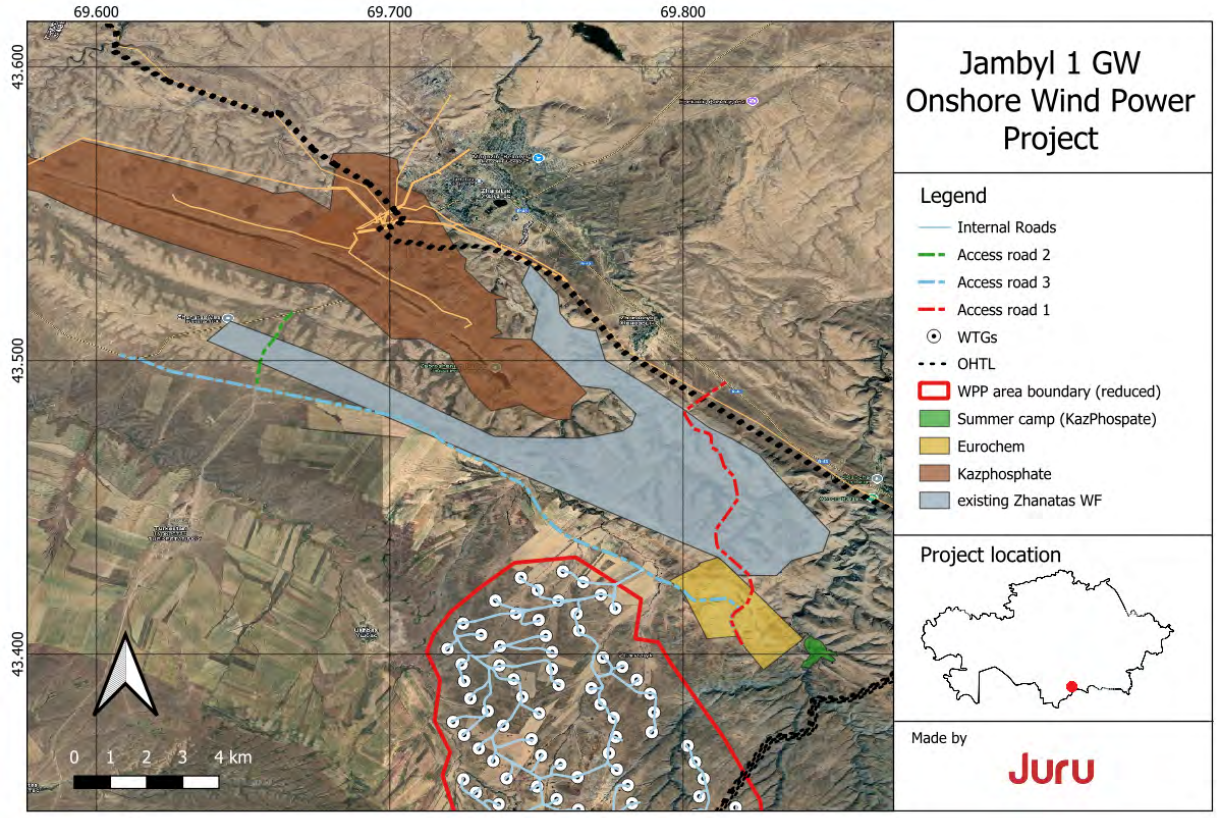


Figure 2-14: Access road 1

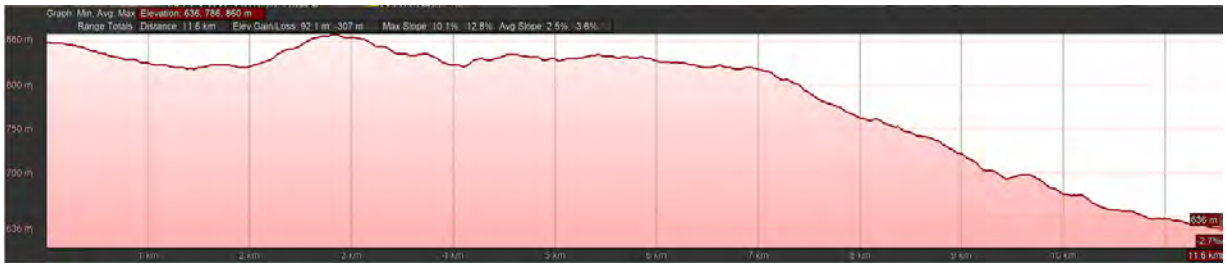


Figure 2-15: Access road 2



Figure 2-16: Access road 3



2.2.5.2 Buildings

Buildings will be constructed to accommodate employees and electric infrastructure for operation and maintenance (O&M) activities. The O&M building will be within the WPP site in a central area. The O&M building shall include:

- Office area (approximate size 100m^2);
- Storage area (approximate size 200m^2) with direct external ramp access;
- Switchgear room;
- Bunded area for products containing oil, area for hazardous substances;
- Workshop;
- Server/communications room;
- Meeting room;
- Kitchen and eating area;
- Mess room;
- Changing area/locker area; and
- Male & female toilets and showers and rest/recreation areas, all in accordance with relevant legislative requirements.

The O&M building shall include permanent water supply and sewage connection or collection system (potentially septic tank) as applicable, as well as all services (electrical, communications, water, etc.) and furniture required in the substation building for the operational phase, including desks, chairs, filing cabinets, etc.

2.2.5.3 Underground Cabling

The 35 kV underground cabling will be laid along internal roads with 1/2 m deep. The total length of cable trench is approx. 100 km.

2.2.5.4 Security system

The WPP will require a variety of security measures to ensure the safety and integrity of their infrastructure and operations, safeguard the assets of the Project, ensure the safety of personnel, and maintain the continuous operation of the WPP. Masdar will initially design the required security system for the Project with the detailed design to be provided by the selected EPC Contractor. Typically, site security systems may include the following main elements:

- **Physical Barriers**: Fencing around the perimeter of the central operation area, which includes the site offices, sub-station and BESS, to prevent unauthorized access and protect against vandalism or theft;
- **Security Personnel**: Site security personnel will be required to man the security posts, surveillance system, as well as undertake periodic site patrols;
- **Surveillance Systems**: Closed-Circuit Television Cameras (CCTVs) in critical areas such as the substation, WTG bases, and storage facilities. These cameras may include night vision or thermal imaging capabilities to ensure round-the-clock effectiveness;

- **Access Control Systems**: Electronic access controls to manage entry to the WPP and critical areas like the control rooms and WTG towers; such systems may require key cards etc. to ensure that only authorized personnel can enter sensitive areas;
- **Lighting**: Adequate lighting around the central control area. This may help in for deterring unauthorized access and assisting surveillance efforts during nighttime hours;
- **Alarms and Intrusion Detection Systems**: Alarms and sensors can detect and alert operators to unauthorized access or disturbances at the WPP. These systems are typically integrated with the overall security monitoring system;
- **Remote Monitoring and Control**: Operators may also use centralized control systems that allow for remote monitoring and management of the WPP. This would include surveillance feeds, access control status, and various alarms.

2.2.5.5 Met Mast and LiDAR

Masdar performed a wind measurement campaign with the use of LiDAR and MetMasts. LiDARs started to perform from summer 2024, whereas the last MetMast started to operate from September 2025.

Wind data are collected from anemometers installed at various heights, ranging from 38 m to 120 m.

Figure 2-17: Location of MM and LiDARs

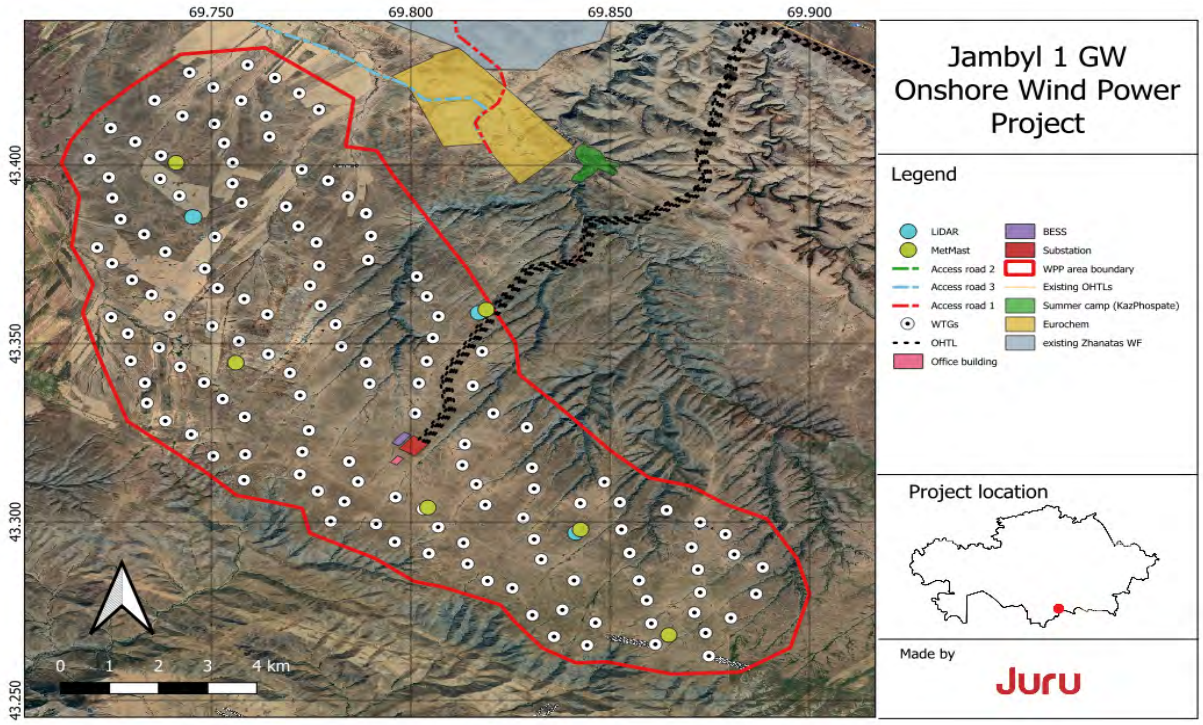


Figure 2-18: Power supply for LiDAR



Figure 2-19: General view of LiDAR Unit



2.2.6 Overhead Transmission Line (OHTL) and grid connection

There will be two OHTLs connecting the Project to existing substations as follows:

- Two double-circuit (total 4 circuits) 220kV OHTL from the Plant Substation to the Jambyl SS, with a total length of around 252 km (2x 126km). The 130 km Jambyl OHTL connecting the WPP site to the existing 220/500 kV Jambyl substation which lies 100 km southeast of the WPP site boundary. The OHTL runs in a north south direction crossing Sarysu, Talas, Zhualy and Jambyl districts of the Jambyl region.
- The second OHTL line runs in a north-westerly direction to Opornaya substation and then a more westerly direction to the Kentau substation, crossing Sarysu, Sozak and Kentau districts of Jambyl and Turkistan Regions, and has a total length of approximately 162 km. It consists of the following components:
    - One 32 km long double-circuit (total 2 circuits) transmission line from the Plant Substation to Opornaya SS, and

- One 130 km long double-circuit (total 2 circuits) transmission line from the Opornaya SS to Kentau SS, with a total length of around. OHTL connecting the WPP site to the existing Opornaya 220 kV substation, which lies 17 km north of the WPP site boundary, and then onto the existing Kentau 220 kV substation which lies 100 km west northwest of the WPP site boundary.

The overall OHTL length is approximately 414km, and approximately 2,400 – 2,800 towers are expected to be required, subject to final design.

The locations of the substations and proposed OHTL routes are shown above in Figure 2-6, Figure 2-7 and Figure 2-8. The final type of tower and routing is still being assessed as part of technical and design studies being undertaken separately.

Five types of overhead transmission towers are being considered for the project, and these are presented below in Figure 2-20. The final selection and exact application of each will be determined during the detailed design stage, based on terrain and environmental conditions. The proposed tower types include:

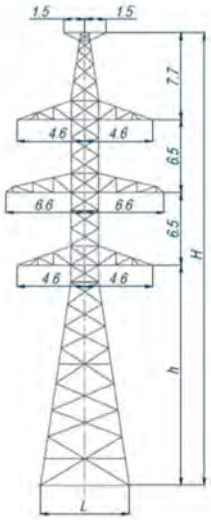
- **Three suspension towers**, primarily used on straight sections of the line:
  - One design for 220 kV systems;
  - Two designs for 330 kV systems — one for flat terrain and one reinforced version for mountainous terrain.
- **Two tension/angle towers**, used to manage line tension and accommodate changes in direction:
  - One design for 220 kV systems (standard type used across Kazakhstan);
  - One design for 330 kV systems, which may also be used in high-wind areas along 220 kV alignments where additional strength is required.

It is anticipated that different tower types may be used along the same transmission alignment to suit changing site conditions and mechanical requirements.

The distance between towers depends on the number of tower circuits of the proposed OHTL. Generally, 150-200 m is considered to be a standard distance in the case of a one-tower circuit OHTL, whereas 400m is more common for a two-tower circuit OHTL.

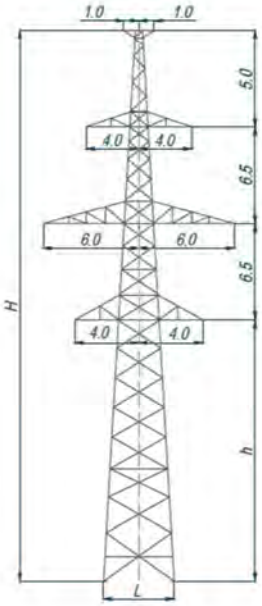
Figure 2-20: Indicative schemes of planed Towers

Item name	U220-2T	U220-2T+5	U220-2T+9	U220-2T+14
Icy area	I-IV	I-IV	I-IV	I-IV
Wire type	ACO-300; ACO-400			
Dimension along foundation axes L m	5,2	6,7	7,9	9,4
Pole heihgt H m	31,2	36,2	40,2	45,2
Height to the lower cross - arm h m	10,5	15,5	19,5	24,5

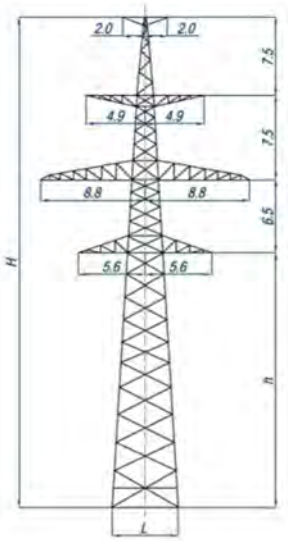


220 KV POWER TRANSMISSION LINE TOWERS

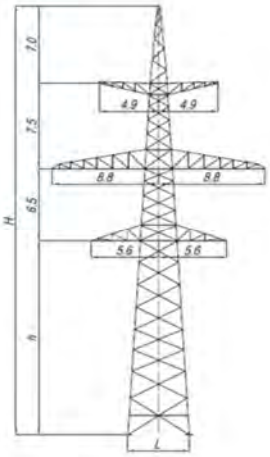
Item name	PC220-6T	PC220-6T+1,8
Icy area	III-IV	III-IV
Wire type	ACO-300; ACO-400	
Dimension along foundation axes L m	4,1	5,5x4,26
Pole heihgt H m	40,5	42,3
Height to the lower cross - arm h m	22,5	24,3



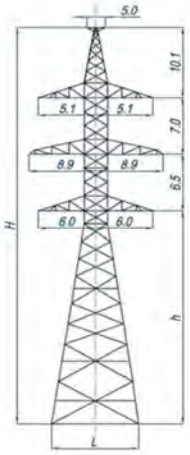
Item name	P330-2T	P330-2T+5
Icy area	I-IV	I-IV
Wire type	2xACO-300; 2xACO-400	
Dimension along foundation axes L m	4,1	5,5x4,26
Pole heihgt H m	40,5	42,3
Height to the lower cross - arm h m	22,5	24,3



Item name	PC330-2	PC330-2
Icy area	I-IV	I-IV
Wire type	2xACO-300; 2xACO-400	
Dimension along foundation axes L m	5,17x3,38	5,17x3,387
Pole heihgt H m	38,5	39,0
Height to the lower cross - arm h m	17,5	17,5



Item name	U330-2T	U330-2T +5	U330-2T +9	U330-2T +14
Icy area	I-IV	I-IV	I-IV	I-IV
Wire type	2xACO-300; 2xACO-400			
Dimension along foundation axes L m	6,85	8,35	9,55	11,0
Pole heihgt H m	34,3	39,3	43,3	48,3
Height to the lower cross - arm h m	10,7	15,7	19,7	24,7



Jambyl-500 kV SS serves as a critical node in the regional power grid and part of 500 kV backbone network of power system of Kazakhstan. The substation operates at 500/220/10 kV levels. The substation is part of the Southern Network (Yuznye MES) and connects Frunze-500 SS (Kyrgyzstan) with Shymkent-500 SS that goes to Tashkent-500 SS (Uzbekistan). KEGOK has a plan of modernisation and expansion of existing Jambyl SS 500 kV. This is a part of state`s project of ensuring the reliability of electricity supply to consumers and strengthen the electrical connection between South grid zone and other zones of National Grid of Kazakhstan.

Above-indicated expansion of the existing Jambyl SS is anticipated to consist of installation or expansion of bays that will allow the Project connection as well as other planned future connections. There is no further specific information on the Jambyl SS extension at this stage. At this stage, the exact routing for the WPP exit point and the entry point to the Jambyl SS is still under review.

KEGOC required the Project connection to the Kentau SS through the Opornaya SS to stabilize the network. A direct connection of the wind farm to Kentau would create a risk of losing the entire line in the event of an accident. With the presence of the Opornaya SS, even in the case of a failure between Opornaya SS and Kentau SS, the WPP–Opornaya SS OHTL would remain operational and allow continued evacuation of energy. The existing OHTL between Kentau SS and Opornaya SS is connected via Chollakurgan SS and the line itself is outdated and does not provide the required level of reliability. The construction of a new line through the Opornaya SS will allow for the modernization of infrastructure and strengthening of the power grid between the two regions of Jambyl and Turkestan.

2.2.7 Associated facilities

Associated facilities, as defined by IFC Performance Standards, refer to facilities that are not financed as part of the project, would not have been constructed or expanded in the absence of the project, and are necessary for the project's operational viability.

No projects or expansion works have been identified during the ESIA process that meet this definition of Associated Facility.

It is noted that KEGOC plan to undertake expansion works at the Jambyl Substation but this forms part of the government led South Kazakhstan Electricity Transmission Reinforcement Project, which is itself a component of the national Energy Development Concept to 2035 and KEGOC's approved investment programme. This wider grid reinforcement project predates the Jambyl WPP Project and includes the construction of two new 500 kV transmission lines (~475 km total) and the expansion of multiple substations, including Shu, Shymkent, and Jambyl. Implementation commenced under KEGOC's 2021–2027 schedule[3].

The works are being carried out independently under a national grid strengthening programme, rather than for the purpose of enabling the WPP. The grid upgrade programme is ongoing and implemented regardless of the Project. The Jambyl WPP could be technically viable with a connection to a single substation. The Project has two grid connection points (Jambyl SS and Kentau SS) and its viability does not rely on both being available.

2.3 Project Phases & Activities

The general development phases for large scale wind power project can be categorised as follows:

- **Mobilisation and Pre-construction**: such as site preparation, mobilisation of equipment and materials to site;
- **Construction and Installation**: including civil works, tower erection, electrical works, and equipment installation;
- **Operation**: Plant operation and routine maintenance;

[3] References:
(Investment projects | KEGOC)

- **Decommissioning**: Dismantling of equipment and associated facilities and site restoration.

The proposed total capacity of the WPP plant is 1 GW and will be built in a single phase, with a Project lifespan of 25 years. It is estimated it will take 3 years to complete construction of the Project, with early generation planned in month 18 and Commercial Operation Date (COD) in month 36. The EPC Contractor will be responsible for development of detailed design, construction and commissioning of the plant.

Potential environmental and social impacts are related to activities undertaken during all the Project phases; key activities during these phases are summarised below.

2.3.1 Pre-Construction and Mobilisation Phase

The pre-construction phase includes development of the detailed design, mobilisation and site preparation stages. Preconstruction activities include, but not limited to, the following:

- Studies required for and completion of detailed design of the WPP, OHTL and grid connections;
- Completion of the EPC tender process and selection of preferred bidder;
- Full ESIA of the facility and associated facilities;
- Stakeholder Engagement;
- Acquisition of permits and approvals (e.g. Environmental approval from the Committee on Environmental Regulation and Control (CERC)
- Selection of EPC contractor and key equipment suppliers and
- Development of the Environmental and Social Management Plans (ESMP) for construction and operations, including pre-clearance and pre-construction surveys for environmental, biodiversity and social receptors.

The mobilisation phase includes:

- Ordering, transportation and storage of materials and equipment;
- Recruitment of local workforce/services;
- Mobilisation of workers;
- Identification of borrow pits (as may be required);
- Planning and transportation of the project components, equipment, machinery and materials to the site (e.g. blades, rotors etc.),
- Establishment of access roads;
- Site preparation which involves clearing, grading and levelling of the WTG and building areas;
- Establishment of TSF (temporary site facilities) and construction compound;
- Establishment of worker accommodation (the selected EPC Contractor will have the final determination as to whether or not dedicated worker accommodation will be required);
- Securing the WPP area.

Preparatory works for the OHTL will also require the following:

- Finalisation of the locations of towers and route of OHTL, including pegging out tower foundation areas and transmission line routes; and
- Construction of platforms for pylons and delivery of materials along the OHTL route.

During the site preparation period, the workforce required for site security, manual labour, civil works, transportation of goods and other similar services will primarily be hired from the local labour pool.

Mobilization and on site pre-construction activities are expected to take place over a 3-month period.

2.3.2 Construction Phase

The expected duration of the construction period is 36-months to fully complete the Project and reach COD.

The final construction schedule will be specified by the EPC Contractor following detailed design phase. The main construction activities and their duration is indicatively provided in the below table.

Table 2-7: Main Construction Activities

Works	Duration (Months)	Main Activities	Key Milestones
Earth works	M1-M12	Turbine foundations, cable trenches, site levelling	Completion of 150 foundation excavations, main control building and substation levelling
Concrete works	M4-M20	Foundation pouring, control building, substation	Approx. 15-20 WTG foundations per month
Installation works	M13-M34	Turbine erection, transformer, BESS installation, cable laying and substation works	15 WTG/month from M18 onwards
Commissioning	M33-M36	Individual tests, cable testing, system integration	Grid connection and final commissioning activities

a. Construction

Construction will be carried out by an EPC Contractor and the main site preparation and construction activities will include, but not be limited to, the following:

- Required road upgrades and widening of turning radii, where needed;
- Construction of temporary construction camp/offices and construction lay-down area(s);
- Site preparation: removal of vegetation and any remaining structures followed by grading of the WTG and hardstanding area and fencing of construction area for community safety.
- Construction of the internal road network;
- Transportation and delivery of key WPP and OHTL components, such as WTG towers and blades, transformer, switch gear, battery containers, OHTL tower components etc.;
- Laydown areas for machinery, equipment and supplies;
- Establishment of concrete batching plant (if determined to be required by EPC Contractor);
- Establishment of borrow pits;
- Construction of foundations, assembly, and erection of structures to support WTGs, this may require blasting activities;
- Installation of WTGs;
- Construction of substation and electrical control room, site offices, storage, and services;
- Construction of array enclosures and power block foundations and housing;
- Excavation, trenching and installation of cables;
- Foundation, earth works and excavations for pylons;
- Installation of foundations and grounding devices for pylons;
- Assembly, installation, alignment and fixing of pylons;
- Rolling out and connecting wires and cables, lifting them onto pylons, stretching and fixing on pylons;
- Installation of vibration dampers and remote spacers, mounting loops;
- Suspension of ground wire and fibre-optic cables along the transmission line route;
- Erection of permanent facility fencing and security system; and

- Construction of buildings.

b. Testing & Commissioning

All systems will undergo a full functional and safety test to ensure that they are fit for purpose. The contractor will be responsible for functional testing, commissioning, performance testing and reliability testing of the complete plant.

Testing will be undertaken to ensure that the WPP project and OHTL performs as per the specifications. The EPC contractor will be responsible for functional testing and commissioning of the WPP and OHTLs. Final commissioning includes the testing of all structures and buildings, including WPP and pylons, to ensure that all joints are correctly made and are tight, the integrity of the system hardware, the control and protection system, etc. Connection of the WPP Project will be checked, and once approved, power connections established.

c. Construction Demobilization

Upon completion of the construction phase all temporary infrastructures, if any, will be removed and the areas rehabilitated. The EPC Contractor shall carefully remove all equipment and materials not required for the operational phase. Roads used for the access to site will be repaired if any damage occurred during the construction, along with any material damage to private properties (to the satisfaction of the owner/s). The site and surrounding area will be cleaned-up of litter and discarded materials.

2.3.2.1 Construction Phase Supporting Infrastructure and Resource Requirements

Existing batching plants

Juru preliminary identified 2 existing batching plants in proximity of the site: in Karatau town (50km) and close to Zhanatas town (9.5 km) (Figure 2-21, Figure 2-22).

Karatau batching plant was launched in 2015 with a production capacity of 150,000 tons per year, with plans to increase capacity to 300,000 tons per year. However, in 2020, the plant was shut down for reconstruction. Currently, it produces asphalt powder. As of March 2025, the plant operations were on hold for modernisation.

Zhanatas batching plant was under construction as of March 2025. The initial capacity will be up to 180,000 tons per year, with a final capacity of up to 300,000 tons per year.

The need for a project-specific batching plant to be provided by the EPC contractor is currently under review. If this requirement is confirmed, the ESIA will be updated accordingly.

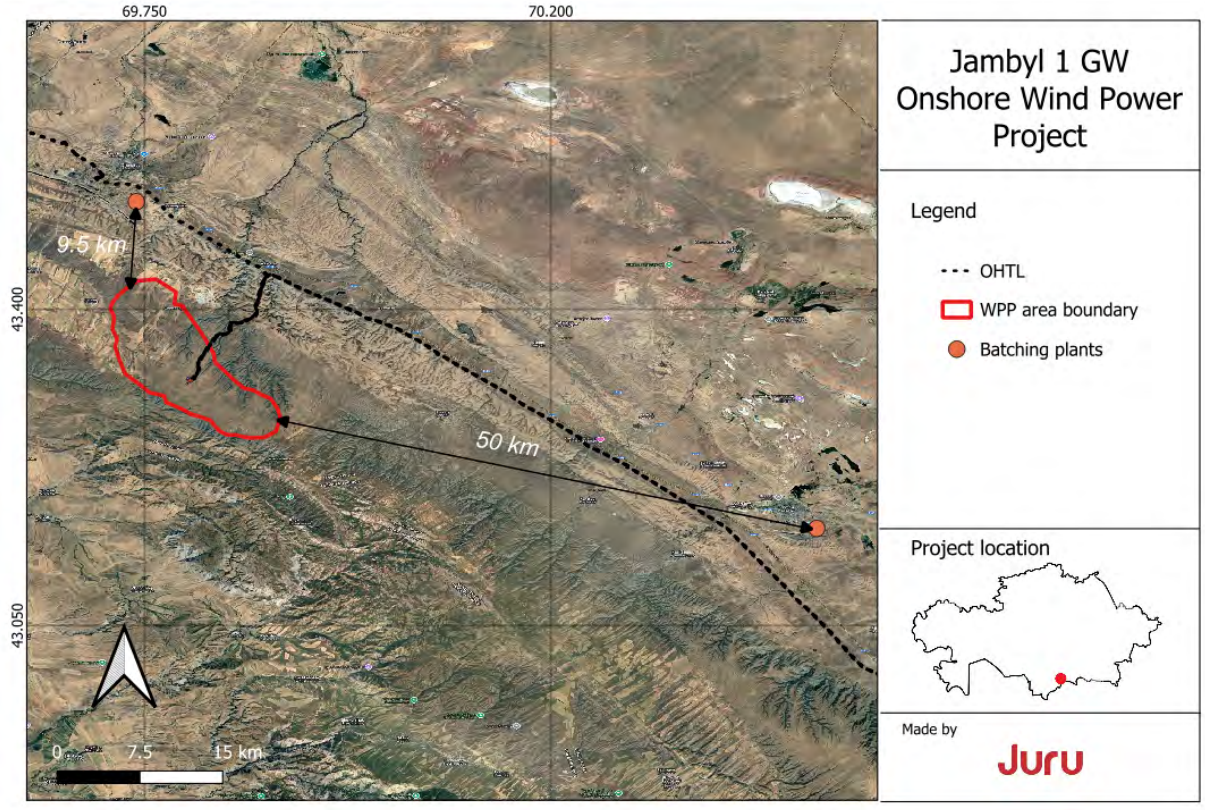
Figure 2-21: Batching plant in Karatau



Figure 2-22: Batching plant in near Zhanatas



Figure 2-23: Existing batching plants



Project workforce

There will be a direct labour force requirement for the Project during construction which will be dependent on the stage of the works. Project workforce needs include skilled, semi-skilled and unskilled workers. Employment of workers from local communities by the EPC will be encouraged.

During the construction stage, approximately 600-800 people are expected on average to be directly involved, peaking at 1,700 people during the installation phase. This includes roles such as civil works, electricians, crane operators, testers, logistics and other management personnel.

The need for worker accommodation will be determined by the appointed EPC Contractor. We understand that the near-by Zhanatas Wind Farm, which was recently developed, the selected EPC Contractor did not require a dedicated worker accommodation, as much of the work force was recruited locally and there was sufficient existing local accommodation available to accommodate the requirements of the non-local work force. Workers were bussed to site on a daily basis.

However, as the proposed Jambyl WPP is significantly larger than the Zhanatas Project and located further away from the town of Zhanatas, the ESIA will assume that dedicated worker accommodation will be necessary.

Project Water Requirements

During construction, water will be required for construction activities (e.g. producing concrete for foundations), dust suppression, domestic purposes and drinking water for the construction teams.

It is anticipated that up to 110m^3 of water will be required to produce the concrete for each WTG foundation (assuming traditional gravity type foundations). Based on a current initial estimate of 140 WTGs for the project, the total water requirement for foundations is initially estimated to be around 15,000 m^3. However, there can be losses during construction and the need to use additional water for closed loop cooling of the foundations when laid due to hot climate conditions, could result in up to 20,000m^3 of water potentially being required for construction of WTG foundations.

The Project will investigate the potential opportunities to obtain concrete from local concrete batching plants in the area; however, in case a batching plant is required at the site, water will be provided by tankers. For the purposes of this ESIA it has been assumed that concrete will be sourced from existing local concrete batching plants.

Table 2-8 below presents the approximate water consumption per WTG for the different construction activities.

Table 2-8: Estimated water requirements

Activity	Maximum water requirement
WTG foundation pouring	110m^3 per WTG foundation for concrete batching etc
WTG foundation curing	1m^3 per foundation per day, assumed that 10 days will be sufficient for foundation curing
WTG components cleaning before erection	2m^3 per WTG

Regarding the potable water for human use (i.e., drinking, washing and cleaning) during construction, water supply is expected to be provided via tankers from an authorised supplier. Potable water requirements for the project are not expected to exceed 50 litres per person per day. An on-site water tank will be installed to provide potable water for construction operations.

Groundwater abstraction is a potential water supply option for consideration. The availability and viability of using groundwater for the construction phase of the Project will be informed by hydrological studies' outcomes. If determined needed, the use of groundwater will be in a manner so as to not impact the local community and grazer water supplies.

Electricity

During construction and commissioning activities, mobile diesel generators will be required to provide the electricity required for construction works.

2.3.3 Operations Phase

WPP & BESS

Operation and maintenance (O&M) requirements for a wind farm are usually quite limited over the estimated 25-year life time of a project. The operation of the WPP will require operational activities such as:

- Operation and maintenance to include normal daily operation of equipment, including maintenance (electromechanical and housekeeping) to optimise energy yield and life of the system;
- Remotely activated WTG shutdown during excessive wind speeds; and
- Management of operations in relation to any bird and bat sensitivities e.g., during migration periods.

The WPP and BESS Plant will be maintained and operated by trained and experienced personnel, ensuring that the system is in optimal condition and that all parts are fully serviced and functional. Routine maintenance will likely be undertaken on the WTGs, substation and BESS equipment, this is likely to be done twice a year. This typically consists of a major maintenance period and a minor maintenance period. The major maintenance is relatively non-intrusive and involves checking connections and inspections. Minor maintenance is typically a visual inspection and rectification of any accumulated noncritical defects.

OHTL

Once commissioned the OHTL line will be transferred to KEGOC for operations and maintenance.

An OHTL generally has very limited O&M requirements and will be designed for continued operability (24 hours per day, 7 days per week) depending on the regime and parameters of the national and regional power transmission grid. From the beginning of operations, the transmission line will work without continuous presence of personnel.

Maintenance of the proposed transmission line will be carried out by KEGOC and will be implemented in compliance to the national legislative requirements stipulated in by-laws and technical standards. Maintenance activities could include line inspection, tower painting, future upgrading, etc. KEGOC will be responsible for vegetation growth control below the line as necessary.

In general, maintenance works include regular maintenance (visual inspections and routine annual maintenance works) and overhauls (detailed examination and elimination of eventual faults). Visual inspection would typically be conducted twice a year and may be followed by certain actions in individual sections and/or on towers, such as replacement of insulators, bridges, strengthening of tension ropes, repair/replacement of tower lattices, repair and maintenance of Bird Flight Diverters, etc. Four-wheel drive vehicles and small trucks would be used for that purpose. Overhauls may be done once in 3 to 5 years and would involve physical inspection of each tower and removal of all registered faults and electrical equipment (short circuits, ground faults, ground wire damages, etc.). These may require use of tracks and heavy tractors.

Maintenance of the OHTL would require access by a range of vehicles of varying size. These vehicles would use the public road system and those access tracks which are retained for permanent use following completion of construction. Operational traffic would be very light and no significant traffic related effects are predicted on any part of the public road system.

2.3.3.1 Required labour

Preference should be given to workers from surrounding areas, depending on the availability of suitably qualified personnel.

During operation, low numbers of permanent employees on site are expected to be required; estimated to be around 60 –80 personnel. In case of outages or major maintenance work during the operation, this may increase to an estimated 100-150 people temporarily depending on the works to be performed.

2.3.3.2 Utility inputs for operations

Water

Water will be required during the operational phase mainly for drinking and other personal use for onsite staff. Potable water for human use (i.e. drinking, washing and cleaning) would be usually supplied via tankers, and with bottled water supplied for drinking. On-site water storage tank(s) will be installed to provide potable water to the buildings. The daily consumption is expected to be up to 50 litres per person per day.

Water will also be required for cleaning of the blades, with cleaning expected to occur once every 3 to 5 years, amounting to 5 to 9 times during the lifetime of the Project. The amount of water required per wash is around 1m^3 per WTG, resulting in expected water use of around 150m^3 per wash cycle (every 3 to 5 years) or 750 m^3 to 1,350 m^3 for the lifetime of the project.

Power Source

Ideally the generated electricity from the WPP and stored in the BESS should be used for Project operational requirements, such as lighting system and buildings. An auxiliary import connection or back-up diesel generator may also be required.

2.3.4 End-of-life disposal/decommissioning

The life expectancy of the WPP facility is around 25 to 30 years. It is expected that the facility will be continuously maintained and repaired and will be operated for several decades. The facility may be upgraded and/or renewed based on cost/benefit analysis and new technologies at the end of their life cycle. The decommissioning processes would be undertaken in accordance with environmental laws and standards in place at the time of decommissioning.

The Project PPA will run for a specific period, assumed to be 25 years, after which the Project will be handed over to the government/utility, and they will then make a decision whether to keep the Project operational as is, upgrade or decommission.

Detailed assessment of the decommissioning phase of the Project is scoped out of the ESIA for Jambyl WPP Project. In the event that the subsequent owner decides to decommission the Project this will be subject to a specific Decommissioning ESIA to be prepared by the owner.

In any event, we have provided a brief outline of the decommissioning phase to provide an indication of the process and main considerations that any future dedicated Decommissioning ESIA will cover.

WTGs will be dismantled when the site is ready for decommissioning. Steel and other recyclable materials will be recycled. The materials that cannot be recycled or reused and contaminated materials, such as oil storage tanks, will be sent to a suitable licensed disposal site.

The Project will be dismantled and removed using conventional equipment with limited impact on the environment. These materials will then be safely recycled or disposed of in accordance with all applicable laws and regulations at the time of dismantling.

On-site roads that will no longer be used will be reclaimed and vegetated with native grasses where appropriate. Overall the WPP site area should be returned to close to its original state as practical.

The overall operational life of the OHTL is around 40-50 years, therefore the OHTL may continue to be used after the decommissioning of the WPP. The eventual final termination of operations of the OHTL will be decided by the owner of the OHTL and similar to the WPP decommissioning will be subject to a dedicated Decommissioning ESIA. The decommissioning of the OHTL will involve activities for dismantling the infrastructure and equipment and their dislocation from the area of the corridor of the transmission line. The area along the OHTL route will be subject to restoration and returning the environment to the initial

condition, to the greatest extent possible. The majority of the OHTL line equipment can be recycled or reused and it may be offered to other interested licensed companies.

Decommissioning is expected to take between 12 and 24 months. The effects of decommissioning are often similar to, or of a lesser magnitude than, construction impacts and therefore the construction-phase impact assessment presented in this ESIA is considered sufficient to characterise potential decommissioning impacts at a conceptual level; this should be further assessed and refined in the dedicated Decommissioning ESIA that will be prepared by the WPP and OHTL owner prior to implementation of the decommissioning activities. There is uncertainty at this stage regarding decommissioning activities and issues as engineering approaches and technologies will evolve over the operational life of the Project.

Masdar will ensure that the relevant agreements with the Government include a requirement for the preparation of a Decommissioning Plan and associated impact assessment prior to any decommissioning activities, in line with applicable lender standards and Good International Industry Practice in force at the time of decommissioning.

2.4 Project schedule

The current overall Project timeframe is as follows:

- Q1 2023 - Initial Site Option Screening
- Q3 2023 - Site Selection
- Q4 2023 - Intergovernmental Agreement (IGA) signed
- Q2 2024 – ESIA Scoping and Baseline Survey started
- Q4 2024 - Power Purchase Agreement (PPA) and Investment Agreement (IA) signed
- Q2 2025 - Intergovernmental Agreement (IGA) ratified
- Q4 2025 - ESIA completion
- Q2 2026 – Start Early Site preparation work
- Q2 2026 – Issue Full EPC Notice to Proceed
- Q1 2029 – Start Early Generation
- Q1 2029 - Commercial Operation Date (COD). Operational Term: 25 Years.
- Q1 2055 - Commercial Operation Date (COD)

2.5 Project Alternatives

2.5.1 No Action" Or "No Project Alternative"

Under the 'Do nothing' option, the proposed WPP Project and associated transmission line would not be built, therefore no capital investment costs will be incurred, and any negative environmental and social impacts associated with the construction and operation of the project would be avoided.

However, under the 'Do Nothing' scenario the benefits of the Project would not be realized, most importantly in supporting Kazakhstan's strategy to meet its growing energy needs and reduce reliance on fossil-fuel based electricity and energy imports, while taking advantage of Kazakhstan's strong good natural resources for wind based electricity generation. The investment in, and development of, wind projects is an important element in achieving the principles of this strategy, and therefore this Project is aligned with the overall objectives of Kazakhstan's national energy strategy. Furthermore, the installation of the 2 new OHTLs will provide added stability and capacity to the electricity network in the region.

Furthermore, any benefits that the Wind Project can bring to the local community with regards to job opportunities, and the local ecology through active biodiversity management within the site footprint would also be lost in the do-nothing scenario. In a wider context, the 'Do nothing' option would limit overall economic development and possibilities for the improvement in the social welfare of people in the region.

2.5.2 Alternative Technologies

The conditions of the Project site are optimal for wind development and unfavourable for the majority of other renewable or fossil based technologies; therefore, such alternative technology options are not considered relevant.

The development and design of the final technical solution and selection of components will be completed by the appointed EPC Contractor who will develop the project under a "design, build, operate, and maintain" model. The ESIA will provide outline summary of relevant optimization design studies that considered alternatives or options in the overall Project design, such as WTG models and layouts etc., as are available at the time of writing the ESIA.

2.5.3 Wind Farm Site Alternatives and Layout

Masdar were initially allocated another development area in southern Kazakhstan, approximately 53 km west of the town of Taraz, in the Zhualy region for the development of a 500 MW WPP (Figure 2-24). This development site comprised of a rectangular-shaped polygon covering approximately 288 km^2. The Project also included a proposed 127 km OHTL connecting the on-site substation to the Jambyl substationand Talas districts of the Jambyl.

Following a biodiversity screening exercise commissioned by Masdar and undertaken by The Biodiversity Consultancy (2023)[4], it was decided to reject this site due to its proximity to Key Biodiversity Areas (KBAs) and other protected biodiversity areas, and relatively high-risk profile for biodiversity aspects (Figure 2-25).

Masdar subsequently undertook an internal environmental and social review to identify a lower risk site in the region which had sufficient setback distances from protected areas. This led to the selection of the proposed 41,211 Ha WPP site area and shows that Masdar considered environmental and social risks at the very earliest stages of site selection.

The WTG layout has undergone a number of iterations and refinements throughout Project development, reflecting an iterative design process that integrated technical feasibility with environmental and social considerations. Initial layout concepts were informed by wind resource data, topography and constructability constraints and were subsequently refined as baseline environmental and social surveys, stakeholder engagement outcomes and specific constraint mapping was developed based on identified E&S risks and constraints identified as result of the baseline acquisition and survey work undertaken throughout the ESIA stages.

This process resulted in successive adjustments to WTG meso and micro-siting, access routes and associated infrastructure in order to avoid or minimise potential impacts on sensitive environmental and social receptors at source, in line with the mitigation hierarchy. Design refinements were undertaken in parallel with the ESIA studies and were informed by discipline-specific findings, including biodiversity, landscape and visual, community proximity and land-use considerations. A summary of the iterative design process of the WTG layout is provided in Section 21 Mitigation Through Design.

[4] Biodiversity Screening for a 500 MW Wind Power Project and associated Overhead Transmission Line in Kazakhstan Report (2023). The Biodiversity Consultancy. Cambridge, UK.

Figure 2-24: Original Project boundary and OHTL to Jambyl SS

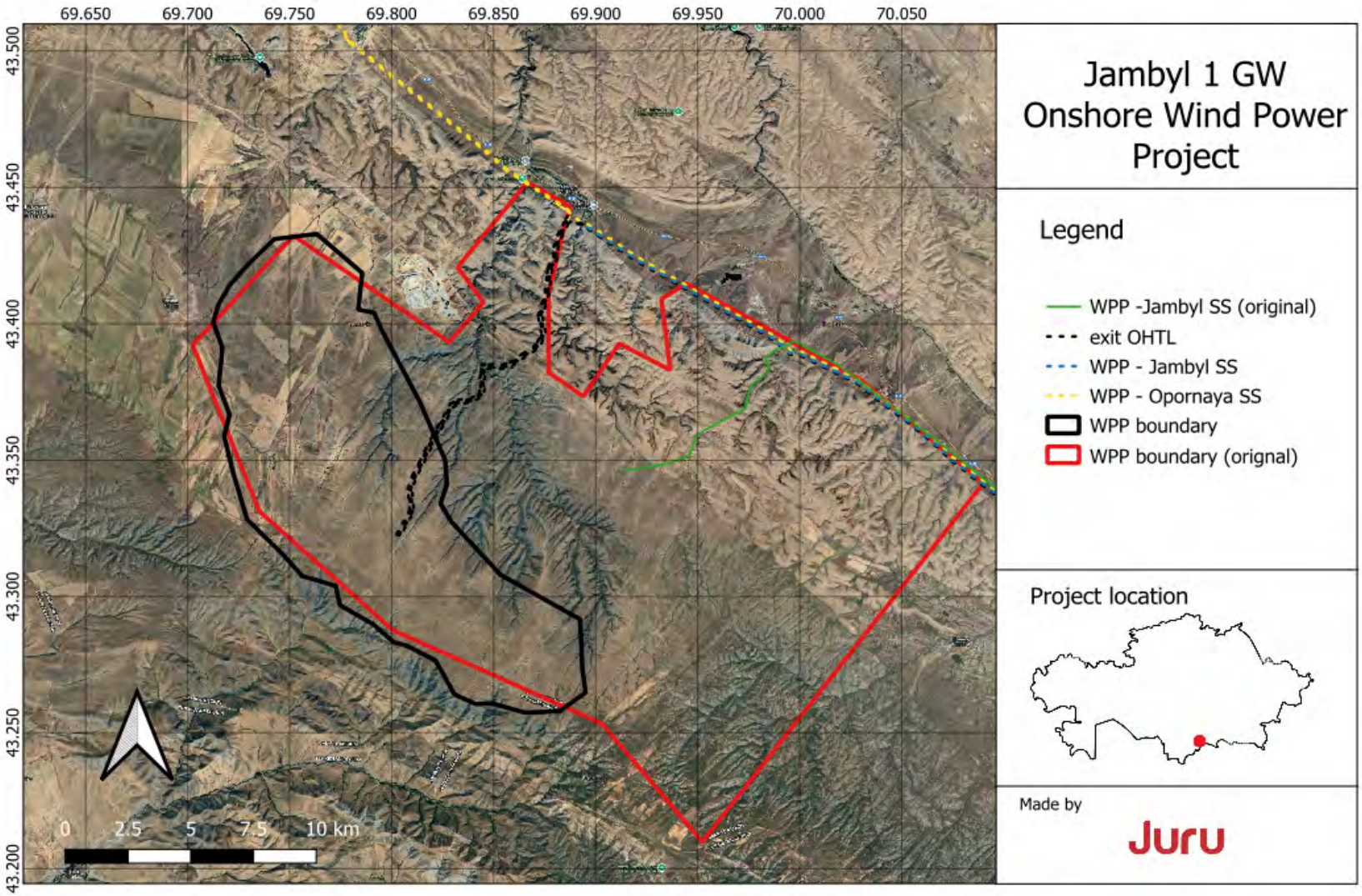
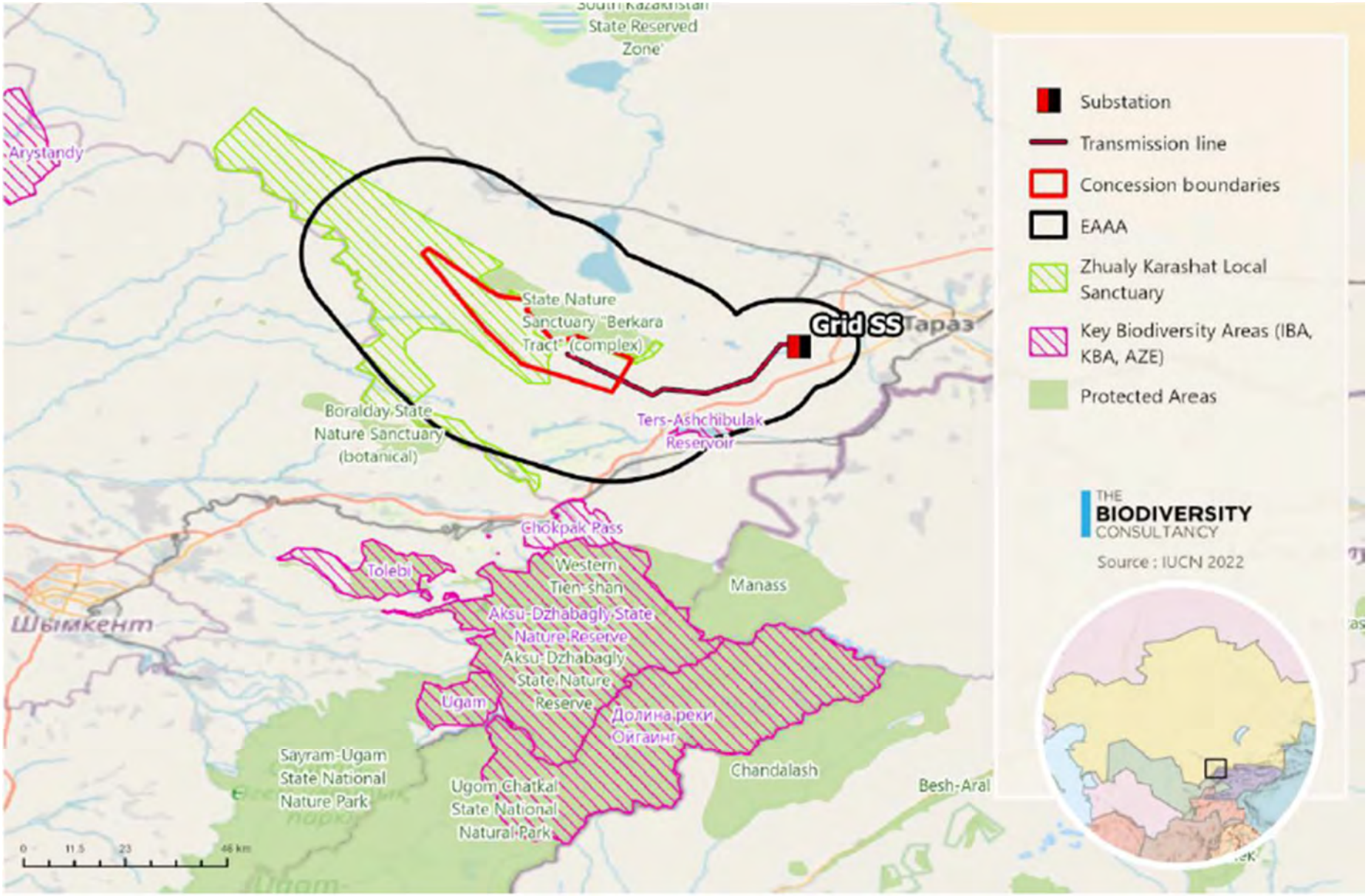


Figure 2-25: Location of Alternative WPP Site Initially Considered (TBC, 2023)



2.5.4 Alternative Grid Connection and Line Routing

Jambyl OTHL Route

Five (5) potential options for grid connection were initially identified[5] and short-listed for the project, which included connection into the existing 200 kV OHTL, as well as connecting to alternative grid substations. The 5 options considered are shown Figure 2-26 below. A further detailed technical review identified Option 1 (as shown in Figure 2-26), with connection into Jambyl substation, as the most feasible from the economic and technical perspective.

Following selection of this option for connecting to the grid via the Jambyl substation a number of OHTL line routes were considered, which are presented in Figure 2-27 and Figure 2-28.

These options were screened from a technical, as well as E&S perspective. With Options 4 and 5 identified as the least favourable option, both from a technical and E&S perspective. A summary of the outcome of the E&S screening was as follows:2

- Option 1: Preferable option as the main route largely follows close to existing roads and OHTLs, which is favourable from both a biodiversity and social perspective;
- Option 2: Offered lower risk, similar to option 1, as the main route follows close to existing roads and OHTLs, however with this option the route as it approaches the Jambyl 500 kV SS passes between 2 lakes which presented elevated biodiversity risks when compared with Option 1;
- Option 3: This option crosses 2 wetlands, and so is less favourable from a biodiversity perspective;
- Option 4: Represented the highest biodiversity risk as the route lies on the top of Karatau mountain range and increases the danger for migrating and threatened birds, as well as the presence of Karatau Argali. Furthermore, this option passes near to some communities and some agricultural land, so is the second least preferred option from a social perspective;
- Option 5: Has a higher biodiversity risk to Option 1 & 2 as the main part of the OHTL lies in natural habitat. Furthermore, this option passes close to a number of communities and therefore is the least preferred option from a social perspective.

All 5 options face similar issues from a social perspective in the area where the lines connect to the Jambyl substation due to the presence of a number of dwellings and communities that surround the substation area.

The outcome of the initial screening of the 5 options concluded that Option 1 represented the best option from both a technical and E&S perspective, and this has formed the basis for the initial proposed OHTL route for the Project. The OHTL route has been informed based on the E&S constraints and risks identified throughout the ESIA development and fed back to the technical design team so as to minimize E&S risks and impacts. These E&S constraints and risks are discussed in more detail in Section 21 Mitigation Through Design.

An expansion of Jambyl SS may be required to accommodate the Project; however there is no specific information on this matter at this stage. Any requirement for Jambyl SS expansion will be described within the ESIA.

Kentau OHTL

5 options for the Kentau OHTL route were initially considered; these are presented in Figure 2-29 and Figure 2-30 below.

Further technical and E&S review indicated that Option 6 (similar to Option 5 with minor adjustments for straightening in the section west of the Karatau ridge) is currently considered the preferred option.

[5] Power evacuation study for interconnection of 500 MW WPP with 150 MW/300MWh ESS project in Jambyl region, Kazakhstan. Juru Ltd (2024)

The conclusions of the technical and E&S screening of the considered options are summarised as follows:

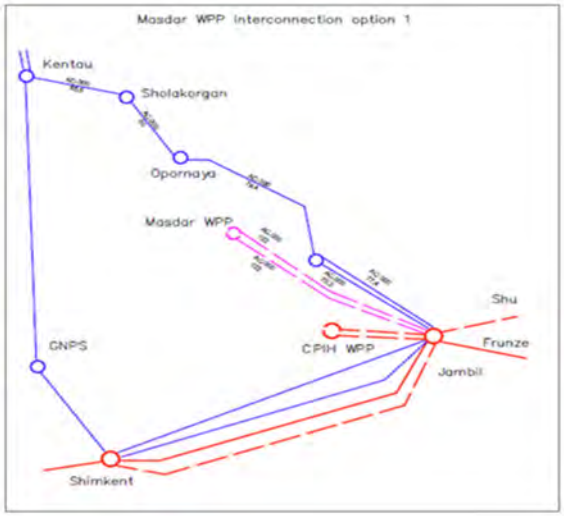
- Option 1 is the shortest and follows the flattest part of the ridge terrain. However, it has drawbacks, including intersecting the potential habitat of the Great Bustard (Otis tarda), partial alignment through agricultural lands, and not following existing transmission lines.
- Option 2 is one of the longest route options. It bypasses the Great Bustard habitat and is mostly routed through flat areas. The main disadvantages are its length and the fact that it runs at a distance from existing lines.
- Option 3 follows existing lines until it reaches the Karatau ridge, then diverges and crosses the ridge via a mountain gorge, where no existing lines are currently present. The positive aspects include avoiding the Great Bustard habitat and shortening the overall route, but a major downside is that it introduces a new transmission corridor through previously undisturbed mountainous terrain.
- Option 4 largely overlaps with Option 2 but adjusts the alignment to bypass the Great Bustard habitat using a more conservative scenario. As a result, this option is the longest among all presented.
- Options 5 and 6 follow existing transmission lines for nearly the entire route and roads, except for a deviation near Chulakkurgan village. This options combine avoidance of the Great Bustard habitat with minimal E&S impacts due to its alignment with existing infrastructure. Among these options, Option 6 is technically more favorable due to having fewer angles (turning points) along the route.

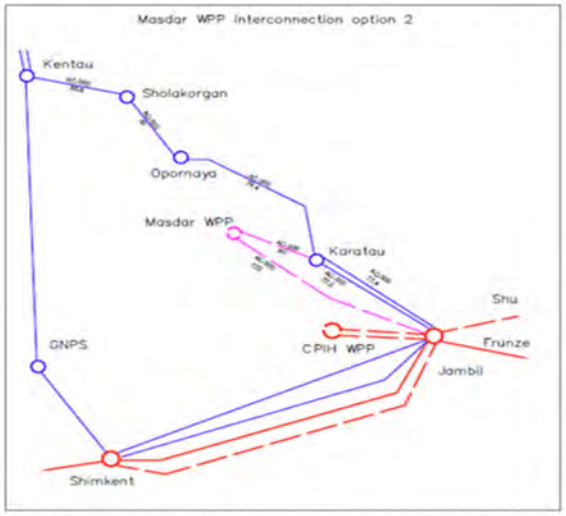
Overall both the Jambyl and Kentau OHTL routes have been designed based on the following key principles:

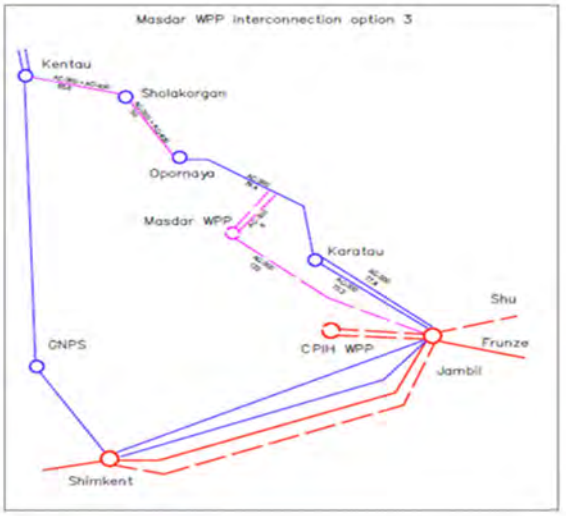
- The new OHTL to follow existing 220 kV OHTL routes where feasible;
- Apply a 50m buffer/exclusion zone from the centreline of the OHTL as the initial basis for planning the OHTL route to avoid impacts on sensitive receptors, such as residential buildings, cemeteries, significant water bodies (lakes) etc. This would give an overall 100m wide OHL route corridor. Where there are instances that this is not practical then minimum safeguard distance to residential dwellings would need to meet national standards[6].
- A minimum safeguard distance for towers of at least 20m from rivers, streams, drainage channels, and wetland areas, where the OHL crosses such sensitive receptors.

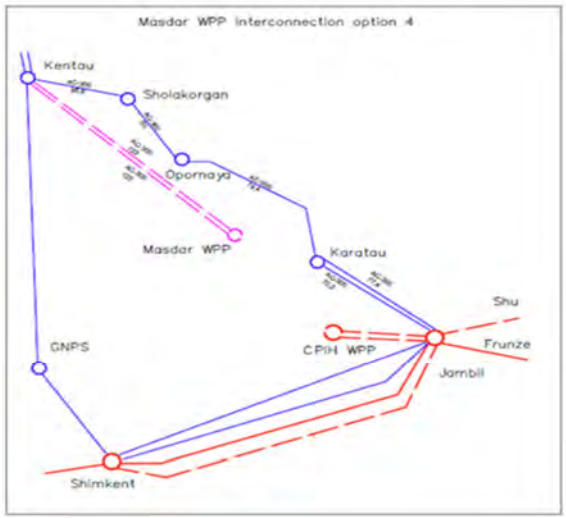
[6] •Not less than 25 meters for 220 kV overhead transmission lines, •Not less than 30 meters for 330–500 kV overhead transmission lines, •Not less than 55 meters for 1150 kV overhead transmission lines - Rules for Establishing Protective Zones of Electrical Network Facilities and Special Conditions for the Use of Land Plots Located Within Such Zones (Order of the Minister of Energy of the Republic of Kazakhstan dated September 28, 2017, No. 330)

Figure 2-26: Grid Connection Options Considered (Juru, 2024)









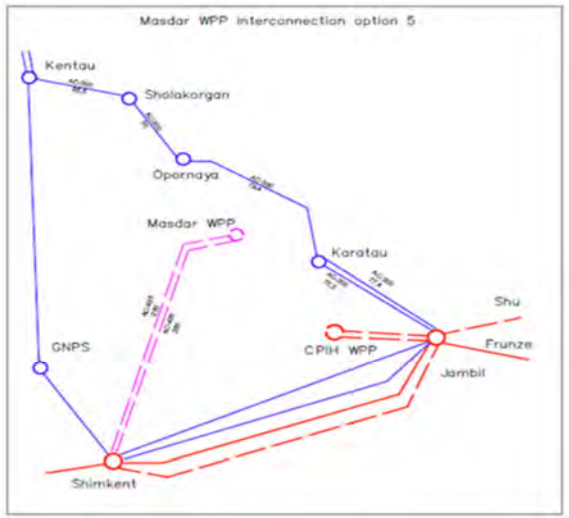


Figure 2-27: OHTL (WPP-Jambyl SS) Route Options Considered

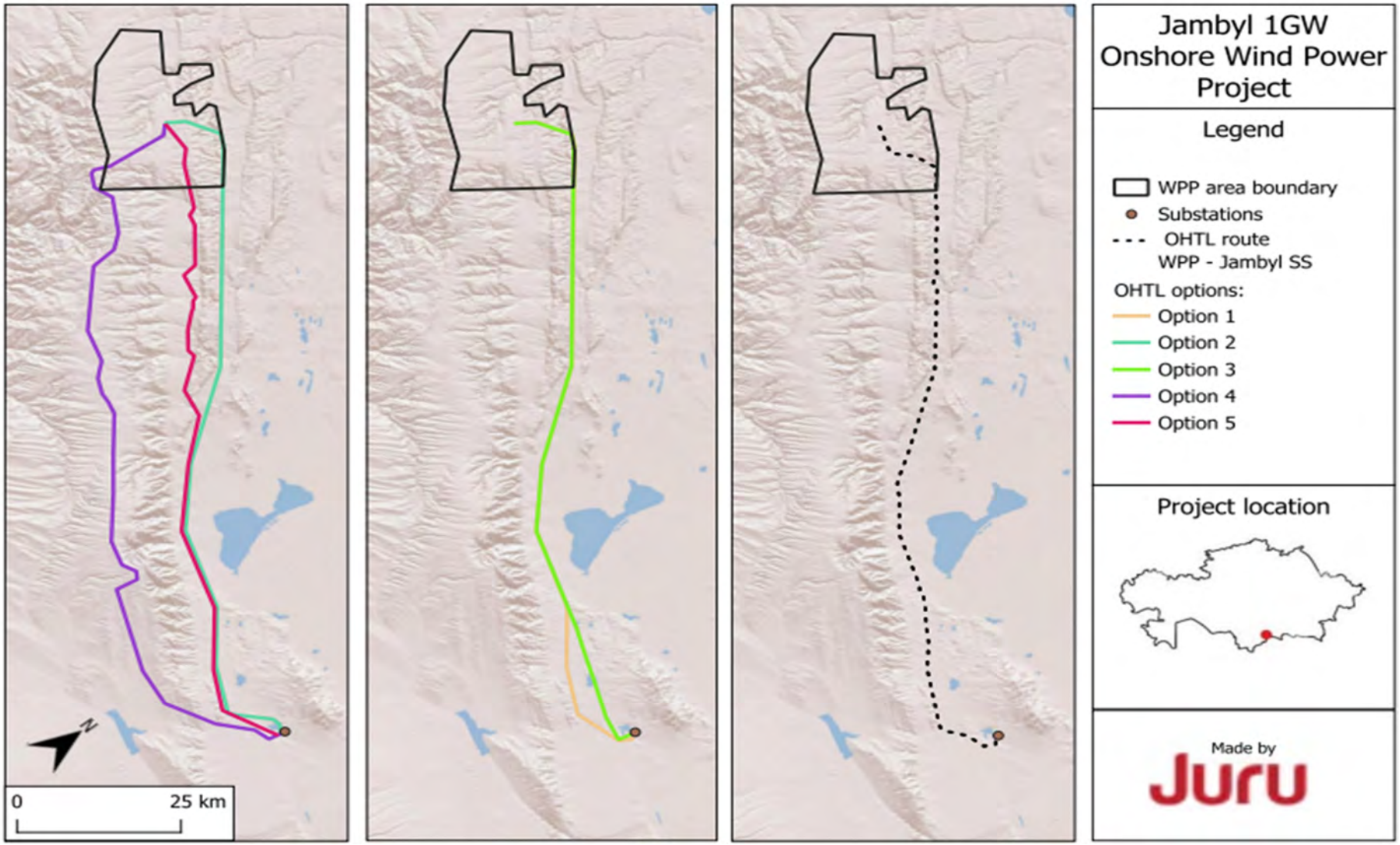


Figure 2-28: OHTL (WPP-Jambyl SS) Route Options Considered

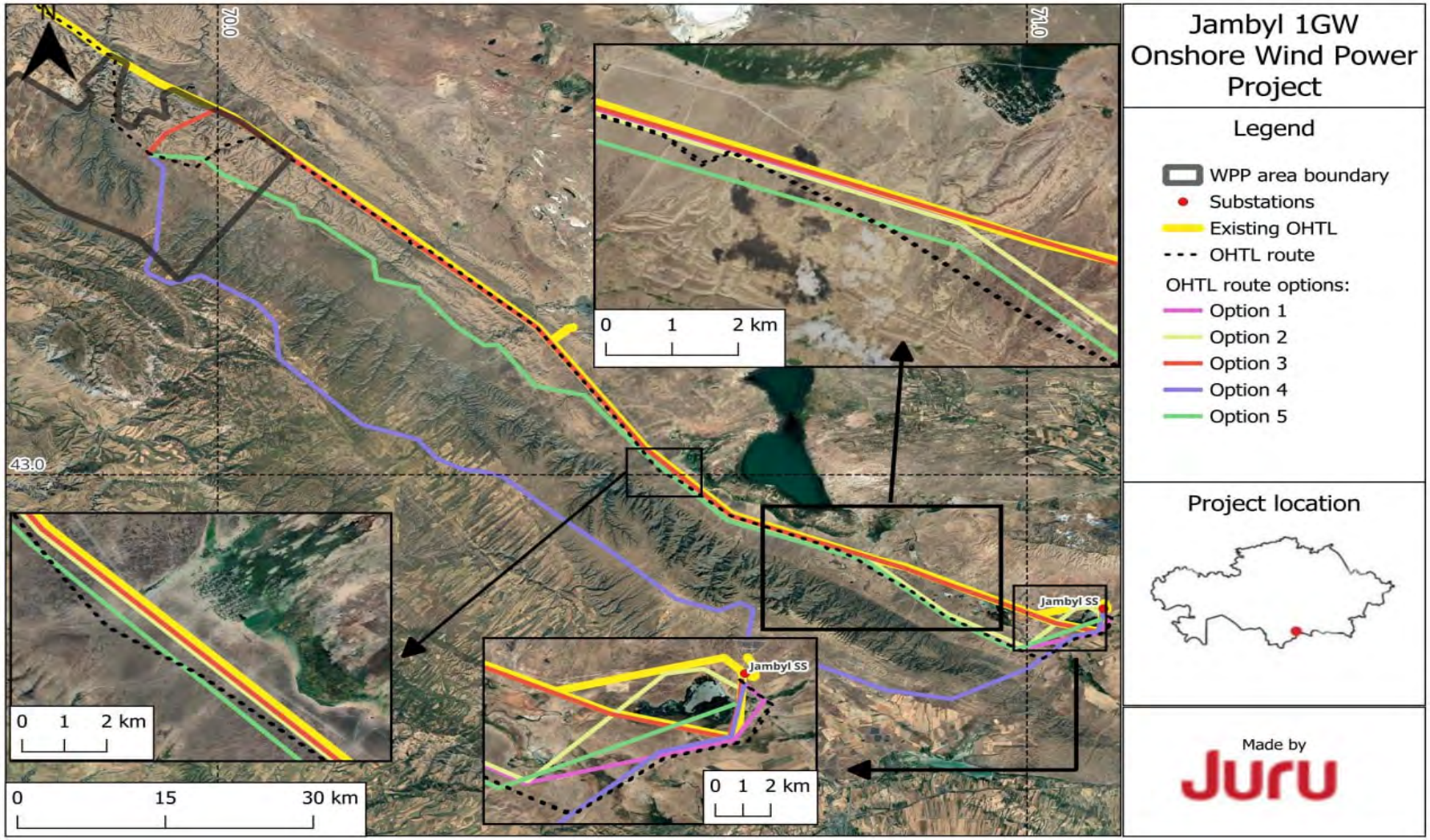


Figure 2-29: OHTL (Opornya SS -Kentau SS) Route Options Considered

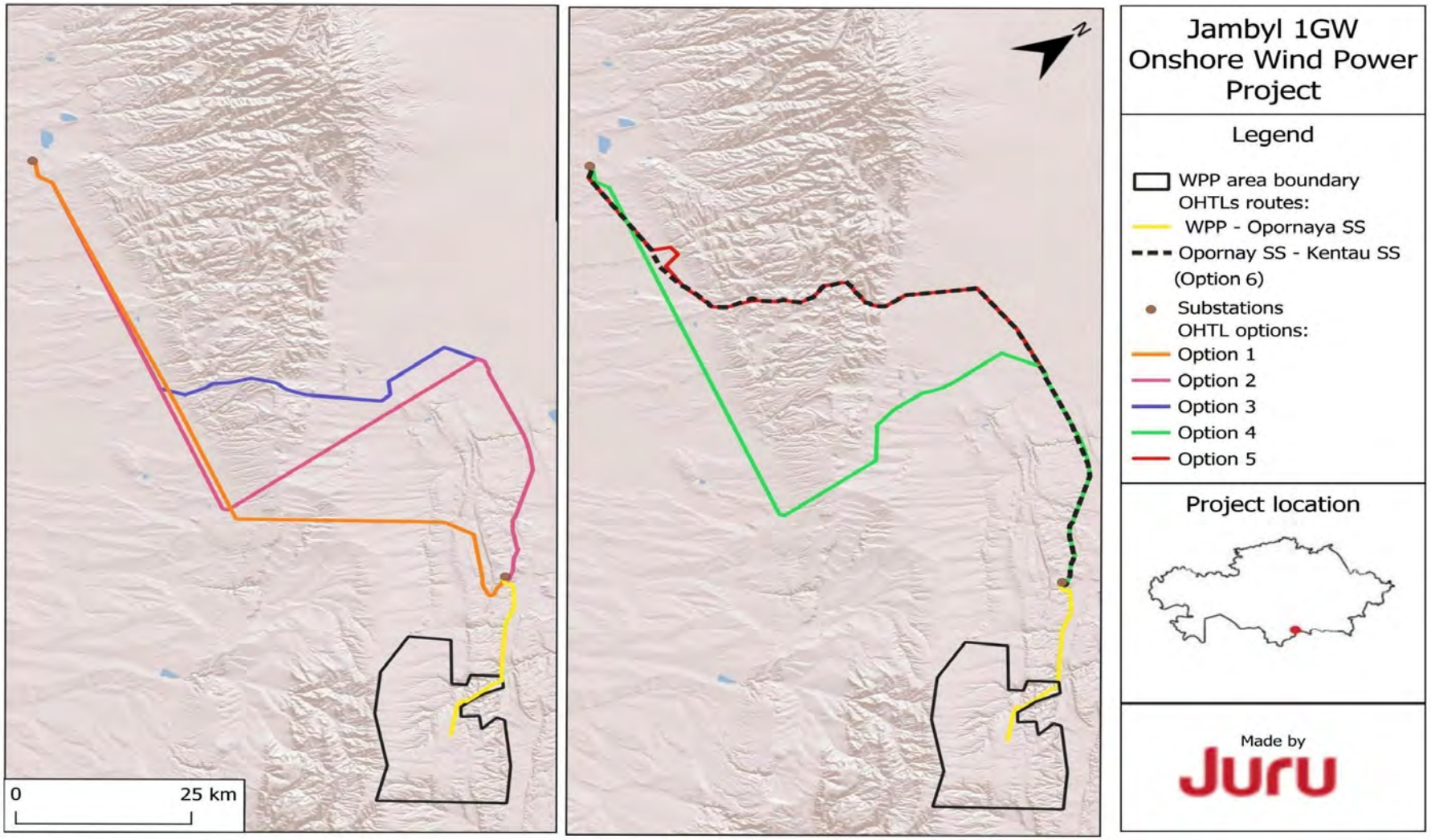
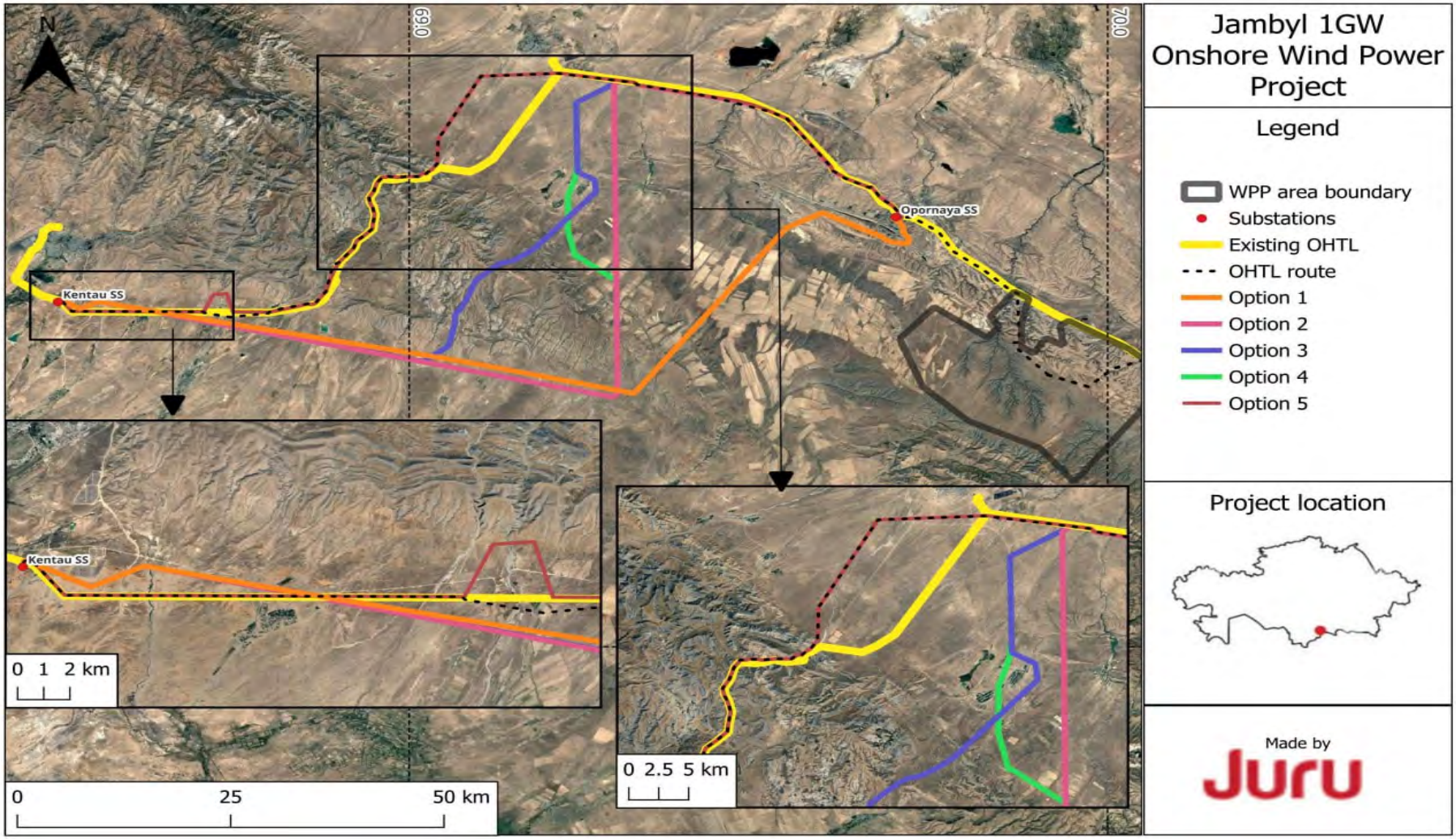


Figure 2-30: OHTL (Opornaya SS -Kentau SS) Route Options Considered


N
690
700
Kentau SS
Opornaya SS
Kentau SS
0 1 2 km
0 2.5 5 km
0
25
50 km
Jambyl 1GW Onshore Wind Power Project
Legend
WPP area boundary
Substations
Existing OHTL
OHTL route
Option 1
Option 2
Option 3
Option 4
Option 5
Project location
Made by
Juru

3 Policy, Legislative and Institutional framework

This section sets out the Kazakh and Lender regulatory framework and standards applicable to the Project.

3.1 Kazakhstan Regulatory Context

3.1.1 Relevant government authorities

Key organizations with responsibility for environmental management in Kazakhstan are:

1 Government of the Republic of Kazakhstan (GRK)
2 Ministry of Ecology and natural resources of the Republic of Kazakhstan (MENR)
3 Environmental Regulation and Control (CERC) Committee, under the Ministry of Ecology and Natural Resources of the Republic of Kazakhstan (MENR)
4 Forestry and Wildlife Committee under the Ministry of Ecology, Geology and Natural Resources of the Republic of Kazakhstan
5 Department for Natural Resources Management and Nature Use Regulation under the Local Executive Authorities (Akimats).

Government of the Republic of Kazakhstan governs the executive body in the Republic of Kazakhstan following the Constitution of the Republic of Kazakhstan (Article 64), and the Constitutional Law of the Republic of Kazakhstan "On the Government of the Republic of Kazakhstan" (latest updated in 2020). The GRK exercises the following main functions:

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

Ministry of Ecology and natural resources of the Republic of Kazakhstan (MENR) is the main regulating body of state administration on environmental protection issues. The primary responsibilities of the MENR include:

- Ensuring the implementation of a unified state policy on environmental safety, environmental protection, and the use and reproduction of natural resources; and
- Enforcing state control over the compliance of ministries, state committees, departments, enterprises, institutions, and organisations, as well as individuals, with respect to the use and protection of land, mineral resources, water, forests, flora and fauna, and atmospheric resources.

The ministry includes departments and committees (including CERC discussed below). Authorities are divided based on natural objects (rivers, forests, soils, etc.) and direct management tasks (audit, policy, management, etc.).

The **Committee for Environmental Regulation and Control (CERC)** of the Ministry of Ecology, Geology and Natural Resources of the Republic of Kazakhstan is engaged in:

- Improving the quality of the environment, ensuring environmental safety, preserving natural resources and achieving a favourable level of environmentally sustainable development of society;
- Improving the system of state regulation in the field of environmental protection and state environmental control within its competence;
- Organization and conduct of state environmental expertise in accordance with the requirements of the current legislation of the Republic of Kazakhstan;
- Organization, coordination, regulation of emissions and implementation of the issuance of environmental permits; implementation of state environmental control.

Forestry and Wildlife Committee under the Ministry of Ecology, Geology and Natural Resources of the Republic of Kazakhstan is engaged in:

- Implementation of State Policy and Oversight Functions in the Field of Protected Areas and Wildlife;
- Responsible for the development and implementation of state policy related to specially protected natural areas (SPNAs), including their establishment and expansion;
- In the field of wildlife protection, the Committee implements state policy on the conservation, reproduction, and sustainable use of wildlife;
- Conducts inspections of wildlife users and ensures compliance with regulations on hunting management, hunting practices, and standards in the field of wildlife protection;
- Oversees the enforcement of protection regimes in the forests of SPNAs and exercises state control over the condition, protection, conservation, and use of SPNAs and the national natural reserve fund.

Department for Natural Resources Management and Nature Use Regulation under the Local Executive Authorities (Akimats) engaged in:

- State regulation and ensuring the rational use of forest and hunting resources, as well as water bodies;
- Participation in the implementation of state policy in the fields of forestry, water management, hunting, and environmental protection;
- Conservation of biodiversity, including flora and fauna, and the protection of typical, unique, and rare landscapes within locally significant specially protected natural areas (SPNAs);
- Implementation of state environmental protection policy;
- Organization and implementation of state environmental expertise within its competence;
- Organization and facilitation of public hearings;
- Ensuring the right of interested members of the public to participate in environmental decision-making processes.

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

- Ministry of Agriculture;
- Ministry of Energy;
- Ministry of Healthcare;
- Ministry of Industry and Infrastructure Development;
- Ministry of Information and Social Development;
- Ministry of Internal Affairs;
- Ministry of Oil and Gas;
- Ministry of Regional Development;
- Ministry of Labour and Social Protection of the Population;
- Ministry of Transport and Communications;
- Ministry of Water Resources and Irrigation;
- Water Resources Committee;
- Forestry and Wildlife Committee.

3.2 Renewable Energy Policy

Kazakhstan is taking tangible steps to create a "green" economy. Laws on wind energy, energy saving, utilization of industrial and solid domestic waste, have been adopted and an Interdepartmental Council has

been established to integrate green economy principles into sectoral policies and for public participation.

On May 30, 2013, Kazakhstan approved the "Concept for the Transition of the Republic of Kazakhstan to a green economy" which was aimed at increasing the innovativeness and competitiveness of the country. Today, the country is implementing the second phase of the Concept. The second phase focuses on the period 2021-2030 and provides measures for the careful use of water, encouragement and stimulation of development and widespread introduction of renewable energy technology.

On February 2, 2023 in Kazakhstan, President Tokayev approved the country's Low-Carbon Development Strategy for Achieving Carbon Neutrality of the Republic of Kazakhstan until 2060. The strategy aims to develop renewable wind, solar and hydropower to help replace existing forms of environmentally unsafe and inefficient energy production.

Over the next 20 years, Kazakhstan plans to implement significant renewal and development of its infrastructure, so there is a unique opportunity for the country to create new infrastructure that will utilize resources efficiently.

In the power sector, the country aims to reach 50% alternative and renewable electricity generation by 2050. Significant investments in the power sector of 50 billion USD by 2030 and about 100 billion USD by 2050 will create employment opportunities for people with scientific, engineering, technical or construction backgrounds. A significant share of these investments - up to 50% - will be in alternative energy sources, so it is expected that new jobs will be created in the high-tech renewable energy sector.

The current economic situation in Kazakhstan that is centred around cities and major extractive industries has created a regional imbalance. Construction of renewable energy projects in remote areas of Kazakhstan allow economic development in these remote areas and allow them to create new industries, and increase the competitiveness of the regions.

The investment required to implement the strategy until 2050 averages 3-4 billion USD annually (or approximately 1% of GDP). It is expected that private investors will provide the majority of the funds required for these investments. It is expected that a little over 90 billion USD will be spent in total on the implementation of energy efficiency measures and development of renewable energy, as well as the creation of gas infrastructure.

3.3 Environmental Law

This constitutional provision was further developed in the Environmental Code of the Republic of Kazakhstan (EC RK), where Article 13 directly provides for the right of individuals to "an environment favourable for their life and health". It should be noted that the right to a favourable environment corresponds to the obligation of the state (state bodies and officials), all legal entities and individuals to take all possible measures to preserve and restore the natural environment.

Since 2007, the Republic of Kazakhstan has had an Environmental Code, which replaced several individual laws. The introduction of this legislative act aims to establish a system of environmental regulation in the country. The latest version of the document was issued in 2021 and currently includes regulations, use, and protection of all components of the natural environment. As well as the constitution, it protects citizens' right to a safe environment and sets out the principles of the state's environmental policy.

Rights of Citizens:

- The right to a favourable environment;
- The right to receive accurate information about the state of the environment;
- The right to participate in decision-making on environmental issues;

- The right to compensation for damage to health or property caused by violation of environmental legislation.

Spheres and Components of the Natural Environment covered by the Code:

- Atmospheric air;
- Water resources;
- Land resources;
- Plant and animal life;
- Specially protected natural areas;
- Production and consumption waste.

Main principles of the Environmental Code are:

- Prevention and control of environmental pollution: establishes environmental quality standards, requirements for emissions and discharges of pollutants, procedures for environmental impact assessment, etc.;
- Waste management: defines the procedures for handling waste, including collection, transportation, processing, and disposal;
- Conservation of biodiversity: establishes measures for the protection of rare and endangered plant and animal species, preservation of ecosystems;
- Economic mechanisms for environmental protection: introduce charges for environmental pollution, environmental taxes, and other instruments. (The main mechanism is "Polluter pays" principle: placing responsibility for environmental pollution on the polluter);
- Principle of public participation: ensuring the possibility for citizens to participate in making environmentally significant decisions.

Furthermore, the Code establishes a system for monitoring the state of the environment and international cooperation in the field of environmental protection. In general, the document comprises 418 articles, covering almost all areas of environmental relations. However, methodological, explanatory, and practical aspects of environmental law may be addressed in subordinate legislative acts.

3.4 National Permitting Process

Before construction begins, projects in Kazakhstan go through three key pre-implementation stages established by national legislation:

- Feasibility Study (TEO) evaluates technical options, economic viability, and project justification.
- Land Acquisition (LA) covers identification, approval, and allocation or withdrawal of land plots required for the project.
- Design and Detailed Engineering (PSD) includes preparation of design documentation and obtaining necessary construction approvals.

The legal framework regulating these project stages in Kazakhstan is defined by the following key laws:

Regulatory Area	Main Legal Acts
On investments and entrepreneurial activity	Entrepreneurial Code No. 375-V ZRK, dated October 29, 2015, and other relevant regulatory legal acts.
On acquisition of land rights	Land Code № 442 dated June 20, 2003
On planning and construction activities	Law On Architectural, Urban Planning and Construction Activities No. 242 dated July 16, 2001
On protection of historical and cultural heritage	Law On the Protection and Use of Objects of Historical

	and Cultural Heritage dated December 26, 2019
On environmental impact assessment (EIA) procedure and requirements for stakeholder engagement and obtaining permits for the construction and operation phases	Environmental Code № 400-VI ЗРК dated January 2, 2021

3.4.1 Feasibility Study (TEO)

The key purpose of surveys and permits at the Technical and Economic Justification (TEO) stage is to justify the project's viability and costs and identify constraints.

Type of survey/permit	Description	Output
Archaeological survey	Archaeological survey must be carried out prior to land allocation to identify historical and cultural heritage sites (Article 30 of the Law "On the Protection and Use of Historical and Cultural Heritage Objects")	Conclusion of the Historical and Cultural Heritage Expertise prepared and issued by a licensed archaeological company
Engineering and geological survey	Engineering and geological surveys assess site conditions for the planned construction and forecast potential changes during construction and operation. (Rules for Conducting Engineering and Geological Surveys, approved by Order No. 509 dated 30 September 2020)	Engineering and geological survey report
Land Acquisition	Land acquisition has been completed	Official documents for a land plots are obtained.
Technical specifications	Application for connection to utilities and infrastructure networks	Technical specification
Statement of Intended Activity - 1 stage of EIA process	This stage includes initial stakeholder engagement and aims to obtain recommendations from authorities and the public for the next stage of the EIA.	Conclusion on the Scope of the EIA permitting document issued by the Committee for Environmental Regulation or its regional department.

After completing all surveys and studies, the results are consolidated and used to develop the Feasibility Study (TEO), which serves as a business case demonstrating to investors that the project is viable and worth funding before proceeding to the land acquisition and detailed design phase (PDD).

3.4.2 Land acquisition

The land acquisition process in Kazakhstan is a multi-stage procedure regulated by the Land Code and related legislation. It aims to ensure that land required for the Project is legally reserved, acquired, or leased in accordance with national regulations, while maintaining compliance with environmental, social, and compensation requirements.

Procedures differ depending on the project component:

- For the main project site (Wind Power Plant – WPP), the process focuses on land reservation, allocation, and conversion from agricultural to industrial use.
- For the Overhead Transmission Line (OHTL), the procedure involves establishing public easement (servitude) rights for linear infrastructure, as well as compensation for temporary and permanent land use impacts.

Land acquisition and permitting for WPPs and OHTLs are carried out in accordance with the Land Code of the Republic of Kazakhstan (2003) and related regulations issued by the Ministry of Agriculture and local Akimats. The process includes land reservation, preparation and approval of the Land Plot Selection Act and Land Survey Project, issuance of Akimat resolutions, and signing of lease agreements.

For OHTLs, a public servitude (easement) is established for tower locations and corridors, with compensation provided to affected land users. All procedures require coordination with relevant state authorities and are finalized through registration of temporary or permanent land use rights in compliance with national legislation.

3.4.3 Project Design Documentation (PDD)

The purpose of the Project Design Documentation (PDD) is to translate the approved technical-economic justification into a detailed, ready-to-build plan. PDD serves as the primary legal and technical document for construction, containing complete working drawings and specifications detailing how the work will be executed, with its main objective being to establish the final, binding estimated cost for tendering, contracting, and project financial control.

Type of survey/permit	Description	Output
Archaeological survey	These studies are required if the area planned for future infrastructure development contains valuable sites such as archaeological monuments or heritage locations. In such cases, archaeological excavations are conducted to identify and remove valuable artifacts for transfer to a museum, and to make the area available for development.	Conclusion of the Historical and Cultural Heritage Expertise prepared and issued by a licensed archaeological company. Alternatively, the project initiator may choose to preserve the identified sites by taking responsibility for their protection during construction, for example, by establishing a buffer zone and implementing a protection commitment.
Engineering and geological survey	Engineering and geological surveys (more detailed) for the development of construction project designs for enterprises, buildings, and structures provide a comprehensive study of the engineering and geological conditions of the selected site (area, plot, or route) and a forecast of their potential changes during the construction and operation periods, with a level of detail sufficient for the development of design solutions. (Rules for Conducting Engineering and Geological Surveys, approved by Order No. 509 dated 30 September 2020)	Engineering and geological survey report
Land Acquisition	Official document for land is not required yet; however, preliminary coordination with the Akimat starts.	Preliminary agreement with Akimat for land use.
Technical specifications	Application for more detailed technical specifications.	Technical specification
EIA (2 stage) -	EIA is a process of identifying, studying,	Authority approval on Environmental

Environmental Impact Assessment	describing, and evaluating the possible significant impacts on the environment. At this stage, public hearings are held, and information about the hearings is announced and disseminated through mass media.	Impact Assessment (EIA), which include possible significant impacts on the environment and requirements that are mandatory for the project initiator.

After completion of all surveys and studies, the Project Design Documentation (PDD) is prepared by a licensed design company based on the approved Feasibility Study (TEO) and the collected baseline data. The PDD is then submitted for review to a state or licensed private expert organization, which conducts a comprehensive examination and issues an Expert Conclusion confirming the project's technical, environmental, and safety compliance.

Once the Expert Conclusion is obtained, the Project proceeds to the Implementation Stage, including construction and commissioning activities.

3.4.4 National Environmental Permitting Process: National EIA procedure.

The most important stage associated with permitting activities for the project is the National EIA. The EIA procedure is established by the Environmental Code of the Republic of Kazakhstan (EC RK) and consists of several important stages:

1) Stage 1 - Statement of Intended Activity (related to Scoping phase of ESIA)

- Preparation of a screening report (Statement of Intended Activity)
- Submission of the screening report to CERC or its regional departments
- Determination of the scope of the EIA by the commission based on the screening.

The **Statement of Intended Activity** (screening) report should include information about the type of planned activity in accordance with Annex 1 of the EC RK (wind farms fall under the category of "Facilities for wind energy utilization for electricity generation with a mast height exceeding 50 meters (WTGs)", power lines under "construction of overhead power transmission lines with a voltage of 220 kilovolts and more and a length of more than 15 km"), general technical solutions, description of the construction stage, list of components of the natural environment that may be affected during the construction and operation of the project.

The application must include an assessment determining the maximum possible impact the facility may have regarding atmospheric emissions, water discharges and consumption, as well as resource mobilization—specifically the number of construction workers, their accommodation, the composition of construction equipment and its working hours, the waste generated, and the proposed waste management methods. For wind farms and power lines, this assessment is primarily required for the construction phase of the project.

It should be noted that the data utilized at this preliminary stage (TEO) may be approximate and is subject to refinement in subsequent design phases.

The screening report is submitted to the CERC in electronic form through the portal https://www.egov.kz/ with the electronic digital signature (EDS) of the future project operator.

The consideration of the screening report takes 20 working days, after which the CERC determines the scope of the EIA materials. The decision on the scope of the EIA is valid for three (3) years.

The conclusion on the Scope of the EIA (1 stage of EIA) identifies additional constraints based on the project

coordinates provided by the project initiator. Relevant government authorities may indicate potential restrictions that have not yet been reflected in the report.

2) Stage 2 – EIA report

- Preparation of EIA materials.
- Submission of EIA materials for consideration by CERC or its regional departments;
- Conducting public hearings in closest settlements;
- Revision of EIA materials in accordance with the comments of the to CERC or its regional departments and public opinion;
- Submission of the final version of EIA materials to the authorized commission for environmental expertise and obtaining a positive conclusion.

Preparation of EIA materials

EIA materials contain a full description of all technological solutions of the project, exact coordinates of the object locations, assessment of environmental impact in accordance with the defined scope by the Commission, specified locations of water acquisition and delivery to the object, wastewater and waste management, as well as measures to reduce negative impacts.

At this stage, the attention is focused on determining the maximum possible impact the facility may have regarding atmospheric emissions, discharges, and water consumption. Furthermore, detailed assessment covers resource attraction, including the exact number of construction personnel, their accommodation, the composition of construction equipment and its working hours, as well as the volume of generated waste and the waste management methods.

Crucially, the data presented at this stage must be precise and substantiated by the final PDD report. For projects like wind farms and power lines, this detailed assessment is primarily required for the construction phase. The findings based on the finalized PDD serve as the definitive basis for obtaining the final construction permits, unlike the earlier TEO stage where data was necessarily approximate.

The sequence of public hearings on the project and submission of EIA for commission review is at the discretion of the client.

3.4.4.1 Public hearings

The Order of the Ministry of Ecology and Natural Resources № 286 “On approval of the rules for public hearings” require projects to conduct a public hearing with relevant organizations as well as local communities to receive their support regarding the Project implementation.

The initiator of public hearings (hereinafter - the Initiator) shall send a letter of request for public hearings through the Information System ecoportal.kz to the Department for Natural Resources Management and Nature Use Regulation under the Local Executive bodies of the relevant administrative-territorial units ‘Akimats’ (oblasts, cities of republican significance, the capital), which are fully or partially located within the affected territory, indicating the proposed places accessible to the public, the date and time of the public hearings.

After receiving approval from the Akimats, the Initiator posts the Announcement in the local Media (newspaper and TV or radio) in two languages: Kazakh and Russian. This announcement must be published no earlier than twenty (20) working days prior to the public hearings.

The Initiator must then submit the Application along with the required documents, the Letter-Approval from the Akimat, and the already published Announcement regarding the planned public hearings in Media.

Concurrently, the Initiator must place posters in crowded locations (such as shops, sports centres, schools) and Akimats to inform the public about the planned hearings.

Five (5) working days before the Public Hearing, a re-announcement must be published in the Media. The Public Hearing must be recorded via video and photo and documented with a Protocol, including evidence of participants' signatures.

Upon completion of the hearings, the Protocol must be signed by the attendees. The results of the Public Hearings, in the form of video and photo documentation, must be posted by the Akimat on ecoportal.kz and its official website no later than two (2) working days after the date of signing. A hearing is considered valid if at least one member of the public attends.

3.4.4.2 Ecological expertise phase

EIA materials are submitted for environmental expertise to the Commission through the portal https://www.egov.kz/ with the electronic digital signature of the future project operator, the review of materials takes five (5) working days. Based on the results of the expertise, the Commission will provide comments on the EIA materials. If significant changes are required as a result of the review, the procedure may require a complete restart with re-submission of the screening report.

If no significant changes are required, the final version of the EIA materials with the comments of the Commission and the public is again submitted through the portal https://www.egov.kz/, supported by EDS, and with a review period of five (5) days. The result of the review is obtaining a positive conclusion from the Commission on the EIA materials.

The project developer is responsible for obtaining the Environmental Impact Assessment (EIA) permit because implementation without State approval on Environmental Impact Assessment (EIA) prohibited.

Subsequently, during the construction phase, the EPC contractor must follow recommendations of Environmental regulations Committee, or its reginal Department provided in their approval on EIA for construction stage, obtain licenses for emissions, water use, and waste management.

During the operational phase, the operating company must secure these licenses depending on the presence of activities or negative impacts. The operating company follows recommendations of Environmental regulations Committee or its regional Department for operation stage.

3.5 Applicable E&S Legislation and Standards

Kazakhstan has enacted a comprehensive framework of environmental and social (E&S) legislation and regulatory standards governing environmental protection, land use, occupational health and safety, and social welfare. Together, these instruments provide the foundation for environmental management and sustainable development across the country.

Kazakhstan has implemented National Environmental Standards (NES) aimed at overseeing environmental quality and ensuring public health. NES refers to the environmental quality standards developed and revised in accordance with Article 36 of the Environmental Code of the Republic of Kazakhstan. These standards are not a standalone piece of legislation, but are instead established through secondary regulations — specifically, the Rules on the Development and Revision of Environmental Quality Standards, adopted under Paragraph 15 of Article 36 of the Code.

These standards define permissible levels of chemical, physical, and biological indicators of environmental quality and are developed separately for: ambient air, surface and groundwater, soils and land, physical impacts (noise, vibration, electric, electromagnetic, magnetic fields, radiation, heat).

The NES serve as a regulatory tool to ensure a healthy environment and minimize adverse effects on human

health and ecosystems, forming a critical component of state environmental regulation. Since 2021, the government has been working on strengthening and updating these standards in line with good international practice.

In addition to the NES, Kazakhstan's legal framework includes a number of social and labour-related laws and regulations designed to protect the rights, health, and wellbeing of workers and communities. Key instruments include the Labour Code of the Republic of Kazakhstan (2015, as amended), which governs employment conditions, worker rights, and occupational health and safety; the Law on Occupational Safety and Health (2004, as amended); and the Law on Public Health and the Healthcare System (2020), which establishes requirements for workplace hygiene, worker protection, and public health standards. Legislation relating to social protection, land acquisition and compensation, gender equality, and community welfare also forms part of the broader E&S governance framework. Collectively, these instruments ensure alignment with international conventions ratified by Kazakhstan, including core International Labour Organization (ILO) conventions and human rights commitments.

To avoid duplication and provide greater relevance to each technical discipline, detailed descriptions of applicable national environmental and social legislation, standards, and regulatory requirements are presented within the corresponding topic chapters of this ESIA (e.g., Air Quality, Noise, Biodiversity, Waste Management, etc.). Each chapter identifies the national laws, regulations, and standards pertinent to the specific environmental or social component under assessment, together with any relevant international or lender requirements, to ensure that the legislative context is directly linked to the assessment of each topic.

3.6 International Conventions and Agreements

Below is a list of International Conventions to which the Republic of Kazakhstan is a signatory:

Kazakhstan has ratified all 8 fundamental conventions, they are listed below:

- Convention No. 29 on Forced or Compulsory Labor, 1932;
- Convention No. 87 on Freedom of Association and Protection of the Right to Organize, 1948;
- Convention No. 98 on the Application of the Principles of the Right to Organize and Collective Bargaining, 1949;
- Convention No. 100 concerning Equal Remuneration for Men and Women Workers for Work of Equal Value, 1951;
- Convention No. 105 concerning the Abolition of Forced Labor, 1957;
- Convention No. 111 concerning Discrimination in respect of Employment and Occupation, 1958;
- Convention No. 138 concerning Minimum Age for Admission to Employment, 1973;
- Convention No. 182 concerning the Prohibition and Immediate Action for the Elimination of the Worst Forms of Child Labor, 1999.
- Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters. Aarhus, Denmark, 25 June 1998.

Kazakhstan has ratified 4 direct conventions, listed below:

- Convention No. 81 concerning Labor Inspection in Industry and Commerce, 1947;
- Convention No. 122 concerning Employment Policy, 1964;
- Convention No. 129 concerning Labor Inspection in Agriculture, 1969;
- Convention No. 144 concerning Tripartite Consultations for the Promotion of International Labor Standards, 1976.

Kazakhstan has ratified 178 Technical Conventions, the 13 conventions that are relevant to the Project are listed below:

- Convention No. 26 on the Establishment of a Minimum Wage Procedure, 1928;
- Convention No. 88 concerning the Organization of the Employment Service, 1948;
- Convention No. 95 concerning the Protection of Wages, 1949;
- Convention No. 135 concerning the Protection of the Rights and Facilities of Workers' Representatives in the Enterprise, 1971;
- Convention No. 148 concerning the Protection of Workers against Occupational Hazards Caused by Air Pollution, Noise and Vibration in the Workplace, 1977;
- Convention No. 155 concerning Occupational Safety and Health and the Working Environment, 1981;
- Convention No. 156 concerning Equal Treatment and Equal Opportunities for Men and Women Workers: Workers with Family Responsibilities, 1981;
- Convention No. 162 concerning Occupational Safety and Health in the Use of Asbestos, 1986;
- Convention No. 167 concerning Occupational Safety and Health in Construction, 1988;
- Convention No. 183 revising the Maternity Protection Convention (Revised), 1952, 2000;
- Convention No. 185 revising the Seafarers' Identity Documents Convention, 1958, 2003;
- Convention No. 187 on Fundamentals Promoting Occupational Safety and Health, 2006.
- Convention for the Safeguarding of the Intangible Cultural Heritage, 2003
- violence in the Republic of Kazakhstan" (signed on June 10, 2019 in Nur-Sultan).

3.7 International Lender Requirements

3.7.1 International Finance Corporation (IFC)

IFC Policy on Environmental and Social Sustainability (2012) sets out a series of Performance Standards (PS). PS relate to various elements of social and environmental assessment and management and are listed as follows:

- Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts;
- Performance Standard 2: Labour and Working Conditions;
- Performance Standard 3: Resource Efficiency and Pollution Prevention;
- Performance Standard 4: Community Health, Safety, and Security;
- Performance Standard 5: Land Acquisition and Involuntary Resettlement;
- Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources;
- Performance Standard 7: Indigenous Peoples;
- Performance Standard 8: Cultural Heritage.

The requirement of each Performance Standard is summarized below:

PS 1: Assessment and Management of Environmental and Social Risks and Impacts

A key objective of PS1 is to identify and evaluate environmental and social risks and impacts of the project, adopting mitigation measures hierarchy to anticipate, minimise, avoid and/or compensate for potential impacts. This is most commonly achieved through the production of an ESIA for the project, including a framework Environmental and Social Management Plan (ESMP) summarising mitigation and management measures to be implemented.

The PS requires the development of an Environmental and Social Management System (ESMS) that entails a methodological approach to managing environmental and social risks and impacts in a structured way on an ongoing basis. It also requires the establishment of an organisational structure that defines roles, responsibilities, and authority to implement the ESMS, as well as a system for the monitoring of identified

E&S impacts and of the implementation and efficacy of the ESMS.

As part of PS1 requirements the project is required to engage with its main contractors, such as the EPC and O&M contractors, in order to either bridge the contractors ESMS systems with the project proponent or include the project proponent's own ESMS requirements as contractual obligations for the contractors.

Information Disclosure and Stakeholder Engagement

This PS recognises the importance of an open and transparent engagement between the client, its workers, local communities directly affected by the project and, where appropriate, other stakeholders as an essential element of good international practice (GIP) and corporate citizenship.

To comply with this PS, identification of individuals and groups that may be differentially or disproportionately affected by the Project should be undertaken and appropriate forms of engagement for each separate group of stakeholders identified. This information should be included in a project Stakeholder Engagement Plan (SEP), which should present a systematic approach to the stakeholder engagement process, detailing any consultation undertaken to date, including outcomes, and describing how communication with identified stakeholders will be handled throughout project preparation and implementation. A grievance procedure should be included in the SEP, which enables concerns to be addressed promptly, effectively and transparently, and in a culturally appropriate manner.

The PS also requires adequate and meaningful disclosure of information through general public access to details of the Project, including the purpose, nature, scale and duration of the Project, associated potential impacts on stakeholders, details of planned stakeholder engagement and the grievance procedure.

PS 2: Labour and Working Conditions

The requirements in this PS have been in part guided by a number of international conventions and instruments, including those of the International Labour Organization (ILO) and the United Nations (UN)

The client is required to ensure the fair treatment, non-discrimination and equal opportunity of workers, and compliance with national labour and employment laws. The PS also addresses child labour and forced labour, and promotes safe and healthy working conditions, protecting and promoting the health of workers by recognising the role of employees.

This PS applies to workers directly engaged by the client (direct workers), workers engaged through contractors and subcontractors (third party workers) and workers engaged by the client's primary suppliers (supply chain workers).

Compliance with this PS will require the provision of an adequate Human Resources (HR) Policy accompanied by a project Labour and Local Employment Plan (LLEP), which should focus on the process and maximizing local employment and specify the required working conditions. As well as appropriate management plans and procedures relating to occupational H&S.

Grievance Mechanism

Compliance with this PS will also require the provision a grievance mechanism for workers to raise workplace concerns. The mechanism should involve an appropriate level of management and address concerns promptly, using an understandable and transparent process that provides timely feedback to those concerned, without any retribution. The mechanism should also allow for anonymous complaints to be raised and addressed.

PS 3: Resource Efficiency and Pollution Prevention

This PS aims to abate pollution to air, water, and land that may threaten people and the environment at the local, regional, and global levels and requires appropriate management of wastes, resource use and emissions.

The PS promotes the ability of private sector companies to adopt such technologies and practices, as far as their use is feasible in the context of a project that relies on commercially available skills and resources; such technologies include the use of renewable energy. By harnessing wind energy to generate electricity, the proponent is generally inherently in line with this PS3 as it helps to prevent pollution and reduce global warming by displacing use of non-renewable energy sources as well as promoting clean technology.

PS 4: Community Health, Safety and Security

The role of this PS is to anticipate and avoid adverse impacts on the health and safety of the affected communities during the life of the project from both routine and non-routine circumstances, including project security, and to safeguard personnel and property in accordance with relevant human rights principles and in a manner that avoids or minimises risks to affected communities. Influx of temporary or permanent project labour may result increase in communicable diseases, availability of resources and ecosystem services and crime rates. The client is required to identify those risks and potential impacts and avoid or minimize those risk.

PS 4 requires the implementation of appropriate management plans and procedures relating to community H&S, project traffic, emergency response and security.

PS 5: Land Acquisition and Involuntary Resettlement

PS 5 deals with land acquisition and resettlement of people that may have been dependent on the land to be used and impacted by the project.

Involuntary resettlement refers both to physical displacement (relocation or loss of shelter) and to economic displacement (loss access to assets that leads to loss of livelihood) as a result of project-related land acquisition and/or restrictions on land use. Where relevant, this PS requires the implementation of appropriate resettlement measures or alternative compensation for loss of assets/livelihood.

This PS requires the implementation of the following elements in relation to land acquisition and resettlement:

- Consideration of alternative project designs in order to balance the potential for minimising displacement with other parameters, such as environmental, social and financial costs;
- Offer displaced communities and persons compensation for loss of assets at full replacement cost and other assistance to help them improve or restore their standards of living and livelihoods, with all compensation standards to be transparent and applied consistently to all communities and persons;
- Engage with Affected Communities, including host communities, through the process of stakeholder engagement described in PS1;
- Establish a grievance mechanism as early as possible in the project development phase to allow the Project to receive and address specific concerns about compensation and relocation;
- Carry out a census to collect appropriate socio-economic baseline data to identify the persons who will be displaced by the project, determine who will be eligible for compensation and assistance, and discourage ineligible persons, such as opportunistic settlers, from claiming benefits;
- Organise consultation to collect adequate and sufficient data to assess whether the quality of life and livelihoods are restored after the resettlement process is completed;

- Develop a Resettlement Action Plan, including compensation for land and other assets lost, providing mitigation measures against negative impacts of displacement, identifying development opportunities; developing a resettlement budget and schedule, paying particular attention to the needs of the poor and the vulnerable;
- Develop a Livelihood Restoration Plan to compensate affected persons and/or communities and offer other assistance, in the case of projects involving economic displacement only.

PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources

This PS addresses how clients can sustainably manage and mitigate impacts on biodiversity and ecosystem services based on the Convention on Biological Diversity. It requires adequate assessment of local biodiversity and living natural resources, including the identification of protected areas, habitats and species. Where appropriate, ecological management measures should be implemented to ensure the avoidance, minimisation or restoration of impacts on local biodiversity and ecosystem services.

Development projects should also adopt a practice of adaptive management in which the implementation of mitigation and management measures are responsive to changing conditions and the results of monitoring throughout the project's lifecycle.

PS 7: Indigenous Peoples

PS 7 deals in safeguarding Indigenous Peoples, defining indigenous vulnerable segments of the population. The PS recognizes that Indigenous Peoples, as social groups with identities that are distinct from mainstream groups in national societies, are often among the most marginalized and vulnerable segments of the population. PS 7 is not applicable to this Project.

PS 8: Cultural Heritage

Cultural heritage, according to this PS, refers to tangible and intangible forms. Tangible forms can include objects, sites or structures having archaeological, paleontological, cultural or religious value, including unique natural features such as sacred groves and other valued geographical features. Intangible forms of culture include cultural knowledge, innovations, and practices of communities embodying traditional lifestyles, which a project developer may propose to use for commercial purposes.

The PS recognizes the importance of cultural heritage for current and future generations. Consistent with the Convention Concerning the Protection of the World Cultural and Natural Heritage, it aims to ensure that clients protect cultural heritage in the course of their project activities.

Based on our initial review of the Project, we consider that it would be categorized as Category A Project: "Business activities with potential significant adverse environmental or social risks and/or impacts that are diverse, irreversible, or unprecedented." As defined by IFC under IFCs Policy on Environmental and Social Sustainability.

All the above IFC PS standards are applicable to Project save for PS 7: Indigenous Peoples, as there are no indigenous peoples present in the project area.

3.7.2 World Bank Group Guidelines

The IFC PSs refer to the World Bank Group (WBG) Environment, Health and Safety (EHS) Guidelines as general guidance for implementing GIIP. The EHS Guidelines applicable to the Project include the following:

- WBG General EHS Guidelines (April 2007) – cover the four areas of the environment; Occupational Health & Safety (OHS); Community Health & Safety (CHS); construction and decommissioning;

- WBG EHS Guidelines for Wind Energy (IFC, 2015);
- WBG EHS Guidelines Electric Power Transmission and Distribution (April 2007).

The WBG EHS Guidelines for Wind Energy define the environmental impacts associated with the construction, operation, and decommissioning of wind energy facilities activities including impacts on the physical environment (such as landscape, visual impacts, noise, shadow flicker, water quality) and biodiversity (affecting birds and bats). The Guidelines also highlight logistical challenges posed by transport of equipment and materials, including long, rigid structures such as blades and heavy tower sections.

In particular the guidelines set the following relevant quantitative requirements: Turbines must be sited at an acceptable distance ("setback") between wind turbines and adjacent sensitive receptors to maintain public safety in the event of ice throw or blade failure. The minimum setback distance for wind turbines is 1.5 times the turbine height (tower + rotor radius). We have set this distance for this Project at 375 m based on the Envision 11MW WTG (as the worst scenario) with a hub height of 145 m rotor radius of 105 m.

The WBG EHS Guidelines requires that noise levels at the receptors should not exceed the noise levels set by World Health Organization (WHO) Guidelines for Community Noise or result in a maximum increase in background levels of 3 dB at the nearest receptor off-site. It should be noted that IFC Guidelines do not set noise limits for construction activities.; this is further discussed in Section 11 (Noise).

WBG EHS Guidelines for Wind Energy Sector recommends that the predicted duration of shadow flicker effects experienced at a sensitive receptor should not exceed 30 hours per year and 30 minutes per day on the worst affected day, if it is not possible to locate the wind energy facility/turbines such that receptors experience no shadow flicker effects; this is further discussed in Section 12 (Shadow Flicker).

WGB EHS guideline Electric Power Transmission and Distribution covers EHS aspects relevant to power transmission between a generation facility and a substation located within an electricity grid and covers general EHS issues. Of particular note the guidelines refer to International Commission on Non-Ionizing Radiation Protection (ICNIRP), which establish allowable levels for public exposure to electric field as 5 kV/m and for magnetic fields of 100μT. This is less stringent that Kazak requirements of electric field strength not to exceed 1 kV/m outside of the Sanitary Protection Zones, and therefore the National standard applies; this is further discussed in Section 7 (Community Health, Safety & Security).

3.7.3 Asian Infrastructure Investment Bank (AIIB) Environmental and Social Framework (ESF) (June 2024)

The Asian Infrastructure Investment Bank (AIIB) applies its Environmental and Social Framework (ESF, 2024) to ensure that all projects it finances are environmentally and socially sustainable. The ESF sets out mandatory requirements through the Environmental and Social Policy (ESP), three Environmental and Social Standards (ESSs), and an Environmental and Social Exclusion List (ESEL).

Overall the requirements of the ESF are aligned with that of IFC PSs (as outlined above) relating to identification of impacts, the requirement to develop and implement plans to avoid, minimize, mitigate, or compensate for the potential adverse impacts; and to ensure affected people are informed and consulted during project preparation and implementation.

The ESP defines the overarching principles and requirements that borrowers (clients) must meet to manage environmental and social (E&S) risks and impacts effectively. It promotes the sustainable development of infrastructure by ensuring that environmental and social considerations are integrated throughout the project lifecycle — from identification and design to implementation and operation.

The AIIB's three ESSs provide detailed requirements to implement the Policy, and are as follows:

1. **ESS 1 – Environmental and Social Assessment and Management:**

Requires borrowers to carry out an environmental and social assessment proportional to the project's risk category. It aims to identify and evaluate potential impacts, propose measures to avoid, minimise, mitigate, or offset adverse effects, and strengthen environmental and social management capacity. Projects are required to apply the World Bank Group Environmental, Health and Safety (EHS) Guidelines as a technical reference for pollution control, occupational and community health and safety, and resource efficiency.

2. **ESS 2 – Land Acquisition and Involuntary Resettlement:**

Seeks to avoid or minimise involuntary resettlement wherever possible. When unavoidable, it requires the borrower to compensate affected persons at full replacement cost and to restore, and preferably improve, their livelihoods and living standards. Stakeholder consultation and grievance mechanisms are mandatory components of the resettlement process.

3. **ESS 3 – Indigenous Peoples:**

Ensures that Indigenous Peoples are respected, that adverse impacts on their communities are avoided or minimised, and that they receive culturally appropriate benefits from the project. Where projects are likely to have impacts on Indigenous Peoples, the borrower is required to conduct a process of meaningful consultation and, where relevant, obtain their Free, Prior and Informed Consent (FPIC). As previously noted this ESS is not triggered for the Project as there are no indigenous peoples within the project area of influence.

The Environmental and Social Exclusion List (ESEL) specifies activities that AIIB will not finance, including those involving harmful child labour, forced labour, or trade in illegal wildlife or hazardous substances.

Projects are categorised based on their potential E&S risks and impacts:

- Category A: Projects with potentially significant, irreversible or unprecedented impacts, often extending beyond the site boundaries.
- Category B: Projects with limited, site-specific impacts that are largely reversible and can be mitigated using standard practices.
- Category C: Projects with minimal or no adverse E&S impacts.
- Category FI: Financial intermediary operations, where the intermediary applies an environmental and social management system consistent with the ESF.

The above categorisation is aligned with that of the IFC, using a risk-based approach (Categories A, B, C and FI) to reflect the nature, scale and significance of potential environmental and social impacts.

3.7.4 Equator Principles

The Equator Principles (EP) is a risk assessment framework used by financial institutions to determine, assess and manage the environmental and social risk in Projects financing.

The purpose of the Equator Principles is to enable the Equator Principles Financial Institution ('EPFI') signatories to encourage their clients to address potential or actual adverse risks and impacts identified during the Project development lifecycle, and to ensure projects are developed in a manner that is socially responsible and reflects sound environmental management practices. The Equator Principles are intended to serve as a common baseline and framework for EPFIs to identify, assess and manage environmental and social risks when financing Projects. 131 financial institutions globally are Signatories to the Equator Principles.

The EP4 represents the latest update which was released on 18/11/2019 and came into force on all mandated transactions on 01/10/2020. EP4 comprises 10 core principles, as follows:

- Principle 1: Review and categorization;

- Principle 2: E&S Assessment;
- Principle 3: Applicable E&S Standards;
- Principle 4: E&S Management System and EP Action Plan;
- Principle 5: Stakeholder Engagement;
- Principle 6: Grievance Mechanism;
- Principle 7: Independent Review;
- Principle 8: Covenants;
- Principle 9: Independent Monitoring and Reporting;
- Principle 10: Reporting and Transparency.

The Project is considered a Category A Project under the Equator Principles version 4: "Projects with potential significant adverse environmental and social risks and/or impacts that are diverse, irreversible or unprecedented."

As such, it must apply the requirements of the applicable IFC PSs and WBG EHS Guidelines as defined above. The project must also implement effective stakeholder engagement, grievance management and an Environmental and Social Management System (ESMS). EP4 also sets out specific requirements relating to Human Rights in line with the United Nations Guiding Principles on Business and Human Rights (UNGPs) by carrying out Human Rights Due Diligence (HRDD) and improving the availability of climate-related information, such as the Recommendations of the Task Force on Climate-related Financial Disclosures (TCFD) to incorporate a Climate Change Risk Assessment (CCRA) for the assessment of potential transition and physical risks of Projects.

3.7.5 Good International Industry Practice (GIIP)

The Project will also follow GIIP, including, but not limited to:

- Voluntary Principles on Security and Human Rights (est. 2000) (http://www.voluntaryprinciples.org/);
- International Labour Organisation (ILO) standards (https://www.ilo.org/international-labour-standards);
- United Nations Guiding Principles for "Protect, Respect and Remedy" Human Rights Framework (2011); (https://www.business-humanrights.org/en/un-secretary-generals-special-representative-on-business-human-rights/un-protect-respect-and-remedy-framework-and-guiding-principles);
- United Nations Code of Conduct for Law Enforcement Officials; and (https://www.un.org/ruleoflaw/blog/document/code-of-conduct-for-law-enforcement-officials/);
- United Nations Basic Principles on the Use of Force and Firearms by Law;
- Use of Security Forces: Assessing and Managing Risks and Impacts (February 2017);
- Worker's Accommodation: Processes and Standards (Guidance Note by IFC and EBRD, 2009), and
- Stakeholder Engagement: A Good Practice Handbook for Companies Doing Business in Emerging Markets, 2007.

Where relevant, the ESIA will identify keys gaps between national and Lender requirements with the more stringent applied as the Project standard. The ESIA will focus on full compliance with all the Lender requirements. A separate National EIA is also being developed as part of the environmental approval and permitting of the Project, which will focus on compliance with National requirements and standards. The National EIA is scheduled to be completed prior to completion of the Lender compliant ESIA; and any requirements or recommendations made within the National EIA will be incorporated within the Lender ESIA, with the more stringent standard or requirement applied.

4 Assessment Methodology

4.1 General Approach and Methodology

For the topics scoped into the ESIA, the impact assessment process will consider the magnitude of the impact and the sensitivity of the receiving environment to evaluate the overall significance of the impact. A framework for assigning magnitude, sensitivity and impact significance is described below. For each E&S topic the proposed mitigation and management measures are considered to give an overall residual impact significance conclusion.

Where relevant, the anticipated impact was compared against appropriate legal requirements and standards. Where no such standards exist, assessment methods involving interpretation and the application of professional judgement were employed.

4.2 Impact Assessment Methodology

Impact identification and assessment starts with scoping and continues through the remainder of the ESIA Process. Interactions with the potential for significant effects are subjected to a detailed impact assessment. The principal ESIA steps comprise the following:

- **Impact prediction**: to determine what could potentially happen to resources or receptors as a consequence of the Project and its associated activities – potential impacts are identified during the ESIA scoping phase.
- **Impact evaluation**: to evaluate the significance of the predicted impacts by considering their magnitude and likelihood of occurrence, and the sensitivity, value and/or importance of the affected resource or receptor.
- **Mitigation and enhancement**: to identify appropriate and justified measures to mitigate negative impacts and enhance positive impacts.
- **Residual impact evaluation**: to evaluate the significance of impacts assuming effective implementation of mitigation and enhancement measures.

4.3 Predicting the Magnitude of Impacts

4.3.1 Identification and Characterisation of Impacts

An 'impact' is any change to a resource or receptor caused by the presence of a project component or by a project-related activity. Impacts can be negative or positive and are described in terms of their characteristics, including the impact's type and the impact's spatial and temporal features (namely extent, duration, scale and frequency). Impact characteristics are defined in the subsections below.

Type of Impact

- **Direct**: applies to an impact which can be clearly and directly attributed to a particular environmental or social parameter (e.g. dust generation directly affects air quality).
- **Indirect**: applies to impacts which may be associated with, or subsequent to, a particular impact on a certain environmental or social parameter (e.g. high levels of dust could entail nuisance and health effects to workers on site).
- **Induced**: applies to impacts that result from other activities (which are not part of the Project) that happen as a consequence of the Project.
- **Cumulative**: applies to impacts that arise as a result of an impact and effect from the Project interacting with those from another activity to create an additional impact and effect.

Duration of impact

- **Temporary** - applies to impacts whose effects are limited to a period of less than 3 years, or only associated with Project pre-construction or construction phases.
- **Short-term**: applies to impacts whose effects are limited to a five year period.
- **Long-term**: applies to impacts whose effects last longer than a period of five years, but limited to within the project lifetime.
- **Permanent**: applies to impacts whose effects last longer than the life of project – i.e. irreversible.

Extent of impact

- **On-site**: impacts that are limited to the Project site.
- **Local**: impacts that are limited to the Project site and adjacent properties.
- **Regional**: impacts that are experienced at a regional scale.
- **National**: impacts that are experienced at a national scale.
- **Trans-boundary/International**: impacts that are experienced outside of Kazakhstan.

Scale of impacts

The scale of an impact is a measure, such as the size of the area damaged/impacted or the fraction of a resource that is lost/affected, or degree of change to a household level livelihood, individual or household quality of life etc. It can be described using numerical values and units rather than assigned fixed designations; however, the following designations will apply:

- **Not distinguishable**: hardly measurable change from the baseline conditions or impacts affect a limited amount of the specific component or impacts are likely to be well within statutory limits or ambient/seasonal range.
- **Distinguishable**: change from baseline conditions or impacts affect a small portion of a specific component or impacts are expected to be within/close to statutory limits or ambient seasonal range.
- **Evident**: difference from baseline conditions or impacts affect a substantial portion of a specific component or impacts are likely to result in occasional exceedances of statutory limits or ambient seasonal range (over limited periods).
- **Major**: change in comparison to baseline conditions or impacts affect the entire or significant portion of a specific component or impacts are likely to result in routinely exceedances of statutory limits or ambient seasonal range (over extended periods).

Frequency of impacts

The frequency of an impact the measure of the constancy or periodicity of an impact, described using numerical values or a qualitative description, as follows:

- One-off
- Intermittent
- Continuous.

Likelihood

Likelihood is a measure of the degree to which an unplanned event (e.g. incidents, spills) is expected to occur. The likelihood of an unplanned event occurring is determined qualitatively, or when data is available, semi-quantitatively. Definitions of likelihood as applied in the ESIA are provided as follows:

- **Unlikely**: The event is unlikely but may occur at some time during normal operating conditions.
- **Possible**: The event is likely to occur at some time during normal operating conditions.
- **Likely**: The event will occur during normal operating conditions (i.e. it is essentially inevitable).

4.3.2 Magnitude of Impact

Once impacts are characterised (see above) they are assigned a 'magnitude'. Magnitude is typically a function of some combination (depending on the resource/receptor in question) of the following impact characteristics:

- duration
- extent
- scale
- frequency.

Magnitude (from small to large) is a continuum. Evaluation along the continuum requires professional judgement and experience. Each impact is evaluated on a case-by-case basis and the rationale for each determination is noted. Magnitude designations for negative effects are:

- negligible,
- small,
- medium and
- large.

The magnitude designations themselves are universally consistent, but the definition for the designations varies by issue.

The magnitude of the potential impact is determined based on the professional judgement of the specialist undertaking the assessment or by quantitative means where possible (e.g. modelling and comparison against legislative standards) considering the criteria above.

In the case of a positive impact, no magnitude designation is assigned as it is considered sufficient for the purpose of the impact assessment to indicate that the Project is expected to result in a positive impact.

Some impacts will result in changes to the environment that may be immeasurable, undetectable or within the range of normal natural variation. Such changes are regarded as having no impact, and characterised as having a negligible magnitude.

In the case of impacts resulting from unplanned events, the same resource/receptor-specific approach to concluding a magnitude designation is used. The likelihood factor is also considered, together with the other impact characteristics, when assigning a magnitude designation.

Table 4-1: Definition of magnitude

Magnitude	Socioeconomical receptors	Biological receptors	Physical Receptors (e.g. air, water, soils)
Large	Change dominates over baseline conditions. Affects the majority of the area or population in the Area of Influence and/or persists over many years. The impact may be experienced over a regional or national area.	Affects an entire population or species in sufficient magnitude to cause a decline in abundance and/or change in distribution beyond which natural recruitment (reproduction, immigration from unaffected areas) would not return that population or species, or any population or species dependent upon it, to its former level within several generations.	Widespread and/or long-term disturbance or permanent change to the air/soil/water components in the Project area. Change in quality over a large area that lasts over the course of several months with quality likely to cause secondary impacts on ecology. Routine exceedance of benchmark limits.

Medium	Clearly evident difference from baseline conditions. Tendency is that impact affects a substantial area or number of people and/or is of medium duration. Frequency may be occasional and impact may be regional in scale. The area affected may be local or regional.	Affects a portion of a population and may bring about a change in abundance and/or distribution over one or more generations but does not threaten the integrity of that population or any population dependent on it. A medium magnitude impact may also affect the ecological functioning of a site, habitat or ecosystem but without adversely affecting its overall integrity.	Localized and/or short-term disturbance of air/ soil/ water components in the Project area. Temporary or localized change in air/soil/water quality with quality returning to background levels thereafter. Occasional exceedance of benchmark limits.
Small	Perceptible difference from baseline conditions. Tendency is that impact is local, rare and affects a small proportion of receptors and is of a short duration.	Affects a specific group of localized individuals within a population over a short time period (one generation or less), but does not affect other trophic levels or the population itself.	Minimal disturbance. Slight change in air/soil/water quality expected over a limited area with quality returning to background levels within a few meters. Discharges are well within benchmark limits.
Negligible	Change remains within the range commonly experienced within the social-economic context.	Immeasurable, undetectable or within the range of normal natural variation.	Immeasurable, undetectable or within the range of normal natural variation.

The magnitude of the impact will be defined in qualitative terms, and where available quantitative terms, and where necessary the determination of impact magnitude will be assisted through the use of modelling.

4.4 Sensitivity of Receptors

In addition to characterising the magnitude of impact, the other principal step necessary to assign significance for a given impact is to define the sensitivity of the receptor. There are a range of factors to be taken into account when defining the sensitivity of the receptor, which may be physical, biological, cultural or human. Other factors may also be considered when characterising sensitivity, such as legal protection, government policy, stakeholder views and economic value.

Sensitivity criteria for receptors are categorised into **high**, **medium**, or **low**. Generic criteria used to determine the receptor sensitivity are provided in Table 4-2. Each topic-specific chapter of the ESIA will define the relevant receptors and assign a receptor sensitivity based on topic-specific criteria.

Table 4-2: Generic criteria for the allocation of Receptor sensitivity

Sensitivity	Physical Receptor	Human Receptor	Biodiversity Receptor
High	Little or no capacity to absorb proposed changes and has national or international value, (e.g. receptors where people or operations are particularly susceptible	Receptors with high vulnerability and permanent presence within the direct or indirect AOI (e.g. school, poor or vulnerable household, hospital). No capacity to absorb project changes or no opportunity for mitigation.	Receptors of high conservation value, including Critical Habitat, IUCN CR/EN species, nationally protected species or habitats, ecosystems of limited resilience or irreplaceable ecological function.

	to noise or air quality changes).		
Medium	Some capacity to absorb proposed changes but could experience noticeable effects under certain conditions. The receptor has regional or local importance and/or moderate sensitivity to disturbance.	Receptors with moderate to high vulnerability and or somewhat affected by project impacts. Limited capacity to absorb changes. Potential opportunities for mitigation	Receptors of regional or local conservation importance, such as IUCN VU/NT species, habitats supporting notable assemblages, or ecosystems of moderate resilience and recoverability.
Low	Good capacity to absorb proposed changes and not protected or has low value, e.g. receptors where the disturbance is minimal and are not sensitive to disturbance.	Receptors with low to moderate vulnerability are infrequently located in the AOI. Good capacity to absorb changes with no lasting effects, or good access to mitigation measures.	Widespread and common species of Least Concern, modified or heavily disturbed habitats, receptors of low conservation value with high resilience and recovery potential.

4.5 Evaluation of Significance

In order to determine the significance of each impact, two overall factors are considered:

- Magnitude and nature of impacts;
- The importance and/or sensitivity of the environmental and social receiving parameter, as determined during the assessment of baseline conditions.

Based on impact magnitude and receptor sensitivity as defined above, the significance of the impact is classed as insignificant, minor, moderate, or major, as presented in Table 4-3. Those that are deemed moderate or major significant are considered the main focus of the management and implementation framework going forward.

Table 4-3: Significance evaluation

Significance		**Magnitude of Impact**			
		Negligible	**Small**	**Medium**	**Large**
Sensitivity, vulnerability, importance of receptor or resource.	**Low**	Insignificant	Insignificant	Minor	Moderate
	Medium	Insignificant	Minor	Moderate	Major
	High	Insignificant	Moderate	Major	Major

Significance		Magnitude of Impact			
		Negligible	Small	Medium	Large
Sensitivity, vulnerability, importance of receptor or resource.	Low	Insignificant	Insignificant	Minor	Moderate
	Medium	Insignificant	Minor	Moderate	Major
	High	Insignificant	Moderate	Major	Major

Impacts are typically considered adverse, but it is also possible for positive impacts to be realised. As mentioned previously, no magnitude designation is assigned for positive impacts as it is considered sufficient for the purpose of the impact assessment to indicate that the Project is expected to result in a positive impact.

General definition of what the various impact significance ratings signify are summarised in Table 4-4.

Table 4-4: Impact Significance Generic Definition

Significance of Impact	Definition
Insignificant	Where a resource/receptor (including people) will essentially not be affected in any way by a particular activity or the predicted effect is deemed to be 'imperceptible' or is indistinguishable from natural background variations. These need not be considered as a determining factor in the decision-making process.
Minor	Where a resource/receptor will experience a noticeable effect, but the impact magnitude is sufficiently small (with or without mitigation) and/or the resource/receptor is of low sensitivity/ vulnerability/importance. In either case, the magnitude should be well within applicable standards. These effects may be raised but are unlikely to be important in the decision-making process and can be managed effectively with appropriate plans and monitoring;
Moderate	'Where the impact remains compliant with applicable standards but exceeds the threshold for a minor impact, up to a level that that might be just short of breaching a legal limit. Demonstration should be sought to show that the impact has been reduced to a level that is as low as reasonably practicable. This does not necessarily mean that impacts of moderate significance have to be reduced to minor, but that moderate impacts are being managed effectively and efficiently. These effects, while important, are not likely to be key decision-making issues and can be managed effectively with appropriate plans and monitoring.
Major	One where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors. A key aim of an ESIA is to get to a position where the Project does not have any major residual impacts, certainly not ones that would endure into the long-term or extend over a large area. However, for some aspects there may be major residual impacts after all practicable mitigation options have been exhausted. It is then the function of regulators and stakeholders to weigh such negative factors against the positive ones, such as employment. These effects are likely to be important considerations but where mitigation may be effectively employed such that resultant adverse effects are likely to have a Moderate or Minor

	significance.

The significance of impacts will be discussed before and after mitigation (i.e. residual impact) for each aspect. Based on the above approach, major or moderate impacts will be classified as significant.

4.6 Mitigation and Management Measures

A key objective of an ESIA is to identify and define socially, environmentally and technically acceptable and cost effective measures to manage and mitigate potential impacts as well as actions to enhance positive Project benefits. Mitigation measures are developed to avoid, reduce, remedy or compensate for potential negative impacts, and to enhance potential environmental and social benefits. For each significant impact, the ESIA will define the mitigation and management actions in the form of a framework Environmental and Social Management Plan (framework ESMP).

The approach taken to defining mitigation measures is based on a typical hierarchy of decisions and measures, as follows:

- **Avoid/reduce** at source: avoiding or reducing at source through the design of the Project (e.g. avoiding by siting or re-routing activity away from sensitive areas or reducing by restricting the working area or changing the time of the activity).
- **Abate on Site**: add something to the design to abate the impact (e.g. pollution control equipment).
- **Abate at Receptor**: if an impact cannot be abated on-site then control measures can be implemented off-site (e.g. traffic measures).
- **Repair or Remedy**: some impacts involve unavoidable damage to a resource (e.g. material storage areas) and these impacts require repair, restoration and reinstatement measures.
- **Compensate in Kind** or compensate through other means; where other mitigation approaches are not possible or fully effective, then compensation for loss, damage and disturbance might be appropriate (e.g. financial compensation for degrading agricultural land and impacting crop yields).

The priority is to first apply mitigation measures to the source of the impact (i.e. to avoid or reduce the magnitude of the impact from the associated Project activity), and then to address the resultant effect to the resource/receptor via abatement or compensatory measures or offsets (i.e. to reduce the significance of the effect once all reasonably practicable mitigations have been applied to reduce the impact magnitude).

4.7 Residual Impact Assessment

Once the application of mitigation and management measures has been defined, the residual significance will be determined. The residual impacts section considers the overall significance of impacts following the implementation of the additional mitigation and management measures not included by design. The significance of such impacts is based upon the same criteria used to determine the impact significance stated above.

Where significant residual impacts remain, consideration has been given to offsetting or compensating for residual impacts.

4.8 Cumulative Impact Assessment

In line with the IFC Good Practice Handbook (2013)[7] "Cumulative impacts are those that result from the successive, incremental, and/or combined effects of an action, project, or activity when added to other existing, planned, and/or reasonably anticipated future ones".

The evaluation of potential cumulative impacts is highly context-specific, depending on the particular locations and activities under review. Therefore, each situation is typically assessed qualitatively on a case-by-case basis. The approach to the cumulative impact assessment (CIA) is undertaken in accordance with the IFC Good Practice Handbook: Cumulative Impact Assessment and Management Guidance for the Private Sector in Emerging Markets (2013).

In line with IFC Performance Standard 1 (PS1) Guidance Note GN41, which states that the assessment should be "commensurate with the incremental contribution, source, extent, and severity of cumulative impacts anticipated", this ESIA focuses on potentially significant cumulative impacts, particularly where the Project's contribution is considered to be material.

In general, as part of this ESIA, the cumulative impact assessment is conducted following the approach described in the IFC Handbook. It is applied to the relevant environmental and social (E&S) aspects for which cumulative impacts may be significant, by following the steps outlined below:

- Definition of the relevant spatial and temporal boundaries;
- Identification of key Valued Environmental Components (VECs) and screening of potentially relevant other projects;
- Establishment of baseline conditions for the VECs; and
- Assessment of potential cumulative impacts and identification of appropriate mitigation measures.

5 Stakeholder Engagement

5.1 Introduction

Stakeholder engagement involves communicating with people and groups who may be affected by, or have an interest in, a project. Its purpose is to understand and respond to stakeholder interests, and it is a core element of the impact assessment process. Engagement allows information to be shared with stakeholders, helps gather their views and insights, and supports the early identification of concerns.

These concerns are then incorporated into the assessment so they can be addressed, managed, or mitigated in a systematic way. Early engagement helps to recognise potential issues before they escalate and affect project outcomes.

Maintaining constructive relationships with communities and other stakeholders is also fundamental to securing a project's "social licence to operate."

Stakeholder engagement typically includes:

- Providing stakeholders with timely and relevant information.
- Receiving timely and relevant information from stakeholders.
- Enabling two-way dialogue to identify and address stakeholder issues.
- Integrating stakeholder priorities into project decision-making and demonstrating how their concerns have been considered.

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

- Maintaining an accessible and timely grievance mechanism.
- Involving affected stakeholders in monitoring mitigation measures and other environmental or social programs.
- Reporting back to stakeholders and following through on commitments.

This chapter summarises the key elements of the Stakeholder Engagement Plan (SEP) prepared on behalf of Masdar to maintain and guide stakeholder engagement over the lifetime of the Project. It outlines the stakeholder analysis, the engagement and consultation activities completed to date, and the main issues raised in relation to the Project. The SEP itself is a dynamic document that will be periodically reviewed and revised over the course of the Project, and the full SEP provides the detailed actions to be taken at each phase of the Project. The SEP is part of Project's HSSE Management System. The system sets out the structure of the Project's HSSE plans and procedures to manage risks and impacts, and the institutional framework to ensure effective implementation. This ensures adaptive management and continuous improvement is applied across all parts of the Project, including in stakeholder engagement.

5.2 Stakeholder Identification and Mapping

Identification of stakeholders is a key process in facilitating meaningful engagement throughout the Project. This process involves a systemic approach to mapping stakeholders according to the areas where the Project may impact them.

For the purposes of this Project, a stakeholder refers to any individual, group, or organization that may be affected by the Project's activities or outcomes, or that holds an interest in the Project and has the potential to influence its implementation, either positively or negatively. The objective of stakeholder identification is therefore to establish which organizations and individuals may be directly or indirectly affected (positively and negatively), or have an interest in the Project and its activities.

Using a structured approach, the current stakeholder matrix has been organized into four categories according to the nature of stakeholders' interests.

1. **Affected parties** — individuals, groups, local communities, and others who may be affected positively or negatively, directly or indirectly, especially those who may be disadvantaged or vulnerable.
2. **Interested and influential parties** — a broader group of stakeholders who can influence Project outcomes through their knowledge of local conditions or their regulatory, technical, or political roles (e.g., government authorities, NGOs, civil society, and academic institutions).
3. **Community representatives** — including elected officials, informal leaders, traditional authorities, and elders who speak on behalf of affected communities or represent legal and customary interests.
4. **Geographically defined stakeholders** — identified through impact area mapping and analysis of affected territories, which supports the delineation and possible adjustment of the Project footprint.

Table 5-1 provides the stakeholder engagement matrix consisting of individuals, communities, organizations, and Government agencies considered stakeholders of the OHTLs and WPP, across potentially affected villages in Turkestan and Jambyl regions, as well as at the national level. The list of stakeholder groups should be regularly reviewed and updated throughout the Project lifecycle and whenever new information is received.

Table 5-1: Stakeholder Matrix

Stakeholder Name	Role and Interest
Key Government Ministries of the Republic of Kazakhstan	
Ministry of Energy	Decision-makers: • Regulatory and policy role in strategic energy projects, issues licences
Ministry of National Economy	Decision-makers: • Responsible for investment in the Republic of Kazakhstan
Ministry of Agriculture	Decision-makers: • Responsible for national land management and land legislation including land acquisition for state needs
Ministry of Ecology and Natural Resources	Decision-makers: • Provision of information on biodiversity and ecologically important water resources within the project-affected areas. • Execution of laws and regulations pertaining to environmental management. • Review of national EIA reports for planned project facilities. • Issue of environmental permits for construction and operation. • Follow-up monitoring of E&S compliance.
Ministry of Water Resources and Irrigation	Decision-makers: • Statutory consultee • Provision of information on planned and existing irrigational water supply facilities within the project-affected areas, and execution of laws and regulations pertaining to the operation and maintenance of related infrastructure (e.g., appropriate buffer zones)
Ministry of Labor and Social Protection of Population	Decision-makers: • Execution of laws and regulations pertaining to the labour in Kazakhstan, and provision of guidelines to implement new legal requirements.
Ministry of Transport	Decision-makers: • Statutory consultee • Provision of information on the transport infrastructure within the project-affected areas, and execution of laws and regulations pertaining to the operation and maintenance of related infrastructure (e.g., tonnage, drainage, upgrade or extension of existing roads and traffic regulation).
Regional Government Representatives	
Akimat of Turkestan region Akimat of Jambyl region	Decision-makers: • District-level planning and administration of development projects. • Preparation of land-use proposals, approval of subsequent land-use plans, commissioning of cadastral registration of landholdings, and administration of Land Lease Agreements (LLAs). • Provision of general information on the district Interested parties: • Provision of information on biodiversity and technical support on ad-hoc baseline surveys for specific floral species and habitats.

Stakeholder Name	Role and Interest
Local Government Authorities	
District Akimats of Turkistan: • Sozak • Sauran • Kentau District Akimats of Jambyl: • Sarysu • Talas • Zhualy • Jambyl	Decision-makers: • District-level planning and administration of development projects. • Preparation of land-use proposals, approval of subsequent land-use plans, commissioning of cadastral registration of landholdings, and administration of Land Lease Agreements (LLAs). • Cadastral registration of landholdings, based on approved land-use plans • Provision of general information on the district
Other Authorities and Agencies	
Kazakhstan Electricity Grid Operating Company (KEGOC)	Decision-makers: • Kazakhstan's national transmission system operator • Grid connections for the Project, reviewing and approving technical requirements • Managing transmission of electricity, providing metering and dispatch to maintain grid stability
• KazTransGasAimak • KazTemirZholy • QazaqGas • KazakhTelecom	Interested parties: • Statutory consultees with information on existing and planned utilities
Government for Citizens (GfC) of Jambyl Region and of Turkestan Region	Decision-makers: • Custodian of land reserved for governmental and pasture use • Providing of Cadaster information, identification of land related information (landusers)
Committee for Environmental Regulation and Control of the Ministry of Ecology of RK	Decision-makers: • Provision of information on biodiversity and ecologically important water resources within the project-affected areas. • Execution of laws and regulations pertaining to environmental management. • Review of national EIA reports for planned project facilities. • Issue of environmental permits for construction and operation. • Follow-up monitoring of E&S compliance.
Institution for the Protection of Forests and Wildlife of: • Akkol • Sarysu	Decision-makers: • Government authority to obtain permission for research works on the territory of Forest Fund in the relevant area
• Forestry and Wildlife Committee of the Ministry of Ecology and Natural Resources of RK • Information and Analytical Centre for Environmental Protection • State Enterprise of the Production Association "Okhotzooprom"	Interested parties: • Provision of information on biodiversity and technical support on ad-hoc baseline surveys for specific floral species and habitats.
Committee of Industrial Safety of the Ministry for Emergency Situations of the Republic of Kazakhstan	Interested parties: • Emergency response to natural disasters and other contingencies, and mobilization of humanitarian aid
Committee of Culture of the Ministry of Culture and	Interested parties:

Stakeholder Name	Role and Interest
Information of the Republic of Kazakhstan	• Provision of information on tangible and intangible cultural heritage within the project-affected areas, and execution of laws and regulations pertaining to labour in Kazakhstan.
Institute of Archaeology named A. Kh. Margulan Kazarchaelogy LLP	Interested parties: • Provision of information on tangible and intangible cultural heritage within the project-affected areas, and completion of archaeological surveys for the national inventory of cultural heritage sites.
JSC 'National geological survey'	Interested parties: • National operator for the collection, storage, processing and provision of geological information, providing information on geologically significant objects and planned exploration
Committee of Geology of the Ministry of Industry and Construction of the Republic of Kazakhstan	Decision-makers: • Provision of information on ongoing and planned and existing mineral exploration surveys (and related exclusion zones within the project-affected areas, and any geotechnically hazardous land.
Shu-Talas Basin Inspection Jambyl Branch of Communal State Institution "Kazvodkhoz" Ministry of Water Resources and Irrigation of RK	Interested parties: • Provision of information on the existing water pipelines and/or irrigation systems near the project area.
Department of Natural Resources and Regulation of Nature Management of the Akimat of Jambyl region	Interested parties:
Institute of Zoology Republic Kazakhstan Institute of Biology	Interested parties: • Provision of information on biodiversity and technical support on ad-hoc baseline surveys for specific faunal species and habitats.
Karatau Nature Reserve	Interested parties: • Provision of information on biodiversity and technical support on ad-hoc baseline surveys for specific floral species and habitats.
National and International Non-Government Organisations (NGOs)	
• Association for the Conservation of Biodiversity of Kazakhstan (ACBK) • Biodiversity Research and Conservation Center (BRCC) • International Union for Conservation of Nature (IUCN) Bustard specialist group • Birdlife International	Interested parties: • Provision of information on biodiversity and technical support on ad-hoc baseline surveys for specific floral species and habitats. • Engagement on avoidance of potential impacts to biodiversity and the mitigations of WPP
Service providers for GBVH prevention, response and support • Jambyl Regional Centre for Social Assistance to Victims of Domestic Violence • Family support centres in Turkestan	Interested parties: • Provision of information on the Project and its GBVH SOP • Coordination on implementation of the GBVH SOP
Private Companies	
• KazPhosphate • Eurochem	Affected parties: • Provision of general information on project affected areas • Potentially affected neighbouring landowners/users
Communities and Community Leaders	
Village Akims	Interested and potentially affected parties:

Stakeholder Name	Role and Interest
	• Representatives of local community members at the local level
Project-affected landowners and land users (Long leaseholders, Herders) in WPP or OHTLs	Affected parties: • Land-users subject to economic displacement as a result of land acquisition for the Project's development. • Changes to business/livelihoods • Local procurement and employment opportunities;
Project-affected communities or residents of towns and villages in Jambyl region: • Aktogay, • Zhanatas • Uzakbay Syzdykbaev (Zhanaryk) • Maytobe • Karaoy • Karatau • Ashir Burkitbayev (Turkestan rural akimat) • Ushbas, (Turkestan rural akimat) • Arystandy (Turkestan rural akimat) • Aulie-bastau • Aulie-kol, • Kyzyltan • Karabastau	Affected and/or interested parties: • Communities potentially affected by and/or interested in environmental and social impacts from components of the Project. This may include: road and other construction works impacts, noise/dust or other nuisance impacts, local employment, local procurement, land use changes and impacts, community health and safety risks, perceptions of health impacts, information disclosure and meaningful engagement opportunities about the Project, access to a grievance mechanism.
Project-affected communities or residents of towns and villages of Turkestan region: • Sholakkorgan, • Uyuk, • Ashisay • Shoktas • Kotyrbulak • Kushata • Kentau	Affected and/or interested parties: • Communities potentially indirectly affected by and/or interested in environmental and social impacts from components of the Project. This may include: local employment, local procurement, land use changes and impacts, community health and safety risks, perceptions of health impacts, information disclosure and meaningful engagement opportunities about the Project, access to a grievance mechanism.
• Vulnerable households • Women • Young people and children • Elderly	Affected and/or interested parties: • Vulnerable people potentially unable to access project benefits and/or disproportionately affected by the Project due to their vulnerability, gender, age, ethnicity.

Vulnerable groups

Project-specific vulnerable groups have been identified based on field observations and interviews, focus group discussions and secondary data sources. The following groups have been identified in relation to the Project:

Women – Project impacts may disproportionately affect women, including in relation to employment opportunities and heightened exposure to GBVH risks. Women in Kazakhstan continue to carry the majority of domestic responsibilities, spending on average 19% of their day on unpaid domestic work, which is around three times more than men[8]. This can constrain their ability to participate in engagement processes. Within households, domestic violence was estimated in 2019 to occur in approximately one in eight homes, and

[8] The Borgen Project 2024, *Career Building Initiatives for Working Women in Kazakhstan*. Available at: https://borgenproject.org/working-women-in-kazakhstan/

around 17% of women aged 18–75 have experienced intimate partner violence in their lifetime[9].

Elderly – Household members aged over 60 who may require additional care. Limited mobility or specific care needs can make it harder for them to participate in consultations and potentially accessing any livelihood restoration activities. Any household disruption may adversely affect their health and could increase the caring burden on family members.

Persons with Disabilities and Chronic Illness – People with disabilities or chronic health conditions, as well as those with caring responsibilities, may experience heightened challenges where households are disrupted. Households supporting a family member with a disability are also statistically more likely to experience poverty.

Poorer Households – Households dependent on social assistance or with insufficient income for basic needs are more exposed to economic shocks. Limited financial resilience can constrain their ability to adapt to resettlement. Nationally, 5.1% of Kazakhstan's population lived below the poverty line in 2023. In 2023, 3.9% of the urban population experienced absolute poverty compared to 7.2% of rural populations. Poverty rates are higher than the national average across the Project area, but lower in Jambyl region (8.1%) compared to Turkestan region (9.0%)[10].

At-Risk Youth – Young people not in employment, education or training (NEET) may face additional difficulties during engagement for livelihood restoration. Official statistics indicate that 6.5% of youth were NEET in 2022. Those without work experience, qualifications or skills may struggle to secure employment, and—if they had no pre-existing livelihood—may fall outside the scope of livelihood restoration programs. This cohort is important for future skills development and may face social exclusion if unable to access project opportunities on an equal basis. NEET rate for youth in 2024 was 6.4% in Turkestan region and 6.8% in Jambyl region[11].

Isolated Rural Communities – Parts of the alignment traverse sparsely populated rural areas, where many settlements have experienced significant depopulation or abandonment. While larger settlements along the Jambyl corridor have connectivity with the R-43 road, livelihood opportunities and access to infrastructure remain limited in some locations. These communities may experience disproportionate impacts from disruptions to access routes or local livelihoods.

People experiencing negative impacts from multiple projects – Consultations have highlighted that some community members from Kenbay and Zhanterek have already experienced adverse effects from the Zhanatas WPP, which is located to the south of Zhanaryk village. Individuals who have previously been affected by other projects may face increased vulnerability if exposed to further impacts, including through cumulative effects.

5.3 Previous Engagement Activities

5.3.1 Initial Scoping Engagement

The first phase of stakeholder engagement was conducted for the initial configuration of the Project, which included a 500 MW WPP and 1 220 kV overhead transmission line (OHTL) connecting the WPP to the Jambyl substation. The initial stakeholder consultations were conducted during a site visit from 27 to 31 March 2024.

Initial scoping engagement focused on building relationships with key local authorities, including regional,

[9] Human Rights Watch (2019): https://www.hrw.org/news/2019/10/17/kazakhstan-little-help-domestic-violence-survivors
[10] Subsistence minimum in Kazakhstan (2025): https://stat.gov.kz/ru/industries/economy/prices/spreadsheets/?year=&name=18621&period=&type=
[11] https://stat.gov.kz/ru/industries/labor-and-income/stat-empt-unempl/

district, and rural-level Akimats, as well as village administrations. The following consultations were undertaken at that time:

1. Akimat of Sarysu District
2. Cadastral Department of Sarysu District
3. Akimat of Zhualy District
4. Akimat of Jambyl District
5. Jambyl-500 Substation
6. Non-Commercial Joint Stock Organization "Government for Citizens"
7. Main Herders located along OHTL
8. Aktogay Village
9. Zhanatas Village

The main objectives of this stage of early stakeholder engagement included:

- Introducing the Project concept to government representatives and the wider public
- Requesting relevant data to inform the baseline studies; and
- Coordinating and facilitating initial meetings with local residents and land users.

Following these visits, further requests for data were sent to relevant government bodies to obtain land-related, environmental, and social information. Given that the region is of high importance for biodiversity conservation, engagement with non-governmental organizations, academic institutions, and relevant government authorities also began in Spring 2024 and continued throughout that year.

Scoping engagement identified that there were some concerns and misinformation in the communities about wind farms, in addition to concerns of local communities about collaborating with project developers. It was identified that this was a result of the construction of the Zhanatas wind farm, which is located near to the Project site. Engagement with communities has kept a watching brief on this issue and has informed this project's engagement approach.

5.3.2 Further Scoping engagement

A second phase of scoping engagement was conducted following the decision to expand the capacity of the WPP to 1 GW. This phase covered both OHTLs – the previously planned line to Jambyl and a newly added line to Kentau substation – as well as the 1 GW WPP layout.

Stakeholder engagement related to the inclusion of a new OHTL route crossing into a different administrative region – Turkestan Region – involved engagement with local authorities, state bodies, and relevant ministries. The first site visit was conducted in February 2025. The process also included requests for information on land users and the identification of key social receptors.

At this stage, engagement related to the initial components of the Project (the wind power plant and the OHTL located within the Jambyl Region) focused on more detailed information requests aimed at identifying potential social, environmental, and biodiversity-related risks, as well as clarifying previously obtained data on land plots. This process gradually transitioned into engagement activities under the ESIA phase.

During the meetings, participants were provided with leaflets that provided the key information about the planned Project as well as contact details of the ESIA Consultant. Grievance mechanism details were also provided.

Common themes that were discussed by all parties during scoping engagement were:

- Project introduction & general information (objectives, layout, ownership, land acquisition).

- Land ownership, acquisition and cadastral data (requests to Akimats, GfC, leaseholders).
- Livelihoods & land use (farming, grazing, housing, infrastructure).
- Experience with existing WPPs (esp. Zhanatas) (perceptions, prior compensation).
- Requests for stakeholder support/collaboration (especially from Akimats to facilitate meetings).
- Biodiversity/forest use (specifically, regarding permits required, Argali surveys).
- Infrastructure & local benefits (employment, road improvements, electricity access).

Common concerns raised by stakeholders related to the following issues:

- Land ownership & acquisition clarity (documents, data requests, lease status).
- Compensation (procedures, adequacy, timing).
- Livelihood impacts (farming, grazing, road access, security of land use).
- Local employment/job creation requests.
- Electricity access, tariffs, and reliability.
- Environmental/biodiversity impacts.
- Requests for project data/maps/coordinates.

The most common concerns or issues raised by Government representatives/authorities have related to:

- Focused on land ownership/acquisition data, cadastral accuracy, procedural requirements, permits, and coordination.
- Some also raised employment and infrastructure expectations.

For leaseholders/farmers, the most common issues raised have related to:

- Concerned mainly with compensation, livelihood impacts, grazing land, road access, electricity connections, and future project benefits.
- Environmental concerns occasionally raised (wind intensity, wildlife).

For most stakeholders, commitment has been given for further consultation as the Project progresses. Additional information has been provided to other stakeholders on request or where clarifications have been necessary (e.g. on land rights, technical explanations, grievance mechanism).

5.4 Engagement at the ESIA Preparation Phase

5.4.1 Summary

At the ESIA stage, stakeholder engagement was expanded to address specific social, environmental, and cultural aspects of the Project. Meetings, letters, phone calls, and site visits have been and, at the time of drafting this document, continue to be held across Jambyl and Turkestan regions. Stakeholder engagement during the ESIA stage included cooperation with local subcontractors responsible for preparing the national EIA in accordance with Kazakhstan's environmental legislation, more detailed consultations on issues related to historical and cultural heritage, clarification of buffer zones around archaeological sites, and the identification of river and stream protection requirements and watercourse buffer zones. This stage also involved the maintenance of the Stakeholder Matrix, Stakeholder Engagement Log and Grievance Mechanism to track all communications and any grievances raised (none to date at the time of drafting).

Site visits were conducted in May, June, and July 2025 to inform the ESIA and identify key environmental and social risks. Baseline data collection at this stage included engagement with Akimats, land users and potentially Project Affected People across the whole of the Project.

Further, baseline data collection for the preparation of the Livelihood Restoration Plans (LRPs) for the Project was conducted. At this stage, a Land Acquisition and Livelihood Restoration Framework (LARF) has been drafted and LRP under development as part of the ESIA study, to guide and implement resettlement planning. The aim of the LARF is to identify resettlement principles and organizational arrangements and to provide a guide to the provision of livelihood restoration. In order to develop the LRPs, more detailed baseline data collection was required of those households that will potentially be directly affected by Project development (Project Affected People, or PAPs), requiring specific engagement and surveying of those people and their households. The specific engagement and grievance management requirements about land issues under the LRPs are detailed in the LRPs. This is due to the nature of the issues that can be raised relating to land, valuation and compensation and specialist expertise required to respond to such issues.

Consultations have included:

- **Local land users and potential Project Affected People** – engagement regarding potential construction activities (e.g., met masts, LIDAR, OHTL), temporary land use, and compensation mechanisms and Site visits and KIIs in the pastureland area on which wind turbines, BESS, site substation, access roads and other ancillary infrastructure will be located
- **Local authorities and state bodies** – coordination on land acquisition, permitting, technical infrastructure, and protected areas
- **Cultural heritage institutions** – requests for data on archaeological sites
- **Biodiversity stakeholders** – engagement with national and international NGOs regarding wildlife corridors and protected species; and
- **Subcontractors** – coordination with national EIA consultants to align procedures.

This engagement has informed and helped clarify regulatory requirements, refine the Project layout, and ensure alignment with national and international standards.

The following stakeholder engagement activities are either ongoing or planned as part of the ESIA and Livelihood Restoration Plan (LRP) preparation and disclosure processes:

- Information disclosure/notifications to key stakeholders – ongoing;
- Business correspondence – ongoing;
- Focus Group Discussions (FGDs) related to ESIA and LRP – completed;
- Key Informant Interviews (KIIs) related to ESIA and LRP – completed;
- Public Hearings (planned as part of the national EIA process) – forthcoming (planned January 2026;
- Lender disclosure activities (planned as part of the international ESIA preparation and project lending process) – forthcoming;
- Other engagements to respond to requests for information and ongoing engagement to clarify issues as required – ongoing.

These activities aim to ensure inclusive engagement, gather targeted feedback, and meet national and international stakeholder engagement requirements.

5.4.2 Feedback from engagement during ESIA preparation

The core themes that have emerged from the ESIA preparation engagements are presented in the following table. Table 5-2 presents concerns raised by stakeholder group.

Table 5-2: Summary of Concerns raised during engagement by Stakeholder group

Stakeholder group	Key themes and issues of concern
Government stakeholders	Land acquisition processes • Engagement by Project team on land ownership data, cadastral accuracy, land survey projects, and clarification of legal procedures. • Engagement by Project team on old/unclear leases and returning land to the state Support for organising stakeholder meetings • Many Akimats committed to helping identify leaseholders and organise group meetings. Electricity supply and tariffs • Clarification that tariffs are set by KEGOC; expectations for lower tariffs. Infrastructure expectations • Requests for road upgrades, gas connection, and improved social infrastructure. Environmental questions • Concerns regarding protected areas, forest fund boundaries, OHTL siting.
Business/Private Sector	Interaction with industrial operations • Desire to ensure construction does not conflict with mining pits, cement plants, or Eurochem's operations. Project timelines & electricity supply • Interest in whether the WPP and OHTL will support local industry growth. Employment • Companies request local hiring and subcontracting opportunities. Infrastructure reliability • Power outages, substation availability, stability of supply.
Landowners/Leaseholders/Local residents	Land acquisition, compensation, and temporary equipment installation • Frequent questions on compensation eligibility, rates, timing, method of payment. Livelihood impacts • Concerns about: o Loss of grazing land o Access to pastures and seasonal routes o Disruption to springs and water sources o Protection of hayfields o Need for improved veterinary services (Karabastau). Climate & weather beliefs • Repeated perceptions that wind turbines cause: o drought o reduced rainfall/snowfall o increased wind intensity Infrastructure needs • Requests for road improvements (Baizhansay road). • Need for electricity stability, low-voltage issues. • Requests for internet, clinics, schools, kindergartens. • Gas supply, borehole repairs. Economic expectations • Job creation • Local hiring and youth employment opportunities • Small-scale community development

	• Shift work dependence (Turkestan region) Biodiversity and blasting concerns • Fear that turbine noise may disturb wildlife. • EuroChem blasting disturbance. Cultural heritage • Kamyr Aulie and rituals near WPP site.
Civil Society/Scientific Institutions	Environmental data & biodiversity • Argali data sensitivity. • Wildlife and hunting area concerns.

The full description of engagements, letters sent, and specific materials developed to facilitate these activities is presented in the SEP.

5.4.3 Targeted engagements

5.4.3.1 Engagement with Biodiversity Stakeholders

Representatives from biodiversity-focused organisations were invited to engage in dialogue regarding the Project and the ESIA process. A targeted, online meeting was held with national and international organisations to present the Project and the ongoing ESIA preparation process. The session aimed to inform stakeholders of potential biodiversity impacts and gather their preliminary feedback on key areas of concern, particularly in relation to sensitive habitats and species such as bustards.

5.4.3.2 Pastureland and Livelihood Stakeholders

Following the site visit to the area designated for the WPP, valuable local water sources and pasture areas used by nearby residents were identified and a further sample of Key Informant Interviews (KIIs) with leaseholders and local community members, as well as additional targeted site visits, have been conducted to collect additional detailed, site-specific information on land use and social dynamics.

5.4.3.3 Baseline Consultations

A household survey was conducted for the Jambyl OHTL and WPP sections under the ESIA and Land Acquisition and Livelihood Restoration Planning (LRP) processes to understand the socio-economic conditions of potentially affected persons (PAPs) and map baseline conditions in the area more broadly for the ESIA. A household survey for the Kentau OHTL section is also currently underway.

The social baseline survey includes:

- Structured socio-economic questionnaires administered to potentially affected households (PAPs) to gather data on demographics, income sources, land tenure, access to services, and livelihood patterns
- Focus Group Discussions (FGDs) with various community groups (e.g., men, women, herders, farmers) to explore collective concerns, seasonal land use practices, and perceptions of Project impacts
- Key Informant Interviews (KIIs) with local leaders, leaseholders, and knowledgeable individuals to gain in-depth insights into land use, social dynamics, and community vulnerabilities; and
- Specific household asset surveys and valuation processes are additionally underway – these are reported on under the LRP in detail and will be summarised within the ESIA, including specific engagement requirements for the LRP process.

5.4.3.4 Meetings with Akimats

Targeted, disclosure meetings were held with Akimats in November 2025 to continue to engage on

livelihoods matters, compensation and cutoff date matters, as well as the Project layout.

In the Turkestan District, Akims expressed support for the Project and a general willingness to support information sharing with the population, gathering residents for meetings and assisting with public consultations, within existing resourcing/capacity. No objections, comments, or concerns were recorded about the Project layout or routing, and an understanding was expressed regarding the need for updated PAP information to proceed. Most Akims shared that while land for land compensation is legally allowed, project affected persons generally prefer monetary compensation.

5.5 Future Stakeholder Engagement

Future stakeholder engagement activities will be undertaken at the following, five key stages of the Project:

- To disclose the ESIA package
- Prior to the start of construction
- During construction
- Prior to the start of operation, and
- During operation.

The stakeholder engagement and information disclosure will cover the main following activities:

- Provide Project information to key stakeholders in a timely manner, in both Kazakh and Russian.
- Ensure engagement is gender-inclusive, recognising that men and women may have different perspectives and needs.
- Tailor engagement to local conditions, including appropriate timing, context and use of local languages.
- Conduct engagement that is free from manipulation, pressure or coercion.
- Maintain clear documentation of all consultations, including who participated, issues raised, and follow-up actions and their resolution.
- Support informed participation and meaningful two-way dialogue with affected stakeholders.
- Provide for adaptive management, whereby meaningful consultation informs ongoing project development and implementation.
- Ongoing implementation of the Grievance Mechanism to ensure concerns from affected stakeholders are received, addressed and resolved.

Masdar currently has one Community Liaison Officer (CLO) engaged. The CLO will be responsible for managing stakeholder engagement and grievances, ensuring regular consultation and ongoing interaction with all affected communities. The CLO will continue to work in close coordination with the Akims of each affected district, who will continue their existing role of providing a liaison and support between communities and the Project, as well as in registering and handling grievances in line with Kazakhstan's legal and administrative processes.

At the stage of disclosure of the ESIA package, potential lenders to the Project additionally have specific disclosure requirements for typical Category A projects, which at minimum are typically disclosed both on the websites of both the Project and the Lender(s) for certain periods of time. Variations are possible under exceptional circumstances according to specific Bank procedures. Equator Principles Financial Institutions following the Equator Principles (2020) require that at a minimum, a summary of the ESIA is accessible and available online and that it includes a summary of Human Rights and climate change risks and impacts when relevant. EPFIs may also have further, specific disclosure requirements.

The Asian Infrastructure Investment Bank (AIIB) requires under its Environmental and Social Framework (2024) that Draft Environmental and Social Documentation for Category A Projects is disclosed sixty (60) calendar days prior to consideration of the Bank's financing for approval.

The Islamic Development Bank (IsDB) requires, according to its Environmental and Social Safeguards Policy (2020), that the Client to ensure that relevant information about environmental and social risks and impacts of the Project is made available in the Project area in a timely and accessible manner, and in a form and language(s) understandable to the Project-affected people, other stakeholders and the general public, so they can provide meaningful inputs into the design and implementation of the Project. The IsDB also discloses the same information as soon as it becomes available.

The following documents are anticipated to be disclosed for effective stakeholder communication:

- ESIA package
- Non-technical summary (NTS)
- Stakeholder Engagement Plan (SEP)
- Environmental and Social Action Plan (ESAP); and
- Livelihood Restoration Plans (LRPs).

The above documents will be accessible to the public, including affected communities. Hard copies of disclosure documents will be available in Akimat offices of the affected districts (Jambyl and Turkestan), while brochures updating the public about project progress will be distributed locally.

The specific engagement and disclosure activities, targeted stakeholder groups, schedule, purpose and the tools to be used to conduct the engagement are presented in full in the SEP (Section 6.2).

5.6 Grievance Redress Mechanism (GRM)

During the consultation and disclosure activities undertaken a Project Information leaflet including the Grievance Redress Mechanism (GRM) were utilised. The Project Information Leaflet included details of the following:

- An introduction to the Project
- A summary of the environmental and social studies that are being carried out
- Details of the consultation process
- Details of what a WTG is and functionality
- Details of the grievance mechanism
- Contact details of Juru and Masdar Project staff.

The Project established a grievance mechanism during the scoping phase of the Project and stakeholders were first informed of the mechanism during scoping phase consultations. To continue to raise awareness about the grievance mechanism, a Project leaflet was distributed to the people attending all stakeholder engagements. The contact details included in the Project brochure are male and female Project staff, with the aim of ensuring that there is a woman who can respond to the questions or concerns of women in the Project Area, should they wish to do so.

Project grievances can be raised during meetings, site visits, phone calls, or in written form (text messages, email, or via WhatsApp or other mobile apps). Once received, each grievance is formally recorded in the project's log. The process guarantees confidentiality, protecting all personal data. Complainants may also submit grievances anonymously. After registration, applicants receive a written notification within three working days detailing the investigation timeline. A response will be provided within two working weeks of submission. Resolution approaches are determined by the type and frequency of the grievance. An overview

of the grievance management process is provided in Table 5-3.

Table 5-3: Grievance Process and Timeline

Step	Description	Responsibility	Timeline
1	Receipt and registration of grievance	Grievance Manager (Juru ESIA team or Masdar CLO)	Day 0
2	Initial screening	Grievance Manager with relevant technical support as required	Maximum 3 days after submission of grievance
3a	If grievance is not within the scope of the Project: • Reject grievance and/or Refer to relevant party • Communicate action and justification to complainant	Grievance Manager	Maximum 3 days after submission of grievance
3b	If grievance is within the scope of the Project: • Provide acknowledgement of grievance receipt to the complainant • Provide information on resolution timeline	Grievance Manager	Maximum 3 days after submission of grievance
4	Assessment/investigation of the received grievance, prioritising where available: • Joint fact finding with relevant technical or other support and/or complainant • Collaborative approach to defining and agreeing grievance resolution	Grievance Manager with relevant technical or other support and/or site management and/or complainant	Maximum 2 weeks after submission of grievance
5	Provide the complainant with a response, including • Actions taken • Evidence of resolution	Grievance Manager	Maximum 3 days after assessment has been completed
6	Seek sign off for closure of grievance, through signature of complainant	Grievance Manager	Maximum 3 days after assessment has been completed
7a	If complainant does sign off on closure of the grievance, • log as closed • capture lessons learned	Grievance Manager	Maximum 3 days after assessment has been completed
7b	If complainant does not sign off on closure of the grievance, • Reassessment of grievance with renewed joint fact finding/ investigation • Revise approach and document • Repeat steps 5-7 • Escalation to Appeals Process and/or national judiciary remains available to complainant.	Grievance Manager with relevant technical or other support and/or site management and/or complainant	Maximum 2 weeks after notification of dissatisfaction by the complainant

Following preparation of the ESIA and during the construction and operational stages of the Project, the

Company will ensure that the grievance mechanism remains available. The grievance mechanism will be led by the Company's Community Liaison Officer (CLO) and will provide a culturally appropriate and accessible mechanism for any person or group to raise a concern, or request additional information. Anonymous complaints will continue to be accepted and the privacy/confidentiality of the person raising the grievance will also be respected.

At all stages of the Project, the Asian Infrastructure Investment Bank (AIIB) Project-Affected People's Mechanism (PPM) can also be reached, via: ppm@aiib.org, or via: https://www.aiib.org/en/policies-strategies/operational-policies/ppm/index.html.

6 Socio-economic environment

6.1 Introduction and Overview of Assessment Methodology

This chapter presents the socio-economic baseline for communities within the Project Area of Influence (AoI). The baseline establishes essential context for assessing potential impacts and will serve as a benchmark against which the effectiveness of proposed mitigation measures can be evaluated.

The purpose of the socio-economic assessment is to identify and evaluate the likelihood, duration, and significance of potential socio-economic effects on sensitive receptors, and to recommend mitigation or management measures where necessary to ensure compliance with Good International Industry Practice (GIIP), national requirements, and lender standards.

The socio-economic assessment has taken account of the relevant legislative, policy and guidance framework. The relevant legislation, policies and guidance are summarised below.

The study area covers the WPP area and the OHTL route alignments, and all settlements within 2km either side of the route alignments and 20 km of the WPP, reflecting the possible extent of direct impacts on land acquisition for the Project, construction access, presence of communities who may directly or indirectly benefit from or be impacted by the Project.

The methodology follows the general ESIA impact assessment process as described in Section 4, and as such the social impact assessment methodology for this Project is based on the following:

- Desk study to obtain socio-economic baseline data (disaggregated information by age and gender on population, education, employment etc.) at the national, regional and, as far as possible, local area. This was carried out in two phases, reflecting the initial Project definition and desk-based study (comprising the WPP and Jambyl OHTL), and later expansion of the WPP and addition of the Kentau OHTL;
- Consultations undertaken by Masdar and Juru with communities and local institutional stakeholders in the Project area in 2024 of the initial Project and 2025 of the expanded Project as described in the Stakeholder Engagement chapter and SEP;
- Site visits, interviews and focus group discussions conducted in 2024 and 2025 with key stakeholders, including regional, district, and municipal Akimats and local community members as described later in this chapter;
- Evaluation of significance of effects based on 'Sensitivity of receptor vs Magnitude of impact', according to international best practice, using knowledge, expertise and professional judgement.

Where accurate and sufficient data could not be obtained, a precautionary approach was adopted.

A summary of the stakeholders consulted to date are presented in Chapter 5 Stakeholder Engagement, and

detailed in full in the SEP. The settlements (and districts) in which consultation and engagement have been conducted to date, presented by relevant project component to that settlement, is described in Table 6-1below.

Table 6-1: Settlements consulted by project component

Settlement (District)	Project Component
Uzakbay Syzdykbaev/Zhanaaryk (Sarysu)	WPP
Ushbas (Sarysu)	WPP
Turkestan/A.Burkitbaev (Sarysu)	WPP
Aktogay (Sarysu)	WPP
Zhanatas (Sarysu)	WPP
Saudakent (Sarysu)	WPP
Karatau (Talas)	Jambyl OHTL
Maitobe (Talas)	Jambyl OHTL
Karaoy (Talas)	Both WPP and Jambyl OHTL
Kaskabulak (Talas)	Jambyl OHTL
Koktal (Talas)	Jambyl OHTL
Aisha bibi (Jambyl)	Jambyl OHTL
Asa (Jambyl)	Jambyl OHTL
Abdikadir/Lenini path (Zhualy)	Jambyl OHTL
Tasbastau (Zhualy)	Jambyl OHTL
Sholakkorgan (Sozak)	Kentau OHTL
Ashisay (Kentau city)	Kentau OHTL
Turlan (Kentau city)	Kentau OHTL
Kushata (Kentau city)	Kentau OHTL
Kotyrbulak (Kentau city)	Kentau OHTL
Uyuk (Sauran)	Kentau OHTL
Shoktas (Sauran)	Kentau OHTL

Assessment of sensitivity is informed by the following vulnerability criteria in relation to socio-economic issues:

Table 6-2: Socio-economic Sensitivity Criteria

Vulnerability	Description
High	Receptors that are highly vulnerable, with little or no capacity to adapt to Project-related change: • A high concentration of vulnerable groups, such as elderly people, persons with disabilities, or other at-risk populations • Widespread difficulty in meeting basic needs, including food and essential household expenses • Dependence on a single primary livelihood that is fragile, unsustainable, highly seasonal, low-productivity, and/or informal or lacking legal security, with no realistic alternative livelihood options • Limited or no access to social support services or financial coping mechanisms or access to land, resulting in marginalisation or exclusion; the lack of access may be associated with the de-population of a community
Medium	Receptors with some capacity to adapt to Project-related changes and maintain quality of life, but with identifiable vulnerabilities: • Basic needs are generally met, though access to financial resources for short-term adaptation (e.g. savings or credit) is limited

Vulnerability	Description
	• A range of livelihoods is present and generally viable, but subject to constraints such as seasonality or market exposure • Access to public services exists, but support mechanisms may be limited in coverage, quality, or reliability
Low	Receptors with a strong capacity to adapt to Project-related changes and maintain or improve quality of life: • Minimal vulnerability, with a high likelihood of benefiting from Project-related opportunities • Good access to political representation, community services, and institutional support • A diverse portfolio of livelihoods that are sustainable, productive, and provide stable year-round income • Relatively affluent community conditions, with good ability to afford food, services, infrastructure, and other essentials • Strong access to financial systems, including savings, banking services, loans, and other mechanisms that support long-term adaptation

Magnitude is informed by the following criteria for socio-economic issues:

Table 6-3: Socio-economic Magnitude Criteria

Magnitude	Description
Large	• A substantial and clearly discernible change from baseline conditions. • The impact is expected to affect a large number of people, social groups and/or businesses across a wide area, regardless of duration or reversibility. • Spatially, impacts may be local, regional or national, and in some cases the impact may result in fundamental and irreversible effects on individuals or groups.
Medium	• A clearly identifiable change from baseline conditions. • The impact is expected to affect a moderate number of people, social groups and/or businesses and is typically temporary (up to three years), though it may be reversible or irreversible. • Spatial extent is generally local or regional.
Small	• A noticeable but limited change from baseline conditions. • The impact is localised, affecting a small number of people, social groups and/or businesses, and is typically short-term (up to one year) and reversible.
Negligible	• An impact that is unlikely to result in a measurable or detectable change for people or businesses. • Any change remains within the range of normal variation commonly experienced by households or the wider community.
Beneficial	• A measurable or perceptible improvement in the wellbeing, livelihoods or economic circumstances of people or businesses. • Positive impacts are not classified by magnitude category.

6.2 Applicable Requirements & Standards

6.2.1 National Regulations

The Republic of Kazakhstan does not have a standalone law specifically addressing the socio-economic impacts of development projects. Instead, a range of sectoral laws applies, regulating labour relations, employment, social protection, migration, public health, cultural heritage, as well as urban planning and land

management.

The key applicable laws and regulations include:

- Labour Code establishes requirements for labour relations, occupational health and safety, employment, working conditions, working hours, and compensation.
- Social Code is a unified systemic document that consolidates legal norms related to social protection, including labour, social insurance, and assistance in difficult life situations.
- Land Code regulates land and property matters, including acquisition, resettlement, and land-use rights.
- Law on State Property is critically relevant when a project affects land, livelihoods, or requires land acquisition or restrictions on access.
- Environmental Code, including the sections on Environmental Impact Assessment (EIA) and public hearings is a key regulatory framework for public participation, public consultation and disclosure.
- Rules for Conducting Public Hearings defines procedures and requirements for stakeholder engagement during project assessments.
- Law "On Migration of the Population" regulates labour migration, recruitment of foreign labour, worker accommodation, and registration requirements.
- Law "On Pension Provision" defines legal and social principles of the pension system.
- Code "On Public Health and the Healthcare System" regulates population access to healthcare services, health impact considerations, and sanitary-epidemiological standards.
- Civil Code of the Republic of Kazakhstan regulates property rights and obligations, relevant for land, assets, and compensation issues.
- Law "On Architectural, Urban Planning and Construction Activities" regulates territorial planning, zoning, and spatial development relevant for project siting.
- Law "On Local Public Administration and Self-Government" defines the functions and competencies of local authorities (akimats), important for engagement and local governance processes.

6.2.2 Lender Requirements

The Lender requirements applicable to this Project are presented in the following section, covering the requirements relevant to the socio-economic environment from IFC, AIIB and IsDB.

6.2.2.1 IFC Performance Standards (PS)

Table 6-4: Relevant IFC Requirements

IFC PS Number/Title	Key Social/Environmental/Safeguard Elements
PS1: Assessment and Management of Environmental & Social Risks and Impacts	Requires systematic identification and assessment of E&S risks and impacts; application of mitigation hierarchy; development of Environmental & Social Management Systems (ESMS); stakeholder engagement; grievance mechanisms; monitoring throughout the project lifecycle.
PS5: Land Acquisition and Involuntary Resettlement	Avoids or minimizes displacement; requires compensation at replacement cost; livelihood restoration; resettlement planning; consultation with affected persons; attention to vulnerable groups; monitoring of livelihood outcomes.
PS7: Indigenous Peoples	Ensures respect for Indigenous Peoples' rights, culture, and livelihoods; requires meaningful consultation; avoidance of adverse impacts; benefit-sharing; Free, Prior, and Informed Consent (FPIC) where applicable; protection of cultural heritage. Note: not applicable for this project.

6.2.2.2 AIIB — Environmental & Social Standards (ESS)[12]

Table 6-5: Relevant AIIB Requirements

ESS Number/Title	Key Social/Economic/Safeguard Elements
ESS 1: Environmental and Social Assessment and Management	Requires systematic identification, assessment, and management of environmental and social risks and impacts, application of the mitigation hierarchy, preparation of ESMPs, monitoring, and adaptive management throughout the project lifecycle. Includes assessment of socio-economic risks, vulnerable groups, and community impacts.
ESS 2: Involuntary Resettlement (Land Acquisition, Restrictions on Land Use & Economic Displacement)	Addresses physical and economic displacement. Requires compensation at replacement cost, livelihood restoration, resettlement planning, transitional assistance, support to vulnerable households, and monitoring of livelihood outcomes.
ESS 3: Indigenous Peoples	Ensures respect for identity, land, culture, and livelihoods of Indigenous Peoples. Requires culturally appropriate engagement, meaningful consultation, and, when applicable, Free, Prior and Informed Consent (FPIC) or broad community support.
ESS 4: Environmental and Social Information Disclosure	Mandates timely disclosure of project-related environmental and social information in a culturally appropriate, accessible manner. Requires transparency, inclusive engagement of affected people, and disclosure of safeguard documents.
Cross-cutting: Stakeholder Engagement & GRM (included within ESS1 requirements)	Requires stakeholder engagement proportionate to the project's risks, accessible grievance redress mechanism, meaningful consultation with women, vulnerable groups, and ethnic minorities. Focus on equitable access to project information and opportunities for feedback.

6.2.2.3 Islamic Development Bank (IsDB) — Environmental & Social Standards (ESN)[13]

Table 6-6: Relevant IsDB Requirements

ESN Number/Title	Key Social/Economic/Safeguard Elements
ESN 1: Assessment and Management of Environmental and Social Risks and Impacts	Requires identification and assessment of environmental and social risks, including socio-economic impacts, gender considerations, vulnerable groups, and community well-being. Mandates ESMPs, monitoring, mitigation hierarchy, and institutional capacity measures.
ESN 5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement	Addresses direct or indirect land impacts. Requires avoidance where possible; otherwise mandates compensation, livelihood restoration, resettlement planning, and tailored assistance for vulnerable people.
ESN 7: Vulnerable Groups	Specific protection for women, low-income households, informal users, ethnic minorities, elderly persons, persons with disabilities, and socially excluded groups. Ensures equal participation and non-discrimination in project benefits.
ESN 10: Stakeholder Engagement and Information Disclosure	Requires meaningful, inclusive, gender-responsive stakeholder engagement; disclosure of relevant project information; and accessible grievance mechanisms for project-affected people.

[12] https://www.aiib.org/en/policies-strategies/framework-agreements/environmental-social-framework.html?utm_source
[13] https://www.isdb.org/projects#environmental-and-social-framework

6.3 Baseline Conditions

6.3.1 Area of Influence

The Project Area of Influence (AOI) is comprised of areas of direct impacts and indirect impacts as follows:

- Direct area of influence considers the physical footprint of the project such as the site layout, work staging area and area affected during construction and operation works (e.g., traffic patterns).
- Indirect area of influence includes area which may experience project related changes in combination with activities not under the direct control of the project (e.g., inward migration, induced development, visitor influx, access to employment).

The direct social AOI includes the land and infrastructure within the right of way of the OHTL and WPP and its owners and users. The landowners and users live in local communities. Members of these communities will also be indirectly impacted by the Project, as a result of construction traffic, noise, visual impact, community health and safety and potential impacts to tourism. Residents of Jambyl and Turkestan regions may benefit from the Project, through provision of goods and services to workers, provision of accommodation facilities, and priority employment of local workers during the Project construction phase. A socio-economic profile of the AOI was developed through a socio-economic survey of households in the AOI communities.

A socio-economic profile of the AOI relative to the components based in the Jambyl Region was developed based on a household survey conducted in the AOI communities from 28 June - 20 August 2024 for WPP and Jambyl OHTL and from 03 August - 30 September 2025 for Kentau OHTL.

Special attention was given to gender representation. Both male- and female-headed households were included, and where possible, female respondents were interviewed to capture women's perspectives on household livelihoods, social services, and gender-specific challenges. This approach ensured a balanced understanding of community realities across genders.

6.3.2 Survey approach

The impact assessment methodology is described in Chapter 4.

The methodology was based on the following approach:

- Collection of official socio-economic data for the local communities from the Akimats – this included each of the settlements identified in Table 6-1;
- Conducting socio-economic surveys of households in two phases. The first round of Socio-economic surveys covered 300 households in the WPP and Jambyl OHTL area (see Table 6-7 below). The second round of socio-economic surveys were covered 172 households in the Kentau OHTL area (see Table 6-8). Villages in the AOI were selected based on their proximity to the WPP and OHTLs and/or villages proximate to the main transport corridors to be used along the OHTLs; all households interviewed are from rural settlements. Households were selected to participate in the survey using a systematic random sampling method with a fixed sampling interval of 3. This method ensures an equal probability of inclusion for each household in the sample and reduces the risk of systematic bias.
- Focus Group Discussions were held. The focus groups were designed to include a diverse range of community members, comprising opinion leaders, teachers, doctors, librarians, pensioners, youth leaders, students, and representatives of non-governmental organizations, to capture a broad spectrum of perspectives within the population. FGD participants were women only or mixed gender. All FGDs included participants from vulnerable categories, including large families, unemployed individuals, and people working abroad (including in Russia) as labour migrants. As part of the FGDs undertaken with the local communities, additional socioeconomic data was collected on the following key topics:

- Employment and economy
- Community safety
- Infrastructure development
- Land use
- Community and social ties
- Gender roles
- Attitudes towards the project

- Key informant interviews were conducted with elders and opinion leaders in each of the communities identified in Table 6-1.
- Specific surveys were conducted with Project-affected people for the purposes of preparing Livelihood Restoration Plans (LRPs) and described within the LRPs; information drawn from those surveys is indicated where appropriate in this chapter.

6.3.2.1 Surveying in Jambyl Region

Table 6-7 presents the number of surveys conducted in each AOI community (Jambyl region), alongside the respondents' distribution, based on their proximity to the project site. Respondents were randomly selected to ensure a representative sample of the Project communities.

Table 6-7: Distribution of respondents in Jambyl region

Project Component	Districts	Settlement	Distance from site (km)	Population (people)	Number surveyed
WPP	Sarysu district	Aktogay	6.9	780	12
		Ushbas	9.2	190	8
		Turkestan/A.Burkitbaev	15	849	13
		Zhanatas	19.8	25,693	100
		Uzakbay Syzdykbayev/Zhanaaryk	11.7	846	11
Both WPP+OHTL	Talas district	Karaoy	WPP 10.7; OHTL 5.8	334	9
Jambyl OHTL	Talas district	Karatau	4.1	28,501	107
		Maitobe	1.1	2,260	18
	Zhualy district	Abdikadyr/Leninskyi Put’	1.6	179	6
		Karatas	19	51	7
	Jambyl district	Aulie Bastau	0.5	9	2
		Kyzyltan/Aulie Kol’	1.1/0.5	146	7
TOTAL				59,838	300

The social baseline for this area has been prepared based on secondary, publicly available information, as well as primary information, such as key informant interviews (KIIs), focus group discussions (FGDs) and the socio-economic survey and analysis.

The respondents’ portrait can be described as follows for the survey, which covered 300 households in the

project area: 144 respondents are from the Sarysu district, 134 are from the Talas region, and the remaining are from Zhualy (13) and Jambyl (9) regions. The respondents' distribution is based on their proximity to the project site.

Gender distribution among respondents' household members was balanced, with 50.3% male and 49.7% female. The age distribution shows a relatively young population, with the largest groups being 25-34 years (14%), 35-44 years (13.3%), and 45-54 years (13.6%). Only 4.3% of respondents are 65 or older. This is representative of the general population in Jambyl region, with comparable distribution among age groups.

Surveying in Turkestan region

Table 6-8 presents the number of surveys conducted in each AOI community for the Kentau OHTL. Respondents were randomly selected to ensure a representative sample of the Project communities.

Table 6-8: Distribution of respondents in Turkestan region

Project Component	District	Settlement	Distance from Kentau (km)	Population (people)	Number surveyed
Kentau OHTL	Sozak	Sholakkorgan	90	323	82
	Kentau	Ashisay	54	212	57
	Half Sauran, Half Kentau	Kushata	11.9	35	10
	Kentau	Kotyrbulak	11	31	7
	Sauran	Uyuk	35	33	10
	Kentau	Shoktas	20	26	6
TOTAL				660	172

The respondents' portrait can be described as follows for the survey, which covered 172 households in the project area. 82 respondents are from the Sozak district (Sholakkorgan settlement), 74 are from the Kentau city administration, and the remaining 16 are from the Sauran district. In total, 6 settlements were interviewed that the respondents' distribution is based on the population of the settlements (larger settlement, larger number of respondents).

Gender distribution among respondents' household members is balanced, with 50.6% female and 49.4% male. The age distribution shows a relatively middle-aged population, with the largest groups being 35-44 years (16%) and 18-24 years (16%). Only 5.9% of respondents were 65 or older. There were fewer children (0-17 years old) – 26%.

The analysis by settlements, despite being based on a non-representative sample and small numbers (6-7 households in some cases), may offer some insights into the general situation in the villages. However, interpretation should be approached with caution and supplemented with further study and interviews.

The highest number of children under 18 years was reported in Kotyrbulak and Shoktas settlements, 39% and 38%, respectively. While the lowest numbers of children were in Sholakorgan (24%) and Ashisay (25%). The highest number of elderly people (65+) was reported in Kushata settlement, while none were reported in Shoktas.

An absolute dominant Kazakh majority, comprising 97.7% of all household members, is prevalent in the

southern rural territories of Kazakhstan. Other peoples of Central Asia (for example, Uzbeks) accounted for 1.5%, while Slavic nationalities were only 0.8%. From the survey non-Kazakh nationalities live in Ashisay settlement.

Household level surveys were undertaken as part of the preparation of the Livelihood Restoration Plans (LRPs). The socio-economic baseline of this Chapter does not report on those results.

6.3.2.2 Summary Profile

Direct impacts cover the Project site and occur during the construction and installation of Wind Turbine Generators (WTGs), the development of internal and access roads to the wind farm, the construction of the Battery Energy Storage System (BESS), substations, as well as along the routes of the two Overhead Transmission Lines (OHTLs).

Indirect impacts extend to settlements located within approximately 20 km of the WTGs and around 2 km from the OHTL corridors, including potential socio-economic and environmental effects that may occur beyond the immediate construction area. Desk-based analysis revealed a number of structures within the WPP site, though most were identified as temporary or movable structures used by grazing activities. One fixed building was found, located roughly 950 m from the nearest WTG; it is intermittently occupied during the grazing season.

The proposed Jambyl OHTL does not pass through or near any communities or villages, except those surrounding the existing Jambyl substation. Both proposed OHTL routes largely follow existing lines, so they are not expected to significantly increase the visual impact or impact envelope in the area.

Along the Jambyl OHTL, several individual dwellings and farmsteads are present, but the proposed route ensures a minimum 50 m setback from the line. In total, there are approximately 430 structures (including individual homes, farmhouses, public buildings, and summer houses) within 1 km, with 85 structures within 500 m, 24 within 100 m, and 15 within 50 m of the line.

Residents of communities within the social AoI are primarily involved in agricultural and livestock farming/grazing activities. These activities are usually conducted at the areas surrounding the communities. In order to conduct livestock farming in large numbers (over 50 head of livestock), local residents need to obtain land plots on a lease basis. If grazing is undertaken for household consumption at a smaller scale, no permission is required.

Given the Project's extensive geographical footprint and linear infrastructure components, it interacts with a diverse range of residential areas and communities located within and around the wider zone of influence. The following summary provides an overview of these settlements, their demographic and socio-economic characteristics, and key considerations relevant to the assessment of potential Project impacts:

Jambyl region

The residential areas surrounding the Project vary from small rural settlements (e.g., Aulie Bastau, population 9) to larger towns (e.g., Zhanatas, population 25,693) and cross four districts: Sarysu, Talas, Zhualy and Jambyl. Proximity to the WPP and OHTL routes ranges from less than 1 km to around 20 km. Most communities rely on agriculture, local services, and small businesses as primary sources of income, with larger settlements providing broader employment and social infrastructure, including schools, healthcare, and markets. Potential socio-economic interactions include employment opportunities, temporary construction activity, noise, traffic increase, and access to local services.

Turkestan region

The residential settlements along the OHTL corridor in Turkestan are predominantly small rural communities,

with household sizes ranging from 26 to 323 people. These communities are largely dependent on agriculture and small-scale local services for livelihoods. Given their proximity to the Kentau OHTL, potential project-related impacts may include temporary construction disturbances, noise, and changes in local access**,** while potential benefits include employment opportunities and improved infrastructure in the vicinity.

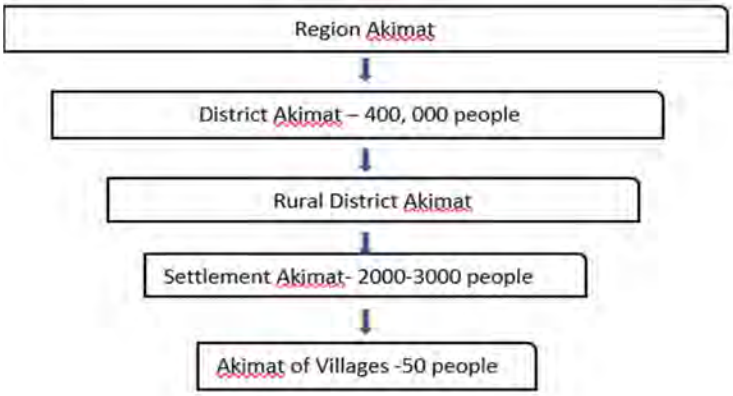
6.3.3 Political and Administrative Structure

The Republic of Kazakhstan declared its independence in 1991 after being part of the former Soviet Union since 1936, beginning its transition toward a market-oriented economy. Kazakhstan is a presidential republic that holds presidential and parliamentary elections on a regular basis. All citizens of Kazakhstan aged 18 and above have the right to vote and to participate in public life. The capital is the city of Kazakhstan is Astana.

Kazakhstan is the largest landlocked country in the world and the ninth-largest country globally by territory, covering 2.7 million square kilometres. It is located in Central Asia and Eastern Europe, sharing borders with Russia to the north, China to the east, Kyrgyzstan, Uzbekistan, and Turkmenistan to the south, and the Caspian Sea to the west.

Administratively, Kazakhstan is a unitary state divided into regions (oblasts), districts (rayons), rural districts (selsky okrug) in Kazakhstan is the smallest third-level administrative unit in rural areas, consisting of two or more rural settlements and villages (see Figure 6-1). The exact number of villages and settlements within a specific rural district is determined by the administrative-territorial division of the respective district, that is, the Rural District Akimat.

Figure 6-1: Administrative structure in Kazakhstan



The state language of the Republic of Kazakhstan is the Kazakh language. The language used for the work and record-keeping of state bodies, organizations, and local self-government bodies of the Republic of Kazakhstan is the state language; along with Kazakh, the Russian language is officially used as well.

The Republic of Kazakhstan has a presidential form of government. According to the Constitution, the country asserts itself as a democratic, secular, legal, and social state, whose highest values are the individual, their life, rights, and freedoms.

The President of the Republic of Kazakhstan is the head of state, its highest official, who determines the main directions of the state's domestic and foreign policy and represents Kazakhstan within the country and in international relations.

The Parliament of the Republic of Kazakhstan is the highest representative body of the Republic, exercising legislative functions. The Parliament consists of two chambers: the Senate and the Mazhilis, operating on a permanent basis. The judicial system ensures the supremacy of law and justice through the Supreme Court and other lower courts.

The Constitutional Court oversees the constitutionality of laws and government acts. At the regional and local levels, executive authority is represented by Akimats, led by Akims (mayors or governors). Local representative bodies, known as Maslikhats, are elected by the population and are responsible for approving local budgets and overseeing socio-economic development programs.

Kazakhstan has the following administrative units:

- **Oblasts/Regions** - 20 territorial units, which include 17 oblasts, 90 cities
- **Districts and Cities** - 195 districts[14] within oblasts, 39 cities of oblast significance[15], 48 cities of district significance and 3 cities of republican significance (Almaty, Astana and Shymkent).
- **Rural districts, Settlements and villages –** 2,160 rural districts, 29 settlements and 6,179 villages in Kazakhstan[16].

The structure ensures effective governance and coordination across all administrative levels:

Jambyl Region

Jambyl region is one of the southern regions of Kazakhstan and has an area of 144,300 km2, which is the tenth largest region in the country. The administrative centre of Jambyl region is the city of Taraz. The territory of the region is divided into 10 auldyk okrugs, in total there are 4 cities and 373 rural settlements in the region.

Sarysu district

The district's administrative centre is the city of Zhanatas, located in the foothills of the Karatau Mountains. The area of the Sarysu district is 31,300 km². The district is located in the southwest of the Jambyl Region. It borders the Ulytau Region to the north, the Moiynkum and Talas districts to the east, and the Turkestan Region to the south and west. The district includes 1 town and 9 rural districts (comprising 24 rural settlements, of which 2 are designated as key settlements, 8 as satellite settlements, and 14 as others).

Talas District

The area of Talas district is 12,200 km2 or 8.5% of the district territory. It is located in the southwest of Jambyl region. The administrative centre of the Talas District is the town of Karatau, located in the foothills of the Karatau Mountains in a mountainous area. Talas District borders Jambyl, Zhualy, Baizak, Sarysu, Moyinkum districts and Turkestan region. A relatively large percentage (30% or 3,546 km^2) of the territory is occupied by the State Forest Fund (i.e., forest and other land under the management of government entity responsible for forestry). The district structure includes 1 town and 13 rural districts (23 rural settlements, of which 4 are central, 5 are satellite, and 14 are other settlements).

Zhualy district

The area of Zhualy district is 4,200 km². The district is made up of 49 rural settlements which are united into 14 rural districts. Its administrative centre is the village of Baurzhan Momyshuly which is located 60 km from the regional centre.

Jambyl District

Jambyl district has an area of 4,309 km^2, it borders the Zhualy, Bayzak, and Talas Districts, and also shares a border with the Kyrgyz Republic. Its administrative centre is the village of Asa. The district structure includes 17 rural districts (42 rural settlements, of which 6 are central, 28 are satellite, and 8 are other settlements).

[14] https://stat.gov.kz/en/industries/social-%C2%ADstatistics/demography/publications/318188/?utm_source
[15] https://mail.kz/ru/news/kz-news/skolko-gorodov-v-kazahstane?utm_source
[16] https://stat.gov.kz/ru/industries/social-statistics/demography/publications/281169/?utm_source

Turkestan Region

Turkestan region is located in the south of Kazakhstan and has an area of 117,249 km², which is 4.3% of the country's total territory. The administrative centre of Turkestan region is the city of Turkestan. The territory of the region consists of 14 districts and 3 cities of regional significance (Arys, Kentau, and Turkestan), 174 rural districts, and 824 rural settlements.

Sozak district

The area of Sozak is 141,000 km^2. It is located in the steppe on the northern slopes of the Karatau Range with administrative centre Sholakkorgan village. The district borders with Sauran and Baidibek districts in the south, Ulytau and Zhanaarka districts of Ulytau region in the north, Sarysu district of Jambyl region in the east, Syrdarya, Shieli, Zhanakorgan districts of Kyzylorda region in the west. Most of the territory of the district is occupied by stony and sandy desert plains (Betpakdala, Moyinkum). The Karatau Range is located in the south and southwest. The district includes 12 rural districts, in which 130 settlements are located.

Sauran district

The district is in the west of Turkestan region. It was created by the Decree of the President on March 15, 2021 with an administrative centre in Shornak village. The Sauran settlement, located within the district, served as a major trade and economic hub of the Kazakh Khanate during the 15th to 17th centuries and is now a monument of historic and cultural significance. The area of Sauran district is 6500 km^2.

Kentau town district

The area of Kentau is 71,04 km². It is located at the southern foot of the Karatau mountaion range, 24 km northeast of Turkestan city, and 190 km from Shymkent. Kentau is a city of regional importance. In addition to the city of Kentau proper (city area – 7,104 ha), the territory includes the villages of: Ashisay; Bayaldyr; Hantagy, Shoktas, Kotyrbulak, Karnak, and Kushata. The total area is 77.45 km2.

6.3.4 National and regional economic setting

6.3.4.1 National

The Republic of Kazakhstan has a diversified economy with significant contributions from the industrial, agricultural, and services sectors. According to the Bureau of National Statistics Agency for Strategic Planning and Reforms of Kazakhstan and World Bank Group, the country's nominal GDP in 2024 was approximately $288.4 billion USD, with a real GDP growth of 4.8%. The Kazakhstan GDP per capita for 2024 is $14,005.30 USD[17]. The average nominal wage was around 405,416 KZT per month (approximately $746 USD), and the national unemployment rate stood at 4.6%. The economy is supported by sectors such as goods production, services, and extractive industries. Kazakhstan is an upper-middle-income country, defined by the World Bank[18] as an economy with a Gross National Income per capita between $4,496 to $13,935 USD. Goods production experienced a real growth of 6.3%, while services increased by 4.6% in 2024. The Kazakhstani tenge (KZT) is the currency of Kazakhstan, and as of 1 November 2025, 1 USD was equal to approximately 530.47 KZT.

The economy of Kazakhstan is one of the largest in Central Asia. The oil and gas sector is the main sector of the economy. Over the last 20 years, Kazakhstan's oil production has quadrupled. There are large oil reserves, as well as reserves of precious metals and minerals. The country has a large agricultural potential, both for livestock breeding and grain production. In addition, Kazakhstan has invested in its space infrastructure,

[17] https://data.worldbank.org/indicator/NY.GDP.PCAP.CD?locations=KZ
[18] https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups

restating in the launch of spacecrafts to the International Space Station.

The Gross Domestic Product of Kazakhstan was made up of the following sectors in 2025 (January-September):[19]

- 26.9% — Industry;
- 3.6 % — Agriculture;
- 6.2 % — Transport and communications;
- 16.7 % — Trading/commerce; and
- 46.6 % — Others.

6.3.4.2 Jambyl Region

The main sectors of Jambyl Region's economy include industry and services. The industrial sector employs over 44,000 people, and hundreds of enterprises operate in the region, making it a significant component of the regional economy[20]. The region is actively developing its investment potential, including through special economic zones, which influences employment structure and investment attractiveness[21]. Jambyl region contributed 2.3% of Kazakhstan's GDP per capita in 2024 and occupies 19th place.

The largest shares of the non-observed economy in the Gross regional product are observed in the Turkistan (27.97%), Jambyl (25.79%) in 2024[22].

The socio-economic conditions in the region are shaped by a substantial rural population share, which affects income structure, employment, and availability of social services. Income levels and standards of living may be lower than in more industrialized regions.

Jambyl Region offers favourable conditions for renewable energy development and has become an attractive destination for foreign investors. Currently, 22 renewable energy facilities operate in the region, providing a total generation capacity of 571.3 MW. These include 6 hydropower plants (24.4 MW), 10 wind power plants (275.65 MW), and 6 solar power plants (271.25 MW). Among them, the 100 MW Zhanatas Wind Power Plant, commissioned in 2021, is visible from the project site. By 2028, the total number of renewable energy facilities in the region is expected to increase to 28 with a combined capacity of 2.5 GW, including the potential Jambyl 1GW Project.

Table 6-9: Main sectors and enterprises in Jambyl region

District	Main sectors	Key enterprises	Other notes
Sarysu district	Mining; manufacturing; chemical processing; water supply; gas; electricity; water disposal; agriculture (crop and livestock farming)	Not specified	Large phosphorite ore deposits; all types of livestock raised; sheep breeding is specialised
Talas district	Mining; manufacturing; chemical industry; water supply; gas; electricity; water disposal; agriculture (crop	Talas Investment Company LLP; Amangeldy Gas LLP; Amangeldy GPP LLP; Karatau PRO LLP; Jambyl Nedr LLP; GPC "Sholaktau"; KGP "Igilik"; Kurylys Zhanar LLP; Wind Power City LLP; Wind Electricity LLP; Shengeldy LLP;	Wide range of mineral deposits (including phosphate, gas, gold, uranium); 3,981 registered SMEs (early 2024); sheep

[19] stat.gov.kz
[20] https://zhambyl.invest.gov.kz/about/human-resources/?utm_source
[21] https://zhambyl.invest.gov.kz/about/human-resources/?utm_source
[22] https://stat.gov.kz/en/news/gross-regional-product-of-the-republic-of-kazakhstan-for-2024-with-the-allocation-of-the-unobserved-/

District	Main sectors	Key enterprises	Other notes
	and livestock farming)	Shengeldy-2 LLP; Novatex LLP	breeding specialised
Zhualy district	Agriculture; industry (milk processing, safflower oil production, solar energy); crop and livestock farming	Burny Sulut Zavoty LLP; AQMOL 2025 LLP; SMTS LLP; LF Company LLP; ALI-KO SUT 2023 LLP; Burny Cheese Company JSC; PK "BAGDAULET" JSC; Alatau Dairy Products JSC; Olya JSC; Kadisha Apa JSC; Agrofood Supply LLP; Burnoye Solar-1 LLP; Burnoye Solar-2 LLP	Economy focused on agri-processing and renewable energy alongside farming
Jambyl district	Mining; manufacturing; chemical industry; water, gas, electricity and wastewater services; agriculture (crop and livestock farming)	Amangeldy GPP LLP; Super-Pharm; Krauf Gypsum Taraz	Gypsum and other mineral deposits; 262 SMEs; sheep breeding considered specialised

6.3.4.3 Turkestan Region

Turkestan Region is an industrial-agricultural hub with a large labour force and rich mineral reserves such as barite, coal, iron, polymetallic ores, and uranium, which are the largest reserves in Kazakhstan. The region also ranks third nationally in phosphorite and iron ore reserves. Agriculture remains vital, with major crops including cotton, corn, tobacco, sunflower, fruits, and vegetables. The region is also known for leather processing and karakul sheep breeding. It has 21 renewable energy facilities with a total capacity of 278 MW (8 solar plants and 13 condensing power stations), with further expansion potential. The unemployment rate was 4.7% of the labour force[23]. The number of persons registered with employment agencies as unemployed as of 1 October 2025 amounted to 37,992 people, or 4.4% of the labour force.

The economy of the four surveyed communities (Sholakkorgan, Ashisay, Kushata, and Uyuk) is predominantly informal and highly dependent on external labour markets. Local employment opportunities are extremely limited, consisting mainly of low-paid government positions, small shops, and seasonal agricultural work. Due to the absence of local industries, a significant share of the working-age population relies on rotational jobs in mining and industrial enterprises located outside their villages. Agriculture and livestock, once central to rural livelihoods, have declined sharply because of land access barriers, water shortages, and the privatization of ancestral farmlands. As a result, unemployment remains one of the most pressing issues, driving large-scale labour migration to cities within Kazakhstan or abroad. Daily commuting costs, low wages, and weak local market activity further constrain economic development in all four communities.

Table 6-10: Main sectors and enterprises in Turkestan region

District/Town	Main sectors	Key enterprises	Other notes
Sozak District	Uranium mining; industrial manufacturing; agriculture and small-scale farming	Kazatomprom (nine uranium mining enterprises); Katko LLP; Budenovskoye LLP; Taiqonyr Qyshqyl Zauyty LLP	Two factories in the industrial zone (table salt and steel barrels); over 950 agricultural enterprises; new uranium and sulfuric acid projects expected to create over 1,000 jobs

[23] https://stat.gov.kz/en/region/turkestan/

District/Town	Main sectors	Key enterprises	Other notes
Sauran District	Agriculture (meat and dairy processing, poultry, crop cultivation, animal breeding); light industry (furniture production)	-	Economy dominated by SMEs; expanding furniture production providing stable employment
Kentau town	Manufacturing; mining; industrial processing	KazOilEnergy LLP; Kentau Redstar LLP; Turan Shenhua LLP; CENTRAL ASIA ALUMINIUM LLP (in nearby Ordabasin District)	Over 8,000 SMEs and 22 large manufacturers; products include transformers, metal products, cement, rubber goods, oxygen cylinders; barite ore mining; major non-ferrous metals plant under construction (1,500 jobs by 2026)

6.3.5 Employment

6.3.5.1 National

According to the sample survey of employment of the population for Q3/2025, 9.3 million people were employed in various sectors of the economy of Kazakhstan, of which 7.2 million people worked for hire (76.7% of the total number of people employed in the economy), 2.2 million people were self-employed (23.3% of the total number of people employed in the economy).

Compared to Q3/2024, total employment increased by 96,300 people, due to hired employees 135,300 people. The largest share of employees was observed in trade (17%), education (13,1%), industry (12,3%) and agriculture (10,8%).

At the main job, on average, the actual hours worked per week were 39 hours per employed person, 40 hours per employee, and 35 hours per self-employed worker[24]. Employment by private companies (except for agriculture) is about 12%, while for entrepreneurs it is 5%. There are low figures for farm employment (both family and non-family) at 1% each, and seasonal work.

The employment rate of the Kazakh population aged 15 years and older in Q1 2024 was 64.8%. The unemployment rate (according to the methodology of the International Labour Organization) was 4.6% in 2024 and 4.6% in 2025. The number of unemployed amounted to 452,700 people[25]. The unemployment rate among young people aged 15 to 34 years for the same period amounted to 3.1%.

In 2024 the number of registered unemployed people in Kazakhstan was 191,900. As of the end of March 2025, the number of registered unemployed persons substantially increased, to 323,700.

6.3.5.2 Jambyl Region

According to the Bureau of National Statistics Agency For Strategic Planning And Reforms Of The Republic Of Kazakhstan[26] the unemployment rate was 4,8% of the labour force. The number of persons registered with employment agencies as unemployed as of October 1, 2025 amounted to 23,643 people or 4,3% of the labour force.

[24] https://stat.gov.kz/en/industries/labour-and-income/stat-empt-unempl/publications/462422/
[25] https://stat.gov.kz/ru/industries/labour-and-income/stat-empt-unempl/publications/158481
[26] https://stat.gov.kz/en/region/zhambyl/

Table 6-11: Economically active population, employment and unemployment in Jambyl region

District	Economically Active Population	Employed People	Unemployed People	Unemployment Rate (%)
Jambyl	36,000	34,300	1,700	4.6
Sarysu	19,100	18,100	1,000	5.2
Talas	21,000	20,000	1,000	4.8
Zhualy	25,800	24,500	1,200	4.8

Table 6-12 describes issues raised by stakeholders during KIIs and FGDs on their perceptions of economy, employment and industry in their region. Direct quotations are indicated.

Table 6-12: Key issues raised by stakeholders on economy, employment and industry (Jambyl Region)

Village	Key issues (***Direct quotes***)
Common issues	• Livestock centred economies as a livelihood; herd sizes vary; livestock raised for consumption and sale (summer grazing on local pastures, winter feeding supported by harvested hay or purchased feed); • Pasture access typically regulated informally through village administrations, elders, and the akimat, with specific areas allocated to households or farms; conflicts are rare and generally resolved locally. Larger farms often hire herders, providing salaries and sometimes social contributions, while smaller households manage livestock collectively. • Significant economic constraints from: water scarcity, limited access to gas, electricity, and transportation, and inadequate infrastructure (incl. pharmacies, medical services, kindergartens, reliable roads). Limitations reduce productivity, hinder market access, and affect overall household welfare. Exacerbated by: seasonal fodder shortages, drought, and harsh winters. Support through community cooperation (provision of hay, livestock aid, logistical assistance for relocation). • Scarce employment opportunities; prompts youth out-migration to larger cities and limiting economic mobility; women face additional barriers to business development (infrastructure gaps, limited local services). • Constrained income diversification: historical practices (e.g. small-scale crop production, garden farming) declined due to water shortages. • Critical to sustainable livelihoods: residents identify equitable compensation, stable electricity and gas supply, improved roads, access to water, support for local entrepreneurship, skill development. • State-supported programs, discounted fodder, and informal community networks supplement market-based resources, reflecting a mixed system of private initiative and local governance.
Maitobe	Predominantly agricultural economy; seasonal employment; reliance on livestock farming, fodder crops, fishing, and small-scale trade; minimal mechanisation; only available jobs are in a small number of public institutions or livestock farming (of employed people, government is a large employer); youth out-migration; unreliable electricity; lack of gas; partially paved roads; limited financial and technical support for local production initiatives (e.g. bakeries, processing).
Karatau	Limited employment opportunities and low incomes; jobs concentrated in technical, service, and public sector (of employed people, government is a large employer); limited access to industrial projects; job vacancies perceived to be pre-allocated or inaccessible to newcomers; men accessing informal work; lower wages for women; small-scale trade facing competition; unreliable water supply; poor roads; lack of vocational training; constrained skill development; renewable energy projects seen as potential opportunity for those with specialist education, if inclusive.

Village	Key issues (*Direct quotes*)
Aktogay	Restricted access to land and water; reduced agricultural productivity linked to industrial and energy projects; only available jobs are in a small number of public institutions or livestock farming (of employed people, government is a large employer); high electricity, heating, and transport costs; livestock farming constrained by distant pastures, water scarcity, and administrative fines; limited horticulture and gardening; lack of local education and vocational training; minimal local economic benefits from industrial and energy projects. "*Livestock are kept mainly for household consumption rather than for sale*."
Zhanatas	High unemployment; low wages; limited local job opportunities (of employed people, government is a large employer); youth and skilled worker out-migration; temporary male migration; high cost of living (utilities, food, clothing); corruption and favouritism limiting access to finance and permits; constrained entrepreneurship; low wages in shops, bakeries, factories; land allocation issues, fines, pasture disputes; inadequate infrastructure, health and education services; social inequality and marginalisation linked to industrial projects and foreign labour.
Abdikadyr	Lack of natural gas; absence of shops and pharmacy; no public transport; high unemployment; loss of gardening and melon farming due to lack of water supply; reduced income diversification. "*Key economic problems include the lack of natural gas, the absence of shops and a pharmacy, no public transportation, and high unemployment. Previously, residents grew gardens and melons thanks to water from Berikkara and sold watermelons, but now this is impossible due to the lack of running water."*
Aulie Kol	Limited access to clean potable water; absence of basic social infrastructure (kindergarten, pharmacy); constraints on household welfare and women's economic participation. "*Economic challenges include limited access to clean potable water and the absence of basic infrastructure such as a kindergarten or local pharmacy*."
Karaoy	Absence of gas and centralised water supply; reliance on individual wells; poor and expensive internet; no local store or pharmacy; dependence on travel to Karatau for basic goods; long winters causing fodder shortages; reliance on community and state support. "*Economic constraints include the absence of gas and centralized water, requiring households to rely on individual wells; poor and expensive internet access; and the lack of a store or pharmacy, forcing residents to travel to Karatau by taxi for basic goods."* *"Long winters can create fodder shortages, but community members assist each other, and large families receive state support."*

6.3.5.3 Turkestan Region

According to the Bureau of National Statistics Agency, the unemployment rate in Turkestan region was 4,6% of the labour force. The number of persons registered with employment agencies as unemployed as of 1 November 2025 amounted to 37,506 people or 4,4% of the labour force[27].

Turkestan Region is an industrial-agricultural hub with a large labour force and rich mineral reserves such as barite, coal, iron, polymetallic ores, and uranium — the largest reserves in Kazakhstan. The region also ranks third nationally in phosphorite and iron ore reserves. Agriculture remains vital, with major crops including cotton, corn, tobacco, sunflower, fruits, and vegetables. The region is also known for leather processing and karakul sheep breeding. It has 21 renewable energy facilities with a total capacity of 278 MW (8 solar plants

[27] https://stat.gov.kz/en/region/turkestan/

and 13 condensing power stations), with further expansion potential.

Table 6-13: Economically active population, employment and unemployment in Turkestan region

District	Economically Active Population	Employed People	Unemployed People	Unemployment Rate (%)
Sauran	42,000	40,000	2,000	4.8
Sozak	27,000	25,700	1,300	4.8
Kentau Town	36,500	34,700	1,800	4.9

Table 6-14 describes issues raised by stakeholders during KIIs and FGDs on their perceptions of economy, employment and industry in their region. Direct quotations are indicated.

It is noted that official statistics on unemployment often differ from the actual labour market, particularly in rural areas. This is frequently because not all unemployed individuals will register with employment centres, thus will not be counted in official data. Some individuals may not register due to inaccessibility or distance to employment centres (typically in regional centres), and others because they have informal, seasonal or casual work, which excludes them from registering as unemployed during the off-season. Additionally, official statistics frequently reflect regional figures rather than disaggregation to the village level, so there can be a masking of higher levels of unemployment in rural areas. These factors can mean official data may not fully reflect the rural labour market.

Table 6-14: Key issues raised by stakeholders on economy, employment and industry (Turkestan region)

Village	Key issues identified (*Direct quotes*)
Common issues	Employment and livelihoods • Unemployment is described as pervasive, affecting an estimated 60–70% of the working-age population, largely due to the absence of stable local employment. • Economic activity is heavily dependent on rotational and migratory labour, with 60–80% of the workforce relying on temporary, seasonal, or external employment in Kazakhstan's cities or abroad (including Russia and Korea), often under insecure conditions. • Approximately 250 people from the communities work daily in nearby mines and companies; these jobs are described as largely saturated and mostly inaccessible to youth. • Average local salaries range from 70,000–100,000 KZT, widely perceived as insufficient, particularly given daily commuting costs of 1,000–1,500 KZT. Sectoral employment structure • Overall, 44.4% of the population is employed. • Government employment is the largest employment category at 24%, including teachers, healthcare workers, administrators, and other professionals, and is described as the most stable income source. • Private sector employment accounts for ~11%. • Entrepreneurs represent 7.4% of employment. • Agricultural employment is minimal, with seasonal agricultural work at only 1.5%, reflecting a sharp decline in farming and livestock activities.

Village	Key issues identified (*Direct quotes*)
	• Agricultural production has reportedly declined by 50–60%, due to land access issues, documentation barriers, water scarcity, and the sale of ancestral land to external buyers. Labour force participation and migration • Unemployment and non-participation are reported as low overall (<3%), though this masks significant variation between settlements. • 96.5% of households report no members earning income outside the region; 3.5% report external earners. Income perceptions • 55.2% of respondents consider household income more than sufficient. • 18.6% report income is sufficient for basic needs only. • Approximately 12–13% describe income as barely adequate or insufficient. Local economy and services • Retail activity is limited to a small number of local shops; many residents travel to Turkestan, Kentau, or Shymkent for clothing and bulk purchases, reducing local economic circulation. • Utility access is uneven: o Centralised water: 89.5% o Sewage: 17.4% o Gas: 9.9% o Heating: 8.1% Overall local economy structure: • 60–80% external rotational/migratory labour • 10-15% agriculture/livestock • 5–10% retail/small trade • 5–7% public sector • 3–5% informal/temporary Central role of livestock farming as the primary source of income and sustenance; livestock holdings vary widely (disparities in wealth and capacity to engage in animal husbandry). Seasonal feeding practices common (summer grazing on communal pastures or nearby mountains and winter feeding relying on purchased or stored fodder). Large herd owners occasionally hire local herders; most households tend their own animals. Grazing is informal and largely unregulated; minimal involvement from local administrations or formal organizations. Limited awareness of legislation governing pasture use/concept of public or community pastures. Conflicts over grazing rare, occasionally arise when outsiders enter local lands. Pastures are central to sustaining livelihoods; access and seasonal rotation critical to economic system. Livestock supplemented by small-scale trade, crop farming, and entrepreneurial activities. Opportunities: construction, market trading, public institutions, local factories, work in Special Economic Zones (e.g. Kentau hosting a Chinese brick factory and a Kazakh reinforced concrete company). Entrepreneurship, SMEs supplement incomes especially where livestock incomes limited: cafes, trade, reselling, confectionery, sewing, construction, and wholesale trade. Heavy

Village	Key issues identified (*Direct quotes*)
	reliance on seasonal labour migration where local industry absent and/or infrastructure gaps. Livelihoods: need for income restoration measures or livelihood support tied to job creation, local enterprise development, infrastructure improvements (e.g. build factories/industrial facilities, supporting SMEs, improve electricity supply, establishing social facilities for jobs access). Limited local economic opportunities are consistently highlighted as a key challenge, driving migration and constraining the community's ability to diversify livelihoods. Communities mainly see potential benefits of the Project in employment creation and infrastructure upgrades. There is optimism, tempered by skepticism about whether jobs will really go to locals.
Kushata	• Heavy reliance on livestock and migratory labour • Limited local employment opportunities • Youth out-migration • Need for livelihood restoration focused on jobs and infrastructure • Part of communities where **60–80%** of income comes from external rotational/migratory labour • Livestock holdings range from **2–3 animals to over 1,000** (village-wide variation) *"If livelihood restoration measures were to be implemented under a project, job creation is the most important need, followed by infrastructure improvements such as sports or recreational facilities for youth."*
Ashisay	• Government employment: 31.3% (among the highest across settlements). • External labour migration: 7.0% of households have members earning income outside the region. • Dependence on livestock and external employment • High cost and limited access to electricity • Lack of local economic diversification • Agriculture/livestock contributes **10–15%** of local economy (reduced compared to past years) *"In terms of potential project benefits, income restoration measures should focus on job creation and improved access to electricity, such as through a local substation, which would reduce costs and support household needs."*
Uyuk	• Government employment: 6.1% (lowest reported). • Entrepreneurial employment: 21.2%, indicating relatively higher self-employment compared to other settlements. • Labour force inactivity: 33.3%, the highest reported inactivity rate. • Limited employment opportunities for youth • Reliance on livestock and seasonal migration • Social infrastructure gaps affecting youth retention • Informal/temporary activities approx. **3–5%** *"For project-related livelihood restoration measures, job creation is the most crucial need, and additional facilities such as a stadium or playground would help retain youth and strengthen the community."*
Sholakkorgan	• Entrepreneurial employment: 11.8%, higher than the overall average (7.4%). • Dependence on pasture access and livestock • Seasonal grazing system: summer communal pastures, winter fodder feeding • Minimal regulation of pasture use

Village	Key issues identified (*Direct quotes*)
	• Vulnerability to displacement from pastures or livelihood change • Infrastructure deficits, particularly gas supply "*In cases where people have to move to other pastures or switch occupations, land, water, and job creation would be necessary."* *"For livelihood restoration, gasification of the village would be the most useful measure to support the community."*
Shoktas	• Government employment: 34.6% (highest reported). • External labour migration: 16.7% of households, the highest share among the listed villages. • Livestock-based livelihoods (Livestock identified as primary income source) • Limited alternative employment • Out-migration for work
Kotyrbulak	• Labour force inactivity: 25.8%, substantially higher than the overall reported level (<3%). • Reliance on animal husbandry (livestock rearing for consumption and sale) • Limited awareness of pasture legislation • Few local enterprises
Kentau	• Mixed livelihoods: livestock, SMEs, wage employment • Dependence on industrial jobs • Presence of Special Economic Zone • In-migration for work opportunities

6.3.6 Poverty and Equity

6.3.6.1 National

In Kazakhstan, the poverty rate (the share of the population with incomes used for consumption below the subsistence minimum) is determined by the ratio of the population with incomes below the minimum subsistence level to the total population; 43 407 KZT is a minimum subsistence level in Kazakhstan in 2024 and 46,228 KZT in 2025. The minimum salary is 85,000 KZT, the minimum pension is 57,853 KZT, and poverty line for 2024 is 30,385 KZT[28].

Jambyl region ranks sixth among 17 regions of Kazakhstan and three cities of republican significance (Almaty, Astana, Shymkent) in terms of the highest poverty in Q1 2024. In comparison, in the fourth quarter of 2024, according to the National Bureau of Statistics, Turkestan Region recorded one of the highest poverty rates in the country, at 8.4%.[29]

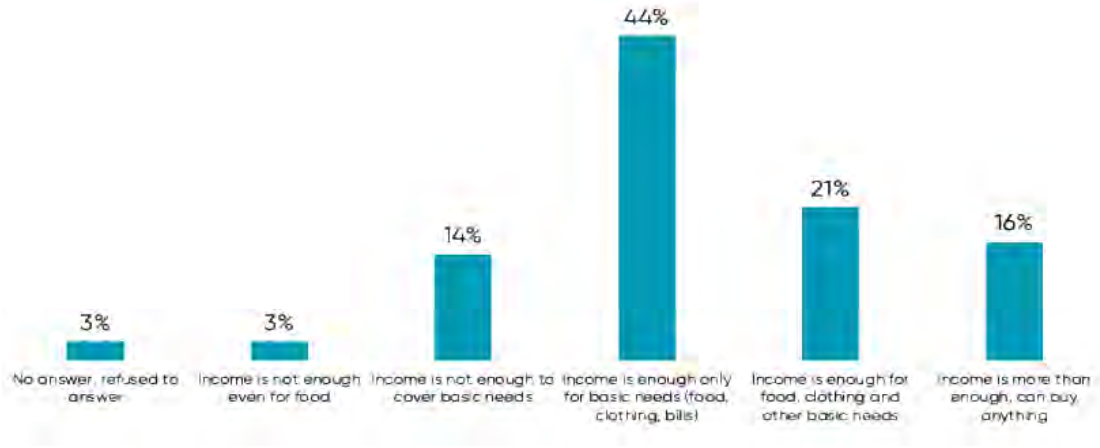
6.3.6.2 Jambyl Region

According to the results of sample survey of households, the share of the population with incomes below the subsistence minimum (poverty level – 30 385 KZT), amounted to 4.8% (14 households)[30].

A total of 129 (43.7%) of respondents report that their income is only sufficient to cover their basic needs such as food, clothing, and bills. Meanwhile, 63 (20.7%) feel their income adequately covers basic needs, and 48 households (16%) feel confident to buy anything. However, 51 1(7%) of respondents struggle to meet even the most fundamental needs, with 9 households (2.7%) unable to afford food.

[28] https://findhow.org/3048-bazovyie-stavki-mrp-mzp-prozhitochnyiy-minimum-rk.html?y=2024
[29] https://www.nur.kz/nurfin/economy/2230683-dolya-bednyh-lyudey-umenshilas-v-kazahstane/
[30] https://astanatimes.com/2025/04/income-disparities-in-kazakhstan-reflect-seasonal-and-regional-variations

Figure 6-2: Household income [n=300]



The majority of respondents (63.7%) do not perceive any threats impacting their income. However, rising prices for consumer goods are a significant concern for 66 (22%) of the respondents. Unemployment also stands out as a concern for 26 (8.7%) of the participants. Other specific threats, like a decrease in prices for agricultural products and lack of irrigation water, are less frequently mentioned.

Household expenditures and income

A separate set of questions on households' expenditures and income were asked to reveal people's habits, needs, and opportunities. However, it is worth noting that respondents were reluctant to answer questions regarding their financial matters.

The highest average expenditure is on farm/garden costs (496,925.37 KZT on average), suggesting that a significant portion of the household budget is required to sustain their agriculture. However, these expenses are relevant for 81 (27%) of respondents who provided expenditure data, which is consistent with the employment and other collected data.

Table 6-15: Average household expenditure per month by categories (KZT) [n=300]

Category	Average	Max	Min	Median
Costs of farm/garden, including the purchase and maintenance of livestock, poultry and fodder	496,925	6,000,000	3,000	250,000
Loan payment	161,043	5,000,000	5,000	110,000
Education	132,710	1,000,000	1,000	100,000
Other expenses	90,747	1,000,000	3,000	60,000
Food	81,406	250,000	10,000	70,000
Transportation (Public and private)	30,207	500,000	500	15,000
Medical treatment	21,618	100,000	500	15,000
Taxes (payment) for public utilities	17,135	250,000	1,000	11,000

Purchase and delivery of water for drinking and domestic needs	5,014	40,000	150	4,000

Loan payments represent the second-highest expenditure (161,042.55 KZT on average), indicating a high level of household debt. Even though the data is absent, researchers could assume that loans are provided for (a) agriculture purposes (due to high prices), (b) household expenses (construction and maintenance), (c) entrepreneurship, and etc.

Education represents the third-highest expenditure (132,709.68 KZT on average), indicating a strong emphasis on educational investment. It might include purchase of school supplies, textbooks, contributions to the school fund, college and university expenses, payment of courses, tutors, etc.

Food is the fifth-highest expenditure category (81,405.62 KZT on average), representing a significant portion of household budgets.

Utilities, water, medical treatment, and transportation show lower average expenditures compared to the top categories, but still represent important household costs. All categories show high standard deviations, indicating significant differences in spending patterns across households.

Regarding the household income, income from employment in both agricultural and non-agricultural sectors forms a significant portion of it, indicating the importance of job opportunities in these areas. It also indicates that despite agriculture being the less common occupation in the region, it is one of the highest values. Also, the sale of livestock and agricultural products are among top three income sources.

Average household income per month by sources

In 2024, the average monthly salary in Kazakhstan amounted to 405,416 KZT which was 11.3% higher than a year earlier. Men's salary reached 468,914 KZT (plus 11.97% from the previous year), women's salaries reached 344,496 KZT (plus 10.69% from the previous year). Men's wages were higher than the average wage in general by 15.67%. Women's wages, on the contrary, were in general lower by 15.03%.[31]

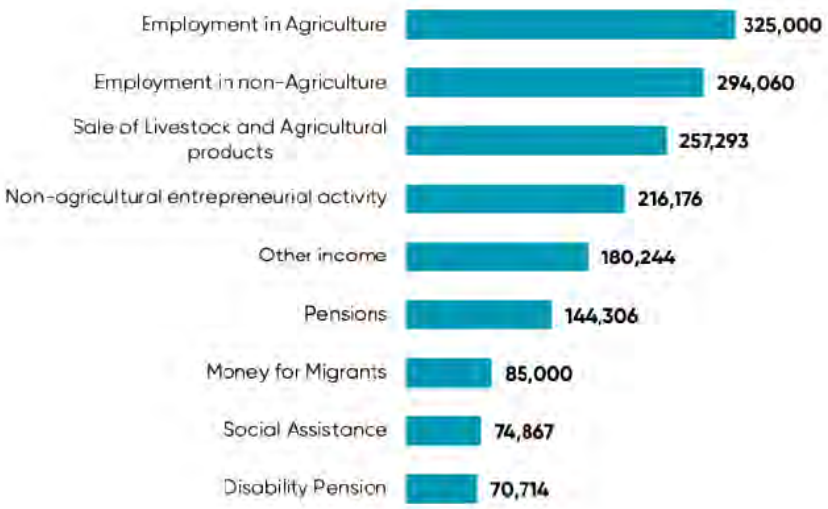
Agricultural employment plays an important role in household earnings. Non-agricultural entrepreneurial activities also contribute significantly to household income, highlighting the role of small businesses and self-employment.

Pensions and social assistance are important income sources for many households, especially for older family members and those with disabilities. Other income sources, including money from migrants, contribute to household income, though they are less significant than employment and entrepreneurial activities.

The average income-to-expenditure ratio is 0.70, indicating that households earn less than they spend on average. This could suggest financial stress or reliance on savings or credit.

[31] https://stat.gov.kz/en/industries/labour-and-income/stat-wags/publications/408250/?utm

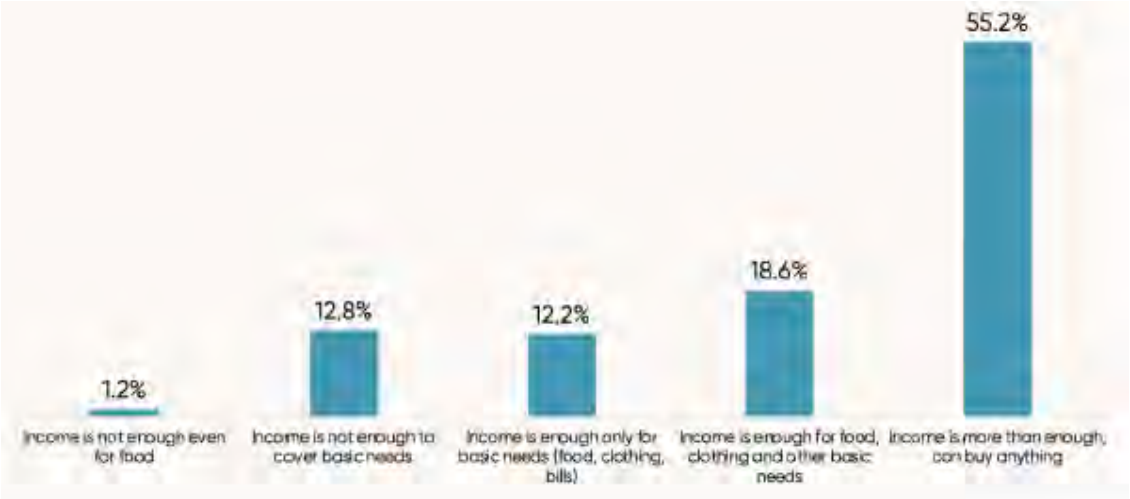
Figure 6-3: Average household income per month by sources [n=300]



6.3.6.3 Turkestan Region

Household income levels and access to resources indicate that poverty is limited but uneven across the surveyed settlements. While 95 (55.2%) of households report their income as "more than enough," a significant minority (22 households, 12–13%) struggle to cover basic needs, and 2 households (1.2%) report being unable to afford sufficient food. Income distribution is closely linked to employment type, with government jobs providing stable earnings, whereas private sector work and entrepreneurship are limited and often insufficient to fully support families. Seasonal and informal labour provide supplemental income but rarely contribute to long-term financial stability.

Figure 6-4: Household income [n=172]



Regarding their expectations, the majority of respondents (89.1%) do not perceive any threats that could impact their income. The remaining reasons are shared by 1-4% of the respondents. Unemployment is considered a threat at 3.9%, rising consumer goods prices at 3.1%, a lack of irrigation water at 1.6%, while 2.3% of respondents said it is difficult to answer.

Expenditures and Income

The highest average expenditure as identified through household surveys is on farm/garden costs (184,200 KZT on average), suggesting that a significant portion of the household budget is required to sustain their agriculture. On the other hand, these expenditures are relevant for 15% of households.

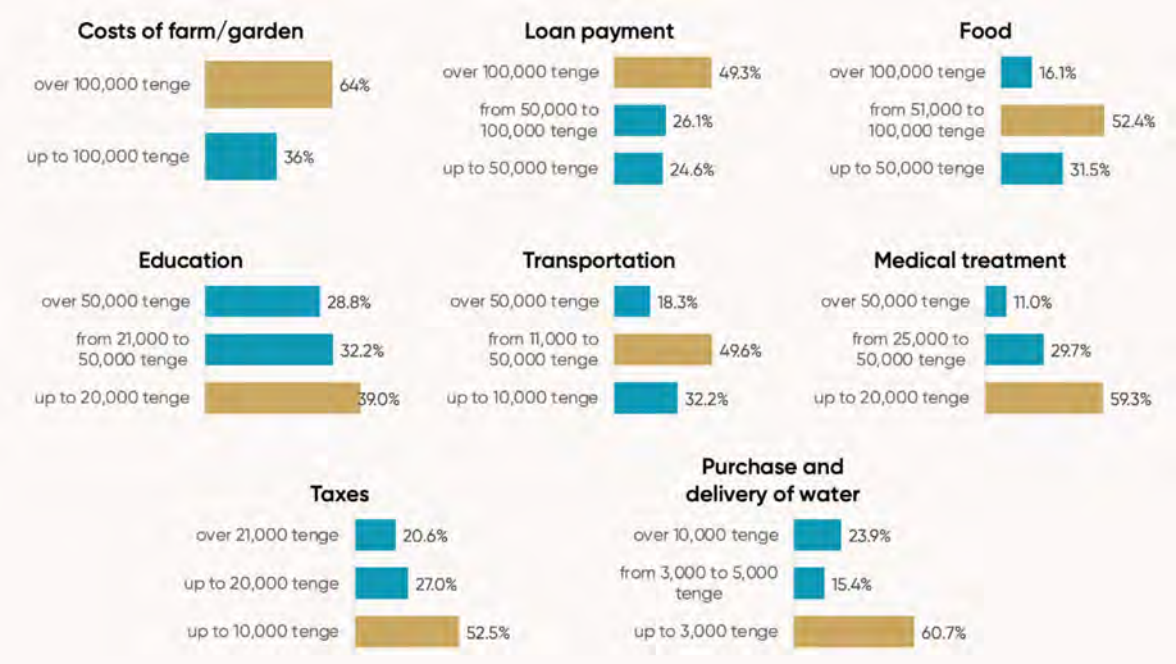
Table 6-16: Average household expenditure per month by categories (KZT) [n=172]

Category	Average	Min	Max	Median	% of households
Costs of farm/garden, including the purchase and maintenance of livestock, poultry and fodder	184,200	20,000	400,000	200,000	15%
Loan payment	147,420	5,000	700,000	100,000	40%
Food	84,650	5,000	250,000	70,000	83%
Other expenses	71,333	8,000	200,000	50,000	3%
Education	53,746	4,000	200,000	40,000	34%
Transportation (public and private)	37,189	1,000	200,000	20,000	67%
Medical treatment	32,516	3,000	200,000	20,000	53%
Taxes (payment) for public utilities	15,590	1,200	50,000	10,000	82%
Purchase and delivery of water for drinking and domestic needs	6,659	360	50,000	2,000	68%

Loan payments represent the second-highest expenditure (147,420 KZT on average), signalling a potentially large share of loans in household expenditures.

Food is the third-highest expenditure category (84,650 KZT on average), representing a significant portion of household budgets.

Figure 6-5: Household expenditure per month by categories and amounts (KZT) n=172]



Average Household Income by Sources

Household income in the surveyed communities is primarily derived from a limited number of sources, with government employment representing the most significant contributor. Approximately 24% of employed respondents work in government positions, including teachers, healthcare professionals, administrators, and other public service roles, which provide relatively stable and predictable incomes. Employment in private companies accounts for roughly 11%, while entrepreneurial activities contribute about 7.4%, with notable concentrations in Uyuk (21.2%) and Sholakorgan (11.8%). Agricultural income, including farming and livestock, plays a minor role, representing only 1.5% of overall income, reflecting the limited agricultural engagement in these areas due to unfavourable climatic conditions, land access barriers, and scarce water resources.

Household surveys indicate that only 12% of respondents reported having any additional income sources beyond these primary categories, and very few were willing to provide specific figures. Migration for work is limited, with 96.5% of households reporting no members earning income in other regions, while only 3.5% have one or more members working elsewhere, predominantly in urban centres or abroad, such as Russia. The highest levels of off-site income were observed in Shoktas (16.7%) and Ashisay (7.0%).

Overall, household income is heavily concentrated in government employment, with minimal diversification across private business, entrepreneurial ventures, agriculture, or labour migration. This limited income base, combined with low reporting willingness, underscores the communities' reliance on public sector salaries and highlights the potential vulnerability of households to economic shocks.

6.3.7 Population, Demographics and Migration trends

6.3.7.1 National

The population of Kazakhstan is approximately 20.4 million people (as of 2025). About 63.5% of the population lives in urban areas, while 36.5% reside in rural areas. There are more women than men in Kazakhstan. The number of women is 10,423,863 (51.1%), while the number of men is 9,963,948 (48.9%)[32].

[32] https://stat.gov.kz/ru/industries/social-statistics/demography/publications/335817/

In January–September 2025, the number of people arriving in the country amounted to 16,175, while the number of people leaving the country was 5,975. The migration balance totalled 10,200 people. Compared to the corresponding period of 2024, the number of arrivals to Kazakhstan decreased by 20.6%, and the number of departures from Kazakhstan decreased by 41.4%.
The country's main migration exchange occurs with CIS member states. The share of arrivals from CIS countries was 82.7%, and the share of departures to these countries was 73.2%.

The number of people relocating within Kazakhstan increased by 22.8% in 2025 compared to the corresponding period of 2024. In terms of interregional movements, a positive migration balance was recorded in four regions of the country: the cities of Astana (67,252 people), Almaty (27,833 people), Shymkent (13,066 people), and the Almaty Region (8,041 people). In Jambyl and Turkestan regions a negative migration balance was recorded: Jambyl region (16,329 people) and (Turkestan region 34,322).

6.3.7.2 Jambyl Region

Population

The population of Jambyl region in October 2025 was 1,216,849 people. The rural population (55.81% or 679,161 people) is greater than the urban population (44.19% or 537,688 people).[33]

The population density in 2025 is 8.4 people per km.

Table 6-17: District population data - Jambyl region

District	Population	Urban population	Urban (%)	Rural population	Rural (%)	Population density (people/km²)	No. of men	No. of women
Sarysu	42,935	25,635	59.72%	17,300	40.28%	0.7	21,812	21,123
Talas	47,201	28,128	59.6%	19,073	40.4%	3.8	23,965	23,236
Zhualy	52,860	0	0%	52,860	100%	12.6	27,274	25,586
Jambyl	87,805	0	0%	87,805	100%	20.4	45,207	42,598

Migration in the surveyed communities is primarily driven by limited local employment opportunities. Households with no members working in other regions account for 96.3%, indicating that most residents either lack the means or the incentive to migrate. In cases where migration occurs, it usually involves only one family member. Higher migration rates in settlements like Karatas (42.9%) and Kyzyltan/Aulie-Kol (14.3%) suggest that unemployment and access to better job opportunities elsewhere are key factors motivating people to move.

Migration

Approximately 27.4% of households reported through the household surveys that at least one member participates in seasonal migration, primarily for work, livestock grazing, or other livelihood activities, while the remaining 72.6% of households do not engage in such migration. Among migrating households, 46% reported that a single member migrates seasonally, 27% reported two members, 19% reported three members, and 8% reported four members. These figures indicate that while seasonal migration is not widespread, it represents a notable component of household livelihood strategies in the area.

The majority of seasonal migration is linked to agricultural and pastoral activities, including grazing, herding cattle (25% of responses), wheat sowing, and haymaking. Additional seasonal work occurs on local farms and cooperatives (e.g., Arbatas, Kokbulak, Maitobede) as well as in industrial enterprises, such as EuroChem in Karatau. This demonstrates that although mobility is largely rural and agricultural, a small portion of the

[33] https://stat.gov.kz/ru/industries/social-statistics/demography/publications/355136/?sphrase_id=1339676

population engages in off-farm or industrial employment within the district.

Most seasonal migrants are away from home for short- to medium-term periods, typically one to four months, most frequently between June and September, corresponding to agricultural cycles. A smaller number of migrants reported longer absences of seven months (March–October or March–November), while approximately 8% indicated year-round or near-permanent work at remote sites. This pattern suggests that while seasonal migration follows the agricultural calendar, a subset of workers maintains continuous or cyclical engagement in off-farm or pastoral labour throughout the year.

Only two households reported members earning income in other regions of Kazakhstan or abroad, with only one individual per household involved. This indicates that external or international labour migration is minimal, and that most income-generating activities and seasonal movements occur locally or within the same district.

Interviews identified that migration with livestock is carried out almost exclusively by men; in the WPP area, women work with cooking for household members staying in wagons, as well as returning to the household to support other family members. Rarely, children are present in the WPP area.

6.3.7.3 Turkestan Region

Population

As of October 2025, the population of the region is 2,148,207 people[34], of which 25.34% (544,406 people) are urban residents and 74.66% (1,603,801 people) are rural residents. The population density in 2025 is 18.3 people per 1 km².

Table 6-18: District population data - Turkestan Region

District	Population	Urban population	Urban (%)	Rural population	Rural (%)	Population density (people/km²)	No. of men	No. of women
Sozak	62,163	0	0%	62,163	100%	2.3	31,929	30,234
Sauran	103,695	0	0%	103,695	100%	15.9	53,029	50,666
Kentau town	99,247	25,275	25.5%	73,972	74.6%	—	49,390	49,857

Household surveys describe children within household structures: 46.8% of respondents are children of the household head, 23.6% are household heads themselves, and 22.7% are spouses or partners, indicating that most households have multiple members. Despite the expectation of larger rural families, the most common household sizes are relatively small: 1–3 members (41%), 4 members (40%), and 5 or more members (20%).

Regarding children and their engagement with education, 35.5% of households report that their children attend school, while 64.5% do not. Child labour is limited but present: 82% of households report no child labour beyond household chores, while 18% report children working outside the home. Among those working, 25.8% of children work over 40 hours per week, 51.6% work 30–40 hours, and 22.6% work less than 30 hours weekly, suggesting that when child labour occurs, it is often substantial enough to potentially impact education and development.

The highest number of children under 18 years was reported in Kotyrbulak and Shoktas settlements, 39% and 38%, respectively. While the lowest numbers of children were in Sholakkorgan (24%) and Ashisay (25%). The highest number of elderly people (65+) was reported in Kushata settlement, while none were reported

[34] https://stat.gov.kz/ru/industries/social-statistics/demography/publications/355136/?sphrase_id=1339676

in Shoktas.

Migration

The vast majority of households (96.5%) reported through the household surveys that no members earn income in other regions of Kazakhstan, while only 3.5% of households have members working elsewhere. This indicates limited labour commuting migration within the project area. Among the households that do participate in external labour migration, it is generally one or two family members who seek employment outside their home district. Some migration occurs to other regions or even abroad, particularly to countries such as Russia, reflecting a preference for longer-distance or international work opportunities. Spatial differences were observed across communities: Shoktas exhibits the highest proportion of households with members earning income elsewhere (16.7%), followed by Ashisay (7.0%).

Seasonal migration emerged as a defining socio-economic feature across the surveyed settlements, shaping both livelihood strategies and demographic dynamics. In nearly all rural communities—including, Uyuk, Sholakkorgan, Shoktas and others—residents consistently emphasized the lack of stable local employment as the main factor pushing people to seek work elsewhere. Young and working-age men most often leave for shift or seasonal work to other regions of Kazakhstan such as Karaganda, Jambyl, Aktobe, and Turkestan, or abroad, particularly to Russia and South Korea.

Residents highlighted that “young people mostly leave for shift work; employment opportunities are limited”. Similar sentiments were echoed in Sholakkorgan, where the participant noted that “those who are not engaged in livestock farming leave for construction work in Turkestan or go abroad.” According to residents of Shoktas, many men “work on a rotational basis in Korea or Russia and return home only once every few months.”

Seasonal migration is also closely connected with traditional pastoral practices. Livestock grazing follows a seasonal pattern: during spring, summer, and autumn, herds are taken to nearby pastures or mountainous grazing areas, while in winter they are kept in barns and fed purchased fodder such as hay, wheat, or barley. Many households rely primarily on livestock, but maintaining winter fodder supplies forces some family members to seek external income. One of the residents remarked that “without livestock people either migrate or face poverty, and young people leave because there is no school and no jobs.”

Several smaller settlements experience noticeable seasonal fluctuations in population. In Uyuk, for example, many families reside only during the summer months and move to cities for the winter due to the absence of basic services and the limited availability of year-round work. This seasonal pattern contributes to long-term depopulation trends, closure of schools, and declining community vitality across several villages.

Overall, seasonal migration has become an essential strategy for sustaining household economies in the region. It provides necessary income in the context of scarce local jobs, increasingly harsh climatic conditions, and rising costs associated with livestock maintenance. Although remittances support families and strengthen their resilience, the continuous outflow of working-age residents places additional burdens on those who remain—primarily women, the elderly, and children—shaping the social fabric of rural Kazakh communities.

6.3.8 Education and Social Infrastructure

6.3.8.1 National

All citizens of Kazakhstan, both men and women, have full access to education. According to the Article 30 of the Constitution of Kazakhstan, citizens are guaranteed free secondary education in state educational institutions. Secondary education is compulsory.

In accordance with the Law on Education, the basic principles of state policy in the field of education are:

equality of rights of all to receive quality education; prioritization of the development of the education system; accessibility of education at all levels for the population, unity of education, upbringing and development; democratic nature of education management, transparency of the education system activity; diversity of educational organizations by forms of ownership, forms of education and upbringing, directions of education.

Kazakhstan has the highest level of higher education among the population in the CIS. The information is based on the results of population census campaigns. According to the source, 276 out of every 1,000 Kazakhstani citizen aged 15 and older, or one in four, have a university degree.[35]

According to the most recent population census in Kazakhstan (2021), approximately 3.7 million people have higher[36] education, 4.1 million have vocational (secondary specialized) education, and 4.9 million have general secondary education.[37]

The share of the population with higher education has significantly increased, rising from 19.8% in 2009 to[38] 27.6% in 2021.[39]

In 2021, there were 276 people with a university degree per 1,000 inhabitants (informburo.kz)[40]

According to a study, approximately 38.9 % of adult women in Kazakhstan have a tertiary education[41].

According to the 2023 report on the higher education system in the country, 53 % of the 592,700 university students are women[42]

Estimates for 2020–2021 indicate that almost every second working woman in the Republic of Kazakhstan has a higher or postgraduate education[43]

Various projects are underway at the national level to support training development for youth in Central Asia and Kazakhstan specifically. There is focus at the policy level to strengthen the links between the education system and the labour market, enabling the modernisation of workforce training, the implementation of independent qualification assessment, and the updating of professional standards.[44] Other investment is focused on upskilling for better work opportunities in the green economy specifically.[45] Nationally, 2025 saw increased investment in vocational training, including collaboration between the Ministries of Energy and Education for training programs in 61 Universities and more than 200 colleges, including in renewable energy.[46] One school has been developed, targeted to renewable energy.[47]

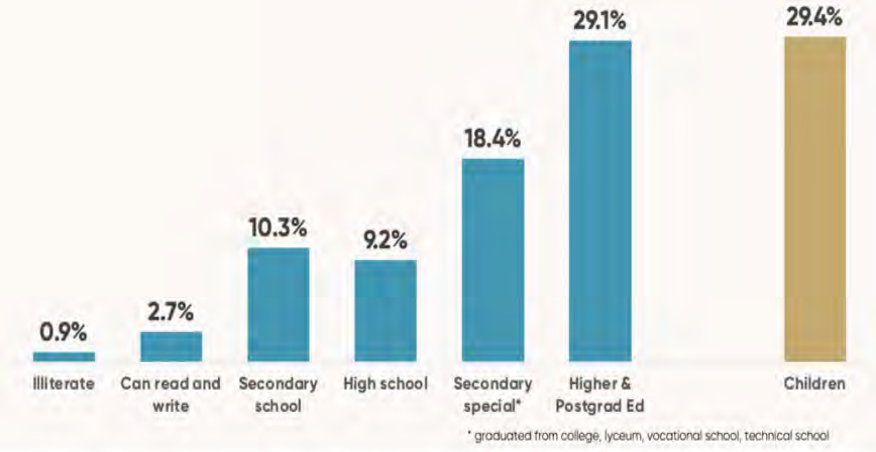
[35] https://ranking.kz/digest/industries-digest/v-kazahstane-okazalsya-luchshiy-v-sng-uroven-rasprostranyonnosti-vysshego-obrazovaniya-sredi-naseleniya.html
[36] https://ortcom.kz/ru/novosti/1699267935
[37] https://ortcom.kz/ru/novosti/1699267935
[38] https://ortcom.kz/ru/novosti/1699267935
[39] Presidential Statistics Committee of the Republic of Kazakhstan
[40] https://informburo.kz/novosti/na-1000-celovek-276-s-diplomom-vuza-poslednie-dannye-perepisi-naseleniya-opublikovalo-byuro-nacstatistiki
[41] https://documents1.worldbank.org/curated/en/099121024150515312/pdf/P5011041791e5c07c19b3d16b0aecd7cc53.pdf?utm_source
[42] https://stat.gov.kz/upload/iblock/806/63tkuhmwluq1giq8wui76umx42lfs3sj/%D0%A0%D0%B5%D0%BB%D0%B8%D0%B7%20%D0%B0%D0%BD%D0%B3.pdf?utm_source
[43] https://finprom.kz/ru/article/prakticheski-kazhdaya-vtoraya-sredi-rabotayushih-zhenshin-v-rk-imeet-vysshee-i-poslevuzovskoe-obrazovanie-v-vremya-kak-dolya-vysokoobrazovannyh-muzhchin-sostavlyaet-vsego-38-zanyatyh?utm_source
[44] For example, the EU-Central Asia DARYA project; https://astanatimes.com/2025/10/eu-central-asia-push-efforts-on-skills-employability-at-high-level-meeting-in-turin
[45] For example, the GIZ 'Professional Green Skills for Central Asia' project https://www.giz.de/en/projects/professional-green-skills-central-asia
[46] https://qazaqgreen.com/en/news/kazakhstan/2499/
[47] Mangystau Energy College (https://mek.edu.kz/en/)

6.3.8.2 Jambyl region

Jambyl Region demonstrates dynamic development in the field of education and the training of qualified personnel. The region has 514 schools, with more than 382,000 children enrolled[48]. The system of vocational and technical education is represented by 42 colleges, where over 28,000 students are studying. Higher education in the region is provided by two universities: TarGU and MTII, which together enrol more than 20,000 students. Moreover, over 70% of the region's schools teach in the state (Kazakh) language, reflecting the preservation and development of national education[49].

The education level of household members in Jambyl region as reported through household surveys indicates a generally well-educated population. Nearly one-third (29.4%) are children still in the process of completing their education. Among adults, 29.1% have higher or postgraduate education, while 18.4% hold secondary special qualifications (ex. college, lyceum, or vocational school). About one in five completed general or high school (10.3% and 9.2% respectively). A small share can read and write without formal schooling (2.7%), and less than 1% are illiterate, reflecting a high overall literacy rate among surveyed households (see Figure 6-6).

Figure 6-6: The education level of household members in Jambyl region [n=300]



Sarysu district

The communities of Aktogay, Suzdykbayev, Ushbas, Burkitbauev have one school, each. In Zhanatas there are five schools, eight preschool institutions, four organizations of additional education and one school of technical and professional education, two medical organizations, and a rehabilitation and adaptation centre for disabled children with 25 places.

Talas district

There are 35 secondary schools, 19 kindergartens, 15 mini-school centres, three out-of-school educational institutions (Children's School of Arts, Children's and Youth Centre, "Zhuldyz" yard club), two colleges, a special boarding school "Umit" for children with locomotor disorders, Talas District Centre for Rehabilitation and Adaptation of Disabled Children, and four children's and youth sports schools.

Zhualy district

In the district there are 39 secondary schools, and one college.

Jambyl district

[48] https://atamekenim.atameken.kz/ru/news/54157-kadrovyj-potencial-zhambylskoj-oblasti-obrazovanie-i-zanyatost?utm_source
[49] https://www.inform.kz/ru/svyshe-70-zhambylskih-shkol-rabotayut-na-kazahskom-yazyke_a4005024?utm_source

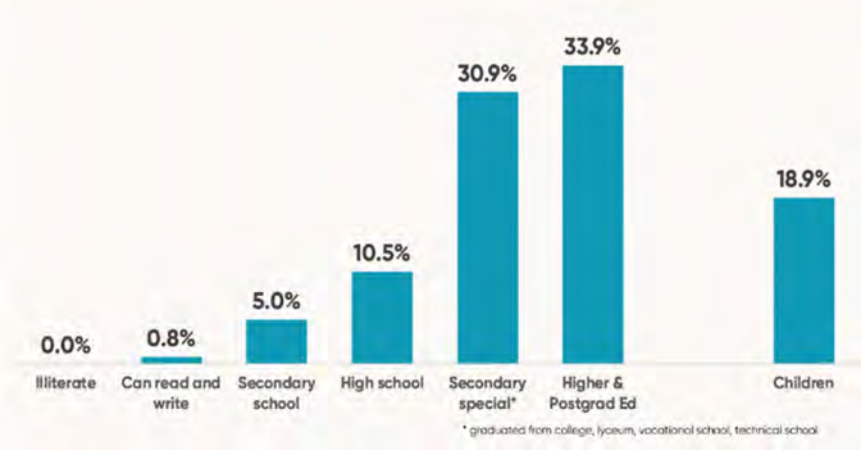
There are 39 secondary schools, and 27 kindergartens. There are also 20 mini-school centres, three extracurricular educational establishments (Art courses, children's and youth centre, general education centre, secondary school, youth Centre, general education centre), and two colleges. For the population are available Jambyl district centre for the rehabilitation and adaptation of disabled children, and two children's and youth sports schools.

6.3.8.3 Turkestan region

The education level of household survey respondents is generally high. About 34% hold higher or postgraduate degrees, while 31% have completed secondary specialized education, such as college, lyceum, or vocational school. There are no illiterate individuals among the surveyed population.

Small schools exist in some villages, but closures occur due to depopulation. Kentau city and Shoktas village provides more options, including private schools. For example, the residents of Oyuk and Ashisay send their children to Kentau or Shoktas schools. Internet connectivity for remote learning is weak or absent in Uyuk and Kushata.

Figure 6-7: The education level of household members in Turkestan region [n=172]



Sozak District

The District is well-equipped with essential public services and healthcare facilities. It features a Central Polyclinic, 1 fully functioning hospital, and a network of 16 medical centres along with 18 outpatient clinics that provide accessible healthcare to residents across the region. In terms of education and early childhood development, the district is home to 38 kindergartens and 35 schools.

Sauran district

The district has 61 schools (across all levels), supported by a technical lyceum and a dedicated music school. There are 58 kindergartens and 4 specialized school preparation centres.

Kentau District

The city’s social infrastructure is well-developed, with 81 educational institutions, including 33 general education schools, 33 kindergartens, 5 colleges, 5 sports schools, 4 supplementary education centres, and a music school. Additionally, Kentau is served by 12 healthcare facilities.

6.3.9 Language and Ethnicity

6.3.9.1 National

Kazakh is the state language of the Republic of Kazakhstan Article 7 of the Constitution, the Basic Law of the

Republic of Kazakhstan, states that Kazakh is the state language. At the same time, in state organizations and local government bodies, Russian language is also used as an official language and has the status of a language of 'interethnic communication'.

According to official statistics[50], at the beginning 2025 the different ethnicities in Kazakhstan were as follows: Kazakhs – 71,3% (14,456,709 people); Russians – 14,6% (2,963,938 people); Uzbeks – 3,3% (678,487 people).

6.3.9.2 Jambyl Region

According to the results of a sociological survey conducted in 2022, 92.6 percent of the population spoke the official language, while 60.2 percent spoke, read, and wrote it fluently. The level of proficiency in Kazakh among representatives of other ethnic groups is 61 percent in Jambyl region. Russian is spoken by 91.5 percent of the region's residents, and English by 29 percent.[51]

In accordance with an official information received from akimats of Jambyl region, the ethnic composition of the districts of Jambyl and Turkestan Regions is shown in Table 6-19.

A strong Kazakh majority, with 94.3% of all households identifying as Kazakh nationality is common for the southern rural territories of Kazakhstan[52]. Among other ethnic groups, a high level of proficiency in the state language is observed among Uzbeks (72%), Uighurs (71.7%), Tajiks (63.6%), Turks (61%), Azerbaijanis (58.5%), Tatars (50.5%), and Dungans (50,2%)[53].

6.3.9.3 Turkestan

The surveyed population in the region is overwhelmingly Kazakh (97.7%), with small minorities of other Central Asian ethnicities (1.5%) and Slavic groups (0.8%). Non-Kazakh residents were primarily located in Ashisay settlement.

Kazakh is the dominant language for daily communication, education, and local administration. Russian is also commonly understood, particularly in administrative and educational contexts, reflecting historical influences and continued use in formal sectors. Minority languages are present only in very small numbers.

Table 6-19: Distribution of ethnic groups across districts (Jambyl and Turkestan Regions)

District	Kazakhs	Russians	Kurds	Koreans	Dungan	Azeris	Uzbek	Others
Sarysu	92.4%	5.1%	1.4%	0.10%	0%	0%	0%	1.0%
Talas	87.5%	4.7%	4.0%	0.4%	0%	0%	0%	1.6%
Zhualy	90.3%	6%	0%	0%	0%	1.1%	0%	2.5%
Jambyl	70.2%	6%	5%	4.1%	9.7%	0%	0%	0.3%
Sozak	91.0%	0.9%	0%	0%	0%	0%	7.6%	0,5%
Sauran	45.4%	n/a	0%	0%	0%	0%	53.8%	0.8%
Kentau	56.8%	2%	0%	0%	0%	0%	39.6%	1.6%

[50] https://stat.gov.kz/en/industries/social-statistics/demography/publications/337150/?utm_source
[51] https://ztgzt.kz/61174/bolshe-praktiki-bolee-92-procentov-zhambylcev-vladeyut-gosudarstvennym-yazykom
[52] https://qazinform.com/news/state-language-share-in-documentation-management-in-zhambyl-oblast-makes-up-94-3_a2198806?utm_source
53 https://vlast.kz/novosti/51399-okolo-80-naselenia-kazahstana-vladeet-kazahskim-azykom-itogi-perepisi.html

6.3.10 Accommodation, Living Conditions and Household Amenities

6.3.10.1 National

In accordance with the Order of the Minister of Health "On the Approval of the Sanitary Rules 'Sanitary and Epidemiological Requirements for Administrative and Residential Buildings'",[54] the following requirements are established:

Dormitories must provide at least 6 m² of living space per person. Each floor must include sanitary facilities, washrooms, and kitchens, with one shower, one washbasin, and one toilet provided for every 4–6 people. Administrative and residential buildings, including dormitories, must comply with state standards for sanitary facilities, including accessibility for persons with reduced mobility. Dormitories must also provide areas for rest, dining, storage of personal and special clothing, and showers.

Sanitary facilities must not be located above living rooms, garbage chutes must not run under or directly into living spaces, and rooms must be used only as intended. Finishing materials must be certified for quality and safety, and floors at entrances and on stair landings must be non-slip and level.

During periods of increased disease incidence, the Chief State Sanitary Officer of Kazakhstan or the relevant local authority may impose restrictive measures, including quarantine, in accordance with Articles 38 and 104 of the Code of the Republic of Kazakhstan "On the Health of the People and the Healthcare System".

The areas surrounding administrative and residential buildings must be maintained, with clean, paved walkways and driveways. All rooms must undergo daily wet cleaning using approved detergents. Equipment, furnishings, and dormitory soft furnishings such as mattresses, pillows, and blankets must be disinfected according to established standards. Mattress covers must be changed as needed, at least monthly, and bed linens at least once every seven days. Soft furnishings must be replaced according to manufacturer guidelines or when worn.

Dormitory kitchens must have tightly sealed containers for food waste, emptied daily or as filled. Administrative and residential buildings must maintain functional and safe water supply, hot water, sewage, heating, lighting, ventilation, and air conditioning systems. Buildings must be supplied with safe drinking water in compliance with established standards. Basement and underground areas must be kept clean, dry, well-lit, and any leaks, blockages, or damage promptly repaired. After sewage system failures, preventive disinfection must be carried out.

6.3.10.2 Jambyl Region

The results of Household Survey conducted in Jambyl region provided source data for this section.

The vast majority of respondents live in either private houses or flats in multi-stored apartments, with these two categories accounting for 99.7% of all responses living:

- in private houses - 50.7%
- in apartments - 49.0%

Only a tiny fraction (0.3%, representing just 1 respondent) lives in a room in a house.

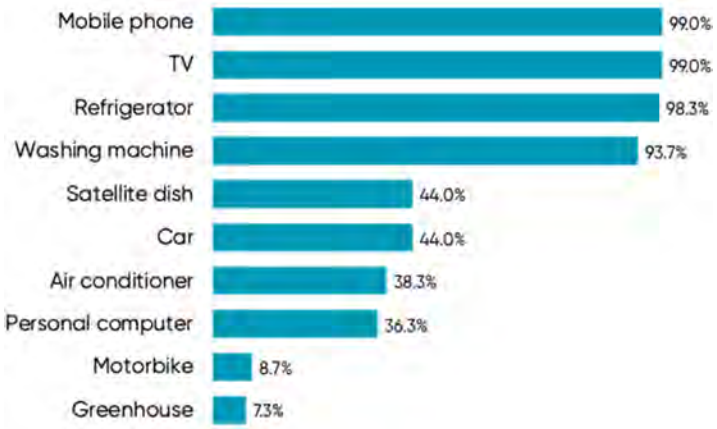
Most respondents (98%) live in their houses year-round, indicating a stable housing situation and presence at these settlements permanently. Remaining respondents live in the houses during summer months, which might indicate using these houses as "dacha" or seasonal houses for agriculture purposes.

[54] 16 June 2022 No. RK DSM-52 "On the Approval of the Sanitary Rules 'Sanitary and Epidemiological Requirements for Administrative and Residential Buildings'", registered with the Ministry of Justice of the Republic of Kazakhstan on 20 June 2022 under No. 28525

Household assets

Most households have basic amenities such as mobile phones (99%), TVs (99%), refrigerators (98.3%), and washing machines (93.7%). Cars are present at almost half of the adult respondents (44%). Further detail is provided in Figure 6-8.

Figure 6-8: Main household assets [n=300]

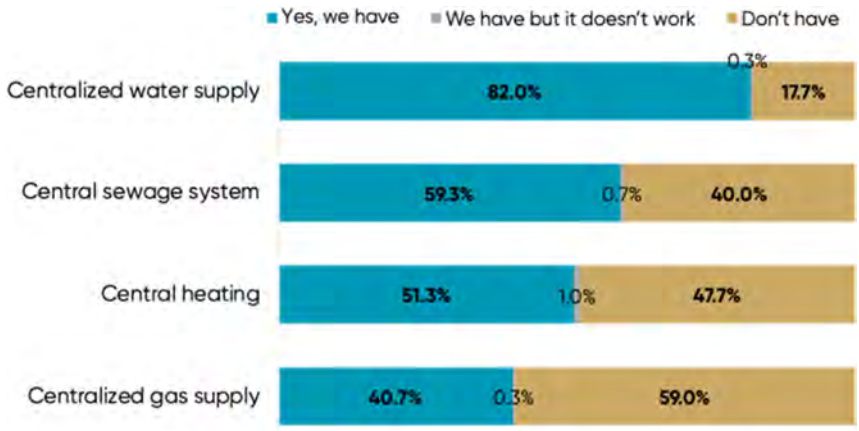


The use of greenhouses is limited in this region, probably due to the region's unsuitable conditions for these purposes and the high expenses required (water, materials, soil, etc.).

Utilities and public services

Regarding utilities, 82% have centralized water supply, 59.3% have central sewage systems, and 51.3% have central heating. However, only 40.7% have a centralized gas supply, as shown in Figure 6-9.

Figure 6-9: Amenities reported in households [n=300]



Apart from centralized water supply, residents might use different water sources for drinking and cooking. The second most common source is own groundwater well in the yard – for 10% of all respondents, and third is a pump in the own or neighbouring yard (3.7%).

Fuel

A similar distribution is observed for other household amenities. In terms of heating houses - there is a significant reliance on central heating, which is the predominant method used by 41.3% of the respondents, indicating a well- established infrastructure in areas. The second most common source is coal, utilized by

31.7% of the households. This high usage might reflect either a need for more access to more modern heating systems or a preference due to cost, availability, or tradition.

Centralized gas for heating serves 19% of the respondents, suggesting that while gas infrastructure is present, it might not be as widespread or preferred as central heating. The use of gas in cylinders is notably lower (3.3%), which could indicate limitations in supply or higher costs associated with this option.

Wood or plant materials and electricity are used by a smaller fraction of the population (4.0% and 0.7%, respectively), highlighting their roles as either supplementary sources or primary sources in areas lacking other infrastructure.

For cooking purposes, coal is the predominant fuel used by 66% of respondents. Gas in cylinders is the second most common choice, used by 29.7% of respondents. Other fuel types, such as centralized gas supply, wood or plant materials, and electricity, are used by a very small fraction of the population, each accounting for less than 3% of the total.

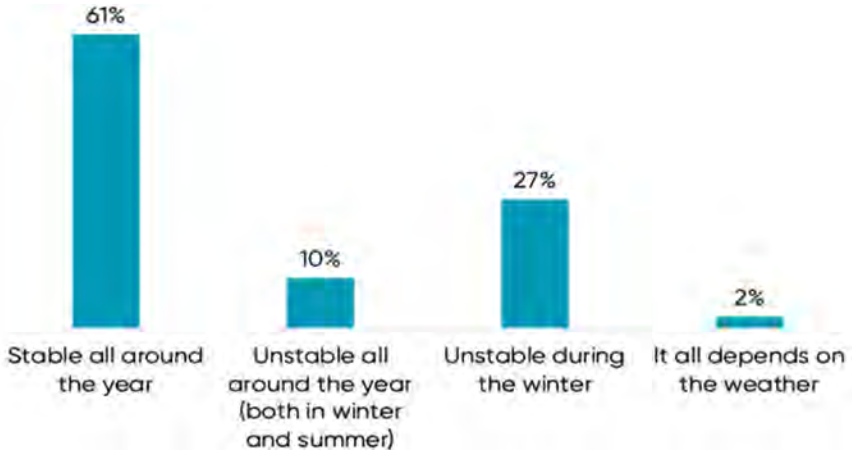
Waste disposal

The majority of respondents (54.9%) prefer to dispose of their waste in public containers on the street. This method is likely favoured due to its convenience and accessibility. A significant portion of respondents (33.4%) manage their waste by using a pit for special waste in their yard, which may reflect traditional practices or lack of access to public waste services. Private waste companies are used by 9.4% of respondents, while state waste disposal services are the least utilized, with only 2.3% of respondents opting for this method.

Power

Regarding electricity, 61% of respondents report stable electricity supply year-round, while 27% experience instability during winter and 10 % describe it as unstable all around the year (both in winter and summer) and 2% of respondents reports that electricity depends on the weather.

Figure 6-10: Reported stability of electricity supply to households (% of respondents, Jambyl region) [n=300]



Modes of Transport

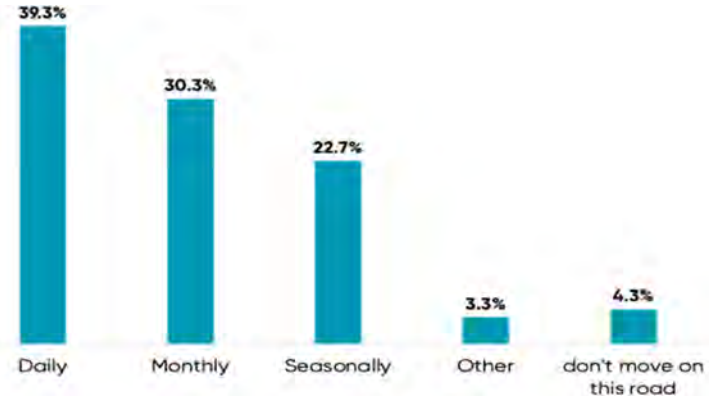
The most common mode of transportation is private car ownership, with 40.1% of households relying on their vehicles. Local taxis are second, used by 38.6% of households as their main mode of transportation. Public transport, including private minibuses, is the least used of the three options, but it is still significant, with 21.4% of households using it.

The high usage of taxis compared to public transport could indicate factors such as convenience, availability, or limitations in the public transportation system.

Citizens were surveyed to understand their use of the WPP and Jambyl OHTL ROW. According to the survey, almost all respondents (98.3%) do not use the Project site or Right-of-Way (RoW) for Overhead Transmission Lines (OHTL).

Regarding the Karatau Public Road, which is relevant for the project site, the road is frequently used, with 39.3% using it daily. This highlights its importance as a transportation route.

Figure 6-11: Frequency of Karatau (R-43) public road use (% of respondents) [n=300]



Moreover, 90.7% of respondents report no alternative roads. This indicates a reliance on the Karatau Road for transportation. Among the mentioned alternatives, there are roads through Tam, Akkol (42.9% of those who mentioned alternatives), Taraz— Shymkent (21.4%), and other villages (14.3%).

Other services

A vast majority of households (89%) do not receive unemployment or large family benefits, indicating limited reliance on these social support systems. Only 1% receive unemployment benefits, while 10% benefit from large family support. Unemployment benefits are provided only to those who register with employment agencies; those in casual or seasonal work do not typically register despite not having full time work.

Awareness and presence of non-governmental or community-based organizations are low, with only 11.3% of respondents acknowledging their existence. A significant portion (42.3%) is unaware or uncertain about such organizations, suggesting a potential gap in community engagement or communication.

Among those aware of community organizations, Soviet veterans' groups are the most recognized (5.3%), followed by Amanat Party (2.7%). Other organizations like charitable funds and women's associations have minimal recognition, highlighting a narrow scope of community involvement.

There is high level of accessibility to police or security services within local areas, with 95% of respondents affirming the presence of such services nearby. This suggests strong local security infrastructure in most surveyed areas. However, for the 5% without local services, alternative locations are identified, primarily in nearby villages like Zhanaaryk.

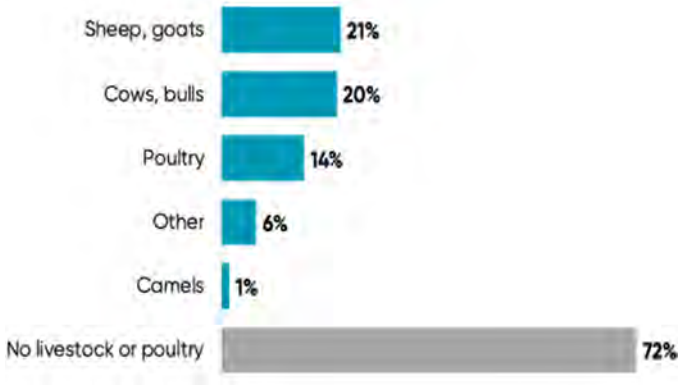
Household Livestock ownership and Agriculture

Despite living in rural areas, most households (72%) do not own livestock or poultry. Among those who do, sheep/goats (21%) and cows/bulls (20%) are the most common.

Also, many of those livestock owners (38%) have two types (usually a pair of sheep and cows), while a

comparable number of households have only one type of livestock (25%) and three types (22%).

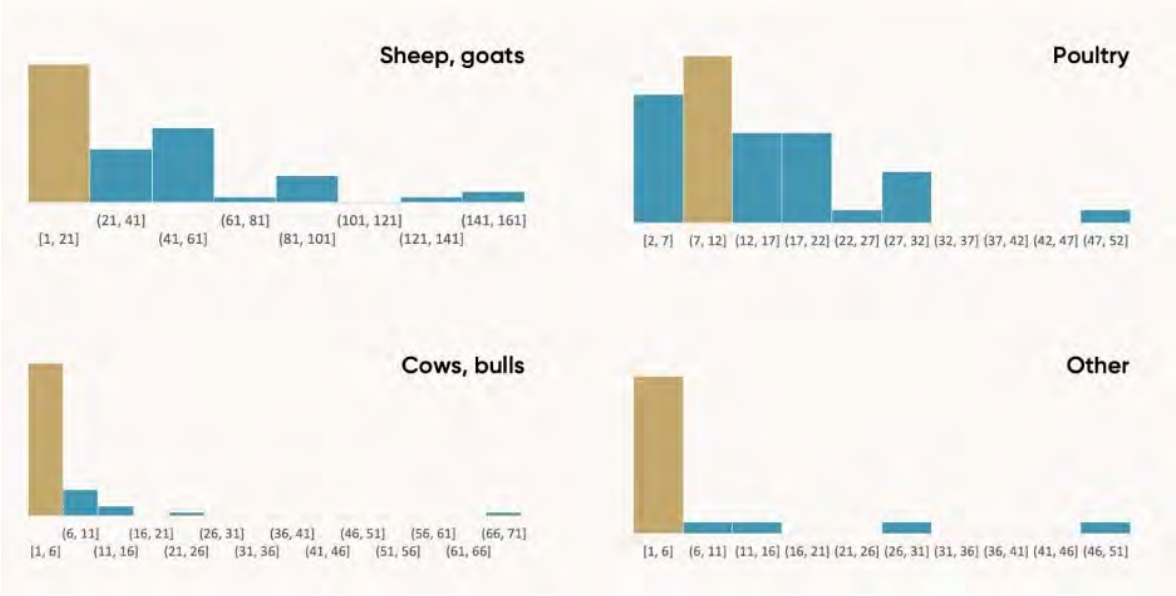
Figure 6-12: Types of livestock and poultry in the households [n=300]



Among those who own livestock, most households have small quantities in any category. For instance, among households that have sheep and goats usually number of livestock goes up to 20, also some households have up to 60, while very limited numbers have higher numbers. Worth mentioning there are 3 cases of owning over 200 sheep and goats.

In the case of cows and bulls, the dominant share of households has only up to 6 animals. This is similar to the distribution of "other" livestock. Poultry is more numerous in households, with numbers reaching 22 birds, and the most common quantity is between 7 and 12.

Figure 6-13: Distribution of livestock ownership by livestock quantity (number of livestock) [n=300]



Regarding land usage, 90.3% of households don't have a farm or additional land plots. Only 9.7% own any land, indicating a weak agricultural presence.

Among those who have additional land, the total area owned is usually below 22 hectares. However, there are few cases of owning more than 150 hectares, and even one respondent owns 2,500 hectares.

6.3.10.3 Turkestan Region

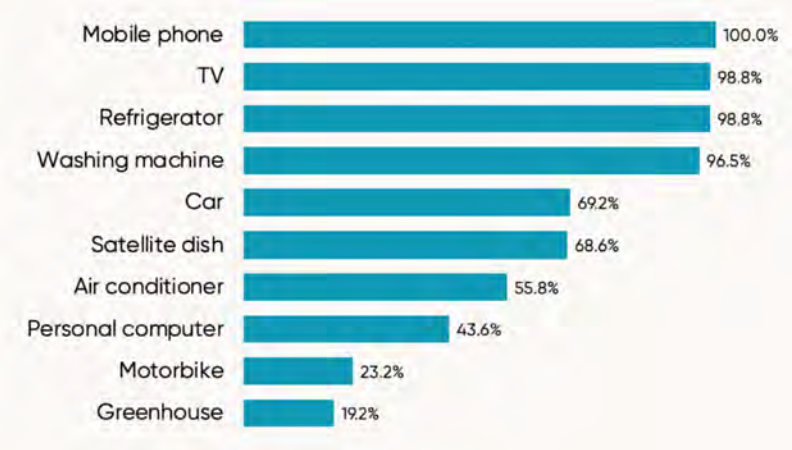
The results of Household Survey conducted in Turkestan region provided source data for this section.

The vast majority of respondents live in private houses – 95.3%. A small share live in apartments in multi-story buildings (2.9%) and in rooms within houses (1.7%). Almost all respondents (99.4%) live in their houses year-round, indicating a stable housing situation and a permanent presence at these settlements.

Household assets

Most respondents in households have mobile phones (100%), TVs (98.8%), refrigerators (98.8%), and washing machines (96.5%). Cars and satellite dishes are present in more than two-thirds of respondents, at 69.2% and 68.6%, respectively.

Figure 6-14: Share of people owning the assets in the household, Turkestan region [n=172]



The use of greenhouses is limited in this region, probably due to the region's unsuitable conditions for these purposes and the high expenses required (water, materials, soil, etc.).

Utilities and public services

Regarding utilities**,** 89.5% have a centralized water supply. However, for other utilities, most respondents don't have access to a centralized sewage system (only 17.4% have access)**,** gas supply (9.9%), or heating (8.1%).

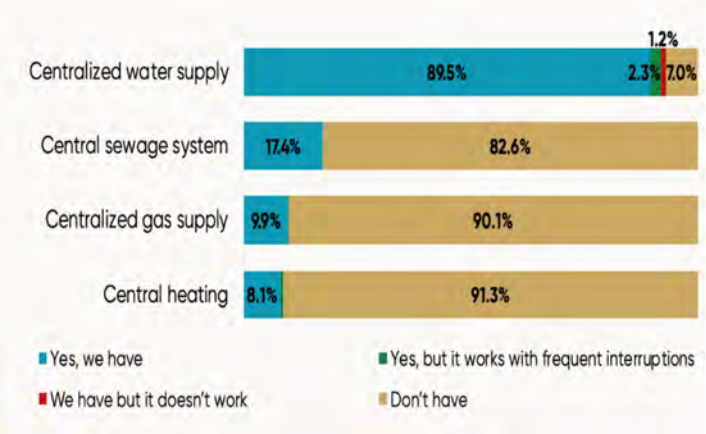
Access to education, health, and basic utilities remains uneven. Centralized water is widely available (89.5%), but access to sewage (17.4%), heating (8.1%), and gas (9.9%) is low, disproportionately affecting households with fewer resources. These conditions highlight inequalities between settlements, especially those with limited government or private sector employment.

Access to utilities and public services varies significantly across settlements. Centralized water supply is available to approximately 90% of households, although interruptions are periodically reported. Centralized gas is limited, and most households depend on gas cylinders for cooking. Heating is primarily coal-based, reflecting the absence of centralized systems in the majority of villages. Electricity is generally available, but reliability issues, such as voltage fluctuations and periodic outages, affect some households. Sewage infrastructure is largely absent, with residents relying on pit latrines.

Public services, including healthcare and education, are functional but constrained by limited staffing, outdated equipment, and aging infrastructure. Schools and clinics often serve multiple settlements, requiring residents from smaller villages to travel for access. Respondents highlighted the need for better medical equipment, expanded outpatient services, and more frequent mobile health visits to remote areas

Only Uyuk reported that they have a 100% centralized gas, heating, and water supply in the household.

Figure 6-15: Access to amenities in the household, Turkestan region [n=172]



Apart from centralized water supply, 8.1% of respondents might use different water sources for drinking and cooking. 3.5% of respondents use their own groundwater well in the yard, 2.3% use a pump in their own or neighbouring yard, and 2.3% use a hand pump. A similar distribution is observed for other household activities.

Fuel

In terms of heating houses, there is a significant reliance on coal, which is the predominant method used by 85.5% of the respondents. This high usage of coal might reflect either a need for more access to more modern heating systems or a preference due to cost or availability. The rest of the heating means constitute less than 7% of respondents. The second most popular fuel for heating is centralized gas supply (6.4%), which is mainly used in Uyuk (90%) and Kushata (20%) settlements.

For cooking purposes, gas in cylinders is used by 86% of respondents. Centralized gas supply is the second most common choice, used by 9.3% of respondents. Other fuel types, such as central heating, coal, dry manure, and electricity, are used by a very small fraction of the population, each accounting for less than 2.5% of the total energy consumption.

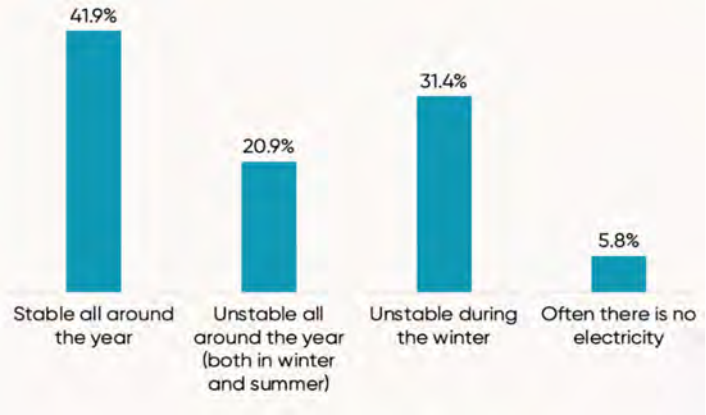
Waste disposal

Households prefer one of two waste management options: disposing of special waste in the yard in a pit (46.5%) or using public waste containers on the street (45.3%). Private waste companies are used by 6.4% of respondents, while state waste disposal services are the least utilized, with only 1.7% of respondents opting for this method.

Power

Regarding electricity, 41.9% of respondents report a stable electricity supply year-round, while 31.4% experience instability during winter, and 20.9% describe it as unstable all around the year (both in winter and summer). Additionally, 5.8% of the respondents often report that there is no electricity at all.

Figure 6-16: Reported stability of electricity supply to households (% of respondents, Turkestan region) [n=172]



Modes of transport

The most common mode of transportation is private car ownership, with 40.1% of households relying on their vehicles. Local taxis are second, used by 38.6% of households as their main mode of transportation. Public transport, including private minibuses, is the least used of the three options, but it is still significant, with 21.4% of households using it.

The high usage of taxis compared to public transport could indicate factors such as convenience, availability, or limitations in the public transportation system.

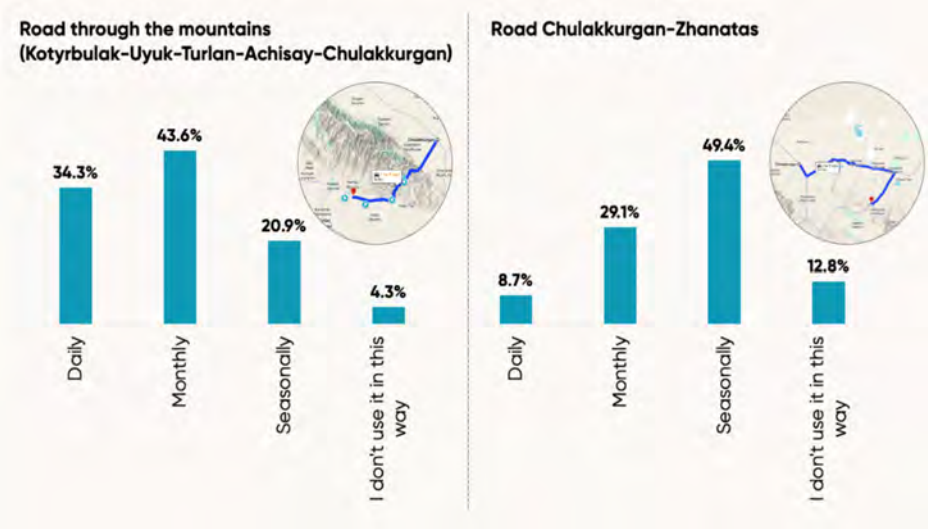
Respondents were asked about their use of the road through the mountains (Kotyrbulak-Uyuk-Turlan-Achisay-Sholakkorgan), which would provide a key access route in project development. The roads was reported to be frequently used, with 34.3% of households using it daily, 43.6% monthly, and 20.9% seasonally. Only 1.2% of the respondents don't use it at all.

In Kotyrbulak 85.7% of households use the road daily, in Ashisay - 56.1%, Uyuk – 70.0%, Shoktas – 33.3%, Sholakorgan – 13.4% and Kushata – 10%.

A second relevant road is the Sholakkorgan-Zhanatas (Jambyl region), which is less frequently used. Half of respondents (49%) use it only seasonally, 29% use it monthly, and only 8.7% use it daily. 13% of respondents don't use it.

This road is used daily by a significant (if any) share of households in Kotyrbulak (57.1%) and Uyuk (40%).

Figure 6-17: Frequency of roads usage (% of respondents) [n=172]

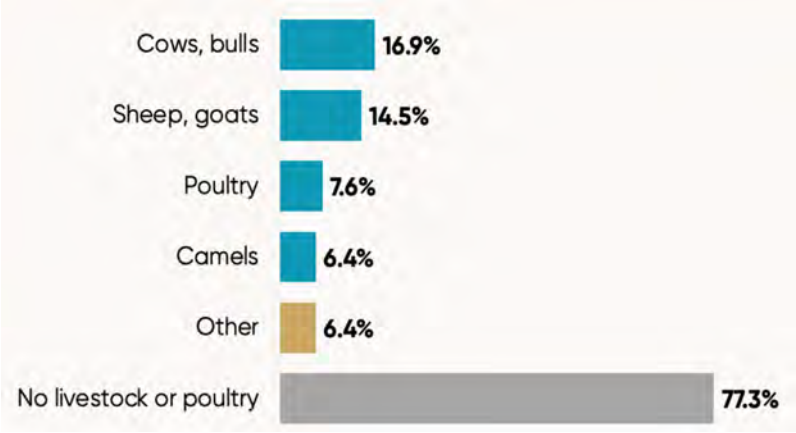


Household Livestock ownership and Agriculture

Despite living in rural areas, most households (77%) do not own livestock or poultry. In addition to insincere answers, the main reason is the unfavourable climate conditions in the region. Among those who do, cows/bulls (16.9%) and sheep/goats (14.5%) are the most common. The rest of the people own poultry, camels, or other types of livestock – about 6.4-7.6% each.

Additionally, many livestock owners (59%) have only one type of livestock, while 25.6% of owners have five types of livestock. Additionally, 7.7% of owners have two types of livestock, 5.1% have three types, and 2.6% have four types of livestock.

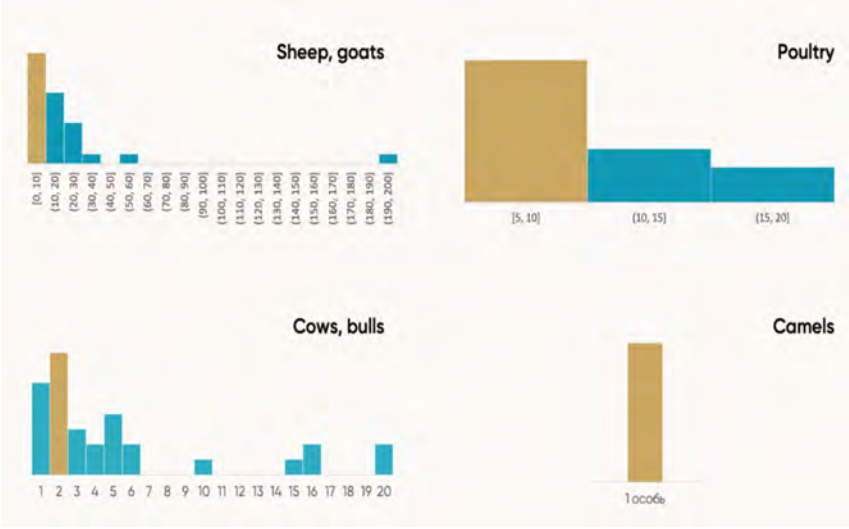
Figure 6-18: Share of households owning different types of livestock [n=172]



Among those who own livestock, most households have small quantities in any category. For instance, among families that have sheep and goats, the number of animals usually increases to 10, but in general, the number of heads is below 30. Interestingly, one of the respondent households has approximately 200 sheep and goats.

In the case of cows and bulls, the dominant household share has 1 or 2 heads. Poultry is usually kept in numbers of less than 10 birds, while all the camel owners have only one head.

Figure 6-19: Distribution of livestock owners by livestock quantity (in heads of livestock) [n=172]



Key issues identified by villages regarding livestock and livelihoods were reported through FGDs and KIIs, as follows in Table 6-20.

Table 6-20: Key livestock and livelihoods issues, Turkestan region

Village	Key issues identified in FGDs, KIIs and engagement
Sholakkorgan (Sozak district)	Strong reliance on livestock farming as a primary livelihood; informal and largely unregulated pasture use; seasonal labour migration due to limited local employment; vulnerability linked to weak infrastructure and lack of gas supply. Livelihood restoration needs emphasise land and water access, job creation, and gasification to support households facing changes in pasture access or livelihoods. *"In cases where people have to move to other pastures or switch occupations, land, water, and job creation would be necessary." "For livelihood restoration, gasification of the village would be the most useful measure to support the community."*
Ashisay (Kentau district)	Livelihoods dominated by livestock farming, complemented by trade and small-scale entrepreneurship; limited local employment opportunities; dependence on external or rotational work; priority placed on income restoration through job creation and improved electricity supply to reduce household costs and support economic activities. *"In terms of potential project benefits, income restoration measures should focus on job creation and improved access to electricity, such as through a local substation, which would reduce costs and support household needs."*
Uyuk (Sauran district)	High dependence on livestock farming and seasonal or rotational labour migration; scarcity of local employment options; youth out-migration; demand for livelihood restoration measures focused on job creation and social infrastructure to strengthen community cohesion and retain younger residents. *"For project-related livelihood restoration measures, job creation is the most crucial need, and additional facilities such as a stadium or playground would help retain youth and strengthen the community."*
Kushata (Sauran/Kentau district)	Livelihoods based on livestock farming supplemented by trade and migration; limited local economic opportunities; strong emphasis on livelihood restoration through job creation and infrastructure improvements, particularly facilities for youth, to address unemployment and

Village	Key issues identified in FGDs, KIIs and engagement
	social challenges. *"If livelihood restoration measures were to be implemented under a project, job creation is the most important need, followed by infrastructure improvements such as sports or recreational facilities for youth."*
Shoktas (Kentau)	Livelihoods primarily centred on livestock farming with supplementary small-scale trade and seasonal labour migration; constrained economic diversification due to absence of local industrial or commercial enterprises and infrastructure gaps (roads, transport, utilities), increasing reliance on external employment.

6.3.11 Gender

6.3.11.1 National

The gender distribution in Kazakhstan is fairly balanced, with women making up 51.1% (10,452,152 people) of the population and men accounting for 48.9% (9,993,079 people).

According to the Law of the Republic of Kazakhstan dated 8 December 2009, No. 223-IV "On State Guarantees of Equal Rights and Equal Opportunities for Men and Women", Article 10 ensures that employers participate in guaranteeing equal rights and equal opportunities for men and women in labour relations.

The table below presents gender-disaggregated data according to the Bureau of National Statistics Agency for Strategic Planning and Reforms of the Republic of Kazakhstan[55]:

Table 6-21: Distribution of genders across regions

#	Region/District	Men	Women	Total	% men	% women
1	Jambyl region	606,548	613,493	1,220,041	49.7	50.3
2	Jambyl district	45,236	42,726	87,962	51.4	48.6
3	Zhualy district	27,431	25,815	53,246	51.5	48.5
4	Sarysu district	21,945	21,275	43,220	50.8	49.2
5	Talas district	24,119	23,413	47,532	50.7	49.3
6	Turkestan region	1,097,528	1,052,700	2,150,228	51.0	49.0
7	Kentau district	49,607	50,048	99,655	49.8	50.2
8	Sozak district	32,019	30,469	62,488	51.2	48.8
9	Sauran district	51,832	50,163	101,995	50.8	49.2

The Jambyl and Turkistan regions is among Kazakhstan's more conservative areas, with lower levels of women's public visibility and economic autonomy compared to major cities such as Almaty and Astana. Consequently, women frequently enter lower-paid occupations or informal work, reinforcing gendered patterns of economic dependency.

Social environment is characterized by deeply rooted traditional gender norms that assign women primary responsibility for household and caregiving duties. These norms limit women's ability to engage fully in the formal economy and reduce opportunities for education, career advancement, and participation in male-dominated sectors.

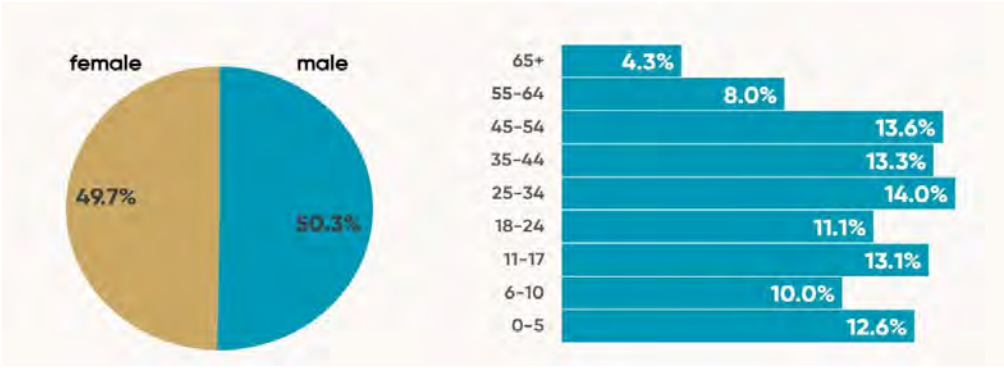
6.3.11.2 Jambyl Region

Gender distribution among household survey respondents' household members is balanced, with 50.3%

[55] https://stat.gov.kz/en/industries/social-statistics/demography/publications/461838/

male and 49.7% female. The age distribution shows a relatively young population, with the largest groups being 25-34 years (14%), 35-44 years (13.3%), and 45-54 years (13.6%). Only 4.3% of respondents are 65 or older. This is representative of the general population in Jambyl region, with comparable distribution among age groups.

Figure 6-20: Gender and age distribution (% of household members) [n=300]

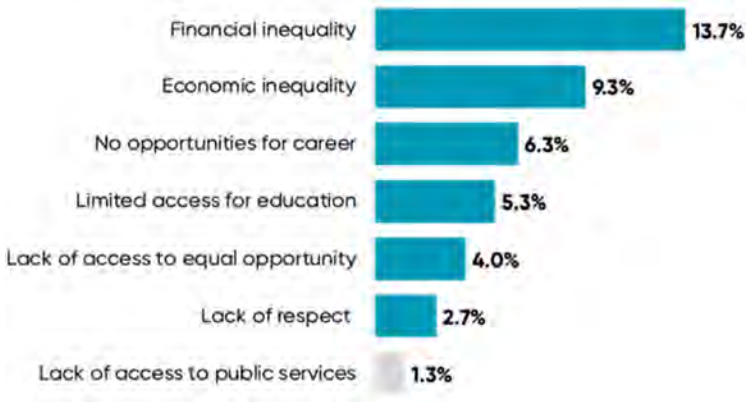


The survey's one bulk of questions focused on researching gender issues and roles in the target communities.

When asked about challenges faced by female household members, particularly in the workplace, the most common "Other" response is "No problem," with 67.7% of respondents selecting this option. The next most common responses were:

- Financial inequality (13.7%) – for example, when women cannot access Bank services without the permission of her husband
- Economic inequality (9.3%) – for example, when men and women are not paid the same wages for the same job
- No opportunities for career advancement (6.3%).

Figure 6-21: Main challenges reported by women in the region [n=300]



At the same time, the picture varies from settlement to settlement, where Zhanatas, Aktogay and Ushbas regions are the only ones with highlighted problems of financial and economic inequality.

In the majority of households (93%), a female person is responsible for chores, indicating a traditional division of labour.

Furthermore, homeownership is predominantly male (66%), with 31% owned by females and only 2% jointly owned, reflecting traditional ownership patterns.

Table 6-22 presents information reported by participants of KIIs and FGDs on the experiences of women in the Jambyl region.

Table 6-22: Women's experiences - Jambyl region

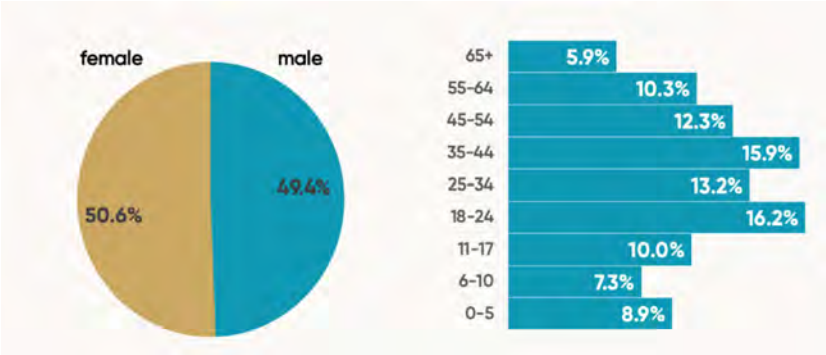
Location	Predominant roles of women	Access to formal employment	Main economic activities	Participation in decision-making	Key constraints and challenges	Illustrative quotes
Maitobe	Household management, childcare, home-based production	Extremely limited; even qualified professionals unable to work in their field	Selling dairy products (butter, kurt, cottage cheese), caring for livestock and gardens	Limited; major decisions largely made by men	Lack of jobs, inability to practice profession, absence of basic services (hairdressing, bathhouses), limited social infrastructure	*"Even being a doctor is not possible; you stay at home making butter, kurt, and dairy products."*
Karatau	Household responsibilities; some engagement in entrepreneurship	Limited; employment and kindergarten access identified as key issues	Small businesses (confectionery, sewing, construction, wholesale trade)	Limited formal authority; issues sometimes resolved through elders' councils	Lack of jobs for women, limited childcare, need for training and professional development, existence of domestic violence handled informally	-
Aktogay	Household work, livestock and garden care, informal income generation	Very limited; formal jobs scarce	Livestock care, gardens, small-scale sales	Low; men dominate land and resource decisions	Reduction of pastures and water access due to large projects, increased household burden	*"The reduction of pastures and water makes it harder for us to care for livestock and gardens."*
Zhanatas	Household, childcare, income-seeking alongside domestic work	Very limited; business opportunities constrained	Informal economic activities; limited scope for entrepreneurship	Some participation, but final decisions mainly by men	High inflation, lack of doctors, poor maternal and child healthcare, high mortality, nepotism, limited business opportunities	*"We take care of the children, manage the household, and look for ways to earn, but we don't always have enough strength."*
Abdikadyr	Not distinguished from general population	Limited due to general unemployment	Not specified	Not specified	Unemployment, lack of social infrastructure, threat of school closure	-
Aulie-Kole	Not distinguished from general population	No specific constraints identified	Not specified	Not specified	General living conditions; access to existing services such as the sanatorium	-
Karaoy	Not differentiated by	Limited due to lack of	Not specified	Not specified	Unemployment leading to youth	-

Location	Predominant roles of women	Access to formal employment	Main economic activities	Participation in decision-making	Key constraints and challenges	Illustrative quotes
	gender	jobs			out-migration	
Karatas	Household roles and entrepreneurship, especially among mothers	Limited; need for business opportunities highlighted	Small business and entrepreneurial activities	Not specified	Lack of employment, need for support for women-led businesses	-
Ushbas	Domestic responsibilities combined with income generation	Limited	Selling household products; agriculture-related activities	Not specified	Lack of water and gas, difficulty selling products, absence of medical centre, risk of school closure	-
Zhanaaryk	Household, agriculture, interest in skills development	Limited	Livestock-related activities; potential sewing and baking businesses	Not specified	Need for training and business support; reduction of pasture land affecting livelihoods	-

6.3.11.3 Turkestan

Gender distribution among respondents' household members is balanced, with 50.6% female and 49.4% male. The age distribution shows a relatively middle-aged population, with the largest groups being 35-44 years (16%) and 18-24 years (16%). Only 5.9% of respondents were 65 or older. On the other hand, there were fewer children (0-17 years old) – 26%.

Figure 6-22: Gender and age distribution (% of Household members) [n=172]

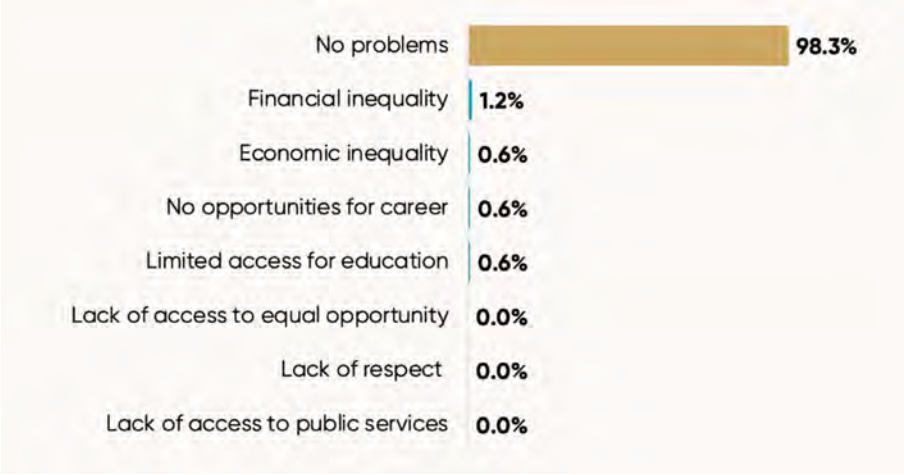


The survey has a few questions focused on researching gender issues and roles in the target communities.

When asked about challenges faced by female household members, particularly in the workplace, the most common "Other" response is "No problem," with 98.3% of respondents selecting this option. This may be the result of the respondents' reluctance to answer questions about personal and highly sensitive topics.

Other responses constituted less than 0.6% to 1.2% or were not mentioned at all.

Figure 6-23: Main challenges for women – Turkestan region [n=172]



In the majority of households (96.5%), a female person is responsible for chores, indicating a traditional division of labour. Adult males are responsible for household chores in 2.9% of households.

Furthermore, homeownership is predominantly held by males (83.1%), with 16.9% owned by females, reflecting traditional patterns of ownership.

In both years, gender-specific survey responses show either the satisfaction with gender issues or limited acknowledgement of challenges faced by women, with the overwhelming majority selecting "no problem" when asked about workplace or community barriers.

The division of household chores continues to fall predominantly on women, a finding stable across both datasets. A small difference is that the 2025 survey reported slightly higher rates of female ownership of houses compared to the 2024 sample, though the overall pattern of male-dominated ownership remains.

Table 6-22 presents information reported by participants of KIIs and FGDs on the experiences of women in the Turkestan region.

Table 6-23: Women's experiences - Turkestan region

Location	Predominant roles of women	Access to formal employment	Main economic activities	Participation in decision-making	Key constraints and challenges	Illustrative quotes
Ashisay	Active in community and social affairs; household responsibilities alongside public roles; participation in physically demanding work	Relatively higher compared to other villages; women work as nurses, early childhood educators, librarians, and in local health or administrative services	Household management; community services; public sector roles	High: women participate in decision-making, help resolve communal issues, and engage in community governance	Limited access to specialised healthcare (e.g. gynaecology); need to travel to Kentau for services	Awareness of family support centres in Kentau providing assistance for domestic violence, psychological issues, and family conflict
Uyuk	Predominantly homemakers and livestock managers; strong role in maintaining social networks	Limited; some women engage in small-scale entrepreneurship	Livestock care; household production; small trade (e.g. local shop)	Informal and community-based: strong mutual support through women's networks rather than formal structures	Out-migration of youth; women often live alone; school closures increase childcare and education burdens; limited local employment	Women's WhatsApp group "The Ladies" coordinates mutual support and community responses
Kushata	Primarily homemakers; some women employed in clerical or administrative roles	Very limited; a few women work as secretaries or akimat specialists	Household-based activities; limited administrative employment	Low: traditional family structures dominate; decision-making largely male-led	Domestic violence not openly discussed; lack of awareness or use of crisis centres or specialised support services; youth out-migration	Domestic issues are "*kept within the family*"
Sholakkorgan	Household-based roles alongside agricultural support	Limited; certain jobs favour men	Livestock farming; household and agricultural activities	Not specifically mentioned; reflects traditional gender division	Gender bias in local hiring practices, particularly for physically demanding jobs	Residents noted that physically demanding jobs tend to favour male applicants
Other surveyed communities (general KII findings)	Domestic responsibilities, caregiving, seasonal agricultural support	Generally limited; no distinct gender-specific barriers explicitly identified by respondents	Livestock farming; dairy production; household-based economic activities	Formal participation not mentioned; governance structures appear male-dominated	Limited access to healthcare; long travel distances to medical services; poor transport; school closures increasing	"*Women experience the same overall living conditions as men*" (as stated by male KII respondents)

Location	Predominant roles of women	Access to formal employment	Main economic activities	Participation in decision-making	Key constraints and challenges	Illustrative quotes
					women's burdens; migration of men for rotational work	

6.3.12 Vulnerable Groups

6.3.12.1 National

Vulnerable groups include people who may be directly, differentially or disproportionately affected by the project and related activities due to their disadvantaged or vulnerable status. This status may be based on ethnicity, income level, economic characteristics, gender, language, religion, national or social origin, age, culture, literacy, physical or mental disability, and dependence on unique natural resources.

The rights and protections of vulnerable groups in Kazakhstan are enshrined in the national Constitution and several sectoral laws:

- Constitution of the Republic of Kazakhstan (1995, as amended): Guarantees equality before the law and prohibits discrimination based on gender, disability, social status, or other grounds.
- Law on Social Protection of Persons with Disabilities (2015, amended 2022): Provides for social support, rehabilitation, education, employment, and accessibility measures for people with disabilities.
- Law on State Guarantees for Equal Rights and Opportunities for Women and Men (2009): Protects women against discrimination and promotes equal opportunities in education, employment, and social participation.
- Law on Social Services (2018): Regulates services for vulnerable populations, including home care, financial assistance, and rehabilitation.
- Labour Code (2015, amended 2023): Protects workers from discrimination and mandates special working conditions for persons with disabilities.
- Law on Education (2007, amended 2020): Guarantees inclusive education and access for children with disabilities.
- Law on Healthcare (2020): Ensures equitable access to health services, preventive care, and rehabilitation for vulnerable groups.

6.3.12.2 Jambyl region

Based on findings from the household survey for the WPP and Jambyl OHTL, the following groups within the Project's AoI are considered as vulnerable:

- Low-income individuals and families;
- People with ill health, physical and/or mental disabilities and/or diagnosed socially sensitive diseases (HIV/AIDS, tuberculosis, etc.)[56];
- Single parents;
- Unemployed people;
- Children and senior individuals; and
- Women.

In Jambyl region the majority of household members (96.9%) reported having no disability, while 16 household members have a physical disability and 1 has a mental disability.

The population within the project area includes a significant proportion of children and adolescents, representing approximately one-third of all residents. Age group distribution among children is as

[56] Publicly available data indicates that an estimated 43,000 people in Kazakhstan were living with HIV in 2024, of which: 82% know their HIV status, of whom 90% receive antiretroviral therapy, and 94% of them have achieved suppressed viral load [Source: https://kncdiz.kz/en/news/item/9683/]. In 2022, 888 HIV-infected people were registered for treatment in Jambyl District, of whom 538 were men, 350 were women and 14 were children. At that time, 829 people living with HIV were receiving antiretroviral therapy, the effectiveness of which was assessed to be 83%. Children born to HIV-infected mothers received full antiretroviral therapy to prevent mother-to-child transmission of HIV. [Source: https://www.inform.kz/ru/888-vich-inficirovannyh-stoyat-na-dispansernom-uchete-v-zhambylskoy-oblasti_a4008487]. It is not known how many people are living with HIV/AIDS in the Project AOI.

follows:

- 0–5 years: 11.6% of the population
- 6–10 years: 8.5% of the population
- 11–17 years: 14.3% of the population

This demographic indicates a relatively young population, highlighting the potential need for services such as education, childcare, and recreational facilities.

The elderly population (65 years and older) accounts for approximately 11% of household members, reflecting a moderately ageing population. While this group is smaller compared to children and working-age adults, they remain an important demographic in terms of social support, healthcare needs, and community engagement.

Table 6-24: Presence of Vulnerable people in Jambyl Region[57]

Category	Sarysu	Talas	Zhualy	Jambyl	Total
Low-income families	137	No data	166	No data	303
People living with disabilities	179	No data	1,531	No data	1,710
People with mental illness	950	No data	355	No data	1,305
Single parents [58]	775	No data	602	No data	1,377
Unemployed youth	Approx. 750	350	488	3,969	5,557
Children (up to 18years old)	4,806	19,200	13,696	No data	37,702
People over 60 years old	2,491	6,400	6,004	No data	14,895
Women	7,524	24,094	11,532	45,292	88,442
Total (of available data)	17,612	50,044	34,374	49,261	151,291

There is the potential for vulnerable households to be impacted by both the Jambyl WPP and other projects. In particular, this may be due to land take (i.e. households who have land in more than one location, and different projects have affected more than one parcel).

Other projects near the Jambyl WPP include the Shokpar/Zhanatas WPPs. There are no PAPs affected by both Zhanatas/Shokpar WPPs and Jambyl WPP.

6.3.12.3 Turkestan region

Based on finding of household survey for Kentau OHTL, as with the WPP and Jambyl OHTL findings, the following groups within the Project's social AoI are considered as vulnerable:

- Low-income individuals and families;
- People with ill health, physical and/or mental disabilities and/or diagnosed socially sensitive diseases (HIV/AIDS, tuberculosis, etc.);
- Single parents;
- Unemployed people;

[57] Source: District akimats; Jambyl and Talas districts provided limited information
[58] It is not specified by Akimats if single parents were male or female, or why they are single

- Children and senior individuals; and
- Women.

The population of households in the project area shows a balanced gender composition, with 50.6% female and 49.4% male household members. Age distribution of household members is as follows:

- Children and adolescents (0–17 years): 26.2%
    - 0–5 years: 8.9%
    - 6–10 years: 7.3%
    - 11–17 years: 10.0%
- Working-age population (18–64 years): 67.1%
    - 18–24 years: 16.2%
    - 25–34 years: 13.2%
    - 35–44 years: 15.9%
    - 45–54 years: 12.3%
    - 55–64 years: 10.3%
- Elderly population (65+ years): 5.9%.

6.3.13 Land Tenure, Use and Acquisition

The following sections provides information on the baseline land ownership and land use conditions on the Project WPP and Jambyl OHTL. This information has been summarised from the Livelihood Restoration Plans for both Project components. An LRP has not yet been prepared for the Kentau OHTL, however one will be completed prior to the commencement of construction on the Kentau OHTL. Therefore, estimates of Project baseline and land acquisition and resettlement impacts have been provided below for Kentau OHTL.

6.3.13.1 WPP

The land required for the WPP is administered by Sarysu district. The total number of land plots (LPs) impacted by the Project is 112. There are an additional 11 LPs that are within the 45dB noise exceedance area (these PAPs will be identified once the final layout has been completed, and a subsequent update to the noise modelling). There are 23 land plots that are within the Project site and do not have infrastructure on them. These land users have also been considered PAPs, as they will be impacted by the Project, including noise, potential blasting and disruptions to grazing during construction..

There are a total of 12 land plots within the WPP that are owned by the State. Some of the state land is state reserve land managed by akimats, that has been returned by previous leaseholders and has not yet been re-allocated by the akimats. Thus informal use of state reserve lands is not extensive as it is in the process of being transferred to new users by akimats and the window of opportunistic use is short for existing herders to extend their reach into those areas. Some of the land on the WPP is communal land managed by the Sarysu Akimat. While the Projects is not required to acquire State land, there may be impacts to the communities that use it. The following rural districts have communal land on the Project site; Turkestan Rural District– will lose 6% of their land plot due to the construction of a WTG and internal roads and Zhanaryk Rural District– will not have any infrastructure on the land, but the land is within the Project site.

There are two communities within Turkestan Rural District that may be impacted by the loss of communal land as a result of the WPP, they are Ushbas and Turkestan. In Zhanaaryk Rural District the community of Zhanaryk has the potential to be impacted by the Project. Based on currently available information, only one community land area is actually being used within the WPP area, which is the area directly adjacent to Ushbas village and used by community members from Ushbas.

There are a total of three (3) privately owned land plots impacted by the WPP. During the identification

process of landowners, the Akimat informed Juru that two of the land plots (owned by the same owner) are in the process of being transferred to state ownership (to return to the state reserve). It is understood that the former owner of the plots had passed away. The third private owner was initially identified as a State land plot, and the landowner was therefore not interviewed. Socioeconomic information for this PAP will be updated in subsequent versions of the LRP.

A total of 60 leaseholder land users (LUs) with 97 land plots (LP) will be impacted by WPP. The land is used to grow fodder crops, and there is a small amount of agricultural activity (growing potatoes and tomatoes) on the WPP site. A total of 21 of the PAPs stated that they use the land for agricultural purposes. Once the fodder crops have been harvested the land is used for livestock grazing. The land is leased for between 15-49 years. There are six households in which more than one household member works on the land (as herders).

Some farms with a lot of livestock hire workers and pay them a monthly salary. Usually, one herder grazes one otara (a flock of sheep, consisting of up to 600-700 sheep). A total of four leaseholders identified that they hired workers, with a total of nine workers on the WPP site. Some leaseholders rent their land to herders (officially or unofficially). According to the results of the LRP survey conducted in October 2025, there is only one lessor among all of the survey respondents. Land user LU104 has fully leased out his only land plot (LP160) to land user LU72. LU72 uses six land plots, one of which he rents from LU104.

A total of six LRP survey respondents stated that they graze livestock owned by others. With a total of 65 cows, 840 sheep and 99 horses. Generally contracts with livestock owners are verbal, and not registered with the akimats, and the LU PAPs did not want this information disclosed to the akimats. Therefore, specific information on the livestock owners is not currently known. A future survey of livestock owners will be undertaken at least 1 month in advance of the start of construction works to record which livestock owners are still present and details of any new livestock owners.

During the grazing period, approximately 21 PAPs currently stay in wagons, which they move around their land plots. The noise impacts of the Project will be significant within the Project site, given that the baseline noise levels are currently so low. This could cause PAPs to change the way that they graze their livestock on the Project site and thus impact their ability to maintain their livelihoods.

It is understood that there are hunters that hunt animals and birds in the area surrounding the Project site. However, it is not yet clear how many, what types of animals or birds they hunt, or how impacted they will be by the Project. Given that this activity is illegal, attempting to find information about hunters and impacts on them is expected to be difficult. One PAP (LU117) indicated that they use their land for hunting, for recreation. It is understood that impacts on hunting will not affect their livelihood.

Interviews indicated collection of wild herbs by households is limited and for personal use only; it is understood that this is not a livelihood activity or specific to a cultural practice. No informal or illegal hunters have been identified during baseline studies and it is not anticipated that the Project will be able to do so.

6.3.13.2 Jambyl OHTL

The length of OHTL is 135 km. The land required for the Jambyl OHTL is administered by four districts: Sarysu, Talas, Zhualy, and Jambyl districts. It originates at the WPP site and terminates at a substation Jambyl – 500 kV where it joins the regional power grid. The total number of land plots impacted by the Project is 116. There are a five (5) land plots along the Jambyl OHTL right of way that are owned by the State. As per the WPP state lands some of the state land is state reserve land, that has been returned by previous leaseholders and has not yet been re-allocated by the akimats. None of the state land was identified as communal land.

There are a total of eight (8) privately owned land plots impacted by the Project, owned by seven (7) private owners. During the identification process of landowners, the Akimat informed Juru that one of the land plots is in the process of being returned to state ownership (to return to the state reserve) (PO2). The reason for its return was not available.

A total of 76 leaseholder land users (LUs) with 103 land plots will be impacted by Jambyl OHTL right of way. The land within the right of way corridor is used as grazing land for animals (by 41 of the LRP survey respondents), and there is a small amount of agricultural activity (growing fodder crops etc). A total of seven (7) of the PAPs stated that they use the land for agricultural purposes. The land is leased for between 15-49 years.

A total of 22 leaseholders identified that they hired workers, with a total of 77 workers along the Jambyl OHTL right of way corridor. Some leaseholders in the region rent their land to herders (officially or unofficially). However, no renters were identified in the right of way corridor of the Jambyl OHTL.

A total of one (1) LRP survey respondents stated that they graze livestock owned by others. With a total of 12 cows. As per the WPP, specific information on the livestock owners is not currently known. A future survey of livestock owners will be undertaken at least 1 month in advance of the start of construction works to record which livestock owners are still present and details of any new livestock owners.

6.3.13.3 Kentau OHTL

The length of OHTL is 162 km and the transmission line passes through the territory of three districts: Sozak, Sauran and Kentau districts. It originates in Sarysu districts at the WPP site and passes through the Opornaya substation, then continues across the territory of three districts before connecting to the Kentau substation. The preliminary number of plots that will be impacted by the Kentau OHTL is 147. Further information will be known regarding the land use of the Kentau OHTL once socioeconomic and census surveys for the Kentau OHTL LRP have been completed. Given that the number of land plots is greater than for the Jambyl OHTL and the WPP, it is expected that the breakdown of land plots (between privately owned, leased and state owned) will be similar, but the total number of PAPs will be slightly greater than the number of PAPs identified for the Jambyl OHTL.

6.3.13.4 Seasonal migration

Seasonal migration is closely connected with traditional pastoral practices. Livestock grazing follows a seasonal pattern: during spring, summer, and autumn (from May until September or October), herds are taken to nearby pastures or mountainous grazing areas. In summer farmers take a wagon to the pasture, and stay on the land to graze their cattle, sheep and goats. In winter they are kept in barns or in cattle pens located in the foothills and fed purchased fodder such as hay, wheat, or barley. Survey respondents keep livestock for both household consumption and for sale.

Each of the land user has their own allocated pasture lands, they pay taxes to the government for its use, people graze only in their allocated territory. Grazing activities are mainly controlled by the rural and urban akimat, because it is necessary for them to divide livestock for grazing, keeping the city clean and the livestock healthy. Elder community members are key in providing support to resolve issues, in particular where this relates to animal and livestock health. While individuals are responsible for their own livestock, elders also facilitate support during winter calving, vaccinations and engagement of veterinary services to ensure health of the wider herd. The poor quality and limited availability of professional veterinary services were repeatedly raised by community members as a concern. Strengthening local veterinary capacity has therefore been acknowledged by the Project as a priority community need to be addressed through the Project's Community Development Plan, including measures to improve local veterinary infrastructure, such as funding the construction or upgrading of veterinary stations, or other related assistance.

The land users grow fodder crops on their land in summer and store it to feed their cattle in winter. Livestock cannot be grazed on the fields until the crops have been harvested. The fodder collected on the Project site in summer is not sufficient to feed the livestock in winter because there is a lack of irrigation and water in the area. Therefore, farmers also buy: barley, wheat, fodder corn, alfalfa, and short grass.

The livelihoods of many households in the Project impact area rely primarily on the sale of livestock (and in some cases also the sale of milk and other animal products), but the cost of maintaining winter fodder supplies forces some family members to seek external income.

6.3.13.5 Land tenure and land use

The land in Kazakhstan belongs to the state and can be owned by private landowners or leased for short/long term periods to individuals and legal entities. Leased land can be returned to the state reserve based on public and state needs. All laws and regulations in Kazakhstan regarding land and land ownership are derived from the Constitution. It includes the following relevant articles:

- Article 6.3 - land (both the surface area and underground) is owned by the State, but can also be privately-owned;
- Article 26.3 - no one may be deprived of property unless stipulated by a court decision. Forcible alienation of property for State needs that is stipulated by law, may occur on the condition that it is compensated.

The Project will acquire land for the footprint of the WTGs, offices, substation, BESS, OHTL tower footprints and the access roads, but the land around the WTGs will not be acquired/leased. There may be additional temporary impacts for the laydown areas and temporary construction buildings (offices, workshops and accommodation, if required).

Land classification

Land tenure in Kazakhstan is broken down into categories. The category of a land plot determines how it may be used. Changing its designation (i.e. re-categorizing the land) requires approval by governmental or local executive authorities.

- Agricultural lands - this includes arable land, pastures, hayfields, lands with perennial crops, fallow land, and lands needed for agricultural infrastructure (roads, irrigation, farm buildings, etc.).
- Lands of inhabited localities (settlements) - this includes lands for residential, urban or rural settlements — cities, towns, villages, rural-type settlements.
- Lands for industry, transport, communications, defense and other non-agricultural purposes – this includes factories, industrial zones, transport infrastructure (roads, rail, airports), communications infrastructure, and defense infrastructure.
- Specially protected/environmental/recreational/cultural lands - Lands reserved for nature protection (forests, reserves, parks), health resorts, recreation, historical and cultural sites.
- Forest fund lands - lands designated as forests (natural or managed), for forestry and conservation.
- Water fund lands — rivers, lakes, reservoirs, water bodies and hydraulic infrastructure.
- Reserve lands - this land is not currently assigned to the above categories — “spare” land held as a reserve.

Agricultural lands have specific protections under Kazakh law. Non-agricultural use, such as building houses or industrial facilities, is generally prohibited unless under exceptional circumstances. Pastureland, which makes up the majority of the Project affected land is a subdivision under agricultural lands.

There is a specific designation for land located in areas directly adjacent to the boundaries of settlements, which are used to meet the livestock grazing needs of the local population. This land is considered to be public pasture. Pastures, including public pastures, are not granted into private ownership or private land use — they remain in state ownership.

Within the WPP boundary the majority of the land plots are considered agricultural land. Although there is also land that is designated as reserve lands. Directly adjacent to the WPP site is an area of Forest fund land, which has been specifically avoided in the Project design. Additional classifications of land are present along the OHTL routes. However, the majority of the land continues to be agricultural and reserve land.

As a result of the Land Survey Project (a national requirement for land acquisition – see the LRP for more details) landowners and land users will be requested to voluntarily renounce their land plots (through a negotiated settlement process). This land will then be designated as reserve lands, which can subsequently be rented to the Project Developer for the construction of the Project.

Land use rights in the Project Area

Land use rights in Kazakhstan are granted to a land user either through a decision from the relevant local executive body (akimat) or by inheritance or legal succession. The use of the land granted to the land user, must align with the land's designated purpose under the land categorization (discussed above). The following classifications of land have been identified as relevant to the Project:

- Private or state land ownership - the government or private entity has the ownership rights over the land. The owner has full rights of "possession, use, and disposal" of the land plot.
- Permanent land use – under this category land can be used for an indefinite and non-terminating period. This category of land use includes lands of state organizations and lands of private entities[59].
- Temporary use – this can either be paid (as a leasehold) or gratuitous (free of charge). This land use right is divided into long-term and short-term land-use.
    - Short-term land use is up to 5 years,
    - Long-term lasts from 5 to 49 years.

Termination of temporary land-use right happens when the term expires, should the user renounce their land plot (this is the primary way the land will be returned for the Project), by transfer/alienation, or in the case of land seizure under legally established grounds (compulsory expropriation for state needs, misuse, non-use, etc.). The majority of the land used in the WPP and along the OTHL rights of way is temporary use, and there is generally a lot of movement in the land use rights for the land in Jambyl Region, with land regularly being returned to the state and leased to other land users.

The termination of temporary land-use rights will be compensated by the Project. A Land Acquisition Consultant will be hired through a competitive bidding process to negotiate the compensation that PAPs will receive when they renounce their land.

6.3.14 Summary of Key Sensitive Receptors

Regarding potential impacts to land from the project, the following sensitive receptors are identified. Any person or entity, whose assets and/or income is affected by the Project, whether permanently or temporarily, and regardless of whether or not they have legal title to the affected land or asset, is eligible

[59] From the 1990s to early 2000s, lands were registered to individuals for permanent use, but due to subsequent changes in the Land Code, lands owned by individuals were automatically transferred to the "temporary use" category with a final period of use: maximum up to 49 years.

to receive compensation and other entitlements. If people or households reside in, occupy or use land needed for the Project prior to a determined cut-off date then they will be considered to be Project affected.

A socioeconomic and census survey has been completed for the WPP and the Jambyl OHTL to identify and establish the households that own assets or earn income on land required by the Project, the same will be completed for the Kentau OHTL. A cut-of-date of 21 October 2025 has been identified and clearly disclosed to PAPs for the WPP and Jambyl OHTL, during consultation meetings. Any persons moving into the Project area after the cut-off date will not be entitled to compensation. A cut-off date has not yet been determined for Kentau OHTL.

Identifying a cut-off-date for farm workers/herders and livestock owners (that are not LUs) is complicated these PAPs are transient in the Project Area and arrive and leave frequently, for various reasons. Therefore, it was not deemed appropriate, to adopt a cut-off date for herders and workers during preparation of the LRP. A future cut-off date will be determined, at a minimum of one (1) month prior to the start of construction works.

The expected Project affected organizations or people are summarized in Table 6-25 below:

Table 6-25: Eligibility for compensation for PAPs

Project Affected People/Organizations	Eligibility	Notes
Landowners (Government entities including State Forest Fund)	Government entities that own and are responsible for the land	Government entities are not expected to be materially impacted as a result of the Project.
Land management (akimats)		
Landowners (companies)	Landowners who will lose their land, leading to a reduction in the size of their land holdings.	Reduction in land size could cause an impact to livelihoods.
Landowners (PAPs with registered land ownership)		
Leaseholders (they may also be herders)	Their leasehold area (which they consider they own) will be impacted by the presence of WTGs, roads their land, causing reduction in their land plots.	Leaseholders are proud of their landholdings and consider that it is better than other land in the area
Noise impacted land users	They may not be able to stay in their wagons on the WPP site during the night due to increased noise.	These potential PAPs will be identified following the completion of the final layout and subsequent noise modelling.
Communal landowners/land users	May have temporary impacts as a result of restrictions to land during construction. There may also be a reduction in the size of landholdings as a result of construction of infrastructure.	These losses may create a small impact, on a large number of people
All herders that rent land from land users (either officially or unofficially)	Their rented area will be impacted by the presence of WTGs, roads their land, causing reduction in their land plots.	It may be difficult to identify herders that rent land, as the land users may not wish to disclose information about them
Informal users of state land	They may be impacted by loss of grazing land and may be vulnerable as they do not have official title to the land.	Such land users have not been identified and are not expected, as the akimat allocates grazing land. However, such informal users might be identified later or come forwards.

Project Affected People/Organizations	Eligibility	Notes
All workers of herders or land users.	They may be impacted by loss of employment, income or loss of livelihood (this could be as a result of loss of grazing land or livestock).	This includes also their families and employees. It may be difficult to obtain information on these PAPs
Livestock owners that give their livestock to other land users to herd		
Hunters that rely on hunting for their livelihood.		

Vulnerable PAPs have been identified within the project affected people. Vulnerable people may require special livelihood restoration assistance measures because they may be less able to cope with economic shocks as a result of displacement impacts, than others. The definition of vulnerability is aligned with Lender standards and include:

- Households who have lost both parents (or child-headed households – not identified on the Project to date);
- Households that include a person living with disabilities
- Female headed households (that do not have other income earning household members)
- Households with elderly people (over the age of 65)
- Households that contain people with poor health or the chronically ill; and
- Households that are of an ethnic minority group.

In addition to vulnerable PAPs, other vulnerable people within the AoI may be affected by non-land/livelihoods related Project impacts, or potentially restricted from accessing Project opportunities. In addition to the list above, potentially vulnerable groups can include:

- Women
- Very poor households
- Young people
- Isolated rural communities or those from depopulated villages
- Informal farmers and herders
- Members of other marginalised groups.

Other potentially sensitive receptors are those from villages that may experience indirect effects of the Project, for example, those that may suffer or benefit from impacts to social cohesion due to the influence of the Project. This may either be negative effects (e.g. social disruptions from the presence of a foreign workforce), or positive (e.g. community-building impacts as a result of increased investment into a Project-affected village, such as the inclusion of construction workers in local team sports events or natural disaster response efforts).

A summary of key receptors is presented in the following table.

Table 6-26: Summary of key sensitive receptors

Receptor	Sensitivity	Description
Landowners (Government entities including State Forest Fund)	Low	Assigned to receptors with a strong capacity to adapt to Project-related changes
Akimats (Land management and other responsibilities)	Low	Assigned to receptors with a strong capacity to adapt to Project-related changes
Landowners (companies)	Low	Assigned to receptors with a strong capacity to adapt to Project-related changes
Landowners (PAPs with registered land	High	High sensitivity assigned to individuals who may be

Receptor	Sensitivity	Description
ownership)		sensitive to economic shocks/lack of other economic opportunities
Leaseholders (they may also be herders)	High	High sensitivity assigned to individuals who may be sensitive to economic shocks/lack of other economic opportunities
Noise impacted land users	High	High sensitivity assigned to individuals who may be sensitive to economic shocks/lack of other economic opportunities
Communal landowners/land users	Medium	Medium sensitivity assigned to individuals with some capacity to adapt to Project-related changes and maintain quality of life, but with identifiable vulnerabilities
All herders that rent land from land users (either officially or unofficially)	High	High sensitivity assigned to individuals who may be sensitive to economic shocks/lack of other economic opportunities
All workers of herders or land users	High	High sensitivity assigned to individuals who may be sensitive to economic shocks/lack of other economic opportunities
Livestock owners that give their livestock to other land users to herd	Medium	Medium sensitivity assigned to individuals with some capacity to adapt to Project-related changes and maintain quality of life, but with identifiable vulnerabilities
Hunters that rely on hunting for their livelihood	High	High sensitivity assigned to individuals who may be sensitive to economic shocks/lack of other economic opportunities
Vulnerable groups (can include: Women, elderly, young people, disabled, carers, those from poor/isolated/depopulated villages, marginalised groups)	High	High sensitivity assigned to individuals who may be sensitive to shocks and little to no capacity to adapt to Project-related changes
Community members indirectly affected by the Project (negatively)	Medium	Medium sensitivity assigned to individuals with some capacity to adapt to Project-related changes and maintain quality of life, but with identifiable vulnerabilities
Construction workers from the local population	Medium	Medium sensitivity assigned to individuals with some capacity to adapt to Project-related changes and maintain quality of life, but with identifiable vulnerabilities
Neighbouring industry	Low	Assigned to receptors with a strong capacity to adapt to Project-related changes
Construction workers/community members	Medium	Medium sensitivity assigned to individuals with some capacity to adapt to Project-related changes and maintain quality of life, but with identifiable vulnerabilities
Local suppliers of goods and services	Medium	Medium sensitivity assigned to individuals with some capacity to adapt to Project-related changes and maintain quality of life, but with identifiable vulnerabilities

6.4 Potential Impacts

6.4.1 Construction Phase

6.4.1.1 Impacts to land use and ownership

The majority of the land in Jambyl region is owned by the Government of Kazakhstan, and all of the land required for the Project will be returned to the Government Reserve Lands as a result of the land acquisition process. This land will then be rented to the Project Developer, for the purpose of constructing the Project.

The Project will not lease the entire area of Project impact, it will only lease the land that is specifically required for the Project. In other words, it will lease land for the:

- Footprints of the wind turbine generators (WTGs);
- Footprints of the OHTL towers;
- Crane hardstands and laydown areas;
- Internal roads;
- Battery Energy Storage System (BESS);
- Project substation; and
- Operations buildings.

Land users will be able to use their remaining land between and around Project infrastructure to continue growing fodder crops and grazing animals. The Project will gain servitude rights over the land impacted by the right of way of the OHTL but will not stop the land users from continuing to use the land. There will only be restrictions in the erecting of structures, and growing trees that may impact the OHTL. Note, that no trees have been identified in the OHTL right of way.

There may also be some temporary acquisition required for laydown areas, worker accommodation and temporary access roads. The exact location and size of temporary land acquisition has not yet been identified and will be updated in later versions of the LRP. To date no physical displacement impacts (relocation of people from their primary houses) have been identified for any of the Project infrastructure.

The total area of the Project boundary for the WPP is 14,000 ha, and the total impacted area, of the WPP infrastructure is, 443.74 ha. The total land use impacts of the Jambyl OHTL is 3.20 ha for the OHTL towers, and 1,511.40 ha for the right of way corridor. While the length of the Kentau OHTL is 30km longer, it will be a single transmission line, meaning the total number of towers will be less and the area of the right of way corridor will be narrower. Therefore, the impacted area is expected to be similar, or slightly smaller than that of the Jambyl OHTL.

The LRP will be completed and implemented before the start of construction. All relevant land will be acquired and compensation will be paid before construction starts on each of the project components (WPP, Jambyl OHTL and Kentau OHTL) and some livelihood restoration activities will continue throughout the construction phase. However, most of the impacts of the land acquisition will be felt by PAPs during construction.

The majority of land users within the WPP site and along the Jambyl and Kentau OHTL routes are leaseholders, that lease land on a long term basis from the akimats. As discussed in the section above, there are also communal lands used, as well is different types of informal land use, such as herders.

There is a small potential for impacts to collection of herbs and medicinal plants on the Project site, there is also the potential that some unofficial hunters may be impacted as a result of the Project as well. These impacts have not been identified in the socioeconomic surveying of PAPs but may be raised by PAPs at a

later date. If they are identified they will be included in subsequent versions of the LRP and assessed on a case-by-case basis.

The following table provides a summary of the potential impacts, and the significance of such impacts on project affected people.

Table 6-27: Construction phase – Land use and ownership impacts

Activity/Impact/Aspect					
Land acquisition and negotiations for the voluntary renunciation of land. This will potentially impact the livelihoods to PAPs in the long term. There may also be short-term impacts as a result of access to land during construction as a result of construction nuisance (noise, dust, traffic etc) and temporary land use by the Project.					
Type	Duration	Extent	Scale of Impact	Frequency	Likelihood
Direct	Permanent	On-site/local	Distinguishable	Continuous	Likely

Receptor	Sensitivity	Magnitude	Significance of Impact
Landowners (Government entities including State Forest Fund)	Low	Negligible	Insignificant
Land management (akimats)	Low	Small	Insignificant
Landowners (companies)	Low	Medium	Minor
Landowners (PAPs with registered land ownership)	High	Medium	Major
Leaseholders (they may also be herders)	High	Medium	Major
Noise impacted land users	High	Small	Moderate
Communal landowners/land users	Medium	Medium	Moderate
All herders that rent land from land users (either officially or unofficially)	High	Medium	Major
Informal users of state land	High	Small	Moderate
All workers of herders or land users	High	Medium	Major
Livestock owners that give their livestock to other land users to herd	Medium	Medium	Moderate
Hunters that rely on hunting for their livelihood.	High	Small	Moderate

6.4.1.2 Local economic impacts from construction

During the construction phase, the Project will generate direct employment opportunities, primarily associated with construction activities. It is currently estimated that the average construction demand is estimated at up to 1,000 workers (distributed across several work fronts for OHTLs plus the WPP), peaking at 2,200 people during the installation phase, although the precise distribution of jobs and detailed skill requirements have not yet been fully defined. A proportion of these roles is expected to comprise unskilled or semi-skilled positions that may be accessible to local community members, alongside skilled roles where suitable qualifications and experience are available locally. In addition to construction labour, the Project will require a range of ancillary services, including administration, reception, account keeping, drivers, catering staff and other support personnel. All construction-related employment opportunities will be temporary and will cease once construction activities are completed. Support roles are expected to reduce in numbers as construction activities are completed and the Project moves into its next phase.

Beyond direct employment, the Project is expected to generate indirect economic benefits at the local level through increased household income and associated spending by the construction workforce. Workers are likely to purchase food, basic goods and everyday services from nearby businesses such as cafés, small shops and convenience stores located close to construction compounds or along access

routes. Informal economic activity may also increase, with community members selling food or other products in the vicinity of construction sites. These indirect benefits will be temporary and will end following completion of construction, with effects likely to be most pronounced in sparsely populated areas along the route alignment where alternative income-generating opportunities are limited and average wage levels are comparatively low.

Additional indirect benefits are expected through construction-related contracts, sub-contracts and procurement activities. Economic gains will accrue to the Engineering, Procurement and Construction (EPC) contractor, which may be local, national or international, as well as to smaller sub-contractors that are more likely to be locally or nationally based. Suppliers of goods and services including catering, accommodation, transport, raw materials and construction equipment, are also expected to benefit from increased demand during the construction period. These supply-chain effects will further stimulate local and regional business activity, particularly among small and medium-sized enterprises (SMEs). Job types and skill requirements are expected to be articulated by the EPC.

At a broader scale, the Project is expected to generate positive effects on the regional and national economy through the direct procurement of materials and services from companies based in Jambyl and Turkestan Regions, elsewhere in Kazakhstan, and internationally. This will include firms supplying earth-moving equipment, cranes and labour for general civil works, as well as logistics providers responsible for transporting wind turbine generators and other construction materials to the Project Area. Residents of nearby villages may also benefit from employment opportunities associated with these activities. The Project represents a substantial capital investment. It will include the manufacture and supply of specialised wind farm components, such as nacelles and blades by companies based outside Kazakhstan. The Project has an estimated foreign direct investment of up to USD 1.4 billion[60].

Overall, the economic impact during construction is expected to be largely positive, driven by direct employment, procurement of goods and services, and increased demand across local, regional and national supply chains. While some short-term increases in the cost of living may occur in nearby communities, workforce numbers are moderate (peak of 2,200) relative to the populations of neighbouring villages, but not to the centres of Zhanatas and Karatau, and some minor inflationary pressures are anticipated. The impact is both direct and indirect, as the Project will generate tax revenues through the purchase of materials and services and create secondary economic opportunities through supplier networks. These effects are reversible and time-bound, as they will be limited to the construction phase.

(Note, discussion on direct employment is covered within Chapter 8 and in-migration and issues associated with influx in Chapter 7).

Table 6-28: Construction phase - Economic benefits

Activity/Impact/Aspect					
Increased income leading to indirect local economic benefits and construction contracts, subcontracts and local opportunities to participate in Project procurement					
Type	Duration	Extent	Scale of Impact	Frequency	Likelihood
Direct	Medium term	Local	Distinguishable	Continuous	Certain
Receptor		Sensitivity	Magnitude	Significance of Impact	
Construction workers/community members		-	Beneficial	Positive	
Local suppliers of goods and services		-	Beneficial	Positive	

[60] https://www.windtech-international.com/projects-and-contracts/kazakhstan-and-uae-agree-on-1gw-wind-power-development

6.4.1.3 Impacts to social cohesion

Feedback from stakeholder engagement activities with farmers, herders, local government representatives and educational institutions has consistently indicated broad support for the Project. This support appears to be influenced by expectations of employment opportunities, improved energy infrastructure and generation capacity, and other anticipated Project benefits.

Notwithstanding this general support, there is a risk that Project-related communications may be misinterpreted. This may arise where information is perceived to be controlled or endorsed by state authorities, or where there is limited understanding of potential Project impacts, such as shadow flicker and noise.

There is also the potential for dissatisfaction to emerge as the project progresses, particularly where there may be misunderstanding on land access, compensation payment timing or issues of transparency of arrangements of these.

Tensions can also emerge where part of the community receives compensation payments due to being impacted by the Project, but this can be perceived as 'benefitting' from the Project. This may in turn create tensions between affected and non-affected households, or, where one household perceives inequity in how compensation amounts and/or livelihood restoration packages are calculated.

Depending on how these are managed by the Project, these consequences can potentially be long-term within the community and between the community and the Project.

Table 6-29: Construction phase – impacts to social cohesion

Activity/Impact/Aspect					
Impacts to social cohesion due to inaccurate information or misunderstandings about project implementation at the construction phase					
Type	Duration	Extent	Scale of Impact	Frequency	Likelihood
Indirect	Long term	Local	Distinguishable	Continuous	Possible
Receptor		Sensitivity	Magnitude	Significance of Impact	
Community members, Construction workers from the local population		Medium	Medium	Moderate	
Vulnerable groups, PAPs (people entitled to receive compensation for project-induced impacts)		High	Medium	Major	
Neighbouring industry, Akimats		Low	Small	Insignificant	

6.4.1.4 Impacts to women and other vulnerable people

During the construction phase, the majority of employment opportunities are expected to be taken up by men, reflecting the male-dominated nature of the construction sector as well as prevailing cultural norms related to women's work and domestic responsibilities. More broadly, men and women may experience Project impacts differently, particularly in contexts where gender inequality remains pronounced and where livelihoods, social roles and decision-making power vary by gender. Even where legal frameworks provide for formal equality, patriarchal norms can limit women's ability to participate meaningfully in, and benefit from compensation and livelihood restoration processes. Changes to household and community dynamics associated with economic displacement may also increase certain social risks, including exposure to violence, for example where women become more socially isolated or tensions arise within households.

The socio-economic profile of the surveyed population in Jambyl reveals several groups experiencing heightened vulnerability due to overlapping demographic, economic, infrastructural, and social factors. While the overall population demonstrates relatively stable housing conditions and access to basic services, a closer analysis indicates that certain groups face disproportionate risks in the context of project implementation.

Households with limited financial resilience constitute a primary vulnerable group. A substantial share of respondents report that their income is sufficient only to cover basic needs, while a significant proportion struggle to meet even fundamental expenses, including food. This vulnerability is reinforced by the high prevalence of household debt, with loan repayments representing one of the largest expenditure categories. The average income-to-expenditure ratio below one indicates systemic financial stress, increasing sensitivity to any temporary income loss, price increases, or project-related livelihood disruptions.

Women emerge as a structurally vulnerable group despite the perception among many respondents that gender-related problems do not exist. Traditional gender roles dominate household organization, with women overwhelmingly responsible for domestic chores and caregiving. Survey respondents report financial and economic inequalities, including unequal pay and restricted access to banking services without spousal permission. These factors point to limited economic autonomy and increased vulnerability of women to income shocks, male unemployment, or migration.

Older persons and individuals dependent on pensions or social assistance form another vulnerable group. Although their numerical share is relatively small, pensions and social benefits constitute an important income source for many households, indicating dependence on fixed and often limited incomes. The prevalence of chronic health conditions, including cardiovascular diseases and anaemia, combined with reliance on centralized or seasonal infrastructure, increases their sensitivity to service disruptions, environmental impacts, and reduced access to healthcare (e.g. if there is competition for healthcare access due to the presence of the construction workforce).

Residents of settlements with limited infrastructure and service reliability are also vulnerable. While access to water, heating, and electricity is generally high, a significant proportion of households experience unstable electricity supply, particularly during winter, and rely on coal for heating and cooking. Dependence on non-centralized water sources and informal waste disposal practices further exposes these households to health and environmental risks that may be exacerbated during construction activities (e.g. from unintended disruption to or increased pressure on services due to the presence of the construction workforce).

Small farmers, livestock owners, and households engaged in subsistence or semi-commercial agriculture constitute a vulnerable livelihood group. Although agriculture is not the dominant occupation, those involved often rely heavily on it for income and incur high farm-related expenditures. Concerns expressed about reduced grazing areas, damage to gardens, and loss of pastoral land indicate that project impacts on land access or mobility could disproportionately affect these households.

Geographically vulnerable groups include residents of settlements highly dependent on a single transportation route, particularly the Karatau public road. The lack of alternative roads for the majority of respondents increases vulnerability to construction-related traffic restrictions, road damage, or access limitations, potentially affecting access to markets, services, and emergency assistance.

Finally, low levels of project awareness and limited knowledge of community or non-governmental organizations indicate institutional vulnerability. A large portion of the population has limited information about the project and limited experience with civic or community-based engagement, which

may constrain their ability to participate meaningfully in decision-making processes or to access grievance mechanisms.

Overall, vulnerability in the project area is not driven by a single factor but by the cumulative effect of economic constraints, gender inequality, child-related risks, infrastructural limitations, and restricted access to information. These groups require targeted engagement, mitigation, and support measures to ensure that project impacts do not disproportionately affect the most vulnerable segments of the population.

In Turkestan region, the majority working-age population may be involved in local labour or seasonal migration, affecting workforce availability and community dynamics. The elderly population, while smaller, requires consideration for mobility, health services, and access to information about project activities.

The predominance of working-age individuals suggests potential engagement in local employment or seasonal labour migration, which may influence workforce availability and community dynamics. Although smaller in proportion, the elderly population requires attention in relation to mobility, access to healthcare services, and the timely communication of project-related information.

The assessment identifies several vulnerable groups within the project area based on demographic, socio-economic, gender, infrastructural, and geographic characteristics. A significant share of the population consists of children, with particularly high proportions in smaller settlements. A notable number of households report children's involvement in work, often for long hours, which indicates a risk of child labour and potential negative impacts on education and health, including potential for unwanted interaction with or exposure to construction workers. As with Jambyl region, households with a high dependency ratio are therefore especially vulnerable to any project-related disruptions affecting livelihoods, access to services, or household income.

Youth and young adults represent another vulnerable group due to limited local employment opportunities, high unemployment, and widespread labour migration, including seasonal and cross-border migration. This economic marginalization increases household instability and places additional pressure on women, children, and elderly family members who remain in the communities. While youth/under 18s will not be employed by the Project with a strict age limit for employees, young adults are potentially vulnerable within the work environment (see also Chapter 8).

Older persons are vulnerable due to age-related health conditions and limited access to reliable infrastructure. The prevalence of chronic illnesses, combined with unstable electricity supply, reliance on coal for heating, and limited access to centralized utilities, heightens their sensitivity to environmental impacts, service disruptions, and reduced access to healthcare during project implementation.

Women constitute a structurally vulnerable group, despite the limited explicit acknowledgment of gender-specific issues at the community level. Traditional divisions of labour place the primary burden of unpaid domestic and caregiving work on women, while their ownership of assets and economic independence remain limited. This increases their vulnerability to income loss, male out-migration, and additional household pressures linked to changes in access to water, energy, and social services.

Households with inadequate access to basic infrastructure, including gas, centralized heating, sanitation, and stable electricity, are particularly vulnerable. Heavy reliance on coal and alternative water sources exposes these households to higher health, environmental, and financial risks, which may be exacerbated by construction activities, increased traffic, or temporary service disruptions.

Residents of small, remote, and geographically isolated settlements are vulnerable due to their

dependence on a limited number of access roads, poor transport conditions, and constrained access to markets, education, and healthcare. Any restrictions to mobility or increased traffic associated with the project could disproportionately affect these communities.

Economic vulnerability is further compounded by high levels of household indebtedness. A substantial share of households carries loan obligations with relatively high monthly payments, making them sensitive to even short-term income interruptions or increases in living costs.

Overall across both Jambyl and Turkestan regions, while the communities may not perceive themselves as highly vulnerable, the analysis reveals multiple, overlapping forms of vulnerability. These groups require targeted attention in project design and implementation to ensure inclusive engagement, protection of livelihoods, prevention of child labour risks, and equitable access to information and grievance mechanisms.

All KIIs emphasize the persistent employment barriers faced by vulnerable populations, particularly women, youth, and persons with disabilities:

- Women face mobility restrictions, childcare responsibilities, family pressure, and limited access to professional training. Many rely on home-based production, seasonal work, or informal activities.
- Youth encounter skill mismatches, insufficient career guidance, and low motivation due to limited job prospects in rural districts.
- Persons with disabilities (PWD) experience infrastructural limitations, lack of adaptive equipment, and employer hesitation to hire them despite state incentives.

Interviewees unanimously agree that targeted career counselling, vocational skills training, and financial support would significantly improve employability.

Most KIIs highlight strong demand for training and filling capacity gaps:

- entrepreneurship training, particularly for women and home-based workers
- agronomy, livestock, and food processing skills
- digital literacy
- business planning, marketing, and financial management
- legal awareness and compliance for MSMEs

Local institutions, colleges, and NGOs stated they are ready to collaborate but often lack curriculum, trainers, or resources. Demand-driven training programs are seen as the most effective approach.

Table 6-30: Types of barriers to access Project benefits, by vulnerable group

Vulnerable group	Types of barriers to accessing socio-economic benefits of the Project
Women	Women may be burdened by caring duties within the home (for children, elderly family members, or both). They may be pressured into social isolation (especially by family members) to prevent them from being able to access opportunities, thus maintaining their 'place in the home' and/or maintaining economic dependency on other (male) family members.
Very poor households	Members of very poor households may face barriers to accessing construction employment, particularly where work locations are distant and transport or accommodation is not provided. Limited financial resilience may constrain their ability to take up short-term employment opportunities.
Elderly people and	As most construction roles are physically demanding and involve long hours or travel to

Vulnerable group	Types of barriers to accessing socio-economic benefits of the Project
people with disabilities	remote worksites, elderly people and people with disabilities are unlikely to directly benefit from construction employment. Elderly people may not wish to take up employment or engage in procurement opportunities at their stage of life. Those with caring responsibilities may also be unable to take up such opportunities where there are no alternatives for provision of care elsewhere (e.g. care of family members).
Young people	Young adults with limited work experience, skills or formal qualifications are likely to be restricted to low-paid, unskilled construction roles, limiting the extent of socio-economic benefit they can derive from the Project.
Children	Children may not be aware of both project risks or benefits through participation in school-based awareness programs/other potential community development activities supported by the Project. Particular barriers may include low-levels of literacy, non-attendance at school,
Isolated rural communities or depopulated villages	Small or remote communities may have limited awareness of Project employment opportunities or face practical barriers to accessing them, particularly where transport or accommodation at worksites is not available. Depopulation can indicate underlying socio-economic problems which may be exacerbated by livelihood disruptions or other Project impacts
Informal farmers and herders	Individuals reliant on informal farming or herding livelihoods may be more difficult to identify and compensate if their livelihoods are disrupted, as they may lack formal land tenure, grazing rights or business records to substantiate claims.
People experiencing cumulative impacts from multiple projects	Individuals or households already adversely affected by other developments may have reduced capacity to adapt to additional impacts, including displacement from the Project or other livelihood disruptions, increasing vulnerability to cumulative effects. There are no PAPs affected by both Zhanatas/Shokpar WPPs and Jambyl WPP. There is the potential, but there are no known individuals affected by other multiple projects.
Members of marginalised groups (e.g. ethnic minorities, LGBT+ people)	May face discrimination or exclusion in access to employment opportunities, limiting their ability to benefit from Project-related jobs. May not be able to access job notifications due to low language capabilities and/or weak social networks. Individuals who have low- or no literacy may be at a disadvantage to access clear information about any aspect of the Project, including potential opportunities/benefits.

Table 6-31: Construction phase – vulnerable groups inability to access project opportunities or benefits

Activity/Impact/Aspect					
Impacts to women and other vulnerable groups not able to access project opportunities or benefits					
Type	Duration	Extent	Scale of Impact	Frequency	Likelihood
Direct and Indirect	Medium to Long term	Local	Distinguishable	Continuous	Likely
Receptor		Sensitivity	Magnitude	Significance of Impact	
Vulnerable people		High	Medium	Major	

6.4.2 Operation Phase

6.4.2.1 Impacts to land and livelihoods

While it is expected that grazing and cultivation of crops can continue in the remaining land around and between the WTGs, and under the OHTLs, noise impacts (and to a smaller extent shadow flicker) and the presence of WTGs and other Project infrastructure on the Project site have the potential to modify the livelihoods of the landowners and land users of the WPP site and the OHTLs. This will particularly be the case for those PAPs that use wagons, or structures, on or within the Project impacted areas. However, by this stage in the Project, the compensation and livelihood restoration activities identified to address these potential impacts will have been identified, compensated and completed during the pre-construction and construction phase. Therefore no additional risks and impacts are expected, and no additional mitigation will be required to address the potential impacts during the operations phase.

Activity/Impact/Aspect					
Impacts to livelihoods as a result of noise and shadow flicker impacts, and the restrictions to land use that result from the presence of Project infrastructure (WTGs, the BESS, offices, OHTL towers etc) on the land they owned or used.					
Type	Duration	Extent	Scale of Impact	Frequency	Likelihood
Direct	Permanent	On-site/local	Distinguishable	Continuous	Likely

Receptor	Sensitivity	Magnitude	Significance of Impact
Landowners (Government entities including State Forest Fund)	Low	Negligible	Insignificant
Land management (akimats)	Low	Small	Insignificant
Landowners (companies)	Low	Medium	Minor
Landowners (PAPs with registered land ownership)			Moderate
Leaseholders (they may also be herders)	Medium	Medium	Moderate
Noise impacted land users	High	Medium	Major
Communal landowners/land users	Medium	Medium	Moderate
All herders that rent land from land users (either officially or unofficially)	High	Medium	Major
Informal users of state land	High	Small	Moderate
All workers of herders or land users.	High	Small	Moderate
Livestock owners that give their livestock to other land users to herd	Medium	Small	Moderate
Hunters that rely on hunting for their livelihood.	High	Small	Moderate

6.4.2.2 Operational phase economic impacts

During the operational phase, the Project will generate a limited number of direct employment opportunities. The operational workforce is expected to be relatively small and will primarily comprise personnel required for operation and maintenance activities, including specific staff at the WPP and routine maintenance crews for the WPP (under the Project operator company) and OHTLs (under KEGOC). At this stage, the precise number of jobs and the specific skills required have not yet been confirmed. Overall, there will be reduced economic activity compared to the construction phase due to the Project itself; the scale of purchasing (locally and internationally) made at the construction phase will be reduced.

However, there will be economic benefits arising through an improved energy supply. Once operational, the Project will contribute to the strengthening of Kazakhstan's national electricity grid. This improved

grid capacity is expected to facilitate the development of additional economic activities through greater electricity availability and stability, and help meet the electricity needs of a growing population. Enhanced energy reliability and security are likely to deliver broader economic benefits for both businesses and households, however, the scale and distribution of these benefits cannot be quantified at this stage.

Table 6-32: Operations phase - economic benefits

Activity/Impact/Aspect					
Increased electricity availability and stability, contributing to indirect local economic benefits					
Type	Duration	Extent	Scale of Impact	Frequency	Likelihood
Indirect	Long term	Local-Regional	Distinguishable	Continuous	Certain

Receptor	Sensitivity	Magnitude	Significance of Impact
Community members	-	Beneficial	Positive
Local suppliers of goods and services	-	Beneficial	Positive

6.4.2.3 Impacts to women and other vulnerable people

At the operations phase, it is also likely that Project jobs are taken up by men. These will include operations and maintenance roles, which are likely to be filled by Kazakh nationals. It is unlikely that significant gains can be made in strongly influencing this culture during the construction phase and so will be influenced by the current cultural norms around women's work identified during baseline studies.

Similarly to the construction phase, vulnerable community members may have more limited capacity to benefit from the socio-economic opportunities associated with Project operations. There is the risk at operations phase that vulnerable groups disengage from the Project, which will be particularly dependent on the success of engagement by the Project through construction phase. If construction phase engagements and activities have, from the perspective of the vulnerable people, been successful, then it is likely that those groups will continue to see the Project as a valuable, supportive member of the wider community.

The vulnerable groups identified and the potential impacts they may experience during the operational phase are outlined below.

Vulnerable group	**Socio-economic impacts**
Women	Women may be burdened by caring duties within the home (for children, elderly family members, or both). They may be pressured into social isolation (especially by family members) to prevent them from being able to access opportunities, thus maintaining their 'place in the home' and/or maintaining economic dependency on other (male) family members.
Very poor households	Individuals from very poor households may face constraints in accessing permanent operational employment, particularly where work locations are distant and transport or accommodation support is not available. Limited financial resources may further restrict their ability to take up or sustain employment opportunities.
Elderly and disabled people	Many operational roles, particularly those related to maintenance, are physically demanding and may not be suitable for elderly people or people with disabilities, including those who are otherwise active in the labour force. Shift-based work patterns may also limit access to employment for individuals with caring responsibilities.

Vulnerable group	Socio-economic impacts
At-risk youth	Young people with limited work experience, skills or formal qualifications are likely to have restricted access to operational employment, which is expected to require a degree of technical or specialist competence. As a result, opportunities for this group may be limited to a small number of lower-skilled roles, if available.
Isolated rural communities	Residents of small or remote communities may have limited awareness of operational employment opportunities or may face practical barriers to accessing them due to distance from the WPP or due to transport limitations.
Members of marginalised groups (e.g. LGBT+ people)	Members of marginalised groups may face barriers or discrimination in accessing employment opportunities as a result of prevailing social or cultural norms, potentially limiting their ability to benefit from Project-related jobs.

Table 6-33: Operations phase – vulnerable groups inability to access project opportunities or benefits

Activity/Impact/Aspect					
Impacts to women and other vulnerable groups not able to access project opportunities or benefits					
Type	Duration	Extent	Scale of Impact	Frequency	Likelihood
Direct and Indirect	Medium to Long term	Local	Distinguishable	Continuous	Likely
Receptor		Sensitivity	Magnitude	Significance of Impact	
Vulnerable people		High	Small	Moderate	

6.4.3 Mitigation, Management & Residual Impacts

6.4.3.1 Land and livelihood measures

There is a prescribed process to complete land acquisition under Kazakh national law. This process will be followed in parallel and in coordination with the land acquisition under international requirements. In order to meet both national and international requirements for mitigation and management of impacts related to land acquisition, the Project has prepared two Livelihood Restoration Plans (LRPs) for the Project (one for the WPP, and one for the Jambyl OHTL section). A third LRP will be prepared for the Kentau OHTL, which will follow the format and entitlements of the Jambyl OHTL LRP.

The Project Company identifies peoples' rights to land and recognises the importance of land to individuals and communities, through access to livelihoods, recreation, culture, and cultural heritage.

The following sections provide a summary of the mitigation measures for land acquisition under the national and international requirements.

National requirements

There are three methods by which land can be acquired for Projects such as this in Kazakhstan. They are:

- Direct Purchase from the Owner;
- Voluntary Renunciation via the Akimat; and
- Compulsory Expropriation.

Each of these options was considered for the Project, and it was found that the best option, in terms of timescale, social risk and alignment with lender standards, was voluntary renunciation. This option is also commonly used in similar projects.

Pursuant to Article 82 of the Land Code, a landowner may renounce their right to the land either by a formal declaration or by conduct indicating their intention to relinquish the land without intent to retain any rights. This renunciation will be compensated by the Project, and the compensation will be paid before at the time of renunciation. The landowner/leaseholder will provide a notarized statement, and the land will then be registered as owner-free. If an agreement cannot be reached, the Project, through the government agency, has the right to initiate a court appeal for expropriation after three months from the date of receipt of the notification by the owner.

Proposed Approach for Project

A company has been hired to complete a Land Survey Project (LSP) for the Project, which is a requirement of Kazak national legislation. This company will assist Masdar to prepare an application to the Akimat for land allocation for all of the Project components (WPP, Jambyl OHLT and Kentau OHTL) separately, and once the Akimat has issued a positive Land Commission conclusion for each component, the LSP company will identify all of the landowners that have legal rights to use the land impacted by the Project (completion of the Land Survey Project).

Masdar has employed an independent valuer to determine the full replacement cost of Project losses to help determine final compensation costs under international requirements. This will also inform negotiations that the LSP company will complete to negotiate relevant compensation and otherwise convince the PAPs to relinquish the land to the State land reserve. Masdar's legal team will then sign a tri-partite letter of guarantee with the PAPs and the Akimat.

Negotiated settlement

The LSP process in Kazakhstan can be time consuming and is heavily reliant on the good will of the PAPs. In some cases negotiations have lasted years, with PAPs refusing to agree to proposed compensation rates. As a result Masdar will hire a Land Acquisition Consultant, to undertake negotiations on behalf of Masdar with the PAPs. This same strategy has been completed in a number of projects in Kazakhstan, including Projects that meet international lender standards.

The Land Acquisition Consultant will be hired through a competitive bidding process. The onus of responsibility will be on the selected Land Acquisition Consultant to convince the PAPs to work with them, as it the PAPs will not be compelled in any way to work with the Land Acquisition Consultant. Should the PAP not wish to work with the Land Acquisition Consultant, they can either negotiate directly with the LSP company, or the Project will attempt to avoid the PAP's land plot, through micro siting the Project infrastructure.

The Land Acquisition Consultant will receive the Project layout and the initial valuation included in the LRP (see the valuation methodology in Section of the LRP). This will be used as the minimum price to start negotiations. Therefore, any compensation agreed with PAPs will be at least at the replacement rate, as calculated in the LRP. Masdar will also provide a maximum price range, so that the Land Acquisition Consultant can agree the compensation without having to confirm with Masdar.

The Land Acquisition Consultant will identify the landowners/leaseholders (PAPs) for each land plot, using a database of cadastral data that it owns, and it will visit the PAPs. Using a land cost range provided by Masdar, it will negotiate directly with the PAPs

and sign an agreement on the compensation for the voluntary renunciation of the land. PAPs will be given the option to receive land-for-land compensation. However, given the small amount of land impacted compared to the remainder of the land, it is not expected that PAPs will choose this option. Should a PAP choose land-for-land, it will need to be negotiated with the Akimat.

The PAP will then sign a power of attorney allowing the Land Acquisition Consultant to negotiate with the LSP on their behalf.

Once the LSP company has completed its submission of District Akimat's Resolution for Acquisition of State Land (Step 5 in Table 5), instead of negotiating with the PAPs (Step 6 in Table 5), it will negotiate with the Land Acquisition Consultant. This is expected to significantly reduce the time it will take to acquire the land. When the agreements are completed between the LSP company and the Land Acquisition Consultant, the PAP will be requested to meet in the Akimat to officially sign the renunciation of their land.

Meeting Lender Requirements and GIIP

In order for the Project to reach lender standards, a Livelihood Restoration Plan (LRP -2025) has been prepared. An LRP is a live document and will continue to be updated throughout the LRP process. The LRP process to date has included identification of all PAPs and the completion of socioeconomic and census surveys. At the time of writing this ESIA, a preliminary valuation has been completed to facilitate the Land Acquisition Consultant's negotiations with PAPs. A full valuation will be completed as part of the LSP process, and this will also be used to update the LRP. The LRP also includes lender requirements for items that are not required under national law, such as vulnerability assistance.

Should the compensation cost negotiated between the PAPs and the Land Acquisition Consultant not reach the final compensation amount identified in the LRP, a top up will be paid. Should the amount negotiated by the Land Acquisition Consultant be higher than the amount identified in the LRP, Masdar will honour the negotiated rate. Masdar, through the Land Acquisition Consultant, will be responsible for the payment of compensation to the legal landowner and land user PAPs (LUs). The LSP and Land Acquisition Consultant will only be negotiating with legal landowners and land users. Therefore, any other PAPs as identified in the LRP will be compensated directly by Masdar through the LRP. The method of payments will be transparent and accessible to all PAPs. It will be determined by Masdar and disclosed during the disclosure of compensation packages.

Livelihood restoration activities will be identified to assist PAPs to restore, if not improve their livelihoods to pre-Project levels. The activities will be developed in consultation with the PAPs. Specific measures will be identified for vulnerable households. In the cases where the Project will impact land owned and used by communities, the Project will complete community benefit activities that will benefit most, if not all, of the community members. This may include targeted upgrades to local infrastructure to improve the quality of veterinary services. Should no community development activities be identified for an impacted community, the community members will be included in the livelihood restoration training activities.

Monitoring will be undertaken during and after LRP implementation to determine if all entitlements have been provided, and if PAPs have improved, or at least regained their livelihoods.

Consultation will be maintained throughout the process with PAPs, district akimats, local communities, local leaders and other relevant stakeholders. PAPs will also have access to the grievance redress mechanism (see the LRP for further details) throughout the land acquisition process.

Any land that has been acquired temporarily (such as for the purposes of construction of the batching plant, worker accommodation, or for laydown areas), will be restored to its previous condition (unless otherwise requested by PAPs), and returned to the use of the respective PAP.

6.4.3.2 Facilitating access to Project Benefits

Facilitating access to Project benefits supports all parts of the community, however it is recognised that

not all stakeholder groups will have equal access, whether due to language skills, applicable work experience, access to information to enable participation, sufficient business support, or some other reason.

The Project will promote local employment and procurement during both the construction and operational phases through the preparation and implementation of a Local Employment and Procurement Management Planning component (LEPMP) within the Project HSSE MS. This will describe, for example, how the Project can help recruit appropriately skilled and available human resources for the construction phase (e.g. this may include working with local Akimats and social development officers). It can also describe targeted outreach activities by CLOs to identify potential partner organisations in helping develop the skills of local SMEs to become eligible for procurement opportunities, or local training organisations to help develop pathways for students to acquire in-demand skills.

The Project will seek to support access for those in the community that may be unable to otherwise access Project benefits, which may include:

Supporting access for women:

- Focus on: responding to the issues identified by women who participated in baseline research on their reported barriers (e.g. in Maitobe, Aktogay, Karatau, Zhanatas); addressing known barriers (e.g. ensuring that women who are employed on the Project have access to Bank services; promoting equal pay between women and men across the Project for equal work); seeking opportunities to support women in areas in which they have identified barriers to their access to training, business support or other livelihoods activities.

Supporting access for migrant communities/ethnic minorities:

- Focus on those communities with higher populations of ethnic minorities in both communicating potential risks but also opportunities to access employment, procurement or other community development support (all districts have some ethnic minority populations recorded, reflecting communities speaking Russian, Kurdish, Korean, Dungan, Azeri, Uzbek and others).

Supporting access for children to safety programs:

- Focus on how children can stay safe around construction sites; road safety programs; and personal safety (including safe interactions with worker population), delivered in partnership with schools; and special programs for hard-to-reach children (e.g. those who have low or no attendance at schools) in partnership with Akimats and/or other relevant organisations.

The Stakeholder Engagement Plan (SEP) will be updated to specify the relevant partner organizations that are most appropriate for these activities, to work with the EPC and Masdar. Masdar's HSSE Management System incorporates preparation of a Community Development Plan, which should focus on those issues requiring external partnerships for sustainable outcomes in implementation, complementing the targets of the LEPMP.

6.4.3.3 Economic impacts

The Project will promote local employment and procurement during both the construction and operational phases through the preparation and implementation of a Local Employment and Procurement Management Planning component (LEPMP) within the Project HSSE MS. The Plan will be implemented in coordination with the Subcontractor and Supplier Management Plan and will set out measures to maximise local economic benefits by prioritising the engagement of local workers and businesses, where practicable.

The LEPMP will consider differentiated impacts and barriers to access faced by women and vulnerable groups, and will include targeted measures to support inclusive participation in employment, training, and procurement opportunities. Specific actions will be included to support skills development for local youth, with the objective of improving access to longer-term operational employment.

Once construction work fronts have been confirmed, the LEPP will be structured on a work-front basis, with location-specific employment and procurement priorities. Preference will be given to communities within each work front that are more directly affected by the Project and/or have limited alternative livelihood opportunities, in order to direct Project benefits towards those most affected.

Where feasible—namely where suppliers are competitive and able to meet applicable technical and quality requirements—the Project Company, together with its contractors, will prioritise the procurement of goods and services from small and medium-sized enterprises (SMEs) located in Jambyl and Turkestan districts. This will include SMEs that may be owned by women, which will be identified during Project implementation.

6.4.3.4 Social cohesion

The Project has developed, and will implement, a Stakeholder Engagement Plan (SEP) to provide accurate and timely information to people living in the Project Area prior to the start of construction right through construction and operations. The SEP will be updated throughout the Project lifecycle. The SEP includes:

- The results of stakeholder identification, including analysis on the stakeholders' level of influence on the Project and how they may be affected
- A programme of engagement activities before and during construction, including roles and responsibilities and measures to monitor effectiveness of engagement. The programme includes targeted engagement with vulnerable people
- Ongoing consultation and disclosure on how the Project will manage adverse risks and impacts and maximise benefits
- Details of the grievance mechanism, including how to raise issues, and the process of how these will be resolved.

The Project will appoint a suitably qualified female CLO, responsible for recording, investigating and resolving grievances, as well as for the active and ongoing programme of engagement activities, including those intending to support economic benefits like local employment and procurement opportunities. The presence of a female representative at community level is intended to encourage women to raise concerns. The Akimats have indicated their willingness to support the Project in facilitating engagement activities and during the resolution of any grievances.

The Project will continue at all phases to report regularly to communities on performance and commitments in the ESIA and ESMPs, as well as conduct periodic review of impacts on all households (including vulnerable households) and adjust the mitigation and management measures where required in a process of continuous improvement. Actions to improve social cohesion will include transparency around local procurement and employment opportunities, community development investments, livelihood restoration measures and environmental commitments, as appropriate.

6.4.4 Residual Impacts

The following table summarises the mitigation and management measures proposed for identified receptors during construction phase activities.

Sensitive Receptor	Pre-mitigation	Mitigation and Management Measures	Residual Significance
Landowners (government entities) and land management companies	Insignificant	• Land acquisition completed through the national requirements, by the LSP company. • Consultation and disclosure of information maintained throughout the land acquisition process.	Insignificant
General – applies to legally recognized land users (landowners, and lease holders)	Minor to Major	• Completion of the voluntary renunciation of land to the state land reserve. Undertaken through the completion of a Land Survey Project. • Negotiations with landowners and leaseholders using the Land Acquisition Consultant as an intermediary. • Preparation and implementation of a Livelihood Restoration Plan, based on socioeconomic and census surveys of project affected people. All compensation, entitlements and livelihood restoration activities will be identified, and should additional entitlements be required, in addition to the compensation negotiated with the Land Acquisition Consultant be required, then a top-up will be provided. • Consultations with PAPs will continue throughout the LRP preparation and implementation process. Monitoring will be undertaken during and after implementation to determine if all entitlements have been provided, and if PAPs have improved, or at least regained their livelihoods.	Minor
General – applies to all other land acquisition receptors during the construction phase	Moderate to Major	• Preparation and implementation of a Livelihood Restoration Plan, based on socioeconomic and census surveys of project impacted people. All compensation, entitlements and livelihood restoration activities will be identified, to international standards and GIIP. • Consultations with PAPs will continue throughout the LRP preparation and implementation process. Monitoring will be undertaken during and after implementation to determine if all entitlements have been provided, and if PAPs have improved, or at least regained their livelihoods.	Minor
Construction workers/community members	Positive	• Preparation and implementation, within the Project HSSE MS of a Local Employment and Procurement Management Planning (LEPMP) component, to facilitate employment of appropriately skilled workers at all phases of the Project • Preparation and implementation of a LEPMP, to facilitate engagement with potential partners to develop pathways to employment and procurement with the Project at all phases of the Project	Positive

Sensitive Receptor	Pre-mitigation	Mitigation and Management Measures	Residual Significance
		• Implementation of the Stakeholder Engagement Plan (SEP) to continue consultations, engagement and promote partnerships with organisations to facilitate appropriate skills development for accessing project benefits.	
Construction workers from the local population/community members	Moderate	• Preparation and implementation of the project ESMP (and subordinate management plans and procedures), including monitoring and disclosing on performance and delivery of commitments at all stages of the Project • Development and implementation of targeted measures to improve social cohesion through inclusive access to Project benefits (including LEPMP, SEP, Grievance mechanism, Community Development Plan)	Insignificant
Vulnerable groups/PAPs	Major	• Preparation and implementation of the project HSSE Management System (and subordinate management plans and procedures), including monitoring and disclosing on performance and delivery of commitments at all stages of the Project • Development and implementation of targeted measures to improve social cohesion through inclusive access to Project benefits (including the LEPMP, SEP, Grievance mechanism, Community Development Plan) • Implementation of the Stakeholder Engagement Plan (SEP) to continue consultations, engagement and promote partnerships with organisations to facilitate appropriate skills development for accessing project benefits.	Minor
Neighbouring industry/Akimats	Insignificant	• Implementation of the Stakeholder Engagement Plan (SEP) to continue consultations, engagement and promote partnerships with organisations to facilitate appropriate skills development for accessing Project benefits, including skills that can benefit other industries in the region.	Insignificant

The following table summarises the mitigation and management measures proposed for identified receptors during operations phase activities.

Sensitive Receptor	Pre- mitigation	Mitigation and Management Measures	Residual Significance
General – applies to all land acquisition receptors during the operations phase	Insignificant – Major	• No additional mitigation is expected, unless there are new impacts identified. Completion of all livelihood restoration activities will be undertaken (if not completed in the construction phase)	Insignificant

Sensitive Receptor	Pre- mitigation	Mitigation and Management Measures	Residual Significance
		• Consultations with PAPs will continue. • Monitoring will be undertaken during and after LRP implementation to determine if all entitlements have been provided, and if PAPs have improved, or at least regained their livelihoods.	
Construction workers/community members/Local suppliers of goods and services	Positive	• Preparation and implementation of a Local Employment and Procurement Management Planning component (LEPMP) within the Project HSSE MS, to facilitate employment of appropriately skilled workers at all phases of the Project • Preparation and implementation of a LEPMP, to facilitate engagement with potential partners to develop pathways to employment and procurement with the Project at all phases of the Project • Implementation of the Stakeholder Engagement Plan (SEP) to continue consultations, engagement and promote partnerships with organisations to facilitate appropriate skills development for accessing project benefits.	Positive
Vulnerable people	Moderate	• Implementation of the Community Development Plan, updated to the operations phase, to facilitate access by vulnerable groups to project opportunities or benefits, including tailored support measures that respond to community-identified needs, such as employment, procurement, enhanced livestock health services/improved veterinary service provisions (e.g. upgrading or constructing new veterinary stations) or other measures, as most relevant to the household.	Minor

Overall, with the implementation of the proposed mitigation and monitoring measures, residual land acquisition impacts across all receptors are assessed as minor or insignificant or beneficial, and no significant adverse effects are expected during the operational phase of the Project.

7 Community Health, Safety and Security

7.1 Introduction and Overview of Assessment Methodology

The social impact assessment of community health safety and security aimed to identify the key socio-economic risks associated with the proposed activity and to evaluate how construction and operation may affect local communities, public health and their security in interacting with the Project. This chapter follows recognised good-practice guidance, and follows the methodology described in Chapter 4. Impacts may be of direct or indirect type, of differing duration, extent, scale, frequency and likelihood, and may result in both positive and negative outcomes. Where significant impacts are identified, the Company is required to apply appropriate mitigation measures.

The social impact assessment process generally includes the following core steps:

- Identifying the potential adverse and beneficial impacts of the proposed activity
- Assessing socioeconomic risks in terms of their likelihood and potential consequences
- Determining whether the identified risks are acceptable; and
- Introducing mitigation measures to reduce risks to an acceptable level.

Assessment of sensitivity is informed by the following vulnerability criteria in relation to community health, safety and security:

Table 7-1: Community Health, Safety and Security Sensitivity Criteria

Vulnerability	Description
High	Limited or no access to adequate healthcare due to cost, distance, or poor service quality. Limited or no access to essential services such as communications, transport, electricity, water supply, or sanitation. Communities with a high proportion of vulnerable groups, including older persons and persons with disabilities. Communities susceptible to endemic or emerging diseases or other factors contributing to poor health outcomes. Community members who are highly sensitive to external shocks and have limited capacity to adapt to Project-related changes, placing their health and wellbeing at greater risk.
Medium	The receptor's overall health and wellbeing is generally good, though there are some sensitivities that increase vulnerability to external shocks or stressors. Health services and infrastructure are accessible and of moderate to good quality, and most community members can access essential services such as communications, transportation, electricity, water supply and sanitation. The population's health status is largely positive, with moderate disease prevalence and relatively low vulnerability to illness. Community members have a reasonable capacity to adapt to external pressures and maintain their health and wellbeing, although a degree of vulnerability remains.
Low	The receptor is generally healthy and demonstrates strong resilience to external shocks or stressors. Health services and infrastructure are accessible, have sufficient capacity, and are of good quality.

Vulnerability	Description
	The community has reliable access to essential services, including communications, transportation, electricity, water supply and sanitation. Overall health status is good, with low disease prevalence and limited vulnerability to illness. Community members have effective coping mechanisms and are expected to adapt well to any Project-related changes, with minimal long-term impact on their health and wellbeing.

Magnitude is informed by the following criteria for Community Health, Safety and Security issues:

Table 7-2: Community Health, Safety and Security Magnitude Criteria

Magnitude	Description
Large	The change substantially alters baseline conditions, affects most of the AoI, and/or endures for many years. Effects may extend to a regional or national scale. A fatal accident is attributed by the community to the Project. Project security personnel engage in serious misconduct, including unauthorised or excessive use of force, representing major breaches of applicable laws and international guidelines. Marked deterioration in community health, safety or security conditions occurs.
Medium	The change is clearly distinguishable from baseline conditions, affects a significant portion of the area or population, and/or persists for a moderate duration. Effects may occur occasionally and may be regional in scale. A severe injury is attributed by the community to inadequate Project care. Instances of minor abuses of authority by security personnel arise and relations with communities are strained. Existing health, safety or security conditions can only be maintained with external support.
Small	The change is noticeable but limited, affecting a small number of households, occurring infrequently, and lasting for a short duration. A minor accident is attributed by the community to insufficient Project care, or potential safety risks such as unattended equipment cause concern. Security personnel act in accordance with applicable laws and international guidelines, though their presence or activities may create some inconvenience for local communities. Health, safety and security conditions can be sustained without outside assistance.
Negligible	No measurable impact on community health, safety or security is expected, and any change is indistinguishable from baseline conditions. Community dissatisfaction with site security or safety is absent or barely perceptible.

This chapter examines issues surrounding community health, safety and security, including: interactions with construction sites and/or traffic; pollution from the project; labour influx; communicable diseases; GBVH and crimes. It should be read with the companion document on Human Rights Impact Assessment and Gender Impact Assessment (HRIA/GIA) prepared alongside this ESIA, and specifically Chapters 11 and 17, as well as Livelihood Restoration Plans regarding noise and dust.

7.2 Applicable Requirements and Standards

7.2.1 National Regulations

Community Health, Safety, and Security (CHSS) aspects of the Project are governed by several key national laws and regulations of the Republic of Kazakhstan that define requirements for environmental protection, public health, labour safety, and emergency response.

Key legislative acts include:

- Environmental Code of the Republic of Kazakhstan (2021) – establishes requirements for environmental protection, pollution prevention, public participation in environmental decision-making, and obligations to conduct environmental and social impact assessments (ESIA).
- Labour Code of the Republic of Kazakhstan (2015, with amendments) – regulates occupational safety, employee protection, and workplace conditions to prevent health risks and accidents.
- Law on the Sanitary and Epidemiological Welfare of the Population (2020) – defines measures to ensure public health, control of infectious and non-infectious diseases, and sanitary supervision.
- Law on Civil Protection (2014) – governs emergency preparedness, response to natural and man-made hazards, and protection of the population and territories.
- Law on the Safety of Hydraulic Structures (2010) – defines safety requirements for dams, reservoirs, and similar infrastructure.
- Law on Fire Safety (1996) – sets out regulations and obligations related to fire prevention, firefighting, and emergency evacuation procedures.

Together, these legal instruments form the foundation of Kazakhstan's national framework for ensuring the health, safety, and security of communities in relation to industrial and infrastructure projects.

Relevant Government Authorities

Key organizations with responsibility for environmental management and community health and safety in Kazakhstan include:

- **Government of the Republic of Kazakhstan (GRK)** – the central executive authority responsible for implementing measures on rational use and protection of natural resources, coordinating environmental activities, implementing ecological programs, and managing disaster response.
- **Ministry of Ecology and Natural Resources (MENR)** – the main regulatory body overseeing environmental protection, environmental policy, and use of natural resources. It enforces compliance with environmental laws across ministries, enterprises, and individuals.
- **Committee for Environmental Regulation and Control (CERC)** under MENR – responsible for environmental quality improvement, state environmental expertise, permitting, emissions regulation, and enforcement of environmental compliance.
- **Forestry and Wildlife Committee** under MENR – oversees protection of wildlife, biodiversity conservation, and management of specially protected natural areas (SPNAs).
- **Department for Natural Resources Management and Nature Use Regulation** under local executive authorities (**Akimats**) – responsible for local implementation of environmental policies, biodiversity conservation, water and forestry management, public hearings, and community participation in environmental decision-making.
- **Ministry of Health (MoH)** – responsible for sanitary and epidemiological control, ensuring public health, and supervising healthcare systems.
- **Ministry of Emergency Situations (MES)** – ensures civil protection, emergency preparedness, and response to natural and industrial disasters.

Other relevant ministries and agencies include: Ministry of Agriculture, Ministry of Energy, Ministry of Labour and Social Protection of the Population, Ministry of Industry and Infrastructure Development, and Ministry of Water Resources and Irrigation.

7.2.1.1 National norms and standards for transmission lines

Sanitary protection zones are areas separating special purpose zones, such as industrial facilities and OHTLs from nearby residential areas, buildings and structures to minimize any potential impacts on them.

There are two key laws that relate to sanitary protection zones:

- Rules for establishing Protection Zone of Electric Grid Facilities and Special Conditions for the Use of Land Plots Located within the Boundaries of Electric Grid Facilities and special conditions for the use of land plots located within the boundaries of such zones issued by Ministry of Energy (Order № 330 dated September 28, 2017). The Rules are focused on protection of equipment of OHTLs;
- Sanitary and epidemiological requirements for Sanitary Protection Zones of Facilities that are Objects of Influence on Habitat and Human Health stipulated by the Order № 26447 of the Minister of Health (dated January 11,2022) – it is focused on protecting the public from the harmful effects of facilities that may have a harmful impact on human health.

Article 33 of the Kazakh Sanitary Rules "Sanitary and epidemiological requirements for Sanitary Protection Zones", requires that a sanitary protection zone shall be established along the route of the high-voltage line, beyond which the electric field strength does not exceed one (1) kilovolt per meter (kV/m).

For newly designed OHTLs, a sanitary protection zone from the outermost wires of the overhead power line shall be the following distances to the nearest residential, industrial and non-production buildings and structures are as follows:

- 25 m - for overhead power lines with voltage of up to 220 kilovolts (kV);
- 30 m - for overhead power lines with voltage of up to 500 kV;
- 40 m - for overhead power lines with voltage of up to 750 kV;
- 55 m - for overhead power lines with voltage of up to 1,150 kV.

Article 34 of the Sanitary Rules "Sanitary and epidemiological requirements for Sanitary Protection Zones": states that residential and public buildings and structures shall not be located within the boundaries of the sanitary protection zones for OHTLs.

When overhead and cable lines are routed within rural and urban areas, local executive bodies shall not allow the development within the protection zones. The land plots that are within the sanitary protection zones for OHTLs will not be acquired or expropriated from the existing landowner and the landowner can continue to use the land for agricultural purposes.

Agricultural field works, such as ploughing, harvesting, hay removal, estuary irrigation, in the protection zones of OHTLs can continue to be carried out by the land users with prior written notification to the relevant akimat.

OHTLs cannot be routed over the properties of stadiums, educational and children's institutions, and cannot pass above buildings and structures.

7.2.2 Lender Requirements

In addition to national laws, the Project must comply with international standards and guidelines set by international financial institutions (IFIs). These requirements ensure that environmental and social risks are properly identified, mitigated, and managed.

Applicable lender and institutional standards include:

- International Finance Corporation (IFC) Performance Standards (2012):
  - *PS1*: Assessment and Management of Environmental and Social Risks and Impacts
  - *PS2*: Labour and Working Conditions
  - *PS4*: Community Health, Safety, and Security
  - *PS6*: Biodiversity Conservation and Sustainable Management of Living Natural Resources
- Asian Infrastructure Investment Bank (AIIB) Environmental and Social Framework/Standards (2022):

- *ESS1:* Environmental and Social Assessment
- *ESS2:* Involuntary Resettlement
- *ESS3:* Biodiversity & Community Health

- Islamic Development Bank (IsDB) Environmental and Social Safeguards Policy/Norms (2020):
  - *ESN 1:* Assessment and Management of Environmental and Social Risks and Impacts
  - *ESN 2:* Labour and Working Conditions
  - *ESN 4:* Community Health, Safety and Security
  - *ESN 5:* Land Acquisition, Restrictions on Land Use and Involuntary Resettlement
  - *ESN 7:* Vulnerable Groups

These standards require that the Project proactively prevents adverse health and safety impacts on communities, ensures fair and inclusive engagement, and maintains robust emergency preparedness and response measures throughout construction and operation.

7.2 Baseline Conditions

7.2.3 Area of Influence

The Project Area of Influence (AoI) defines the spatial boundaries within which environmental and social changes attributable to the Project may occur, as well as the communities that may be affected by those changes. The AoI is defined in accordance with the IFC Performance Standards and related sector guidance.

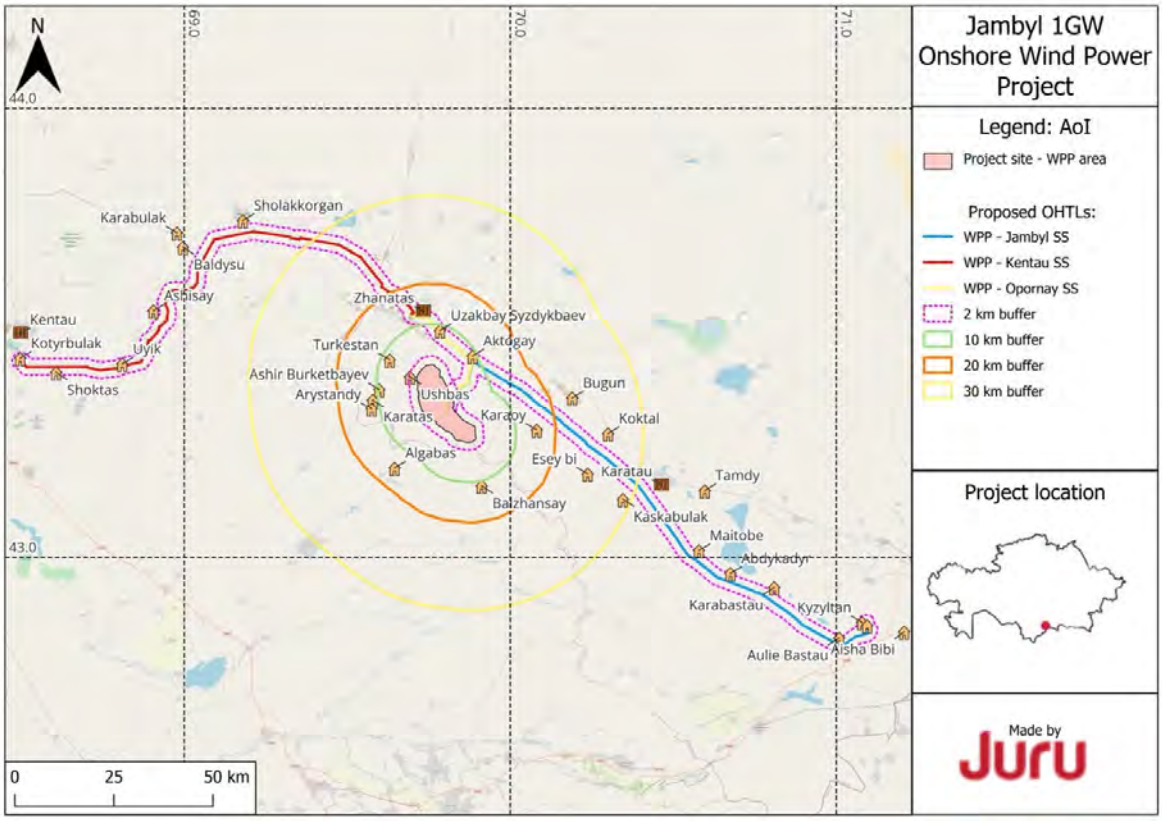
7.2.3.1 Definition

The AoI is defined based on the potential for direct, indirect, and induced impacts associated with the Project's construction and operation phases.

- **Direct impacts** will occur within the Project footprint, including the WTG (wind turbine generator) locations, internal access roads, Battery Energy Storage System (BESS), substations, and construction facilities, as well as along the Overhead Transmission Line (OHTL) routes.
- **Indirect impacts** may occur within approximately 2 km of the OHTL routes and around 20 km of the WPP site, where effects such as noise, shadow flicker, and visual disturbance could extend.
- **Induced impacts** may arise from associated infrastructure, in-migration of workers, local procurement, and other socio-economic dynamics, potentially extending up to 30 km from the Project site.

These distances are consistent with IFC definitions of an AoI and correspond to the boundaries used in the Scoping Report (2024).

Figure 7-1: Project Area of Influence



The general AoI includes all areas that may experience direct, indirect, or cumulative impacts, encompassing both environmental and social receptors, as well as settlements along the transport and transmission corridors.

7.2.3.2 Methodology and Criteria

In accordance with the IFC Performance Standards, the AoI has been identified using the following criteria:

- Areas and communities where social impacts may occur to individuals, communities, or workers, including effects on working conditions, socio-economic status, cultural identity, human rights, and/or health, in line with IFC PS1 requirements for risk and impact assessment.
- Areas and communities potentially affected by cumulative effects from associated or planned developments, such as access roads, substations, OHTLs, quarries, and other project-related infrastructure, consistent with IFC guidance on indirect and induced impacts.
- Areas and communities indirectly impacted by activities or facilities that are not directly financed by the Project but are functionally dependent on it, reflecting IFC's approach to associated facilities and cumulative impacts.

7.2.3.3 Identified Settlements within the Primary AoI

The main communities expected to fall within the primary AoI include settlements on both the eastern and western sides of the Project site, as well as along the Jambyl and Kentau OHTL corridors. The following Table 7-3 describes potential community health, safety and security (CHSS) impacts on the localities within the AOI.

Table 7-3: Localities within the AOI and potential CHSS impacts

Locality	Potential Social Impact
Wind Power Project (WPP) area settlements	
Aktogay	Located near WTG area; potential temporary noise and dust impacts during construction.
Ushbas	Close to site boundary. Temporary construction impacts (noise, dust).
Karaoy	Close to site boundary. Temporary construction impacts (noise, dust).
Turkestan	No direct construction-phase disturbances expected; however, minor indirect impacts such as increased regional traffic and demand for services may occur.
Uzakbay Syzdykbaev/ Zhanaaryk	No direct construction-phase disturbances expected; however, minor indirect impacts such as increased regional traffic and demand for services may occur.
Karatas	No direct construction-phase disturbances expected; however, minor indirect impacts such as increased regional traffic and demand for services may occur.
Arystandy	No direct construction-phase disturbances expected; however, minor indirect impacts such as increased regional traffic and demand for services may occur.
Zhanatas (town)	Potential indirect impacts from increased traffic and workforce presence; benefits from employment and local procurement.
Karatau (town)	Temporary disturbance during OHTL construction; potential benefits through job creation.
Jambyl OHTL area settlements	
Karaoy	Village near Jambyl OHTL; potential access limitations during works.
Koktal	Village near Jambyl OHTL; potential access limitations during works.
Esei bi	Village near Jambyl OHTL; potential access limitations during works.
Kaskabulak	Village near Jambyl OHTL; potential access limitations during works.
Akshukyr	Village near Jambyl OHTL; potential access limitations during works.
Tamdy	Village near Jambyl OHTL; potential access limitations during works.
Kozhagapper	Potential temporary access constraints during construction works; minor noise and dust during peak activity.
Maytobe	Village near Jambyl OHTL; potential access limitations during works.
Abdikadir	Potential temporary access constraints during construction works; minor noise and dust during peak activity; short-term employment
Zhylybulak	Potential temporary access constraints during construction works; minor noise and dust during peak activity; short-term employment.
Darbaza	Potential temporary access constraints during construction works; minor noise and dust during peak activity; short-term employment.
Karabastau	Potential temporary access constraints during construction works; minor noise and dust during peak activity; short-term employment.
Aulie-bastau	Potential temporary access constraints during construction works; minor noise

Locality	Potential Social Impact
	and dust during peak activity; short-term employment.
Aulie-kul	Located close to substation and OHTL; potential safety and noise impacts; need for community engagement and information.
Kyzyltan	Located close to substation and OHTL; potential safety and noise impacts; need for community engagement and information.
Kentau OHTL area settlements	
Sholakkorgan	Large settlement along Kentau OHTL; potential for cumulative impacts from multiple projects.
Uyuk	Small settlement near Kentau OHTL; likely to experience temporary impacts during construction (dust, noise).
Ashisay	Small settlement near Kentau OHTL; likely to experience temporary impacts during construction (dust, noise).
Shoktas	Small settlement near Kentau OHTL; likely to experience temporary impacts during construction (dust, noise).
Kotyrbulak	Small settlement near Kentau OHTL; likely to experience temporary impacts during construction (dust, noise).
Kushata	Small settlement near Kentau OHTL; likely to experience temporary impacts during construction (dust, noise).
Kentau(town)	Urban centre near OHTL endpoint.

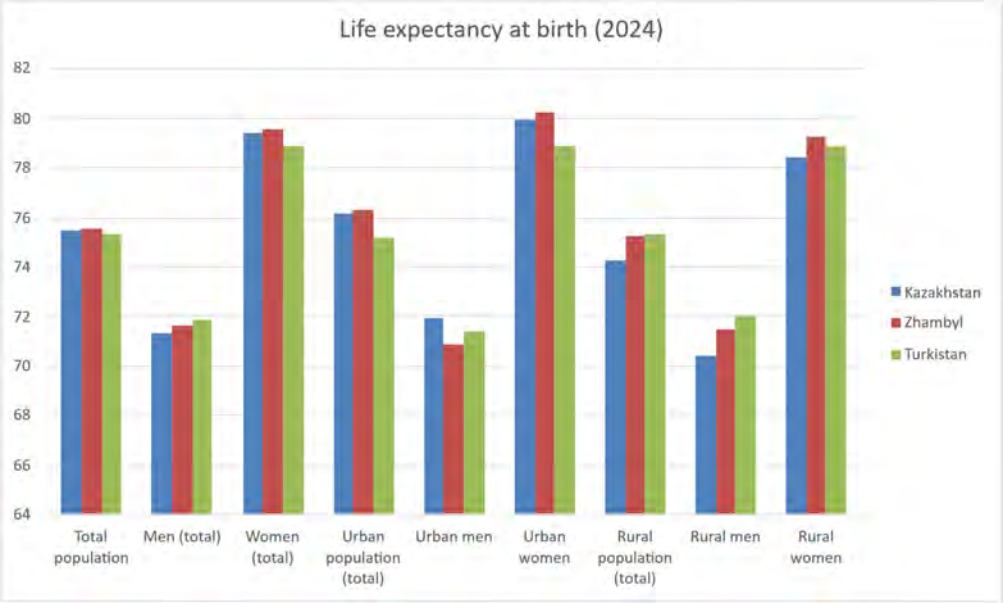
7.2.4 Public Health Profile

According to national statistics (as at March2025), the life expectancy at birth of the population of the Kazakhstan was 75.44 years. For men, life expectancy was 71.33 years, while for women it was 79.42 years. Urban populations live slightly longer on average than rural populations, with life expectancy of 76.14 years and 74.26 years respectively.[61]

Women live longer than men on average across all regions, and urban populations live longer than those in rural areas. As shown in Figure 7-2, women living in urban areas in Jambyl district have the longest life expectancy, at 80.24 years, while rural men in the same district have an average life expectancy of 71.46 years.[62]

Figure 7-2: Life expectancy in Kazakhstan, and Jambyl and Turkestan regions (2024)

[61] https://stat.gov.kz/en/industries/social-statistics/demography/publications/336999
[62] https://stat.gov.kz/en/industries/social-statistics/stat-medicine/



Health expenditure in 2021 was 3.9% of GDP, or 10.6% of the national budget in 2022, while improved drinking water sources are available for 98% of the urban population (2022 estimate).

The country has access to 3.75 physicians/1,000 population (2023) and 6.7 hospital beds/1,000 population (2020 est.). Access to sanitation facilities is very high, with access to improved systems available to 99.9% of the population (2022 estimate).

The prevalence of infectious diseases (number of cases per 100,000 population) in 2023 is presented in the table below.

Table 7-4: Infectious diseases (number of cases per 100,000 population) (2023)

Disease	Kazakhstan	Jambyl Region	Turkestan Region
Brucellosis	3.48	7.54	4.46
Viral hepatitis	10.23	3.69	3.14
COVID-19 Coronavirus Infection	57.89	24.17	3.10
Flu	10.54	7.37	1.78
Tuberculosis	30.67	30.65	19.85
Syphilis	9.04	3.44	4.88
Measles	149.40	293.68	107.25
Acute upper respiratory infections	20,982.18	28,199.63	11,742.43

7.2.5 Healthcare and Services

This section provides an overview of Kazakhstan's national healthcare system and the existing mechanisms for social and medical insurance. It then describes the level and accessibility of medical services at the regional level (Jambyl and Turkestan Regions) and at the local level, in settlements located

within the Project's Area of Influence (WPP and OHTL corridors).

7.2.5.1 National Overview of the Healthcare System

Kazakhstan's healthcare system operates as a multi-tiered structure comprising both public and private sectors. The core of the system consists of state-owned healthcare organizations providing the Guaranteed Volume of Free Medical Care (GVFMC) and services under the Mandatory Social Health Insurance (MSHI) scheme.

The MSHI reform, launched in 2020, expanded population coverage and diversified funding sources, including the state budget, employer contributions, and citizen premiums. As of 2024, approximately 85% of the population is covered under MSHI, though disparities remain between urban and rural areas in terms of service availability. The government continues programs aimed at incentivizing medical personnel to work in rural areas and constructing new primary healthcare facilities. Healthcare expenditures amount to approximately 3.8% of GDP, showing a steady growth trend under national programs for modernization and digital transformation of medicine.

The main priorities of the healthcare sector include strengthening the system of primary healthcare, developing and expanding the infrastructure of rural medical facilities, promoting disease prevention and healthy lifestyles among the population, as well as advancing digital healthcare systems to improve accessibility and efficiency of medical services.

Key indicators (2024):

- Number of doctors — 42,500 (2.2 doctors per 1,000 population);
- Number of mid-level medical staff — approximately 98,000;
- Infant mortality — 8.3 per 1,000 live births;
- Number of healthcare organizations — more than 5,600, including around 1,000 hospitals, 3,500 polyclinics, and about 1,100 rural health posts and outpatient clinics.

The national emergency medical system includes regional ambulance stations and dispatch centres. Accessibility is higher in urban areas, while rural areas experience longer response times due to a limited number of emergency teams.

7.2.5.2 Jambyl Region

In 2025**,** a total of USD 42.2 million was allocated for the healthcare system of Jambyl Region, of which USD 21.0 million (97.2%) had been utilized by the reporting period.

- USD 9.3 million was directed to ensure the guaranteed volume of free medical care;
- USD 22.9 million was allocated for strengthening the material and technical base of healthcare facilities;
- USD 7.7 million was earmarked for the development of new healthcare infrastructure.

The regional construction plan includes five healthcare facilities:

- two outpatient clinics (90 visits per shift) in Kordai and Talas districts;
- a polyclinic for 200 visits per shift in Sortobe village, Kordai District;
- reconstruction of the reception department of the central district hospital in Merke District;
- engineering and communication infrastructure for a clinic in Talas District;
- reconstruction of the central district hospital (200 beds) in the city of Karatau.

Between January and August 2025, there was an increase in the incidence of malignant neoplasms, narcological diseases, syphilis, and cardiovascular diseases. At the same time, the incidence of tuberculosis, mental disorders, and diabetes decreased**.** Three cases of maternal mortality were recorded

in Moiynkum District and in the cities of Taraz and Shu.

The network of public healthcare facilities in Jambyl Region includes 383 organizations, comprising:

- 27 hospital organizations;
- 141 outpatient and polyclinic organizations;
- 4 dispensaries;
- 58 feldsher-midwife posts;
- 145 medical stations;
- 8 other healthcare institutions.

7.2.5.3 Turkestan Region

The healthcare system of Turkestan Region comprises over 400 medical institutions**,** including central district hospitals, polyclinics, outpatient clinics, and feldsher-midwife posts (FAPs). The region is characterized by a predominantly rural population (over 70%)**,** which results in a higher workload on primary healthcare and a shortage of medical personnel, particularly in paediatrics, therapy, and obstetrics.

In the districts crossed by the Project's linear infrastructure (Sozak, Kentau, Sauran), central district hospitals, polyclinics, and medical points are in operation. Several reconstruction and new construction projects are being implemented under the national program **"**Healthy Nation (2021–2025)"**,** which includes modern equipment procurement and digitalization of patient records.

Table 7-5: Health infrastructure within the Project AoI

Settlement	**Population (approx.)**	**Healthcare infrastructure/type**
Ushbas	190	Rural medical point/feldsher Nearest district medical centre located in a nearby larger settlement.
Aktogay	780	Feldsher station; mobile medical visits; nearest district hospital in Zhanatas.
Zhanatas	25,693	Central district medical infrastructure: hospital, polyclinic, pharmacies, several private clinics.
Karatau	28,501	Several medical institutions, including hospitals and polyclinics; developed pharmacy network.
Maitobe	~2,260	School medical post/feldsher service; nearest hospital in Karatau.
AulieKol/Aulie-Bastau	Small rural settlements	Local feldsher posts; pilgrimage site (Aulie-Bastau Spring).
Sholakkorgan	20,171	District centre with hospital and polyclinic; includes an industrial substation zone
Uyuk, Ashisay, Kushata, Shoktas	313–2,176	Feldsher points and small clinics; Ashisay — polyclinic/clinical centre in Kentau.
Kentau	74,662	12 healthcare institutions, hospitals, polyclinics, pharmacies.

In areas with small or seasonal settlements (pastures and livestock farms), residents often rely on mobile

or irregular healthcare services (visiting feldshers or doctors), which increases vulnerability to infectious disease outbreaks and occupational injuries. Most healthcare services are provided by public institutions, although the private sector is actively developing in urban centres (Karatau, Kentau, Zhanatas). For serious or specialized medical cases, patients are referred to district centres (Zhanatas, Karatau, Kentau) or to Taraz.

7.2.6 Peace

In the Global Peace Index for 2025, Kazakhstan is ranked 56 of 163 countries assessed, and has a 'high' state of peace. The country increased 5 places since the previous assessment, putting it in third place for the Eastern Europe and Central Asian region, behind Bulgaria and Romania. Kazakhstan's index score was 1.875 points, reflecting improvements across several indicators, including safety and perceptions of crime. Despite the global trend of growing militarization, Kazakhstan maintained relative stability, which positively influenced its ranking.[63]

7.2.7 Crime

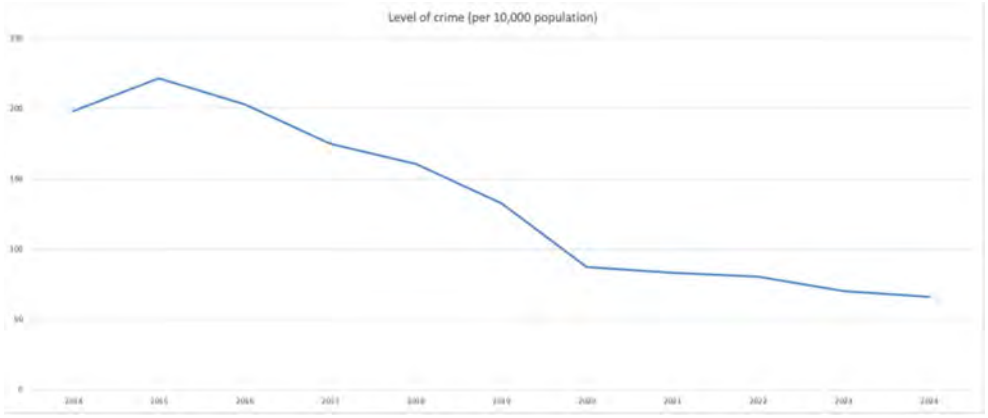
The Bureau of National Statistics reports that there is a decline in the numbers of crimes being committed in Kazakhstan overall, and within both Jambyl and Turkestan regions, as shown in Table 7-6.[64]

Table 7-6: Number of crimes committed, Kazakhstan, and Jambyl and Turkestan regions (2018-2024)

	2018	2019	2020	2021	2022	2023	2024
Kazakhstan	292,286	243,462	163,226	157,884	157,473	140,272	132,778
Jambyl	9,804	8,692	6,220	5,667	5,273	4,511	4,133
Turkestan	11,031	8,309	6,004	5,842	5,929	5,453	5,262

Similarly, in Kazakhstan overall, the level of crime per 10,000 head of population is also in decline, since 2015, as shown in Figure 7-3.

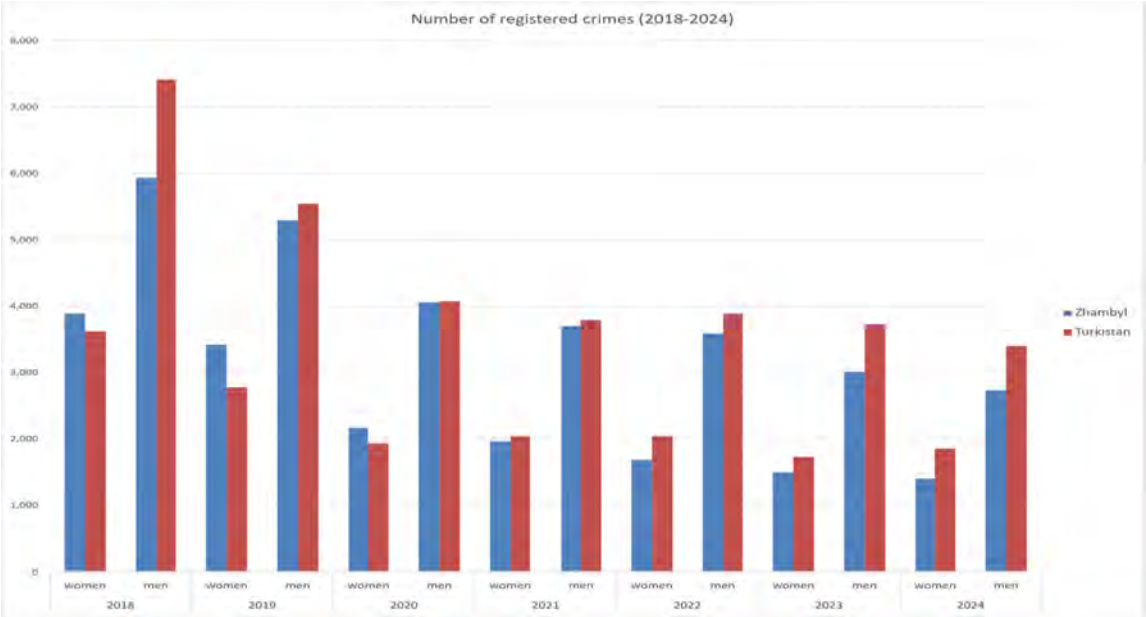
Figure 7-3: Level of crime per 10,000 population (2014-2024)



[63] https://www.visionofhumanity.org/wp-content/uploads/2025/06/Global-Peace-Index-2025-web.pdf
[64] https://stat.gov.kz/en/industries/social-statistics/stat-crime/spreadsheets/

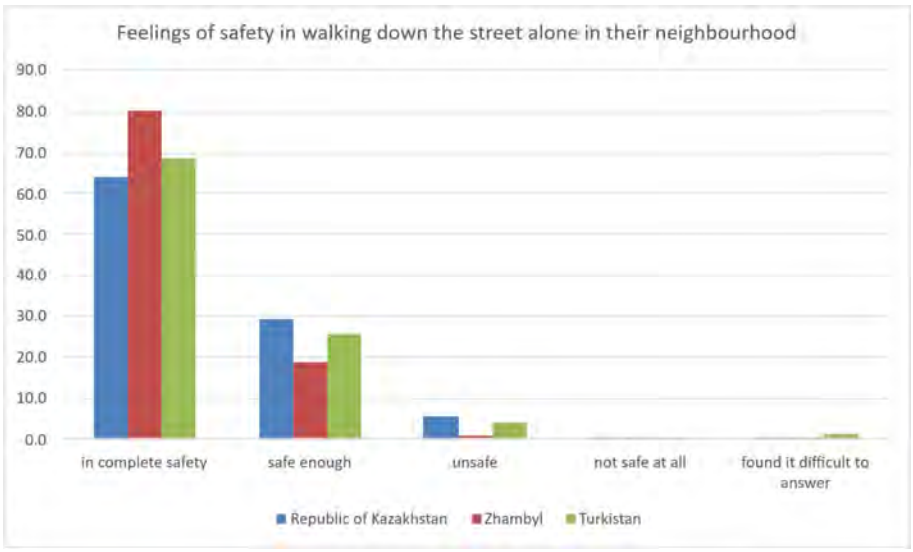
Fewer crimes are committed by women than men, including in Jambyl and Turkestan regions, as shown in Figure 7-4.

Figure 7-4: Number of registered crimes (2018-2024)



The Bureau of National Statistics also tracks people's perceptions of safety, reporting on graduated responses to the feelings of safety in walking alone down the street in the area in which they reside. The majority of people (65%) feel complete safety in Kazakhstan overall, while 80% of respondents from Jambyl region report the same. Perceptions of one's own safety (in percentage) is shown in Figure 7-5. [65]

Figure 7-5: Perceptions of one's own safety (April-May 2024)



Crime rates are reported for Jambyl region by the Bureau of National Statistics, indicating an overall decline in Q1/2023 compared to the same period the year before. Reports on crime for the Turkestan region are drawn from news reports about official statistics for 2024; trend data was not included, as

[65] https://stat.gov.kz/en/industries/social-statistics/stat-crime/spreadsheets/

shown in Table 7-7.

Table 7-7: Crime rates in Jambyl and Crime report for Turkestan

Crime Rate in Jambyl Region (Q1/2023)[66]	2024 crime report for Turkestan[67]
• In the first three months of the year, 1,234 criminal offenses were registered, compared to 1,710 for the same period in 2022, a decrease of 27.8%. • Jambyl Region ranks 13th in terms of registered offenses from 17 regions and three cities of national significance. By Category: • Over the first three months of 2023, compared to the same period in 2022, there was a 39.6% decrease in the number of particularly serious offenses Number of cases by crime type: • Murder: 12 • Trafficking narcotics: 147 • Property crimes: 649, of which 321 were thefts • Fraud: 219. • Hooliganism: 39 • Causing grievous bodily harm: 21 • 8 criminal offenses were committed by minors	In 2024, the criminal police of the Turkestan region eliminated eight groups of apartment burglars and detained 40 suspects involved in 16 cases of property theft. Dismantling of 16 groups of cattle thieves, with 40 individuals detained. Approximately 800 head of cattle were returned to their owners. Organized Crime Police officers detained 13 members and leaders of an organized crime group. 117 crimes were uncovered, including 17 cases of extortion, 34 cases of illegal possession of weapons and drugs, three cases of illegal subsoil use, and three cases of organizing illegal migration. More than 500 rounds of ammunition, 21 weapons and about two kilograms of drugs were seized. As part of the fight against extremism, 24 crimes were prevented, including five cases of terrorist propaganda and four cases of knowingly false reports of terrorist attacks.

7.2.8 Gender-based Violence, Harassment and Exploitation

Gender-based violence (GBV) remains a significant social and public health issue in Kazakhstan. According to national statistics and UNFPA estimates, approximately 17% of women aged 18–75 who have ever been in a partnership have experienced physical and/or sexual violence. Domestic violence represents a substantial share of all recorded crimes in the country: about 39% of criminal cases in 2022 were related to violence against women. Each year, law enforcement agencies register over 100,000 complaints related to domestic violence, reflecting both the continued prevalence of the issue and increased public awareness and willingness to report incidents.

In recent years, the Government of Kazakhstan has undertaken consistent measures to strengthen the legal and institutional framework for preventing violence and protecting survivors. In April 2024, the country adopted Law No. 72-VIII, which officially criminalized domestic violence, marking an important shift from administrative to criminal liability. Amendments were also introduced to expand the scope of protection orders and strengthen penalties for repeated offences.

Following the entry into force of the new law in the first quarter of 2025, the number of domestic violence reports declined by 21% compared to the same period in 2024, according to the Office of the Commissioner for Human Rights. This decline is attributed to improved preventive measures, enhanced interagency coordination, and widespread public awareness campaigns.

The network of support institutions for survivors continues to expand. As of 2025, 61 crisis centres operate

[66] https://www.gov.kz/memleket/entities/zhambyl/press/article/details/120745
[67] https://kaztag-kz.translate.goog/ru/news/na-16-8-snizilas-prestupnost-za-2024-god-v-turkestanskoy-oblasti

across Kazakhstan, providing shelter, medical, psychological, and legal assistance to victims. These centres function with the support of the state, non-governmental organizations, and international partners, including UN agencies and local akimats.

At the regional level, the situation reflects national trends. Higher rates of reported gender-based violence are observed in densely populated and industrial regions — Almaty, Turkestan, and Karaganda regions, as well as in the city of Astana. In contrast, Jambyl and Kyzylorda regions record comparatively fewer cases, though experts note issues of underreporting and hidden statistics, particularly in rural areas where access to specialized and psychological support remains limited.

In the Jambyl region, more than 2,000 domestic and family violence complaints are registered annually, about 10% of which involve threats to life and health. Two temporary shelters for survivors operate in the region, although their coverage remains limited, particularly in remote rural areas.

In the Turkestan region, the rate of reported cases is above the national average (around 12% of all registered complaints in Kazakhstan). This is linked to high population density and socio-economic factors. The region has a crisis centre in the city of Turkestan and a network of shelters run by non-governmental organizations offering assistance to women and children.

In both regions, there is no sustainable system for violence prevention in remote settlements, and coordination among medical, social, and police services remains fragmented, reducing the effectiveness of response mechanisms and access to protection for vulnerable populations.

7.2.9 Conflict and Security

The overall situation in the field of public and regional security in Kazakhstan remains stable. The country is characterized by a low level of armed conflict and political violence, strong state institutions, and effective internal security control. Kazakhstan is not considered an area of active conflict and is among the most stable countries in Central Asia.

However, certain socio-economic and ethno-cultural factors can occasionally lead to localized tensions, particularly in regions with high unemployment rates, uneven access to resources, and ethnic diversity. In previous years, isolated cases of domestic and interethnic conflicts were recorded in several regions (including Jambyl and Turkestan regions); however, these incidents were limited in scope and were promptly resolved through the involvement of government authorities and local administrations.

The national security strategy is based on a comprehensive system of law enforcement and preventive measures. The Ministry of Internal Affairs (MIA), the Committee for National Security (KNS), and local executive bodies are responsible for maintaining public order, protecting strategic facilities, and responding to emergencies.

In recent years, Kazakhstan has strengthened its approach to public safety in rural areas through the establishment of local police units, implementation of the “Safe Village” and “Safe City” programs, and the active use of digital surveillance and monitoring systems.

There have been few recent conflicts and protests, as outlined in the following paragraphs.

Local Labor Protests

In recent years, sporadic labour protests have occurred in several regions, particularly in the western part of the country (Mangystau and Atyrau regions), mainly within the oil and gas sector. These protests were generally peaceful, local, and short-term in nature, primarily related to wage and working condition disputes. Most cases were resolved through negotiations between workers, employers, and local authorities. Such incidents have not had a material impact on overall public safety or socio-economic

stability.

Regional Level Jambyl and Turkestan region

Jambyl region is characterized by a generally stable socio-political environment. Occasional conflicts are mostly related to domestic or land disputes and remain localized. Law enforcement bodies operate routinely, and local administrations maintain commissions on social issues and crime prevention.

Turkestan region**,** with its higher population density and ethnic diversity, presents slightly higher social sensitivity. However, in recent years, proactive measures have been implemented to strengthen interethnic cohesion, promote dialogue between communities, and resolve disputes at an early stage through reconciliation councils and public mediation bodies.

In recent years, while Kazakh-Chinese relations are developing strategic cooperation at an official level, negative attitudes can be observed among the population due to growing concerns regarding the China's increasing influence, trade imbalances (rising imports amid stagnant exports), and migration flows, particularly the presence of Chinese workers and employees of large Chinese companies in Kazakhstan, which sometimes provoke ambiguous reactions in society. Negative reactions and tensions were reported during stakeholder engagement in preparation of this ESIA, regarding relations and solicitation between foreign workers and local women during the construction of a project in Jambyl region.

7.2.10 Civil Unrest

In January 2022, Kazakhstan experienced large-scale public unrest initially triggered by an increase in liquefied gas prices. In several regions — particularly Almaty, Mangystau, and Aktobe regions, as well as the city of Almaty — the protests escalated into violent clashes, arson, and looting. The government declared a state of emergency, and public stability was restored within several weeks.

Subsequently, institutional reforms were implemented to improve transparency, strengthen public trust, and enhance social dialogue between the government and citizens. Since 2023, the overall security situation has stabilized, and no significant incidents have been recorded that could impact the implementation of investment projects.

According to official government reports, 238 people were killed during the unrest, including security-service personnel. Many thousands were injured — independent and human-rights sources describe widespread use of lethal force, torture and mistreatment of detainees, and mass arrests[68].

Following the unrest, mass trials were held. By early 2025, a final verdict was delivered in one major trial related to the January 2022 events: 45 individuals were sentenced for roles in the unrest — including a notorious figure given 20 years' imprisonment, and former security-service officers among the defendants.

Human-rights observers note that many of those arrested had no clear proof of involvement in violence, and that allegations of abuse in custody remain widespread.

Analyses of social attitudes and protest potentials show that between 2019 and early 2022 the number of protest events increased markedly. According to a database covering that period, there were 2,591 protest events in Kazakhstan between 2019 and early 2022, approximately 77.5% of which were peaceful.

7.2.11 Road Traffic Incidents

According to the most recent national review on road crashes, "Kazakhstan Road Crash Data Review and Reporting (March 2025)", over the five-year period from 2018 to 2022 the total number of road crashes

[68] https://www.hrw.org/news/2022/12/20/kazakhstan-no-justice-january-protest-abuses

across Kazakhstan decreased by approximately 6.2 percent and the number of reported injuries fell by around 6.4 percent. Despite the reduction in crashes and injuries, the number of recorded fatalities increased by about 15.9 percent over the same period, indicating that the risk of a fatal outcome from road traffic accidents grew in that timeframe.[69]

More recent data show a concerning upward trend: according to national official reporting, in 2024 the total number of road accidents registered across the country amounted to 31,597, resulting in 43,452 casualties (of whom 2,579 died). Further, in the first half of 2025 alone, 15,698 road accidents were reported throughout Kazakhstan, which is a 54 % increase compared to the same period in 2024.[70] These figures reflect a clear national-level trend: while fewer accidents and injuries were recorded during 2018-2022, the share of fatal crashes rose, and by 2024–2025 the absolute number of accidents appears to be increasing again.

Given this situation, the 2025 CAREC report emphasizes the importance of maintaining a robust national crash data management framework, integrating police, health, emergency and insurance data, to reliably capture crash locations, severity, and outcomes, in order to support evidence-based interventions and road-safety planning.

7.2.12 Terrorism

Kazakhstan currently ranks among the countries with the lowest terrorism impact worldwide. In the 2025 edition of the Global Terrorism Index (GTI), published by the Institute for Economics & Peace (IEP), Kazakhstan received a score of 0.0 and was ranked 100th, indicating minimal or no recorded terrorist-incident impact in recent years[71].

Despite the generally low profile of terrorism in the country, state security agencies continue to actively monitor and prosecute extremist and terrorist offences. For example, as of April 2025, the National Security Committee of Kazakhstan (NSC) reported that 34 individuals had been convicted, and another 23 were under investigation, for terrorism-related crimes during the current year[72]. In July 2025, seven additional persons from several regions, including Jambyl and Turkestan, were convicted for promoting terrorism, plotting to join terrorist organizations abroad, or related offences[73].

7.2.13 Anthrax

During the site visits for this Project, several suspected or confirmed anthrax burial locations were identified inside the Wind Farm area, based on field observations and official information obtained from district Akimats.

Anthrax is an infectious disease caused by *Bacillus anthracis*. The pathogen persists in contaminated soil and infected animals, and the spores can remain viable in soil for several decades. Transmission to humans typically occurs through contact with infected livestock, animal products, or contaminated soil.

Anthrax is classified as a highly contagious disease. In accordance with Kazakh sanitary requirements, a Safety Protection Zone (SPZ) of 1 km is established around anthrax burial sites, within which any construction and ground-disturbing activities are prohibited.

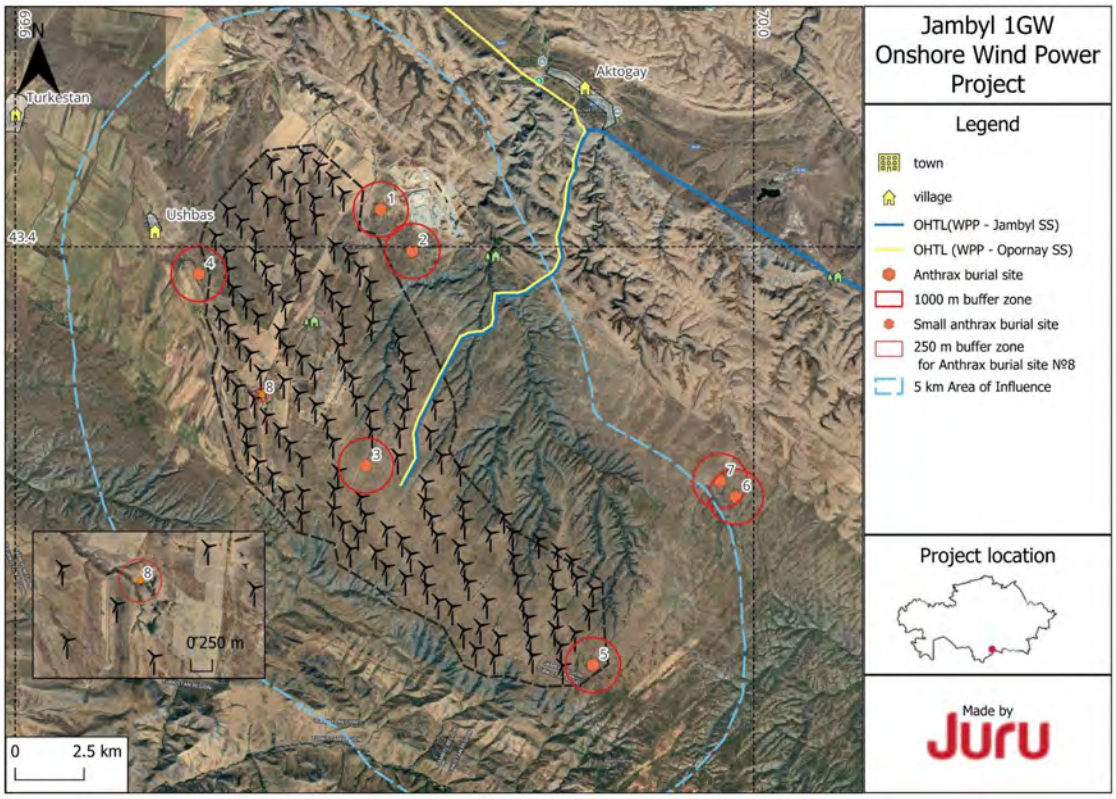
Anthrax outbreaks are recorded regularly in Kazakhstan, with recent statistics showing an upward trend. In 2022, 20 human anthrax cases were registered nationwide, and as of 16 October 2023, 34 cases had

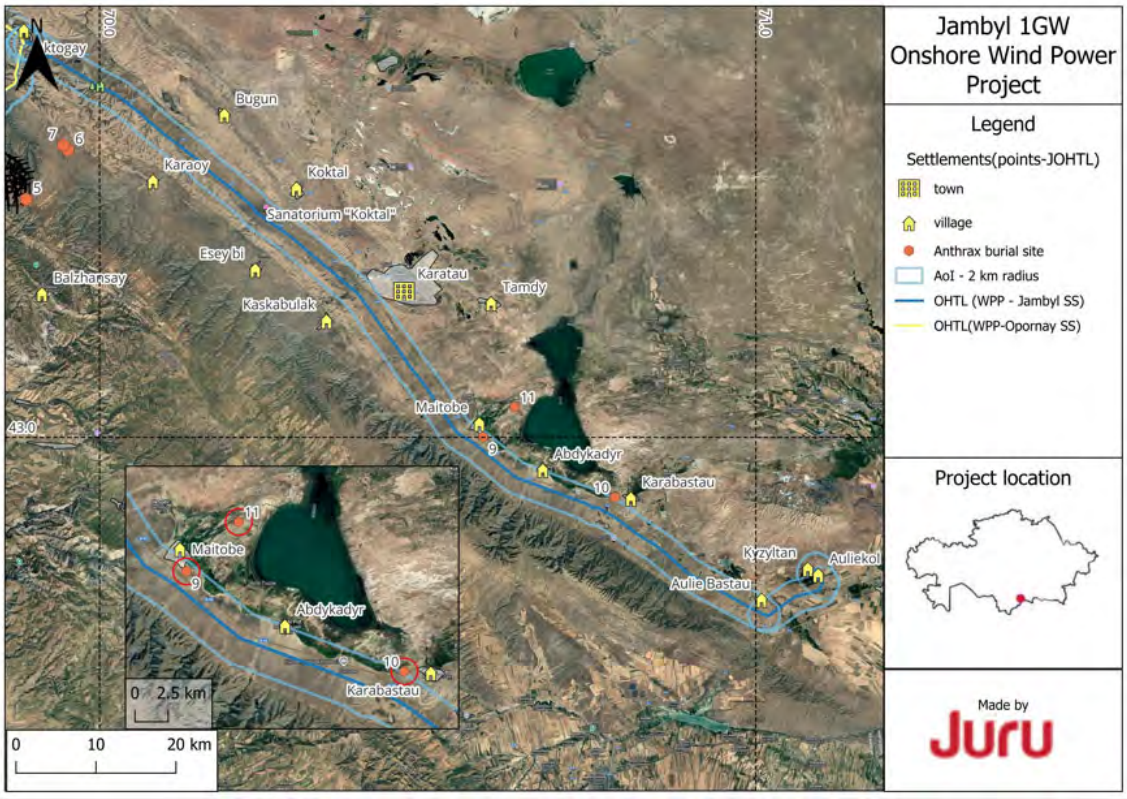
[69] https://www.carecprogram.org/uploads/KAZ-Road-Crash-Data-Review_MAR2025_web.pdf
[70] https://qazinform.com/news/kazakhstan-records-over-15000-road-accidents-in-h1-2025-1fb0f5
[71] https://astanatimes.com/2025/03/kazakhstan-ranks-100th-in-2025-global-terrorism-index-indicating-low-risk/
[72] https://kaztag.kz/en/news/34-people-have-been-convicted-and-23-under-investigation-for-terrorism-in-kazakhstan-since-the-begin
[73] https://en.tengrinews.kz/kazakhstan_news/seven-people-convicted-of-terrorism-in-kazakhstan-268989/

been reported, of which 19 occurred in Jambyl Region. According to the regional health authorities, most cases are associated with the slaughter of sick livestock or handling contaminated meat or carcasses.

Mapping of anthrax burial sites was developed based on the data collected from site visits and Akimat information.

Figure 7-6: Anthrax burial sites





Within the 14,000-hectare WPP site, three anthrax burial sites №. 3, 5, and 8 are located in the western part of the site. Two of these sites (№. 3 and 5) have established buffer zones of 1 km, while one site (№. 8) has a buffer zone of 250 meters from the centre point, shown in Figure 7-6.

According to the Sarysu District Territorial Inspection of the Committee of Water Cadastre and Subsoil Use (of the Ministry of Agriculture), this burial site marks the location where two horses died from anthrax. The carcasses, along with the contaminated soil at the place of death, were incinerated using the specialized KRIN-1000 technique. For this concreted burial site, the recommended protective buffer zone is defined as a radius of 500 meters (i.e., 250 meters from the centre).

In addition, five more anthrax burial sites №. 1, 2, 4, 6, and 7 are located within the AoI but outside the boundaries of the WPP site. Within the 1 km buffer zone of Anthrax Burial Site № 4 lies the Kamar Aulie sacred site, which holds intangible cultural importance for local communities (see Chapter 9). Local legends describe Kamar Aulie as a powerful woman and spiritual healer, whose spirit is believed to have the ability to cure illnesses in both people and animals. The site is closely associated with healing traditions, with visitors coming to seek recovery from various ailments.

The site is also linked to fertility practices, whereby women experiencing difficulties conceiving spend nights at the location to receive spiritual blessings. Livestock health rituals are another important aspect, with herders bringing animals to stay overnight in the belief that the sacred energy of the site can cure diseases. These practices are largely seasonal, with most rituals and healing ceremonies taking place during the summer months. Kamar Aulie cemetery is located within the cemetery of Ushbas village with the site for overnight stays (in a grove) approximately 50m to the north of this.

Furthermore, two anthrax burial sites (№ 1 and 2) are situated between the boundaries of the project site and the EuroChem land plot.

Most anthrax sites are clearly marked with whitewashed walls and danger signage (as shown in the

examples in Figure 7-7 below). During the April 2025 site visit another site that is potentially an anthrax burial site was identified. This site has been prepared under different conditions to those shown below, in what is understood to be a newer, safer technique. Additional information is being sought from the relevant ministries on the safety requirements of this newly identified site.

Avoidance of Anthrax sites has been a key design consideration for the WPP and OHTLs; observation of buffer distances has been included in the layouts to avoid risks to workers throughout the life of the Project.

Figure 7-7: Examples of Anthrax burial sites locations (Source: Sarysu and Talas akimats)



7.2.14 Summary of Key Sensitive Receptors

Table 7-8: Summary of key sensitive receptors

Receptor	Sensitivity	Description
Residential receptors	High	High sensitivity is assigned to residential receptors including permanent houses; seasonal wagons/structures used in grazing areas; worker housing. These can be exposed to noise, shadow flicker, and traffic safety risks, which although not necessarily permanent exposure, are of high sensitivity for residents.
Vulnerable groups	High	High sensitivity is assigned to some of the more potentially

Receptor	Sensitivity	Description
		vulnerable community members (e.g. children, elderly, people with disabilities, low income/isolated households, herders/pastoralists using grazing areas/routes, women and girls, migrants), as they may experience additional risks and/or have higher exposure / lower resilience to security, worker influx, GBVH, disease exposure and road safety risks.
Community and public facilities, and community infrastructure	Medium	Medium sensitivity is assigned to places where people typically gather can include: schools, kindergartens and other camps or education facilities; clinics, hospitals and pharmacies; community centres; religious buildings; markets/trading areas; recreation areas; public transport stops; sanitoriums, or facilities for specific care. Community infrastructure can include drinking water sources; power lines; gas pipelines; telecoms towers; emergency response facilities (fire, police). These receptors are not permanently exposed to hazards, and can typically be exposed to traffic and road safety related risks, or could impact community safety if disrupted.
Livelihoods and land use receptors	Medium	Medium sensitivity has been assigned to public safety (construction hazards, ice throw, road safety) and restriction of access for livestock grazing and agricultural areas, water points or pasture tracks/informal access routes; these receptors are not permanently exposed to hazards.
Transport receptors	Medium	Medium sensitivity is assigned to transport related receptors (e.g. road junctions and crossings, village entry/exit points, pedestrian crossings/informal walking routes, livestock crossing points used by herders); these receptors are potentially exposed to road and traffic hazards, particularly the transport of large plant and equipment.

7.3 Impact Assessment

7.3.1 Construction Phase

The following construction phase impacts are assessed in other chapters and therefore not covered here:

- Potential impacts to people from Noise and Vibration – see Chapter 11
- Potential impacts to people, livestock or the environment from waste and wastewater management – see Chapter 16
- Potential impacts to people due to Project-induced Air quality impacts (e.g. dust near haul roads or batching plants) – see Chapter 17.

Potential impacts from Anthrax have been scoped out; the design incorporates avoidance by respecting buffer distances thus avoiding potential disturbance of sites by workers and/or community members.

7.3.1.1 Collisions and other public safety risks between local communities and the workforce

Potential health and safety risks between the workforce and local communities can arise due to collisions between Project vehicles and people, livestock, property, or other vehicles, causing injuries and damage.

The project will result in a surge of heavy vehicle movements on local roads and through settlements (turbine components, cranes, concrete, aggregates). In a serious incident, fatalities or debilitating injuries may occur to a member of the public, other road user, driver of a Project vehicle and its occupants. Local

herders, who often travel by motorcycle to reach livestock, may also be at risk of collision due to being difficult to see by construction vehicle drivers, and due to them not wearing protective clothing/helmets. Damage from an incident could also be caused to a third-party structure (such as a house).

Transportation of project components, equipment, machinery and materials to the site (e.g. blades, rotors, etc) is to be planned during the pre-mobilisation phase and implemented during the construction phase. The transportation route of the WTGs, their major components and the substations is to be studied and road modifications may be required.

There is also going to be a higher number of project vehicles in the Project area, which elevates the risk of crashes, particularly at village crossings, school areas, and narrow rural roads, as well as potential interactions between Project traffic and other heavy vehicles from other industry in the area (e.g. Eurochem). Heavy vehicles can additionally cause damage to local roads, making journeys by local route users more difficult and hazardous, for example, through rutting of unpaved roads from heavy vehicle usage.

The impact is relevant to all stages of the Project, although the greatest risk will take place during construction when large equipment is being transported, earth moving equipment is being used and excavations are present in close proximity to working areas. The roads accessing the WPP will be at greater risk due to the size and number of heavy vehicles transporting WTG components to the site. OHTL components will also present a risk but will be of lower intensity on roads across the Project AoI.

Table 7-9: Construction CHSS risks – Collisions and public safety risks between local communities and the workforce

Activity/Impact/Aspect					
Risk of collisions and public safety risks between local communities and the workforce					
Type	Duration	Extent	Scale of Impact	Frequency	Likelihood
Direct	Short-medium term	On-site/local	Distinguishable	Continuous	Possible

Receptor	Sensitivity	Magnitude	Significance of Impact
Construction workers/community members	Medium	Medium	Moderate

7.3.1.2 Unauthorised Construction Site Access

Construction sites can draw unauthorised visitors from nearby communities, including curious children or individuals seeking to take materials. Anyone entering the site would be exposed to hazards such as moving machinery or hazardous substances. The nearest settlement to the proposed WPP is Ushbas, with several other settlements located 1–2 km from the alignment as described above in section 7.2.3. Herders also move widely across the WPP area and OHTL alignments with their livestock. As a result, there is a possibility that community members could intentionally or inadvertently enter construction areas.

Within the construction sites, where plant and heavy equipment, mechanical excavation machinery, and rotating equipment at use, there are risks to herders and local residents from open excavations, crane lifts, blasting (if any), and moving equipment near informal grazing routes and tracks.

Additionally, there is potential interaction with existing livestock/pastoralist movements around turbine footprints and new access roads.

A community health and safety incident during construction, such as a local person gaining unauthorised entry into a working area where excavations are present, could result in an injury or fatality.

Table 7-10: Construction CHSS risks – Unauthorised construction site access

Activity/Impact/Aspect					
Risk of unauthorised construction site access					
Type	Duration	Extent	Scale of Impact	Frequency	Likelihood
Direct	Short-medium term	On-site/local	Distinguishable	Continuous	Possible

Receptor	Sensitivity	Magnitude	Significance of Impact
Community members, herders, children	Medium	Medium	Moderate

7.3.1.3 Opportunistic labour influx

Large infrastructure projects often require a workforce that exceeds what is available locally, resulting in labour influx. This typically involves in-migration of workers (often young men travelling without their families) who can be accommodated in construction camps or local apartments. For this Project, average construction demand is estimated at up to 1,000 workers distributed across several work fronts for OHTLs plus the WPP, peaking at 2,200 people during the installation phase. Although most labour is expected to be drawn from the Project-affected districts, commuting distances and the dispersed nature of the work sites mean that many workers will still require temporary accommodation. Certain specialist or managerial roles are also likely to be filled by personnel from outside the local area, particularly along OHTL sections and around the WPP where agricultural livelihoods dominate and relevant technical skills are limited or have already been absorbed into other local industry (e.g. Eurochem, Kazphosphat or Zhanatas/Shokpar WPPs).

The EPC contractor has not yet been appointed, and an international contractor is a possibility. While Kazakhstan's "Kazakh content" requirements limit the extent to which the workforce can be sourced from abroad, a full construction team could be brought in from another region of Kazakhstan and supplemented with foreign workers as needed. Depending on contractor practices, the number and distribution of work fronts, and the proportion of local workers recruited, labour influx could vary significantly. In a high-end scenario, in-migrant workers could be present at each work front along both OHTLs and at the WPP, peaking where work fronts converge. More moderate scenarios anticipate far fewer non-local workers concentrated in one place, reducing the potential for broader community impacts.

Labour influx can create pressures on local infrastructure, services and social dynamics, particularly in small or underserved settlements. Cultural differences, such as norms around alcohol consumption, communication styles, hygiene or interactions within communities, can lead to misunderstandings or tension, especially where workers come from different regions or countries. In small communities, a sudden increase in young male workers may heighten concerns about safety, contribute to perceptions of insecurity among women and girls, and increase the risk of GBV/SEA. Depending on the selected EPC, there may be existing suspicions about the intent of any foreign workers within local communities due to past experiences. There is also evidence from similar contexts that young men living away from their families may be more prone to antisocial or violent behaviour, particularly if living conditions are perceived to be monotonous or where alcohol is available.

Some settlements along the alignment are extremely small and therefore more sensitive to even a modest influx of non-local workers. For example, Maitobe had only 7 registered residents during field surveys. Even the lowest influx scenario, involving around 20 non-local workers in one place at a time, could have noticeable social impacts in such locations. This includes the potential for conflict between local and in-migrant men and heightened GBVH risks for women and girls.

In addition to the formal workforce, construction projects can attract uninvited job-seekers or opportunistic migrants from outside the region. These individuals are likely to gravitate towards towns

and cities, where transport routes and services are concentrated. Given the close-knit nature of local communities, newcomers are expected to be quickly recognised, and locally recruited security personnel at construction sites and accommodation facilities should be able to identify unauthorised individuals attempting to access workers or facilities. Formal or informal influx may also increase the risk of communicable diseases, place pressure on local utilities if camps are near settlements, and generate further potential for harassment or conflict in settings with conservative social norms.

Table 7-11: Construction CHSS risks – Labour influx

Activity/Impact/Aspect					
Risk of labour influx					
Type	Duration	Extent	Scale of Impact	Frequency	Likelihood
Direct	Short-Medium term	On-site/local	Distinguishable	Continuous	Likely
Receptor		Sensitivity	Magnitude	Significance of Impact	
Community members, in-migrants, jobseekers		Medium	Medium	Moderate	

7.3.1.4 Communicable disease transmission

Kazakhstan has a generally well-functioning public healthcare system, and overall population health is comparatively good. However, labour influx introduces greater population mixing, which can elevate the risk of communicable disease transmission, particularly when workers arrive from other regions or countries. Diseases may spread through routine community interactions, sexual relationships, or sex work, and the risk is heightened where temporary accommodation is crowded or maintained with poor hygiene standards.

Some Project-affected communities are located in remote areas with limited access to healthcare facilities, making them more vulnerable to outbreaks or delays in treatment. Any increase in communicable diseases, whether among workers or local residents, would place additional pressure on nearby clinics and hospitals. While significant strain on food supplies, wastewater or sanitation systems is unlikely in established towns, modest increases in demand cannot be fully ruled out, especially during peak construction periods.

Table 7-12: Construction CHSS risks – Communicable disease transmission

Activity/Impact/Aspect					
Risk of communicable disease transmission					
Type	Duration	Extent	Scale of Impact	Frequency	Likelihood
Direct	Short term	On-site/local	Distinguishable	Continuous	Possible
Receptor		Sensitivity	Magnitude	Significance of Impact	
Construction workers, community members and their families		Medium	Medium	Moderate	

7.3.1.5 GBVH and violence between local communities and the workforce

Gender-based violence and harassment (GBVH) refers to violence or abusive conduct directed at individuals because of their sex or gender, or conduct that disproportionately affects people of a particular sex or gender. It includes sexual or physical violence, verbal or psychological harassment, and economic abuse. While GBVH is most commonly perpetrated by men against women and girls, it can affect people of any sex or gender, including LGBT+ individuals.

The Project will introduce a large, predominantly male construction workforce into an area with small and, in some cases, conservative communities. This creates several potential GBVH risk pathways. The most direct relates to inappropriate or harmful behaviour by Project workers towards local women and girls, particularly in settlements near construction compounds or along access routes, and in public places where workers and residents interact. Such incidents can cause serious harm to victims and may undermine community trust in the Project. In some cases, women or girls who experience harassment may also face secondary victimisation from family members who believe they provoked the incident.

Indirect GBVH risks may also arise where consensual or benign interactions between workers and local women trigger jealousy or anger among local men, leading to controlling or violent behaviour within households. These risks are amplified in more conservative communities where interactions between unrelated men and women are closely scrutinised, and where women and girls often have limited ability to raise concerns or influence outcomes. Past experiences described during interviews in the local area suggests that this is a risk.

Project personnel may also encounter GBVH occurring within the community but unrelated to the Project. This is particularly relevant for community-facing staff such as CLOs, who may witness or receive disclosures of domestic or sexual violence. Such situations can be distressing for staff, especially where they are unsure how to respond without worsening risks for the victim.

Given the size of the workforce, it is likely that at least some of these scenarios will occur to varying degrees, with the greatest risk arising from male Project workers towards local women and girls. More broadly, labour influx may also contribute to social tension, petty crime, or conflict if newcomers become frustrated by unmet expectations or are perceived as competing for scarce local employment. In some cases, job-seekers may establish informal settlements on the outskirts of towns, which can further heighten tensions and increase vulnerabilities, including vulnerability to GBVH, within already marginalised communities.

Table 7-13: Construction CHSS risks – GBVH and violence

Activity/Impact/Aspect					
Risk of GBVH and violence					
Type	Duration	Extent	Scale of Impact	Frequency	Likelihood
Direct	Short-Medium term	On-site/local	Distinguishable	Intermittent	Possible

Receptor	Sensitivity	Magnitude	Significance of Impact
Community members, construction workers	Medium	Medium	Moderate

7.3.1.6 Security issues and abusive conduct by security personnel

Within the broader Area of Influence, public security conditions are assessed as stable, and the likelihood of conflict is low. Potential sources of social tension may arise during construction, particularly from the temporary presence of a non-local workforce, perceived inequities in employment opportunities, or minor pressures placed on transport or utility infrastructure. These risks are generally limited and can be mitigated through effective community engagement and transparent communication on recruitment and project activities.

Security-related risks associated with the Project are considered low. Security personnel can, in some contexts, be linked to violent or abusive behaviour, particularly where weapons are carried or the use of force is authorised. The security workforce is anticipated to be small and primarily stationed at access points to construction sites, reflecting the overall low security risk profile of the area.

Even with a modest security presence, there remains a need to manage risks such as excessive use of force, harassment, or intimidation by private security personnel or police operating around camps or laydown areas. There is also a possibility that security arrangements could inadvertently restrict customary access routes used by local residents. Ensuring that security providers operate in line with international good practice, including the Voluntary Principles on Security and Human Rights, will be essential to maintaining community trust and minimising adverse impacts.

Table 7-14: Construction CHSS risks – Abusive conduct by security personnel

Activity/Impact/Aspect					
Risk of abusive conduct by security personnel					
Type	Duration	Extent	Scale of Impact	Frequency	Likelihood
Direct	Short-Medium term	On-site/local	Distinguishable	Intermittent	Unlikely
Receptor		Sensitivity	Magnitude	Significance of Impact	
Community members, Construction workers, Security personnel		Medium	Small	Minor	

7.3.1.7 Additional CHSS risks for vulnerable groups

Several groups within the Project Area may face heightened community health, safety and security risks during construction. Elderly people and those with pre-existing health conditions (e.g. respiratory illnesses) may be more sensitive to dust, emissions, and general construction disturbance. Women and girls, especially in conservative communities, face particular vulnerabilities related to GBVH, which may be exacerbated by the temporary presence of a predominantly male workforce. Very small or remote settlements may also be disproportionately affected by labour influx, particularly if construction camps or access routes are located nearby.

Children and adolescents are at elevated risk because of their natural curiosity and tendency to engage in high-risk behaviour. They may be more inclined to approach hazardous areas, circumvent fencing, or interact with construction equipment. Clear communication and community awareness measures are therefore essential to ensure young people understand the dangers of construction sites, substations and access roads. Elderly people may similarly underestimate or be unaware of the risks associated with active construction areas.

Some land-users, such as farmers or herders, may also be exposed to CHSS risks if they are unable to read warning signs or identify hazard markings. Livestock entering work areas may prompt owners to follow animals into unsafe locations, increasing the likelihood of accidents. Engaging directly with these groups and ensuring that warnings are communicated through multiple formats (not only written signage) will be important to managing these risks.

Table 7-15: Construction CHSS risks – Additional CHSS risks for vulnerable groups

Activity/Impact/Aspect					
Risk of additional CHSS risks for vulnerable groups					
Type	Duration	Extent	Scale of Impact	Frequency	Likelihood
Direct	Short-Medium term	On-site/local	Distinguishable	Continuous	Likely
Receptor		Sensitivity	Magnitude	Significance of Impact	
Vulnerable community members (esp. women and girls, elderly, children/ adolescents), CLOs, land users		High	Large	Major	

7.3.2 Operations Phase

The following operational phase impacts are assessed in other chapters and therefore not covered here:

- Potential impacts to people from Noise and Vibration – see Chapter 11
- Potential impacts to people from Shadow flicker – see Chapter 12
- Potential impacts to people due to Project-induced Air quality impacts – see Chapter 17
- Potential impacts to Aviation, radar and telecommunications – see Chapter 20
- Potential impacts to people from Ice throw – see Chapter 19.

7.3.2.1 Collisions and other public safety risks between local communities and the workforce

Potential health and safety risks between the workforce and local communities can arise due to potential collision risks between project vehicles and members of the public. This impact is not predicted to be significant, but can be further minimised by ensuring all employees who drive for work have adequate driver training, including regular refresher training. All maintenance workers who will undertake driving will be provided with driver induction training, including discussion of location-specific risks and the importance of maintaining a safe speed. The number of vehicles, frequency of movement and types of heavy equipment being transported will be significantly lower than the construction phase.

Working with live electrical components during operations can present a public health and safety risk. It is assumed that security at substations, the design of the support points, accessibility of the BESS and WTGs will be adequate to reasonably prevent attempts at trespassing and vandalism. However, this risk cannot be totally eliminated.

Table 7-16: Operations CHSS risks – Collisions and other public safety risks between local communities and the workforce

Activity/Impact/Aspect					
Risk of vehicle collisions and other public safety risks between local communities and the workforce					
Type	Duration	Extent	Scale of Impact	Frequency	Likelihood
Direct	Long term	Local	Distinguishable	Intermittent	Possible
Receptor		Sensitivity	Magnitude	Significance of Impact	
Operations workers, community members		Medium	Small	Minor	

7.3.2.2 Security issues and abusive conduct by security personnel

Security-related risks associated with the Project are considered low at the operations phase. Security personnel can, in some contexts, be linked to violent or abusive behaviour, particularly where weapons are carried or the use of force is authorised. The security workforce is anticipated to be small and primarily stationed at access points to WPP, reflecting the overall low security risk profile of the area. Security providers will need to operate in line with international good practice, including the Voluntary Principles on Security and Human Rights, to maintain community trust and minimise adverse impacts.

Table 7-17: Operations CHSS risks – Abusive conduct by security personnel

Activity/Impact/Aspect					
Risk of abusive conduct by security personnel					
Type	Duration	Extent	Scale of Impact	Frequency	Likelihood
Direct	Long term	On-site/local	Distinguishable	Intermittent	Unlikely
Receptor		Sensitivity	Magnitude	Significance of Impact	

Community members, Operations workers, Security personnel	Medium	Small	Minor

7.3.2.3 Additional CHSS risks for vulnerable groups

While the construction workforce will have been demobilised, the risk remains for vulnerable groups to be exposed to heightened community health, safety and security risks during operations. Women and girls, especially in conservative communities, face particular vulnerabilities related to GBVH, which may be exacerbated by the presence of a predominantly male workforce. Very small or remote settlements may also be disproportionately affected by access routes that are located nearby.

Children and adolescents are at elevated risk because of their natural curiosity and tendency to engage in high-risk behaviour. They may be more inclined to approach hazardous areas, circumvent fencing, or interact with any maintenance equipment. Clear communication and community awareness measures are therefore essential to ensure young people understand the dangers of WTGs, electrical networks and access roads. Elderly people may similarly underestimate or be unaware of the risks associated with operational areas.

Some land-users, such as farmers or herders, may also be exposed to CHSS risks if they are unable to read warning signs or identify hazard markings. Livestock entering work areas may prompt owners to follow animals into unsafe locations, increasing the likelihood of accidents. Engaging directly with these groups and ensuring that warnings are communicated through multiple formats (not only written signage) will be important to managing these risks.

Table 7-18: Operations CHSS risks – Additional CHSS risks for vulnerable groups

Activity/Impact/Aspect					
Risk of additional CHSS risks for vulnerable groups					
Type	Duration	Extent	Scale of Impact	Frequency	Likelihood
Direct	Long term	On-site/local	Distinguishable	Continuous	Likely
Receptor		Sensitivity	Magnitude	Significance of Impact	
Vulnerable community members (esp. women and girls, elderly, children/ adolescents), CLOs, land users		High	Medium	Major	

7.3.2.4 Electric and magnetic fields (EMF)

Overview

The operation of electrical infrastructure associated with the Project, including wind turbine generators (WTGs) and 220 kV overhead transmission lines (OHTLs), will generate electric and magnetic fields (EMF). EMF are invisible fields that occur wherever electricity is generated, transmitted or used. Their strength depends primarily on voltage (electric fields) and current (magnetic fields) and decreases rapidly with distance from the source.

- Electric fields are produced by voltage and increase in strength as the voltage increases; the electric field strength is measured in units of volts per meter (V/m).
- Magnetic fields result from the flow of current through wires or electrical devices and increase in strength as the current increases; magnetic fields are measured in units of gauss (G) or tesla (T).

EMF effect on human health

World Health Organisation (WHO) provides a summary of health effects of EMF, describing:

- low-frequency electric fields as influencing the human body just as they influence any other material made up of charged particles. When electric fields act on conductive materials, they influence the distribution of electric charges at their surface and cause current to flow through the body to the ground: and
- low-frequency magnetic fields induce circulating currents within the human body. The strength of these currents depends on the intensity of the outside magnetic field. If sufficiently large, these currents could cause stimulation of nerves and muscles or affect other biological processes.

Both electric and magnetic fields induce voltages and currents in the body, but according to WHO, even directly beneath a high voltage transmission line, the induced currents are very small compared to thresholds for producing shock and other electrical effects. To date, no adverse health effects from low level, long-term exposure to EMF have been confirmed; scientists are continuing to actively research this area.

EMF Standards

National Regulatory Requirements

In the Republic of Kazakhstan, public exposure to physical factors, including electromagnetic fields (EMF) generated by overhead transmission lines (OHTLs), is regulated through mandatory norms such as the "Sanitary-epidemiological requirements for sanitary protection zones of objects that are objects of impact on the habitat and human health," approved by the Order of the Acting Minister of Health No. KR DSM-2 dated 11 January 2022. These rules establish that to protect the population from the electric field generated by high-voltage lines, a sanitary gap (sanitary rupture) is established along the route, beyond which the electric field intensity must not exceed 1 kV/m.

To ensure compliance with the above, Kazakhstan national legislation specifies a minimum safeguarding distance for 220 kV OHTLs of at least 25 m to the ground from the outermost wire for all residential and public buildings and structures, as discussed above in Section 7.2.1.1, which sets out Sanitary protection zones around OHTLs.

International standards

IFC EHS guideline refers to International Commission on Non-Ionizing Radiation Protection (ICNIRP), which establish allowable levels for public exposure to electric field as 5 kV/m and for magnetic fields 100 µT.

Corresponding ICNIRP limits for occupational exposure to electric and magnetic fields are significantly higher at 10 kV/m and 500 µT, respectively (OHS limits).

Accordingly, compliance with Kazakhstan's sanitary norms ensures alignment with GIIP as these limits are substantially more conservative than the ICNIRP/WHO international public exposure guidelines. Accordingly, lender requirements are met through project design measures that ensure statutory safety clearances and setbacks are maintained, sensitive receptors are avoided where feasible, and predicted EMF levels at publicly accessible locations remain well below ICNIRP guideline values. Thus, no additional mitigation required where statutory clearances and sanitary protection zones are respected.

Where these conditions are satisfied, IFIs do not typically require additional mitigation or long-term EMF monitoring.

Impacts from Electromagnetic fields (EMF)

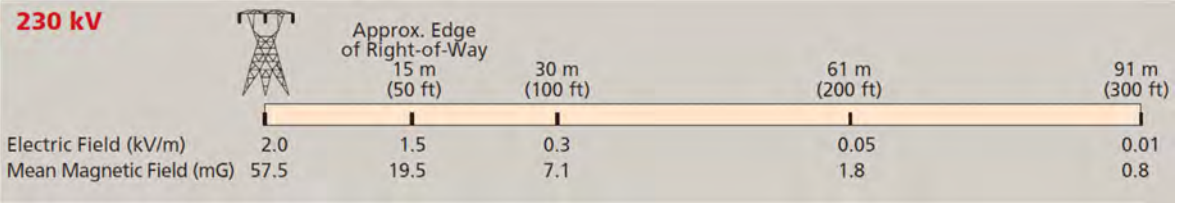
EMF associated with WTGs arise from internal electrical components such as generators, transformers and cabling. These sources generate extremely low-frequency EMF that is largely confined within the

turbine structure. Field strengths diminish rapidly beyond the tower and nacelle, and EMF levels at ground level and at publicly accessible locations around WTGs are typically indistinguishable from background levels and well below applicable public exposure limits. As identified in the Scoping Report, EMF from WTGs does not represent a credible impact pathway and has therefore been scoped out of further assessment.

The 220 kV OHTLs represent the principal potential source of EMF associated with the Project. EMF levels around transmission lines decrease rapidly with distance from the conductors and are highest directly beneath the line centreline.

Figure 7-8 illustrates typical electric and magnetic field levels around a representative high-voltage transmission line, demonstrating the rapid attenuation of EMF with distance. The figure is provided for illustrative purposes only and reflects generic international data rather than project-specific modelling.

Figure 7-8: EMF levels associated with typical 500kV transmission line[74]



In accordance with the Project design criteria, the routing of the OHTLs was developed to avoid sensitive receptors wherever practicable. As described in Section 2.5.4, an initial 50 m buffer from the OHTL centreline (resulting in an overall 100 m wide corridor) was applied as the basis for route selection in order to avoid residential buildings, cemeteries, and other sensitive receptors. Where this buffer could not be fully achieved due to local constraints, the routing was required to comply as a minimum with national sanitary safeguarding distances applicable to 220 kV OHTLs.

The detailed review of the current OHTL routing undertaken as part of the ESIA has identified that along the Jambyl OHTL one residential dwelling is located within 25 m of the alignment, with a small number (8) of additional dwellings located within 100 m. Along the Kentau OHTL, one residential dwelling (together with two animal pens) has been identified within 25 m of the alignment. This information has been communicated to Masdar's technical and engineering teams. As part of the ongoing detailed OHTL design and route finalisation, the Project will ensure that the final OHTL alignment complies with national regulatory requirements, including maintaining a minimum distance of at least 25 m from the outermost OHTL conductors to the nearest residential dwelling. With the implementation of these design refinements, the Project will maintain compliance with applicable sanitary protection requirements and ensure that EMF exposure at publicly accessible locations remains within national and international standards.

In certain locations near existing substations, multiple transmission lines run in proximity to each other. Magnetic fields are primarily dependent on the current carried by individual lines and decrease rapidly with distance. There is no additive or cumulative amplification of EMF beyond the combined spatial extent of individual fields. Compliance with statutory sanitary protection zones for each line ensures that EMF exposure at publicly accessible locations remains within applicable limits.

[74] Source: https://www.niehs.nih.gov/health/materials/electric_and_magnetic_fields_associated_with_the_use_of_electric_power_questions_and_answers_english_508.pdf

Workers involved in OHTL construction, operation and maintenance may experience higher EMF exposure than the general public due to their proximity to energised equipment. Occupational exposure will be managed in accordance with applicable national occupational health and safety requirements, IFC EHS Guidelines for Electric Power Transmission and Distribution, and Project-specific health and safety procedures. An EMF safety programme will be implemented as part of the Project's Occupational Health and Safety Management System to ensure that occupational exposures remain within applicable limits.

EMF associated with the Project will occur during the operational phase and will be confined to the immediate vicinity of the OHTLs. Taking into account the application of mandatory sanitary protection zones, routing to avoid residential receptors where feasible, and compliance with conservative national exposure limits that are aligned with international guidelines, potential impacts on community health associated with EMF are assessed as negligible and not significant. No additional mitigation or long-term EMF monitoring is required beyond compliance with statutory requirements and standard occupational health and safety controls.

Table 7-19: Operations CHSS risks – CHSS risks associated with EMF from OHTLs

Activity/Impact/Aspect					
Risk of exposure to EMF from OHTLs					
Type	Duration	Extent	Scale of Impact	Frequency	Likelihood
Direct	Long term	Local (OHTL right-of-way and immediate vicinity)	Not perceptible/Indistinguishable from baseline	Continuous (field presence), intermittent exposure of receptors	Unlikely (due to compliance with statutory safeguarding distances)

Receptor	Sensitivity	Magnitude	Significance of Impact
Community members and land users	High	Negligible	Insignificant

7.4 Mitigation, Management and Residual Impacts

7.4.1 Construction Phase

Collision/transport related risks

The Project will prepare and implement a Traffic and Transportation Management Plan (TTMP) that incorporates a detailed logistics assessment to identify potential social sensitivities along transport routes. Where feasible, transport routes will avoid settlements, and movements of abnormal loads will be scheduled to minimise interactions with local traffic. Road-safety campaigns will be delivered in schools throughout the area of influence, with tailored outreach for villages where wind turbine components will be transported. These sessions will explain the anticipated traffic patterns, highlight road-crossing hazards, and emphasise safe behaviour around construction vehicles and internal access roads. Recognising that school-based engagement does not reach all children or vulnerable groups, additional village sessions will be held for women, caregivers, and children who may not attend school regularly. Warning signs will be installed along access roads and near work areas.

Other public health measures

The Project will incorporate community health measures into the TTMP, the Emergency Preparedness and Response Plan (EPRP), and its Occupational Health and Safety Plan (OHS MP). Public health considerations include managing dust, noise, construction waste, and traffic-related emissions, and ensuring communities are informed of any temporary restrictions or hazards including seasonal advisories such as

the risk of ice throw during winter months. (See also Chapters 17 Air Quality regarding dust, and Chapter 11 Noise and Vibration and the LRP regarding noise impacts). The EPRP will map the nearest emergency services, outline medivac procedures, and detail coordinated response arrangements with local authorities, ensuring clarity of roles. Community awareness sessions, delivered with support from Akimats, schools, and health authorities, will communicate general construction risks, safe distances from work areas, and procedures for reporting concerns through the Project grievance mechanism.

Unauthorised construction site access

To minimise the risk of accidental entry into hazardous areas, all construction zones will be fenced where risk of public access is high, and fitted with warning signs in Kazakh and Russian. Contact details for the grievance mechanism will be displayed prominently. Security personnel will manage access at designated points, supported by continuous patrols during construction hours. An HSE inspector or security officer will be present whenever works are underway, and all security staff will carry radios for rapid incident communication. The Project will maintain an accurate system for identifying, accounting for, and locating workers to ensure safe evacuation and emergency response. Community-facing safety campaigns will be delivered in local schools and settlements to explain the hazards associated with construction sites and the importance of avoiding fenced-off areas, with attention to ensuring gender-balanced participation.

Should blasting be required, a targeted impact assessment is to be conducted to assess potential impacts and develop a Blasting Management Plan. This will include pre-blasting planning and risk assessments, including: site-specific geotechnical investigations, confirmation/identification of sensitive receptors and establishment of a blast exclusion zone based on worst-case scenarios of flyrock and vibration modelling (refer to Chapter 11 Noise and Vibration). The construction site boundary will at minimum incorporate the zone identified through this worst-case scenario modelling and engagement with the public will communicate the risks associated with this activity with advance notice to communities and land users (24-72 hrs in advance). Disclosure to communities will include the date and time window of blasts; duration and frequency; expected noise and vibration effects; and safety instructions including visual flags and audible warning sirens/horns (i.e. preparation warning signals and all-clear signals). Targeted engagement and grievance readiness will be conducted with those households and herders closest to blasting locations to ensure people and livestock will be clear of the area in advance of blasting; seasonal herders and vulnerable groups in the area (see also SEP). Physical safety controls during blasting will include the clearly demarcated blast exclusion zones (temporary fencing, barriers and signage); physical access control points staffed by trained personnel; and temporary suspension of grazing, traffic and non-essential site activities. Adaptive management measures will include adjustment of blast design or schedules should complaints or exceedances occur, and additional engagement or mitigations where community concerns persist despite compliance.

Influx

The Project will implement influx-management procedures aligned with World Bank (2006) and IFC (2009) guidance. These measures will be integrated into the Labour and Working Conditions Plan, Security and Human Rights Management Plan, Worker Accommodation Plan, and the SEP. Public notices will clarify the Project's local hiring process, emphasising that priority will be given to residents of Jambyl and Turkestan regions and that individuals from outside the region will not be prioritised for employment unless specialist skills in demand are being targeted for recruitment. Recruitment at construction gates will be strictly prohibited. Media announcements will inform potential job seekers that recruitment is complete, discouraging travel to the Project area. Engagement with Akimats, land-use authorities, public health officials, and police will guide the refinement of influx-management measures. The Project will monitor the arrival of newcomers and, if significant numbers appear, provide additional outreach to maintain calm

and advise individuals that no employment or economic benefits are available. Any concerns such as crime, tensions, or informal settlements raised through the grievance mechanism will be investigated and addressed collaboratively with local authorities.

Communicable diseases

The Project will incorporate communicable disease prevention into the OHSMP, Worker Accommodation Management Plan, and the Project's community health measures embedded within the SEP and camp procedures. Information campaigns to workers and where appropriate, the community, will promote good hygiene, safe food handling, and awareness of seasonal or endemic diseases, developed with local health authorities. The Project's Code of Conduct and induction training will reinforce expectations for safe and respectful behaviour in communities, helping reduce risks of disease transmission associated with worker–community interactions. Community information sessions will explain any public health measures relevant during construction, including protocols for reporting concerns or accessing medical assistance through designated local services.

GBVH, construction workers and the community

The Project will adopt a zero-tolerance policy for GBVH and other forms of violence, harassment, or bullying. These requirements will be embedded in the worker Code of Conduct, employment contracts, induction sessions, and refresher training. A confidential grievance mechanism, including a dedicated channel for sensitive complaints, is already accessible to women and vulnerable community members and will be continued as the Project progresses. Survivor-centred procedures will guide how grievances are received, referred, and addressed. Alcohol and drug policies will be enforced consistently to reduce the likelihood of unsafe or inappropriate behaviour. Engagement with community representatives, women's groups, and local NGOs will support awareness-raising on expected worker conduct and available reporting pathways. Workers will be prohibited from establishing informal settlements or "pop-up camps," reducing opportunities for unregulated worker–community interaction.

Security personnel

Security personnel will operate under a Security and Human Rights Management Plan aligned with the Voluntary Principles on Security and Human Rights (VPSHR). All guards will receive training on the appropriate use of force, cultural sensitivity, conflict de-escalation, and community engagement expectations. Radios will be provided to ensure timely reporting of any incidents, and all security staff will be required to log interactions with community members. Incident-reporting pathways and grievance mechanisms will be accessible to workers and community members, ensuring transparency and accountability. Continuous coordination with local police and Akimats will help clarify jurisdictional responsibilities and manage any sensitive incidents.

Additional risks for vulnerable community members

The Project recognises that elderly residents, herders, farmers, women, low-literacy groups, and children may face elevated exposure to construction-related risks. Tailored engagement will therefore be undertaken to warn these groups about hazards near construction zones and transport routes. School-based safety sessions will prioritise gender-balanced attendance, with additional outreach if girls are under-represented. Separate village meetings or home-based visits may be arranged for elderly or mobility-restricted residents where those individuals face particular, elevated CHSS risks. Materials will use simple language and visual aids to ensure accessibility. CLOs will maintain regular presence in affected villages to support ongoing risk communication, respond to grievances, and monitor whether vulnerable groups feel adequately informed and safe.

7.4.2 Operations Phase

Mitigation measures for the above-mentioned risks will be updated to reflect the Operations phase.

Collision/transport related risks

The Project will update the Traffic and Transportation Management Plan (TTMP) that incorporates a detailed logistics assessment to identify potential social sensitivities along transport routes appropriate to the Operations phase activities. Where feasible, transport routes will avoid settlements, and movements of abnormal loads will be scheduled to minimise interactions with local traffic. Road safety campaigns will emphasise updated phase risks (e.g. types of operational traffic and the risks it poses to communities). Engagement with especially vulnerable groups will be targeted to particular groups and/or locations (e.g. traffic that can be expected to occur around potentially affected schools or health facilities).

Security personnel

Security personnel will operate under a Security and Human Rights Management Plan aligned with the Voluntary Principles on Security and Human Rights (VPSHR), updated to reflect operational phase activities. All guards will receive training on the updated plan; police and Akimats will continue to be engaged during its implementation.

Additional risks for vulnerable community members

Tailored engagement will be undertaken to ensure vulnerable groups are updated about hazards that can be anticipated during the operations phase, and the mechanism through which to raise any grievances or concerns. This will be documented in an updated SEP.

Electric and magnetic fields (EMF)

During the operational phase, electric and magnetic fields (EMF) will be generated by the 220 kV overhead transmission lines (OHTLs); however, EMF levels decrease rapidly with distance and, where statutory sanitary protection zones are maintained, remain well below applicable national and international exposure limits at publicly accessible locations. A limited number of dwellings identified within the initial safeguarding envelope during the ESIA review will be addressed through route refinement during detailed design to ensure regulatory compliance prior to operation, and residual EMF-related community health risks are therefore assessed as insignificant.

The following table summarises the mitigation and management measures proposed for identified receptors during construction phase activities.

Sensitive Receptor	Pre- mitigation	Mitigation and Management Measures	Residual Significance
Construction workers/community members at risk of collisions/public safety risks	Moderate	• TTMP implemented; routes avoid settlements where possible. • Road-safety campaigns in schools and villages. • Warning signs along access roads. • Targeted outreach for women, children, and low-literacy groups. • OHSMP, TTMP and EPRP include public health controls. • Dust, noise and waste managed per good practice. • Community awareness sessions on construction hazards. • Clear emergency procedures shared with authorities.	Minor
Community members, herders at risk of unauthorised construction site access	Moderate	• Fencing and warning signs (Kazakh/Russian). • Security-controlled access points and patrols. • HSE/security presence during all works. • School and community sessions on site hazards. • Blast Management Plan (as required)	Minor
Community members, in-migrants, jobseekers at risk of exacerbating influx	Moderate	• Influx procedures aligned with IFC/WB guidance. • Public disclosure of hiring process; locals prioritised. • No recruitment at gates; media notices discouraging newcomers. • Monitoring of arrivals and response through CLOs and authorities.	Minor
Construction workers, community members and their families at risk of communicable disease	Moderate	• Hygiene and health awareness campaigns. • Worker accommodation meets IFC/EBRD standards. • Clear protocols for reporting illness. • Controlled worker–community interaction via Worker Code of Conduct.	Insignificant
Community members, construction workers at risk of perpetrating/being a victim survivor of GBVH	Moderate	• Zero-tolerance policy in CoC and contracts; see also Chapter 8 Human Rights and Labour on these requirements. • Confidential grievance channel for sensitive cases. • Survivor-centred procedures.	Minor

Sensitive Receptor	Pre- mitigation	Mitigation and Management Measures	Residual Significance
		• Alcohol/drug policies enforced.	
Community members, Construction workers, Security personnel at risk of conducting/exposure to abusive conduct by security personnel	Minor	• VPSHR-aligned training and conduct expectations. • Radios for incident reporting; log of interactions. • Security and Human Rights Management Plan implemented. • Coordination with local police and Akimats.	Insignificant
Vulnerable community members (esp. women and girls, elderly, children/ adolescents), CLOs, land users at risk of additional CHSS exposures	Major	• Targeted engagement for elderly, herders, farmers and women. • Gender-balanced school sessions; follow-up if girls underrepresented. • Simple-language materials; visual aids. • CLO presence in villages for continuous support.	Minor

The following table summarises the mitigation and management measures proposed for identified receptors during operations phase activities.

Sensitive Receptor	Pre- mitigation	Mitigation and Management Measures	Residual Significance
Operations workers, community members at risk of vehicle collisions/other public health impacts	Minor	• Update TTMP for operations-phase logistics and sensitivities. • Avoid settlements where feasible; schedule movements to reduce traffic interaction. • Deliver road-safety campaigns reflecting operational traffic risks. • Target engagement to vulnerable groups and locations (e.g., schools, health facilities).	Insignificant
Community members, Operations workers, Security personnel at risk of conducting/exposure to abusive conduct by security personnel	Minor	• Implement Security and Human Rights Management Plan aligned with VPSHR for operations. • Provide updated training to all security guards. • Maintain coordination with police and Akimats.	Insignificant

Sensitive Receptor	Pre- mitigation	Mitigation and Management Measures	Residual Significance
Vulnerable community members (esp. women and girls, elderly, children/ adolescents), CLOs, land users at risk of additional CHSS exposures	Major	• Provide tailored engagement on operations-phase hazards. • Ensure vulnerable groups understand grievance channels. • Capture these measures in the updated SEP.	Minor
Community members and land users potentially exposed to EMF from OHTLs	Insignificant	• Ensure final OHTL routing and detailed design comply with national sanitary protection requirements and minimum safeguarding distances to residential buildings. • Refine OHTL alignment where required to avoid permanent residential receptors prior to operation. • Manage occupational EMF exposure for maintenance personnel through the OHS Management System and electrical safety procedures.	Insignificant

Overall, with the implementation of the proposed mitigation and monitoring measures, residual community health, safety and security impacts across all receptors are assessed as minor or negligible, and no significant adverse effects are expected during the operational phase of the Project.

8 Human Rights, Labour & Working Conditions

8.1 Introduction and Overview of Assessment Methodology

The social impact assessment of human rights and labour aimed to identify the key socio-economic risks associated with the proposed activity and to evaluate how construction and operation may affect local human rights and labour conditions, following recognised good-practice guidance, and follows the methodology described in Chapter 4. Impacts may be of direct or indirect type, of differing duration, extent, scale, frequency and likelihood, and may result in both positive and negative outcomes. Where significant impacts are identified, the Company is required to apply appropriate mitigation measures.

The social impact assessment process generally includes the following core steps:

- Identifying the potential adverse and beneficial impacts of the proposed activity
- Assessing socioeconomic risks in terms of their likelihood and potential consequences
- Determining whether the identified risks are acceptable; and
- Introducing mitigation measures to reduce risks to an acceptable level.

Assessment of sensitivity is informed by the following vulnerability criteria in relation to labour and human rights:

Table 8-1: Labour and Working Conditions Sensitivity Criteria

Vulnerability	Description
High	The Project workforce and/or supplier workforce is at elevated risk due to at least one of: The location is in a context or sector where labour conditions are generally weak, or where there is a heightened likelihood that labour standards will not be consistently implemented. The workforce is expected to comprise a significant proportion of migrant workers, including those from lower-income countries. Work activities will occur under elevated-risk conditions, such as hazardous tasks, extreme temperatures, extended working hours, or in remote or isolated locations. Workers will rely on employer-provided accommodation, which may present a higher risk of not meeting applicable standards.
Medium	There are some potential risks associated with the Project's workforce and/or supplier workforce: The location is in a context or sector where limited reports or anecdotal information suggest that labour practices may fall short of international standards, although the extent of these risks is uncertain. The workforce will include a proportion of migrant workers. Work will occur under conditions that pose some level of risk (e.g. use of heavy machinery or working at heights), but these activities are common and the associated risks are generally well understood. Basic safety requirements are expected to be enforced.
Low	The Project workforce and/or supplier workforce is assessed as presenting a low level of risk: • The location and sector do not have a history of poor labour practices. • Workers will not depend on employer-provided accommodation, or any accommodation provided is considered unlikely to fall below applicable standards.

Vulnerability	Description
	• The workforce is primarily local, with only a small number of foreign workers. • The work does not involve activities that are considered high risk.

Magnitude is informed by the following criteria for labour and human rights issues:

Table 8-2: Labour and Working Conditions Magnitude Criteria

Magnitude	Description
Large	Safeguards to support alignment with applicable labour and human rights standards are largely absent or insufficient.
Medium	Some safeguards exist to support alignment with applicable standards, though notable gaps may still occur.
Small	A well-developed system of safeguards is in place to support alignment with applicable standards, with any remaining non-compliance likely to be minor or limited in scope.
Negligible	A robust and comprehensive safeguard system is in place that ensures alignment with applicable standards, with only isolated instances of non-compliance considered possible.

This chapter examines human rights and labour issues, including: supply chain impacts, local sourcing opportunities and potential impacts on local markets for goods and services, employment issues and opportunities, and occupational health and safety issues during construction and operations phases of the Project, and particular aspects affecting women in these spheres. It should be read with the companion document on Human Rights Impact Assessment and Gender Impact Assessment (HRIA/GIA) prepared alongside this ESIA.

Interactions between community members and workers are addressed in Chapter 7: Community health safety and security.

8.2 Applicable Requirements & Standards

8.2.1 International conventions and agreements

Below is a list of International Conventions to which the Republic of Kazakhstan is a signatory: Kazakhstan has ratified all 8 fundamental conventions, they are listed below:

- Convention No. 29 on Forced or Compulsory Labor, 1932;
- Convention No. 87 on Freedom of Association and Protection of the Right to Organize, 1948;
- Convention No. 98 on the Application of the Principles of the Right to Organize and Collective Bargaining, 1949;
- Convention No. 100 concerning Equal Remuneration for Men and Women Workers for Work of Equal Value, 1951;
- Convention No. 105 concerning the Abolition of Forced Labor, 1957;
- Convention No. 111 concerning Discrimination in respect of Employment and Occupation, 1958;
- Convention No. 138 concerning Minimum Age for Admission to Employment, 1973;

- Convention No. 182 concerning the Prohibition and Immediate Action for the Elimination of the Worst Forms of Child Labor, 1999; and
- Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters. Aarhus, Denmark, 25 June 1998.

Kazakhstan has ratified 4 direct conventions, listed below:

- Convention No. 81 concerning Labor Inspection in Industry and Commerce, 1947;
- Convention No. 122 concerning Employment Policy, 1964;
- Convention No. 129 concerning Labor Inspection in Agriculture, 1969; and
- Convention No. 144 concerning Tripartite Consultations for the Promotion of International Labor Standards, 1976.

Kazakhstan has ratified 178 Technical Conventions, the conventions that are relevant to the Project are listed below:

- Convention No. 26 on the Establishment of a Minimum Wage Procedure, 1928;
- Convention No. 88 concerning the Organization of the Employment Service, 1948;
- Convention No. 95 concerning the Protection of Wages, 1949;
- Convention No. 135 concerning the Protection of the Rights and Facilities of Workers' Representatives in the Enterprise, 1971;
- Convention No. 148 concerning the Protection of Workers against Occupational Hazards Caused by Air Pollution, Noise and Vibration in the Workplace, 1977;
- Convention No. 155 concerning Occupational Safety and Health and the Working Environment, 1981;
- Convention No. 156 concerning Equal Treatment and Equal Opportunities for Men and Women Workers: Workers with Family Responsibilities, 1981;
- Convention No. 162 concerning Occupational Safety and Health in the Use of Asbestos, 1986;
- Convention No. 167 concerning Occupational Safety and Health in Construction, 1988;
- Convention No. 183 revising the Maternity Protection Convention (Revised), 1952, 2000;
- Convention No. 185 revising the Seafarers' Identity Documents Convention, 1958, 2003; and
- Convention No. 187 on Fundamentals Promoting Occupational Safety and Health, 2006.

8.2.2 National Regulations

Labour policy in Kazakhstan is implemented at the national government level and is reflected in the following relevant laws, regulations, and national social programs.

8.2.2.1 Constitution of the Republic of Kazakhstan

The Constitution establishes Kazakhstan as a democratic, secular, legal, and social state whose highest value is the individual, their life, rights and freedoms (Art. 1). Human rights have direct effect and must inform all state actions. Kazakhstan is also bound by international treaties that, when ratified, have priority over national laws (Art. 4).

The key human rights provisions established in the Constitution of Kazakhstan are as follows:

- Right to Life, established under Article 15: Everyone has the right to life. The death penalty is prohibited except for terrorist crimes causing loss of life and exceptionally grave war crimes.

- Prohibition of Torture and Inhuman Treatment, under Article 17: No one shall be subjected to torture, violence, or other treatment and punishment that is cruel or degrading.
- Personal Liberty and Security, under Article 16: Person's liberty and security are guaranteed. Arrest is allowed only on the basis of a court order.
- Right to Privacy, under Article 18: Privacy of personal life, personal and family secrets, honour and dignity are protected. Confidentiality of communications and home inviolability are guaranteed.
- Freedom of Thought, Conscience, and Religion, under Articles 19–22: Everyone may determine and indicate their national, linguistic, and religious affiliation. Freedom of conscience is guaranteed. The state is secular; religious associations are separate from the state. Freedom of speech and creative expression is protected, with limitations to protect rights of others and national security.
- Freedom of Assembly, established under Article 32: Citizens have the right to peaceful assembly, including meetings, rallies and demonstrations, subject to lawful regulation.
- Equality and Non-Discrimination, Article 14: Everyone is equal before the law and court; no discrimination on grounds of origin, social status, race, nationality, gender, language, religion, convictions, place of residence, or other circumstances.
- Rights of the Child. This is not a separate article, but multiple provisions give enhanced state protection to family, motherhood, fatherhood and children (under Article 27).
- Right to Work and Fair Conditions, Article 24: Everyone has the freedom to work, choose a profession and occupation. Forced labour is prohibited. Workers have the right to safe labour conditions and fair remuneration.
- Freedom of Association and Trade Unions, Article 23: Everyone has the right to form associations, including political parties and trade unions. Restriction applies only to military personnel and certain public servants.
- Freedom of Movement, Article 21: Everyone legally residing in Kazakhstan may freely move and choose their residence. Citizens may leave and return without hindrance.
- Right to Education, Article 30: Citizens have the right to free secondary education. Competitive access to higher education programmes.
- Right to Health and Social Security, Article 29: Everyone has the right to health protection and guaranteed volumes of free medical care.
- Right to Property, Article 26: Everyone has the right to private property. No one may be deprived of property except by court decision; compulsory acquisition requires equal compensation.
- Right to an Effective Remedy, Article 13: Everyone has the right to judicial protection. Access to legal assistance is guaranteed. Innocence presumed until proven guilty.
- Cultural Rights, Articles 20 and 37: Freedom of creative activity. Obligation to preserve historical and cultural heritage.
- Right to a Clean Environment, Article 31: The state shall set goals to protect the environment favourable to human life and health; environmental harm must be prevented and compensated.
- Rights of Indigenous Peoples. Kazakhstan does not recognise an "indigenous peoples" category in its Constitution; all ethnic groups are considered equal citizens. Therefore, FPIC and related indigenous rights are not constitutionally embedded, though some cultural rights are indirectly protected via equality, cultural association and language rights.

- Right to Water, Housing, and Adequate Living Standards. These are not framed as explicit constitutional rights, but elements appear in: Article 28: Right to social security in cases of disability, loss of breadwinner, unemployment and old age; Article 29: Free basic healthcare; and, Article 31: Healthy environment.

8.2.2.2 Administrative Code

The Administrative Code of the Republic of Kazakhstan, the "*Administrative Procedural and Process-Related Code of the Republic of Kazakhstan, (1 July 2021)* establishes administrative liability for a wide range of violations, including:

- Violations of labour legislation
- Breaches of occupational safety and health (OSH) requirements
- Noncompliance with industrial safety standards
- Failure of employers to ensure safe working conditions
- Violations related to employment contracts and workplace inspections

These provisions are located in the section that regulates administrative offences in the field of labour, occupational safety and health, and they specify fines, responsibilities, and enforcement measures.

8.2.2.3 Labour laws

The key labour laws of Kazakhstan include:

- The Labour Code of the Republic of Kazakhstan (№ 414-V, adopted on 23 November 2015, last amendment dated 21 July 2018);
- The Entrepreneurial Code of the Republic of Kazakhstan (№ 375-V ZRS dated 29 October 2015, last amendment dated 19 April 2024).
- Law of the Republic of Kazakhstan "On Trade Unions" of 27 June 2014.

Key questions on labour provisions and their relevant references within the Labour Code are shown in Table 8-3:

Table 8-3: Application of key international labour requirements in Kazakhstan

Key labour questions	Current legal requirement	Reference in the Labour Code
Is there a national minimum wage?	Yes. Kazakhstan sets a national minimum wage annually by law.	Minimum monthly wage established by separate legislation; Labour Code, Article 104 references wage guarantees. As of January 1, 2024 the minimum wage in Kazakhstan is set at 85,000 tenge per month (approximately US$193) based on the Law of the Republic of Kazakhstan "On the Republican Budget for 2024 – 2026", dated December 5, 2023 № 43-VIII.
Are employment contracts commonly used?	Yes. A written employment contract is mandatory for all employment relationships.	Art. 33–36 (employment contract requirements).
Can employers confiscate passports?	No. Passport confiscation by employers is prohibited except in cases legally	Labour Code prohibits restricting employees' freedom; general prohibition under

Key labour questions	Current legal requirement	Reference in the Labour Code
	authorised (e.g., for safekeeping at employee request). Forced retention is unlawful.	constitutional rights; also referenced in enforcement practice under Art. 7 (freedom of labour).
Are workers entitled to compensation for overtime?	Yes. Overtime must be paid at not less than 1.5× of the normal hourly rate or compensated by time off.	Art. 108 (overtime work and payment).
Are workers entitled to annual leave?	Yes. Minimum 24 calendar days of paid annual leave per year.	Art. 87–92 (annual paid leave).
Are workers entitled to sick leave?	Yes. Sick leave (temporary disability benefits) is paid and must be granted upon presentation of a medical certificate.	Art. 133 (temporary disability benefits).
Are male employees entitled to paternity leave?	Yes. Male employees may take leave in connection with the birth of a child, and can also take unpaid parental leave.	Art. 99(2) and Art. 100 (parental leave provisions).
Are female employees entitled to maternity leave?	Yes. Maternity leave is 126–140 days (pre- and post-natal), fully paid through the compulsory social insurance fund.	Art. 99(1) (maternity leave).
Must a valid reason be given to lawfully terminate an employment contract?	Yes. Termination must be based on legally defined grounds (e.g., organisational changes, misconduct, redundancy). Arbitrary dismissal is prohibited.	Art. 52–54 (grounds for termination).
Are workers entitled to work injury benefit?	Yes. Workers injured at work are entitled to compensation for lost earnings, medical costs, and rehabilitation. Employers must insure against workplace accidents.	Art. 166–171 (compensation for injury or occupational disease).
Does the labour law prohibit discrimination?	Yes. Discrimination in employment (based on sex, age, race, disability, ethnicity, religion, etc.) is prohibited.	Art. 6(1) (prohibition of discrimination).
Does the law explicitly prohibit sexual harassment?	Partially. The Labour Code prohibits harassment and harmful behaviour, but sexual harassment is primarily addressed through other laws (e.g., Law on State Guarantees of Equal Rights and Equal Opportunities of Men and Women).	Art. 7 (protection of dignity and prohibition of unethical behaviour); Equal Opportunity Law Art. 9.
Is there a minimum age for employment?	Yes. Minimum working age is 16. Employment at 15 is allowed with parental consent; 14 is allowed for light work not harming health or schooling.	Art. 31 (age requirements for employment).
Can workers join and	Yes. Workers have the right to form and join	Art. 12 (freedom of association); regulated

Key labour questions	Current legal requirement	Reference in the Labour Code
form unions?	trade unions, although registration requirements can be restrictive.	further by Law on Trade Unions (2014).

Further details on the provisions within the Labour Code are covered in the Human Rights Impact Assessment and Gender Impact Assessment (HRIA-GIA), Section 5.4.

8.2.3 Lender Requirements

8.2.3.1 International Finance Corporation

IFC requires that clients that request funding from the bank, should "respect human rights, which means to avoid infringing on the human rights of others and address adverse human rights impacts business may cause or contribute to".

Human rights are a cross-cutting topic within the IFC Performance Standards (PSs); meaning that there is no one PS dedicated to human rights, but instead it is reflected across all of the PSs. The IFC requirements that specifically relate to human rights and gender include.[75]

- PS1 – Assessment and Management of Environmental and Social Risks and Impacts – which relates to identification of risks, including embedded human rights considerations;
- PS2 – Labor and Working Conditions – with standards that relate specifically to human rights to equality, to work, to have just and favourable conditions at work, rights to rest and reasonable working hours, and adequate accommodation. It also includes occupational health and safety standards that relate to human rights to life, health and wellbeing;
- PS4 – Community Health, Safety and Security – which relate to rights to life, liberty and security of person.
- PS5 – Land Acquisition and Involuntary Resettlement – which relates to human rights to own property;
- PS7 – Indigenous Peoples (not triggered for this Project and scoped out).

The key rights holders that would be covered under the IFC PS are Project and supply chain workers, local community members and landowners/property owners impacted by the Project.

IFC states that in a limited number of high-risk circumstances, the client should prepare a specific human rights due diligence as relevant to the particular business, in addition to its process of identifying environmental and social risks and impacts. It is not specified in the PSs which high- risk circumstances would require the human rights due diligence, however, understood to be applied on a case-by-case basis.[76]

IFC and EBRD have jointly prepared a good practice note 'Addressing Gender-Based Violence and Harassment: Emerging Good Practice for the Private Sector' (July 2020), which provides examples of good practice that are drawn from recent experience in the private sector, as well as a larger body of work from the non-profit sector. In addition to this good practice note, sector-specific briefs provide targeted guidance on addressing GBVH risks in key sectors have been developed. Relevant to this Project is

[75] The related human rights included in this list are not exhaustive but are considered the key risks that relate to the lender standards

[76] Guidance Note 1 to IFC Performance Standard 1 (2012), § GN14

'Addressing Gender Based Violence and Harassment (GBVH) in the Construction Sector' (2020).

IFC and EBRD have also jointly prepared guidance on 'Workers' Accommodation: Processes and Standards' (2009), which looks at the provision of housing or accommodation for workers by employers and the issues that arise from the planning, construction and management of such facilities.

8.2.3.2 Equator Principles IV

The Equator Principles are a voluntary framework adopted by financial institutions, referred to as Equator Principles Financial Institutions (EPFIs), to demonstrate their commitment to identifying and managing the environmental and social risks associated with the projects they finance. By becoming signatories, EPFIs commit, among other obligations, to "fulfil our responsibility to respect Human Rights in line with the United Nations Guiding Principles on Business and Human Rights (UNGPs) by carrying out human rights due diligence." The Equator Principles explicitly reference the UNGPs in relation to human rights, corporate social responsibility and the responsibilities of corporate entities toward affected communities.

In line with these commitments, EPFIs are required to assess potential adverse human rights impacts for every applicable project and to integrate this assessment within the ESIA documentation. Where an EPFI concludes that a standalone human rights impact assessment is not warranted, it must provide a clear justification, explaining the basis for the decision and identifying the stakeholder groups, including any vulnerable populations, considered during the analysis. [77]

Guidance is available in the Equator Principles Guidance Note on Implementation of Human Rights Assessments Under the Equator Principles (September 2020), which supports EPFIs in conducting human rights due diligence by helping them evaluate risks based on their severity and likelihood.

8.2.3.3 United Nations Guiding Principles on Business and Human Rights (UNGPs)

Under the UN Guiding Principles on Business and Human Rights (UNGPs), the responsibility to respect human rights is a universal standard that applies to all business enterprises, regardless of where they operate. This responsibility exists independently of a state's capacity or willingness to meet its own human rights obligations and goes beyond simple compliance with national laws. Accordingly, the UNGPs form the primary framework for this Human Rights Impact Assessment (HRIA).

Businesses, including this Project, must identify measures to prevent, mitigate and, where appropriate, remediate adverse human rights impacts. While the UNGPs allow companies to undertake voluntary initiatives that support or promote human rights, such activities cannot compensate for failures to respect human rights within their operations. Moreover, businesses are expected to respect the state's role in fulfilling its human rights duties and must ensure that their conduct does not undermine state actions or compromise the integrity of judicial processes.

The UNGPs include 15 foundational principles (Principles 1-15) and nine operational principles (Principles 16-24) that are most relevant to this Project.[78] These are also the principles identified in the Equator Principles.

8.2.3.4 Asian Infrastructure Investment Bank

The Asian Infrastructure Investment Bank (AIIB) does not establish a standalone human rights standard; however, its Environmental and Social Framework (ESF) explicitly acknowledges the relevance of human

[77] https://equator-principles.com/app/uploads/The-Equator-Principles_EP4_July2020.pdf
[78] https://www.ohchr.org/sites/default/files/documents/publications/guidingprinciplesbusinesshr_en.pdf

rights to project risk management. Under the ESF, clients are required to identify, avoid and mitigate adverse social impacts, particularly those affecting vulnerable and disadvantaged groups, and to conduct stakeholder engagement and maintain accessible grievance mechanisms. These requirements align with core elements of human rights due diligence, and AIIB further emphasises zero tolerance for intimidation, harassment, reprisals or other forms of retaliation against individuals or communities engaging with the project.[79]

Although AIIB does not expressly reference the UN Guiding Principles on Business and Human Rights (UNGPs), its reliance on Good International Practice, drawing on standards such as the IFC Performance Standards and the World Bank ESF, means that clients are expected to meet human rights–relevant obligations consistent with international norms. In practice, AIIB-financed projects must manage risks that could amount to human rights impacts and ensure that project activities do not undermine the rights, safety or dignity of affected people. This HRIA therefore interprets AIIB's ESF as requiring a level of human rights due diligence proportionate to the scale and severity of potential project impacts.

8.2.3.5 Islamic Development Bank

The Islamic Development Bank (IsDB) does not establish a standalone human rights policy nor explicitly reference the UN Guiding Principles on Business and Human Rights. However, its Environmental and Social Framework (ESF) embeds human rights–related requirements throughout its Environmental and Social Standards. These include obligations to identify, avoid and mitigate adverse impacts on individuals and communities—particularly vulnerable and marginalised groups—across areas such as displacement, labour and working conditions, community health and safety, gender-based violence, cultural heritage and environmental harms. As a result, although not framed as human rights commitments, the ESF requires borrowers to implement measures that are substantively aligned with international human rights protections.[80]

8.3 Baseline Conditions

8.3.1 Area of Influence

The direct social Area of Influence (AOI) includes the land and infrastructure within the right of way of the OHTL and WPP and its owners and users, who live in local communities. Members of these communities will also be indirectly impacted by the Project, as a result of construction traffic, noise, visual impact, community health and safety and potential impacts to tourism. Residents of Jambyl and Turkestan regions may benefit from or be negatively affected by the Project, through provision of goods and services to workers or to the Project through the supply chain; provision of accommodation facilities; and priority employment of local workers during the Project construction phase. The socio-economic profile of the AOI was developed through a socio-economic survey of households in AOI communities and is described in full in the Socio-economic Chapter 8 of this ESIA. For this Chapter, the focus is on those communities potentially engaged in the Project workforce or its supply chain.

1.1.1. Human Rights context

8.3.1.1 Development Context

The Human Development Index (HDI) is a summary measure for assessing long-term progress in three

[79] https://www.aiib.org/en/policies-strategies/_download/environment-framework/AIIB-Environmental-and-Social-Framework_ESF-June-2024.pdf
[80] https://www.isdb.org/sites/default/files/media/documents/2020-10/IsDB%20Environmental%20and%20Social%20Safeguards%20Policy%20(Feb%202020).pdf

basic dimensions of human development: a long and healthy life, access to knowledge, and a decent standard of living. According to the most recent data, Kazakhstan's HDI value in 2023 was 0.837, placing the country at rank 60 out of 193 countries and territories. This reflects a significant improvement over time: from 0.689 in 1990 to 0.837 in 2023, an increase of about 21.5%[81].

With an HDI of 0.837, Kazakhstan is classified among countries with "very high human development."[82] Adjusted for inequality (IHDI), the score drops to about 0.766, indicating that inequality erodes roughly 8.5% of potential human-development gains[83].

8.3.1.2 Political changes and constitutional reform

Kazakhstan's political landscape has evolved through ongoing efforts to modernise governance and strengthen state institutions, particularly following the 2019 presidential transition and the January 2022 unrest. In response to public demand for change, the government launched a series of political and constitutional reforms aimed at reducing excessive executive concentration and expanding civic participation. These developments signal an intention to build a more accountable and transparent system; however, international observers continue to highlight constraints on media freedom, limits on political pluralism and challenges for civil society engagement.[84] [85]

Kazakhstan functions as a presidential republic, with a strong executive branch, a bicameral Parliament, and a judiciary that is constitutionally independent. The 2022 constitutional referendum introduced wide-ranging reforms, including enhanced parliamentary powers, restrictions on nepotism, and strengthened protections for human rights. A major institutional change was the re-establishment of the Constitutional Court in 2023, intended to provide stronger constitutional oversight and to allow direct citizen appeals.[86] Despite these reforms, concerns persist regarding the judiciary's susceptibility to political influence and the limited competitiveness of the political environment, as noted by the OSCE/ODIHR and the U.S. Department of State.[87] [88]

Overall, while Kazakhstan's reform agenda reflects a stated commitment to political modernisation, the practical implementation of reforms remains uneven. Observers note that accountability and institutional independence continue to be constrained by executive dominance and by structural limitations within the judiciary and oversight bodies.[89] [90] The long-term effectiveness of recent changes will depend on sustained efforts to reinforce judicial autonomy, strengthen checks and balances, and create a more enabling environment for civic and political participation.

8.3.1.3 Economic and Social Rights

Kazakhstan's economic freedom score for 2024 is 62.8, placing the country 54th globally and classifying its economy as "moderately free."[91] While this represents a modest improvement compared with previous years, Kazakhstan's score remains below the European regional average, reflecting persistent

[81] https://hdr.undp.org/data-center/country-insights
[82] https://www.undp.org/kazakhstan/press-releases/undp-kazakhstan-maintains-its-position-human-development-index-rankings-action-needed-address-inequality-and-environmental
[83] https://hdr.undp.org/sites/default/files/2025_HDR/HDR25_Statistical_Annex_I-HDI_Table.pdf
[84] OSCE/ODIHR, Election Observation Reports: Kazakhstan, 2022–2024
[85] U.S. Department of State, 2024 Human Rights Report: Kazakhstan.
[86] Venice Commission & OSCE/ODIHR, Joint Opinion on the 2022 Constitutional Amendments, 2022.
[87] U.S. Department of State, 2024 Human Rights Report: Kazakhstan.
[88] Freedom House, Nations in Transit: Kazakhstan, 2023.
[89] OSCE/ODIHR, Election Observation Reports: Kazakhstan, 2022–2024
[90] Freedom House, Nations in Transit: Kazakhstan, 2023.
[91] Heritage Foundation, 2024 Index of Economic Freedom – Kazakhstan.

structural constraints within the economy. According to national statistics, the average monthly salary is approximately 355,000 KZT (about USD 780), while around 8.5% of the population lives below the national poverty line.[92] [93]

Despite facing external economic pressures, including geopolitical instability, reduced oil price predictability and supply-chain disruptions, Kazakhstan has maintained solid macroeconomic performance. The government has pursued policy measures to diversify the economy, improve regulatory efficiency and support private-sector development. Reforms aimed at strengthening market competition, increasing transparency, and modernising public administration have yielded incremental gains. However, international financial institutions note that inflation remains elevated, fiscal pressures persist due to high social spending commitments, and public-sector dominance continues to constrain broader private-sector growth.[94] [95]

Structural challenges remain substantial. Productivity growth is hindered by the large role of state-owned enterprises, limited competition in key markets, significant skills mismatches, and uneven economic opportunities across regions. Small and medium-sized enterprises continue to face barriers in accessing credit, despite ongoing financial-sector reforms.[96] Labour-market segmentation persists, with a notable share of employment concentrated in low-productivity sectors, including rural agriculture and informal services. Kazakhstan's reliance on hydrocarbons exposes the economy to external shocks, although the government's long-term modernisation agenda, articulated in national development strategies and supported by multilateral institutions, emphasises diversification, human capital investment and green economic transition.[97] [98]

8.3.1.4 Supply chains for Wind farm and BESS Development

Key supply chain risks include forced labour, child labour, and material harm to workers, including gender-based violence. Wind farm and BESS developments use technologies that rely on complex, globalised supply chains that carry heightened environmental and social risks. The International Labour Organization (ILO) estimates that 27.6 million people worldwide are in situations of forced labour, including 17.3 million in the private economy, demonstrating the baseline global risk across manufacturing supply chains.[99] In the renewable energy sector specifically, traceability analyses show that over 70% of the world's wind turbine rare-earth permanent magnets rely on processing in China, where labour rights enforcement varies.[100] Battery supply chains carry similar risks: the Democratic Republic of Congo (DRC) supplies roughly 70% of the world's cobalt, and research shows that an estimated 40,000 children are engaged in artisanal mining activities in the DRC.[101] Gender-based violence and harassment has been identified as a significant risk in mineral extraction and component manufacturing, particularly in regions where women are over-represented in informal or lower-paid production roles.[102]

[92] Bureau of National Statistics of Kazakhstan, Income and Living Standards (2023–2024).
[93] IMF, Kazakhstan: 2023 Article IV Consultation Report.
[94] IMF, Kazakhstan: 2023 Article IV Consultation Report.
[95] World Bank, Kazakhstan Economic Update (2023–2024).
[96] ADB, Country Partnership Strategy: Kazakhstan (2023)
[97] World Bank, Kazakhstan Economic Update (2023–2024)
[98] Government of Kazakhstan, National Development Plan to 2029.
[99] ILO, Global Estimates of Modern Slavery, 2022
[100] IEA, The Role of Critical Minerals in Clean Energy Transitions, 2023
[101] UNICEF, 2021; Amnesty International, 2016
[102] ILO Convention 190, 2019; BSR, Gender and Renewable Energy Supply Chains, 2022

Wind turbines, inverters and batteries all require minerals and manufactured parts sourced from regions where labour rights, environmental management and traceability may vary significantly. Developers are therefore expected to demonstrate that materials are responsibly sourced; that exposure to risks such as forced labour, unsafe working conditions, and poor waste management is identified and mitigated; and that suppliers comply with the project's ESG requirements. IFC and OECD guidance emphasise that renewable energy companies must conduct supply chain due diligence proportionate to the risk profile of sourced materials, including Tier 2–4 suppliers, high-risk geographies, and minerals linked to human rights abuses.[103]

8.3.2 Gender context

8.3.2.1 Gender Development Index

According to UNDP, Kazakhstan ranks 67th among 193 countries in the 2023/2024 Human Development Report. Kazakhstan is a leader in progress on gender equality, ranking 76th out of 146 countries in the Global Gender Gap Index 2024, a report designed to measure gender equality. The country has received the highest score in the "level of education" category and scored highly in the area of "survival and health". However, the report shows that progress is still insignificant in the areas of "political empowerment" and "economic participation and opportunity". For wages and access to employment and career opportunities, the gender wage gap was 25.2 per cent in favour of men in 2022.[104] The government's Human Rights Ombudsperson received no complaints related to domestic violence, gender discrimination, and workplace harassment.[105]

8.3.2.2 Gender-based Violence

In Kazakhstan, rape and sexual violence are criminalised, with penalties ranging from three to fifteen years depending on aggravating circumstances.[106] However, rights organisations, including Human Rights Watch and UN treaty bodies, argue that the legal definition of rape does not fully align with international standards, as it does not adopt a "consent-based" definition and relies heavily on proving physical resistance, limiting effective prosecution.[107] [108] Underreporting remains widespread due to stigma, inadequate victim protection, and evidentiary burdens imposed by law enforcement. The UN Committee on the Elimination of Discrimination against Women (CEDAW) has repeatedly raised concerns about low conviction rates for sexual violence and barriers faced by survivors, particularly in rural regions.[109]

Gender-based violence remains a significant human rights issue in the country. According to the U.S. Department of State and Kazakhstan's Bureau of National Statistics, domestic violence affects a substantial proportion of women, with NGOs reporting thousands of cases annually and noting that femicide remains under-recognised in national law.[110] [111] Women's rights organisations report insufficient preventive measures, inconsistent enforcement of protection orders, and limited access to shelters, especially outside major cities. Some progress has been made: in 2020–2023, the government expanded electronic monitoring of high-risk offenders, strengthened administrative liability for domestic violence (introducing or recriminalising criminal liability), and piloted risk-assessment tools within the

[103] https://www.cao-ombudsman.org/sites/default/files/2021-06/CAO_AdvisorySeries_SupplyChain_Final%20%281%29.pdf
[104] UN Women, Europe and Central Asia https://eca.unwomen.org/en/where-we-are/kazakhstan
[105] U.S. Department of State, 2024 Human Rights Report: Kazakhstan
[106] Criminal Code of the Republic of Kazakhstan, Article 120 (Rape) and related provisions
[107] Criminal Code of the Republic of Kazakhstan, Article 120 (Rape) and related provisions
[108] CEDAW, Concluding Observations on Kazakhstan, 2019–2022 review cycles
[109] CEDAW, Concluding Observations on Kazakhstan, 2019–2022 review cycles
[110] U.S. Department of State, 2024 Human Rights Report: Kazakhstan
[111] Bureau of National Statistics of Kazakhstan, Social and Demographic Indicators on Domestic Violence (2022–2023).

Ministry of Internal Affairs.[112] However, Kazakhstan has not yet adopted a standalone domestic violence law that criminalises 'domestic violence' as a specific offence, thus improvements to the law in 2024 were welcomed but do not meet international (Istanbul Convention-aligned) standards.[113]

8.3.2.3 Reproductive rights

Reproductive rights are legally recognised, and there are no reports of coerced abortion or involuntary sterilisation by state authorities.[114] Women have access to contraception and sexual and reproductive health (SRH) services, although barriers persist for ethnic minority women, rural populations, and low-income households, including limited availability of trained SRH providers and sociocultural stigma around sexuality.[115] Comprehensive sexuality education is not consistently integrated into school curricula, limiting awareness among adolescents – particularly girls – about early marriage, pregnancy risks and bodily autonomy.[116] UN Women and WHO note that sociocultural norms, limited SRH literacy, and stigma contribute to unmet reproductive health needs, especially among marginalised groups.[117]

8.3.2.4 Women's participation in the labour market

The Global Gender Gap Index benchmarks progress on gender equality across four dimensions: Economic Participation and Opportunity, Educational Attainment, Health and Survival, and Political Empowerment. In the 2023 Global Gender Gap Index, Kazakhstan ranked 62 out of 146 countries, reflecting comparatively higher performance within the region but persistent gender gaps, particularly in political representation and senior economic leadership positions.[118] Despite relatively strong educational attainment among women, structural inequalities remain evident in labour market outcomes, including gender wage gaps and underrepresentation in managerial roles.

Over recent years, Kazakhstan has taken steps to strengthen women's participation in the labour market through national gender strategies, labour code amendments and state programmes such as the 2030 Concept of Family and Gender Policy and the Employment Roadmap initiatives. These programmes aim to expand women's access to employment, support entrepreneurship, and reduce occupational segregation.[119] Official statistics indicate that women make up nearly half of the labour force, yet remain disproportionately concentrated in lower-paid sectors such as education, health care, and social services.[120]

Efforts to improve female labour force participation have also focused on addressing long-standing barriers, including unequal caregiving responsibilities, limited availability of childcare, and cultural expectations influencing job choice. Surveys and studies conducted by UN Women and national research institutions highlight that many women prefer public-sector work due to perceived job stability, predictable working hours and family-friendly conditions, while private-sector employment is sometimes viewed as less accommodating to women with caregiving duties.[121] In addition, gender stereotypes in recruitment and workplace expectations continue to contribute to occupational segregation and restrict women's advancement into senior positions. Despite these challenges, ongoing reforms combined with

[112] U.S. Department of State, 2024 Human Rights Report: Kazakhstan
[113] https://www.hrw.org/news/2024/04/23/kazakhstan-new-law-protect-women-improved-incomplete
[114] U.S. Department of State, 2024 Human Rights Report: Kazakhstan
[115] UN Women & WHO, Kazakhstan Gender Assessment (2022–2023)
[116] CEDAW, Concluding Observations on Kazakhstan, 2019–2022 review cycles
[117] UN Women & WHO, Kazakhstan Gender Assessment (2022–2023).
[118] World Economic Forum, Global Gender Gap Report 2023: Kazakhstan Profile
[119] Government of Kazakhstan, Concept of Family and Gender Policy 2030
[120] Bureau of National Statistics of Kazakhstan (2023), Labour Force Indicators
[121] UN Women Kazakhstan (2022–2023), Gender Assessment and Labour Market Analysis.

rising involvement of women in entrepreneurship and small business indicate gradual progress toward more equitable participation in Kazakhstan's labour market.

8.3.2.5 Women, Business and the Law

The World Bank's Women, Business and the Law (WBL) index[122] assesses economies across eight indicators to evaluate how national legislation supports or restricts women's economic opportunities and labour market participation. In the 2024 WBL index, Kazakhstan scored 78.8 out of 100, reflecting moderate progress toward gender-equal legislation but leaving significant room for improvement. Kazakhstan performs strongly in areas related to women's mobility, workplace protections, pay, and entrepreneurship, where laws generally provide equal rights for men and women. However, gaps remain in parenthood-related protections, including the absence of paid paternity leave and limited shared parental leave options, as well as in pension equality, where retirement ages for men and women are still in the process of being equalised. Legal frameworks around gender-based violence, sexual harassment, and domestic violence exist but remain only partially aligned with international standards and are weaker than in peer countries with higher WBL scores. The HRIA-GIA (section 5.5.5) provides additional information regarding Kazakhstan's national-level performance across key WBL indicators.

8.3.2.6 Social Norms

Despite ongoing government reforms to strengthen gender equality and expand women's participation in the labour market, social norms and traditional gender roles continue to pose significant barriers to the effectiveness of these policies in Kazakhstan. Patriarchal expectations around caregiving, household responsibilities, and leadership norms shape labour market outcomes and can limit women's career progression. In Kazakhstan, the risks of workplace harassment and gender-based discrimination constitute one of the factors limiting women's participation in employment in the private sector, particularly in traditionally "male-dominated" industries. National and international studies (including reports by UN Women and the U.S. Department of State on human rights practices) indicate the prevalence of verbal and behavioural forms of harassment, alongside the absence of clearly defined and effectively functioning protection and grievance redress mechanisms within labour legislation and corporate practices. In the context of weak law enforcement and limited trust in internal company procedures, women often perceive the private-sector working environment as unsafe, which results in refusal to seek employment or early withdrawal from the workforce. These risks are particularly pronounced in small enterprises, remote project sites, and rural settlements, where social pressure, stigmatization, and fear of income loss further reduce women's willingness to report incidents. Taken together, these factors create a structural barrier to women's participation in the private sector, despite the formal equality of access to employment opportunities

Studies by UN Women, the OECD, and Kazakh research institutes highlight that women remain underrepresented in decision-making roles, particularly in the private sector, where cultural expectations and workplace practices may discourage women from pursuing or remaining in senior positions. Many women report a preference for public-sector employment, which is perceived as offering greater stability, more predictable hours, and working conditions that better accommodate family responsibilities.[123] Government and civil-society stakeholders similarly note that indirect discrimination persists, such as employer expectations regarding overtime, travel, or availability requirements that disproportionately disadvantage women with caregiving responsibilities.[124] In some sectors,

[122] https://wbl.worldbank.org/en/wbl
[123] UN Women Kazakhstan (2022–2023), Gender Equality Assessment
[124] OECD (2023), OECD Gender Policy Review: Kazakhstan.

interviewees observed that cultural attitudes toward women in leadership still influence hiring and promotion decisions, contributing to a perception that "women face limited opportunities for advancement beyond mid-level roles."[125] These social and institutional constraints continue to deter women from accessing management pathways and reduce the overall impact of legislative reforms intended to promote gender equality in the workforce.

8.3.3 Worker safety and health

8.3.3.1 Workplace injuries

Kazakhstan reports comparatively low levels of workplace injuries relative to many countries, although fatality risks remain a concern in specific sectors. According to the most recent internationally comparable ILO data,[126] Kazakhstan records approximately 42 non-fatal workplace injuries per 100,000 workers, placing it around the middle of the 78 countries assessed. However, its fatality rate (estimated at around 4.3 deaths per 100,000 workers) remains higher than the non-fatal injury rate would suggest, ranking Kazakhstan 21st out of the same 78 countries. This fatality rate is lower than several other Commonwealth of Independent States (CIS) countries, including Ukraine (7.6) and Russia (5.0), and also below the United States (5.3).

The Bureau of National Statistics reported 2,471 work-related accidents in 2024, including all incidents causing at least one lost working day and fatalities.[127] Official data also indicate that the injury rate in the country[128] compared to 2023 decreased by 7.5% and workplace fatalities decreased by approximately 25% compared with 2023,[129] demonstrating a continuing downward trend in severe incidents nationally, with moderate injury rates but relatively elevated fatality risks in certain industries.

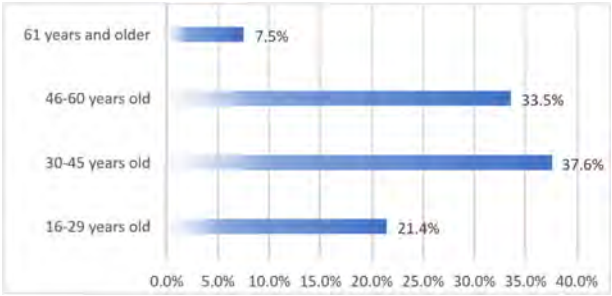
Of the 2,471 accidents recorded in 2024, 288 cases involved group accidents, 529 cases were classified as occupational diseases, and 26 incidents were related to workplace poisoning. The most frequently reported occupational diseases in 2024 were nonspecific back pain (274 people) and pneumoconiosis caused by silica-containing dust (129 people).[130] Most injuries (2,100 of 2,471) were at workplaces of large and medium sized enterprises.

Data for current year is available only from informal sources, primarily news outlets.[131] According to these reports, in the first nine months of 2025, a total 934 workers were injured in workplace accidents, of which 133 were fatal.

The Bureau of National Statistics reports that in 2024, most of the injured workers in were people aged 30-45 years (37.6%) and 46-60 years (33.5%).[132]

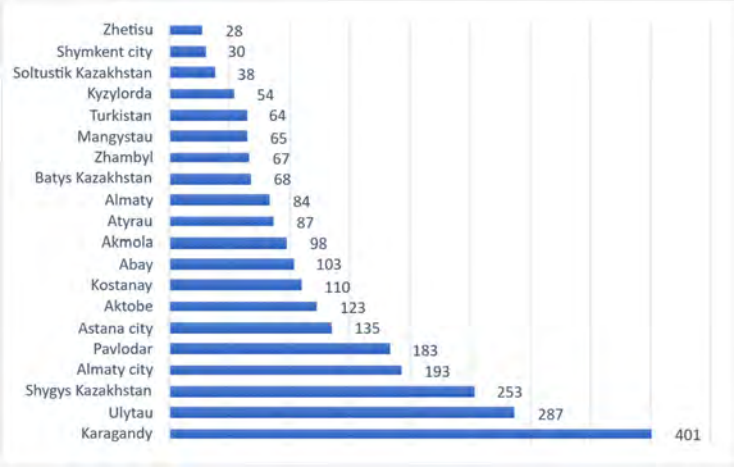
[125] Nazarbayev University / UNDP (2021–2022), Labour Market Diagnostics and Gender Analysis.
[126] https://ilostat.ilo.org/data/country-profiles/kaz/
[127] "On work-related injuries and occupation diseases in the Republic of Kazakhstan" Bureau of National Statistics (2025)
[128] The statistics is given for 2024, as the statistics for 2025 will be published in the mid-2026.
[129] https://stat.gov.kz/en/industries/social-statistics/stat-medicine/publications/382907/
[130] https://stat.gov.kz/en/industries/social-statistics/stat-medicine/publications/382907/
[131] https://en.orda.kz/over-130-workers-killed-in-industrial-accidents-across-kazakhstan-in-2025-8908/
[132] https://stat.gov.kz/en/industries/social-statistics/stat-medicine/spreadsheets/

Figure 8-1: Ages of the victims of work-related incidents (Kazakhstan, 2024)



Among the regions of the country, Karaganda and Ulytau in central and eastern Kazakhstan recorded the highest numbers of work-related accident victims, while Jambyl region reported 67 such incidents and Turkestan 64, as shown in the figure below.

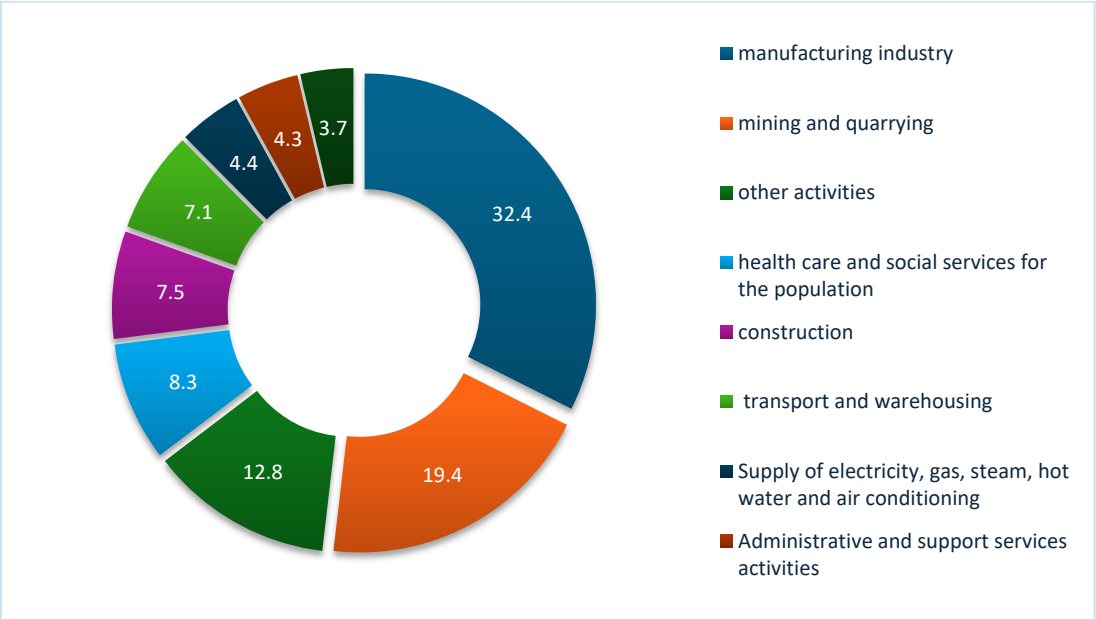
Figure 8-2: Number of victims of work-related accidents by region (2024)



8.3.3.2 Sector-specific Workplace Incidents in Kazakhstan

By the type of economic activity, the manufacturing industry accounted for the largest share of incidents (32.4%), followed by mining and quarrying (19.4%). The construction sector had 7.5% of incidents in 2024, as illustrated in the figure below.

Figure 8-3: The proportion of victims of accidents by sector (2024)



In 2024, there were 37 fatalities in the construction sector, all of whom were men. Of the 185 total recorded fatalities across all sectors, this was the highest share (20.0%), followed by manufacturing (19.5%) and mining (14.6%). By comparison, the manufacturing industry experienced 34%, mining and quarrying 20% and the construction industry 8% of the nationally reported lost time injuries, for 2023. In the same year, the mining and quarrying sector experienced 76 fatalities (31% of the total), and the construction sector 43 (17%). [133]

8.3.3.3 Causes and reporting of workplace accidents

According to reporting by Orda.kz[134] the main causes of the workplace incidents occurred in 2025 included poor work organization (34.2%), employee negligence (33,6%) and safety violations (8.5%) and road-related accidents (7.8%). In connection with these violations, authorities initiated 211 criminal cases.

Multiple sources indicate that under-reporting of OHS incidents is likely. National statistics show comparatively low non-fatal injury rates alongside relatively high fatality rates[135], a pattern commonly associated with weak incident reporting systems. The ILO has repeatedly noted under-recording of occupational injuries in Kazakhstan, partly due to weak reporting incentives and fear of repercussions. Reports highlight the limited resources for labour inspectors, low frequency of inspections, employer resistance to reporting workplace accidents, and cultural and organisational disincentives for workers to complain.[136] OECD labour governance reviews similarly report that workers may be reluctant to file OHS complaints due to cultural norms and perceived ineffectiveness of enforcement institutions.[137] The Ministry of Labour has also acknowledged low utilisation of hotline and complaint mechanisms and that most OHS inspections arise from employer notifications or accidents rather than worker reports.[138]

[133] https://stat.gov.kz/en/industries/social-statistics/stat-medicine/spreadsheets/?year=&name=50178&period=&type=
[134] https://en.orda.kz/over-130-workers-killed-in-industrial-accidents-across-kazakhstan-in-2025-8908/
[135] Bureau of National Statistics, Work-Related Injuries and Occupational Diseases in the Republic of Kazakhstan, 2024
[136] International Labour Organization (ILO). 2022. *Occupational Safety and Health in Central Asia: Baseline Assessment*. ILO Office for Eastern Europe and Central Asia.
[137] OECD, Labour Market Reforms in Kazakhstan, 2021
[138] Ministry of Labour and Social Protection, Annual Labour Safety Reports, 2021–2023

Collectively, these sources suggest that workers in Kazakhstan may be hesitant to report hazards or incidents through formal Government channels, increasing the likelihood of unrecorded unsafe conditions.

8.3.3.4 Workplace incidents and gender

Workplace incidents and fatalities are gendered, with the vast majority occurring to men. Data from 2023 at the national level shows 82% of workplace incidents and 97% of workplace fatalities are men.[139] This reflects gendered patterns of labour force participation, where men are disproportionately engaged in high-risk sectors and tasks. Women's lower share of workplace injuries reflects differences in occupational roles and exposure, rather than an absence of vulnerability.

Table 8-4: Workplace incidents and fatalities in Kazakhstan (sex-disaggregated, 2023)

Gender	Workplace incidents leading to >1 lost working day (fatal and non-fatal) (no. of people)	%	Workplace fatalities (no. of people)	%
Men	2,184	82%	238	97%
Women	486	18%	8	3%
Total	**2,670**		**246**	

8.3.3.5 Relations with foreign workforces

Interviews with representatives of Akimats included the locally sensitive topic of experiences regarding worker accommodation. The project area has had experience with a number of construction projects over recent years. Akimats requested that foreign workers are accommodated separately, due to negative past experiences with other projects in the area whose construction workforces included foreign nationals. Specifically, concerns were raised about sexual exploitation of local women by foreign workers and several incidents involving confrontation between foreign workers and local people. It was reported that workers had rented houses in nearby villages, facilitating close contact, thus alternative accommodation and/or management arrangements were requested to avoid a similar situation.

8.3.3.6 Summary of key sensitive receptors

The key sensitive receptors identified are potential workers, women, young people and foreign workers, or a combination thereof.

Individuals or groups may be located within Jambyl or Turkestan regions (villages or towns in the vicinity of either the Jambyl or Kentau OHTL rights of way), or Kazakh nationals from other regions. Receptors may also include foreign workers brought specifically to work on this project from abroad.

Related to any part of the Project, there are the following sensitive receptors.

[139] https://stat.gov.kz/en/industries/social-statistics/stat-medicine/spreadsheets/

Table 8-5: Summary of key sensitive receptors

Receptor	Sensitivity	Description
Construction workforce – vulnerable groups	High	High sensitivity is assigned to some of the more potentially vulnerable workers (e.g. women, migrants), as they may experience additional risks and/or have reduced access to support to minimise those risks during either construction or operations phases (e.g. isolation, working environments with elevated risk conditions, reliance on worker accommodation, personal safety and security risk exposure).
Construction workforce	Medium	Work will occur under conditions that pose some level of risk (e.g. use of heavy machinery or working at heights), but these activities are common and the associated risks are generally well understood. Basic safety requirements are expected to be enforced. Worker accommodation will be required for at least some of the workforce. It is likely that some migrant and/or foreign labour will be employed, including some highly-qualified managerial and technical personnel sourced from elsewhere in Kazakhstan and/or internationally.
Operations workforce – vulnerable groups	High	High sensitivity is assigned to some of the more potentially vulnerable workers (e.g. women, migrants), as they may experience additional risks and/or have reduced access to support to minimise those risks during either construction or operations phases (e.g. isolation, working environments with elevated risk conditions, reliance on worker accommodation, personal safety and security risk exposure).
Operations workforce	Medium	Work will occur under conditions that pose some level of risk (e.g. use of heavy machinery or working at heights), but these activities are common and the associated risks are generally well understood. Basic safety requirements are expected to be enforced. Operations phase workers will have access to a union and Masdar's corporate systems.
Supply chain	High	High-risk sector supply chains are assigned as high sensitivity as these may carry risks of forced labour, unsafe manufacturing conditions, and/or poor traceability (especially for WTG components, battery suppliers and battery recycling).

8.4 Potential Impacts

8.4.1 Construction Phase

8.4.1.1 Occupational health and safety

The construction sector experiences the highest number of fatalities in the workplace (20.0% of those recorded across all sectors) and 7.5% of lost time injuries, in 2024. These injuries disproportionately affect men.

The types of risks that may be faced by any workers during the construction phase of the Project can include:

- Risk of death or serious injury – electrocution, energisation or other electrical hazards; excavation collapse; tensioning equipment hazards; thermal runaway events (following commissioning); burns; falls from height/falling objects during tall structure assembly; collisions with vehicles or moving plant; collisions in vehicles with livestock or wildlife including during transport of oversized loads; inhalation, burns or exposure to hazardous materials particularly fire suppression agents (following commissioning); altercations/violence with other persons; miscommunication/no translation of hazards or safety protocols; alcohol and/or other drug use
- Risk of injury – manual handling injuries; outdoor work in harmful conditions; fatigue from long distance heavy transport and/or construction schedule; and
- Risk of disease – rabid animal attack; hazardous material exposure.

Turbine erection, lifting operations, work at heights, craning, and electrical works carry high inherent OHS risk, especially if contractors do not apply adequate GIIP measures. Similarly, BESS installation risks can include confined space entry risks, chemical exposure and electrical hazards.

Risk of insufficient training or PPE misuse, particularly among subcontractors, can also increase exposure to hazards in WTGs, OHTLs and BESS installations. In particular, there may be gaps in local contractor understanding of lithium-ion safety protocols and/or an absence of the required specialist technical labour for installation of lithium-ion batteries, inverters, HVAC systems, and fire suppression equipment.

Masdar is an established company with experience in the development of renewable energy projects including WPP and BESS development. Masdar requires, through its Green Finance Framework, that its projects are to have in place an Occupational Health & Safety management system aligned with international standards (such as ISO 45001/OHSAS 18001) that is proportionate to the project's scale and risk profile. It commits Projects to train workers on health, safety, and emergency procedures, and prohibits the use of substances while also encouraging access to appropriate support programs for workers with substance abuse issues.[140] Further, as part of its Business Partner Code of Conduct, Masdar projects must provide and maintain safe and healthy workplaces in compliance with local laws and good international industry practice, as well as put in place appropriate worker welfare facilities. This includes, inter alia, appropriate sanitation, rest areas, and clean water provisions.[141] As a business partner, these provisions will be included in the EPC contract requirements.

Table 8-6: Construction labour and human rights impacts - OHS

Activity/Impact/Aspect					
Risk of exposure of construction workers Occupational Health and Safety risks					
Type	**Duration**	**Extent**	**Scale of Impact**	**Frequency**	**Likelihood**
Direct	Short term	On-site/local	Distinguishable	Continuous	Likely
Receptor		**Sensitivity**	**Magnitude**	**Significance of Impact**	
Construction workers		Medium	Medium	Moderate	

[140] https://masdar.ae/-/media/corporate-revamp/downloads/investors/2025/masdar_green-finance_2025_march21.pdf
[141] https://masdar.ae/-/media/corporate/downloads/taqa-business-partner-code-of-conduct.pdf

8.4.1.2 Labour recruitment and employment practices

There is a risk of poor labour practices in response to labour shortages for targeted skillsets. The Institute for Human Rights and Business has identified that Labour shortages can cause bottlenecks in implementation of decarbonisation initiatives, leading to workers being at risk of exploitation through informal labour or opaque sub-contracting arrangements.[142]

There can be a reliance on short-term construction labour, often hired through subcontractors, which may lead to variable compliance with labour laws and PS2. Long shifts, night work and tight construction schedules can elevate risks of fatigue, accidents and non-compliance with the working-hours requirements. This project has a construction timeline of 3 years, which for the WPP in particular will be constrained by the extended period of winter conditions; interviews with local people report that the WPP area is generally under heavy snow from November-December until March-April. This may put pressure on construction timelines and indirectly increase worker fatigue risks.

There is a risk of forced labour in the workforce, to which migrant workers are most potentially vulnerable. Those most at risk are international migrants who may be in more vulnerable positions if their paperwork is not correct for migration purposes, if ID documents are retained by the employer, if they cannot speak the local languages or navigate bureaucracy without assistance. They may experience a lack of clear employment terms or be less aware of how to exercise their rights locally. Uneven capacity in human resources teams among contractors may lead to non-transparent pay practices or delayed payment of wages. Approximately 10,000 people arrive per year in Kazakhstan, mostly from other CIS countries, for work opportunities.

The likelihood of underage labour arises primarily from within the local community, especially in lower-income areas where young people have limited opportunities. The Project could be viewed by local teenagers as a rare chance to earn income and gain work experience. There is also a risk that underage migrant workers may attempt to obtain employment using falsified documents.

Table 8-7: Construction labour and human rights impacts – labour practices, child and forced labour

Activity/Impact/Aspect					
Risk of exposure of construction workers to poor labour and recruitment practices, including forced and child labour					
Type	**Duration**	**Extent**	**Scale of Impact**	**Frequency**	**Likelihood**
Direct	Short term	Local	Distinguishable	Continuous	Possible
Receptor		**Sensitivity**	**Magnitude**	**Significance of Impact**	
Underage or forced labour in the construction workforce		High	Medium	Major	

8.4.1.3 Suppliers

Wind turbines, inverters and batteries all require minerals and manufactured parts sourced from regions where labour rights, environmental management and traceability may vary significantly. There is the potential that the EPC will source construction phase materials from China due to proximity and cost, however specific potential suppliers have yet to be identified.

Turbines, tower, and cable supply chains carry risks of forced labour, unsafe manufacturing conditions, or poor traceability, which require IFI oversight under PS2 supply chain provisions. Through Masdar's

[142] https://www.ihrb.org/latest/top-ten-business-and-human-rights-issues-in-2026

internal processes, documented in the TAQA Business Partner Code of Conduct,[143] the areas of its supply chain carrying potential forced and child labour risks have been identified; it has found that the key risks were in its suppliers in the manufacturing sector and the construction phase of its projects. To mitigate the risks, Masdar engages with its suppliers and contractors to ensure that appropriate safeguards and reporting mechanisms are in place to take immediate action against any violations of its standards. Masdar engages in inspections before and during the production process, where risks are identified. This approach helps it to mitigate risks in its supply chain, maintain ethical business practices, and adhere to legal requirements in all its operational regions.

The construction supply chain for OHTLs will mostly include raw materials, electrical parts, and construction equipment. As the design has not yet been completed, it is not possible to estimate what suppliers may be involved or assess key supply chain risks in detail. However, as mining and quarrying and manufacturing are the most and third-most hazardous sectors in Kazakhstan, it can be assumed that there will be significant risks to supply chain workers providing Kazakh-sourced materials for the Project. Suppliers will be covered by Masdar's Business Partner Code of Conduct, and contract terms will be rolled down to the EPC who is also anticipated to carry out procurement.

BESS battery manufacturers will be required to disclose information that may include (but not limited to) battery technology and chemistry, such as Digital Battery Passport certification or similar, and supplier declarations regarding commitments to zero tolerance to Forced or Child Labour direct (Tier 1) and Tier 2 suppliers, particularly in high-risk geographies. Contractual obligations will be the responsibility of the procuring entity (Masdar or EPC, as appropriate during the different project phases).

Table 8-8: Construction labour and human rights impacts – Supply chain

Activity/Impact/Aspect					
Risk of exposure to poor labour and working conditions in construction phase supply chain					
Type	**Duration**	**Extent**	**Scale of Impact**	**Frequency**	**Likelihood**
Indirect	Short term	Local	Distinguishable	Infrequent	Likely
Receptor		**Sensitivity**	**Magnitude**	**Significance of Impact**	
Supply chain		High	Medium	Major	

8.4.1.4 Worker accommodation and facilities

There will be a direct labour force requirement for the Project during construction which will be dependent on the stage of the works. Project workforce needs include skilled, semi-skilled and unskilled workers. Employment of workers from local communities by the EPC will be encouraged.

During the construction stage, approximately 800-1,000 people are expected on average to be directly involved, peaking at 2,200 people during the installation phase. While the EPC will be responsible for determining the need for and location(s) of worker accommodation, it is noted that the nearby Zhanatas WPP did not require a dedicated worker accommodation facility, as there was sufficient local accommodation to house non-local workers. However, the workforce was smaller and the work site closer to the nearest town. Thus, for this Project, some external worker accommodation is likely to be required for the construction workforce.

Poor-quality accommodation, sanitation and catering services on construction sites can adversely affect workers' health and the surrounding environment. Inadequate or overcrowded living quarters may lead

[143] https://masdar.ae/-/media/corporate/downloads/taqa-business-partner-code-of-conduct.pdf

to unhygienic conditions and the spread of contagious diseases, while sub-standard toilet facilities can contribute to environmental contamination (including impacts on nearby water bodies) or increase the risk of disease transmission among workers. Safe and hygienic food preparation and dining areas, with appropriate hand-washing facilities, are necessary to reduce the likelihood of food-borne illness.

Workers also need appropriate food provision, rest breaks and sheltered rest areas to maintain their wellbeing and performance. Kazakhstan's continental climate is characterised by significant temperature fluctuations, meaning that accommodation and rest facilities must be adequately ventilated, insulated and heated.

The EPC contractor will be responsible for all on-site and off-site worker facilities. As the EPC has not yet been appointed, contractual obligations have not yet been detailed, however, at minimum these are expected to require compliance with the IFC-EBRD guidance on worker accommodation[144] and periodic audits of performance against this standard.

Table 8-9: Construction labour and human rights impacts – Worker accommodation

Activity/Impact/Aspect					
Risk of exposure to inadequate worker accommodation of construction phase workers					
Type	**Duration**	**Extent**	**Scale of Impact**	**Frequency**	**Likelihood**
Direct	Short term	On-site/local	Distinguishable	Continuous	Possible
Receptor		**Sensitivity**	**Magnitude**	**Significance of Impact**	
Construction workers in worker accommodation		Medium	Medium	Moderate	

8.4.1.5 Women and vulnerable workers

Female workers may face specific risks and impacts, particularly where cultural expectations influence their roles in the workplace. As in many countries, the construction industry in Kazakhstan is largely male, and while women are employed in the construction industry, the workforce remains predominantly male. Social perceptions about "appropriate" work for women can limit career progression, and both explicit discrimination and unconscious bias can restrict women's opportunities. Safety can also be affected if women's needs are overlooked, such as using personal protective equipment designed for men may provide insufficient protection and could introduce additional risks, such as tripping from oversized footwear. A lack of gender-appropriate facilities (e.g. toilets, separate accommodation) can also present specific issues for women.

Other groups of workers may also be vulnerable to negative treatment including:

- Ethnic or religious minorities
- Migrant workers
- LGBT+ people, or those perceived as such
- Persons with disabilities
- Young/junior workers
- Individuals with union or political affiliations.

Potential types of harassment or experiences in the work environment for vulnerable groups within the

[144] Workers' accommodation: processes and standards, a guidance note by IFC and the EBRD (2009)

workforce can include:

- GBVH, along with other forms of bullying, harassment or discrimination, may arise within the Project workforce. Other forms of negative treatment could include bullying, harassment or unequal access to opportunities
- Workers may be unwilling to report issues due to hierarchical workplace culture, fear of retaliation, or lack of anonymous channels
- Language barriers (Kazakh, Russian, Turkish/Chinese subcontractors) may limit accessibility of opportunities, clear communication about risks
- Women employed in catering, cleaning or administration roles may experience unequal conditions or informal employment.
- Union leaders or members can be targets of harassment. While lawful in Kazakhstan, in practice unionisation is limited; workers may have restricted avenues for collective representation.

While all workers are covered by the same policies and systems to protect worker health and safety and prohibit discrimination, the claims of vulnerable workers are less likely to be taken seriously, increasing sensitivity to risk for this group.

Table 8-10: Construction labour and human rights impacts – Women and Vulnerable workers

Activity/Impact/Aspect					
Risk of exposure of women and vulnerable workers to poor labour and working conditions					
Type	**Duration**	**Extent**	**Scale of Impact**	**Frequency**	**Likelihood**
Direct	Short term	On-site/local	Distinguishable	Continuous	Possible
Receptor		**Sensitivity**	**Magnitude**	**Significance of Impact**	
Vulnerable construction workers (women, migrant labour)		High	Medium	Major	

8.4.2 Operation Phase

At the operations phase, occupational health and safety, risks to women and vulnerable workers, and supply chain workers have been assessed. There will be no worker accommodation provided at this phase, thus this has been scoped out of the assessment. Further, labour recruitment is scoped out as employees will be specialist direct employees of the Operating Company at the operations phase.

8.4.2.1 Occupational health and safety

The operations workforce will be substantially smaller than the construction phase as the activities will be limited to operations and maintenance (electromechanical and housekeeping) of the WPP and BESS. Twice-yearly maintenance is anticipated. For the OHTLs, once commissioned, these will be transferred to KEGOC for operations and maintenance, which will be conducted in compliance with national legislative standards and requirements, typically twice per year. During operation, low numbers of permanent employees on site are expected to be required; estimated to be around 60 –80 personnel. In case of outages or major maintenance work during the operation, this may increase to an estimated 100-150 people temporarily depending on the works to be performed.

The types of risks that may be faced by any workers during the operations phase of the Project across OHTLs, WPP and BESS can include:

- Risk of death or serious injury – confined space like conditions; electrocution, arc flash or other electrical hazards; thermal runaway events; burns; falls from height; mechanical hazards during tensioning maintenance; collisions with vehicles or moving plant; collisions in vehicles with livestock or wildlife; inhalation, burns or exposure to hazardous materials particularly fire suppression agents; suffocation; altercations/violence with other persons; miscommunication/no translation of hazards or safety protocols; weather hazards; alcohol and/or other drug use
- Risk of injury – noise, vibration or heat stress working with HVAC systems; manual handling injuries; outdoor work in harmful conditions; fatigue; and
- Risk of disease – rabid animal attack; hazardous material exposure.

Work at heights and electrical works carry high inherent OHS risk. BESS can include confined space entry risks, chemical exposure and electrical hazards. It is assumed that operations phase workers will be Operating Company employees who will operate under an OHS management system that reflects the existing Masdar OHS management system.

Masdar operates under a comprehensive Health, Safety, Security, and Environment Management System (HSSE MS) compliant with ISO 45001 for Occupational Health and Safety, ISO 14001 for Environmental Management and ISO 9001 for Quality Management System. The HSSE MS is subject to annual internal audits and external assessments by certified organizations to ensure its ongoing effectiveness and continuous improvement. Masdar implements its "Life Saving Rules" across all sites and discloses its performance through the company's Annual Sustainability Report (for example, HSSE GRI indicators for employees only).[145]

Table 8-11: Operations labour and human rights impacts - OHS

Activity/Impact/Aspect					
Risk of exposure of operations workers Occupational Health and Safety risks					
Type	**Duration**	**Extent**	**Scale of Impact**	**Frequency**	**Likelihood**
Direct	Short term	On-site/local	Distinguishable	Continuous	Likely
Receptor		**Sensitivity**	**Magnitude**	**Significance of Impact**	
Operations workers		Medium	Medium	Moderate	

8.4.2.2 Supply chain

The operational supply chain for the BESS will most significantly include replacement battery units, which will present the same risks and require the same mitigations and management as at the construction phase. The operational supply chain for the OHTLs will be limited to providing spare parts for the substation and OHTL, as well as any equipment needed to carry out maintenance. As during construction, risks in the manufacturing supply chain must be considered. Suppliers will be covered by Masdar's Business Partner Code of Conduct including supply chain due diligence and monitoring.

Table 8-12: Operations labour and human rights impacts – Supply chain

Activity/Impact/Aspect					
Risk of exposure to poor labour and working conditions in operations phase supply chain					
Type	**Duration**	**Extent**	**Scale of Impact**	**Frequency**	**Likelihood**
Indirect	Short term	Local	Distinguishable	Continuous	Likely

[145] Masdar 2024 Annual Sustainability Report (p.112)

Receptor	Sensitivity	Magnitude	Significance of Impact
Supply chain	High	Medium	Major

8.4.2.3 Women and vulnerable workers

The types of risks faced by women and vulnerable workers during operations will be similar to those faced during the construction phase, only the number of people potentially affected will be lower and all parties will be direct employees with an increased exposure to the Operating Company workplace training and other ESMS and labour management systems and enforceable processes, that replicate the requirements of the Masdar quality and management systems.

Table 8-13: Operations labour and human rights impacts – Women and Vulnerable workers

Activity/Impact/Aspect					
Risk of exposure of women and vulnerable workers to poor labour and working conditions					
Type	**Duration**	**Extent**	**Scale of Impact**	**Frequency**	**Likelihood**
Direct	Short term	On-site/local	Distinguishable	Continuous	Possible
Receptor		**Sensitivity**	**Magnitude**	**Significance of Impact**	
Vulnerable construction workers (women, migrant labour)		High	Medium	Major	

8.5 Mitigation, Management & Residual Impacts

8.5.1 Construction Phase

A Project-specific Construction OHS Management Plan (OHSMP) will be prepared and implemented in line with Masdar's OHS Policy and its ISO-accredited OHSMS. The plan will set out the principal OHS risks relevant to the Project which includes those described in this chapter, and any others yet to be identified, location- or activity-specific hazards. It will also define reporting channels and responsibilities to ensure Masdar maintains oversight of EPC contractor and subcontractor performance. Provisions for enforcing requirements, including consequences for non-compliance at both company and individual levels, will be included.

Implementation of the Construction OHSMP will be subject to regular internal and external monitoring. The plan will specify a review cycle of no more than 12 months to assess the effectiveness of measures and make adjustments where needed. It will also incorporate incident-response procedures and set out links to the Project's workers' grievance mechanism.

A Construction Emergency Preparedness and Response Plan will be developed prior to the commencement of contractor activities and applied throughout the construction period. This plan will outline potential emergency scenarios during construction and identify proportionate preparedness and response measures. It will address typical on-site construction risks (e.g., fire, leaks, spills), location-specific risks (e.g., collision with other infrastructure), and off-site risks (e.g., flooding, severe weather, acts of vandalism).

A Project-specific Labour and Working Conditions Management Plan will be prepared before construction begins and implemented throughout the construction phase. As a minimum, it will include the following:

- Contractor management processes will require labour and OHS standards to be embedded in tendering and contractual documents. Contractors will be required to report regularly on accident rates, near misses, incident severity, recurring non-compliances, fatalities, serious injuries, and associated corrective actions, with defined penalties for non-compliance.
- Non-discrimination and equal opportunity principles will be applied, including fair recruitment and employment practices and effective implementation of the Project Code of Conduct. Specific measures will be adopted to support women and other vulnerable workers.
- A zero-tolerance approach to GBVH and all forms of harassment will be enforced. All workers will receive mandatory induction and periodic refresher training on gender, respectful behaviour, and anti-harassment policies
- Freedom of association will be respected, including the right to join trade unions and access information on union membership rights
- Forced labour and child labour will be strictly prohibited. The plan will define required actions by workers and supervisors in cases of suspected forced or underage labour and will include age-verification procedures
- Migrant workers will be afforded full rights and protections. All must hold valid visas and retain personal documents in an accessible location (e.g., personal lockers). They will not face discrimination in wages or opportunities and will be provided with competent translators and key documents in their own languages
- Terms and conditions of employment will be clearly defined, including contract content and disclosure, sick leave, rest days, annual leave, local hiring practices, retrenchment procedures, overtime rules, shift duration, and payment schedules
- All workers' accommodation, whether purpose-built or rented from local communities, will at minimum meet the standards set out in the IFC/EBRD guidance note Workers' Accommodation: Processes and Standards (2009). These standards cover requirements for drinking water, food quality and nutrition, training, laundry services, sanitation facilities, ventilation, temperature control, sewage and waste management, fire safety measures, and regular cleaning and inspections
- Construction compound locations, including worker camps, will be selected to minimise impacts on nearby communities (see also Chapter 7 on Community health safety and security)
- Transport will be provided between workers' accommodation and construction sites, and from agreed locations within local communities to support commuting for local workers
- Penalties for breaches of key employment requirements including OHS rules will be outlined, together with procedures for verbal and written warnings and dismissals
- A drug and alcohol policy will apply, clarifying permissible alcohol use within worker accommodation and a zero tolerance approach to alcohol and drug use when driving or operating machinery.

The Labour and Working Conditions Management Plan will be under the joint responsibility of the EPC and Masdar to implement.

The Construction phase management plans will be sensitive to the needs of women and vulnerable groups, including measures such as:

- A zero-tolerance approach to GBVH, harassment, bullying and other forms of violence will be embedded in the Code of Conduct, labour contracts, induction and refresher training, with clear consequences for non-compliance, up to and including dismissal.

- The workers' grievance mechanism will include a confidential channel for reporting sensitive issues, particularly GBVH and bullying, provide for anti-retaliation, differentiated pathways for sensitive cases, and the personnel responsible for managing the mechanism will be trained in survivor-centred procedures.
- All workers will have access to appropriate facilities, including women's-fit PPE in a full range of sizes, and separate, well-lit hygiene, changing and accommodation areas for female workers that meet the same standards as those provided for men.
- The Project will take proactive measures to support women and other vulnerable workers. Opportunities for women's employment will be maximised where feasible, including through targeted training for operational roles and reasonable adjustments to the working environment.

The Workers Code of Conduct will be included in all construction worker contracts and all sub-contracts and will be required to be signed by workers at contract signing, prior to commencement of work on site. The Code of Conduct will provide for, at minimum: OHS requirements; anti-corruption; policy on alcohol and other drugs; GBVH and bullying prevention, standards and expectations; environmental protection; interactions with the community; grievance processes. Violations of the Code of Conduct will be subject to penalty measures, as defined in the worker contract. The Code of Conduct will be available in relevant languages to the workforce: Kazakh, Russian and others if needed by any migrant workers.

A Project-specific Workers Grievance Mechanism will be prepared, disclosed and regularly refreshed with the workforce (e.g. during Toolbox talks, during refresher training). The mechanism will include special grievance reporting channels for any potential GBVH claims, which will be treated confidentially and accessed to selected members of the SPV for further investigation.

Payments to workers are to be made to workers' bank accounts, with no cash payments permitted by any subcontractors. Construction sites will have on-site security guards.

A project-specific Supply Chain Management Plan (SCMP) will be prepared once detailed design is finalised and priority suppliers are identified, to be managed by the EPC with oversight from Masdar. The plan will set out measures to identify, manage, and address risks of labour exploitation and other material environmental or human rights concerns within the supply chain. These requirements will be embedded into procurement documentation, with monitoring and reporting arrangements appropriate to the nature and the scale of the risk profile of each supplier/sector.

8.6 Operations Phase

The Operating Company will be responsible for ensuring that a Project-specific Operations OHS Management Plan (OHSMP) will be prepared and implemented in line with Masdar's OHS Policy and its ISO-accredited OHSMS. The plan will set out the principal OHS risks relevant to the Project which includes those described in this chapter, and any others yet to be identified, location- or activity-specific hazards. It will also define reporting channels and responsibilities to ensure Masdar maintains oversight of operational performance. Provisions for enforcing requirements, including consequences for non-compliance at both company and individual levels, will be included.

Updates will be applied to the construction phase management system documentation to reflect operational requirements. The workforce will be smaller, comprising specialised technicians performing maintenance, inspections and troubleshooting. Through the Operations HSSE Management System (HSSE MS), a labour management system appropriate to the nature and the scale of the operational

activities will be implemented that contains at least:

- Human Resources policy
- Labour management plan, with a Local Employment and Procurement Management Planning component
- Working conditions and worker code of conduct
- Gender Management Plan
- Security and Human Rights Management Plan
- GBVH Policy
- Worker Grievance mechanism, maintaining a specific channel for reporting any potential GBVH claims
- Community Grievance mechanism
- Stakeholder engagement plan
- OHS management plan
- Supply chain risk management plan

Key differences to the mitigations at the construction phase, the demand for contractors will decrease substantially and instead, there may be a small number of specialist contractors brought into the project for a short duration. Any contractors will still be required to comply with the operating company's QHSE and labour management requirements; this includes the Worker Code of Conduct.

Emergency preparedness and response, and occupational health and safety management planning will be updated to reflect operational activities, risks and relevant partner agencies and incident responders. The local Akimats will be updated and participate in preparedness scenarios.

The supply chain management approach will focus on operational phase risks, which will include periodic battery augmentation, replacement and recycling. Procurement of new batteries will follow the same requirements as at the Construction phase, updated periodically to reflect the requirements of Masdar's Business Partner Code of Conduct including supply chain due diligence and ongoing monitoring.

The following table summarises the mitigation and management measures proposed for identified receptors during construction phase activities.

Sensitive Receptor	Pre- mitigation	Mitigation and Management Measures	Residual Significance
General – applies to all construction phase workers	-	As part of the HSSE MS, implement labour management system that contains at minimum: • Human Resources policy • Labour management plan • Working conditions and worker code of conduct • Gender Management Plan • Security and Human Rights Management Plan • GBVH Policy • Worker Grievance mechanism • Community Grievance mechanism • Stakeholder engagement plan • OHS management plan • Supply chain risk management plan • Worker Accommodation Management Plan Specific measures: <u>Labour Management and compliance</u> • Implement a Construction Labour and Working Conditions Management Plan aligned with Kazakh Labour Code and IFC PS2 and AIIB ESF. • Include labour standards in EPC and subcontractor agreements • Apply Masdar's HSSE MS Requirements for Contractors, specific HSSE obligations for contractors to follow • Conduct pre-employment verification to prevent child labour or forced labour. <u>Occupational Health and Safety compliance</u> • Occupational health and safety management plan • Hierarchy of controls to be applied in construction and operations (Elimination; substitution; engineering controls; administrative controls; PPE) • Worker grievance mechanism • ESMMPs inc. monitoring, auditing and continuous improvement • Site-wide OHS Management System; inductions, toolbox talks, high-risk work permits. • Implement Life Saving Rules, Daily Job Hazard Analysis (JHAs). • Specific controls for high risk activities and core work activities	-

Sensitive Receptor	Pre- mitigation	Mitigation and Management Measures	Residual Significance
		Recruitment, Equality & Non-Discrimination • Transparent recruitment processes, using local employment centres where possible. • Measures to promote women's access to roles in traditional and non-traditional areas (technical specialisations, administration, HSE, surveys, works supervision). • Prohibit discrimination in wages and working hours, including for migrant workers. Contractor Management Contractor OHS plans reviewed and approved before mobilisation. Routine audits, inspections and reporting; corrective action tracking. Enforcement of a unified Code of Conduct for all contractors, which includes specific reference to GBVH. Worker grievance mechanism Confidential, non-retaliatory mechanism available in Kazakh and Russian. Multiple channels (SMS, hotline, boxes, digital). Special pathway for GBVH complaints, with confidential handling of GBVH cases, a survivor-centred protocol, commitment to provide external support services, no requirement for GBVH risk assessment scoring, a contractor-specific GBVH Action Plan. Emergency Preparedness & Response Construction emergency response plan covering fires, turbine erection failures, electrocution, BESS chemical incidents, medical evacuation and other high risk scenarios. Coordination with local akimats and responders. Monitoring & Reporting Daily and weekly reporting of required KPIs Contractor performance scoring Regular labour compliance audits Worker Accommodation • Construct or procure accommodation meeting IFC/EBRD Workers' Accommodation Standards. • Provide gender-segregated facilities, adequate heating, hygiene services, fire protection systems, and potable water. • Routine inspections by the Project and contractors. Stakeholder engagement	

Sensitive Receptor	Pre- mitigation	Mitigation and Management Measures	Residual Significance
		• Include labour management in the CLO communication plan, disclosing and communicating simple fact sheet content explaining how the Project is managing its labour force (both local and foreign labour) and what the rights and responsibilities of workers are (Code of Conduct). • Provision for female CLOs in SEP/grievance mechanism implementation	
Underage or forced labour in the construction workforce	Major	As part of the HSSE MS, implement labour management system – as above. Compliance with Masdar human rights & labour practices requirements, primarily through: Labour management plan Worker grievance mechanism Incorporating provisions for: <u>Prohibition of Forced and Child Labour</u> No use of forced, bonded, trafficked, or compulsory labour. No employment of children (in line with ILO minimum age conventions). Prohibition applies both directly and throughout the supply chain.	Minor
Vulnerable construction phase workers (women, migrant labour)	Major	As part of the HSSE MS, implement labour management system – as above. Compliance with Masdar human rights & labour practices requirements, primarily through: Labour management plan Worker grievance mechanism Incorporating provisions for: <u>Recruitment, Equality & Non-Discrimination</u> • Measures to promote women's access to roles in traditional and non-traditional areas (technical specialisations, administration, HSE, surveys, works supervision). • Prohibit discrimination in wages and working hours, including for migrant workers. <u>Fair Wages and Working Hours</u> Pay fair wages that meet or exceed legal and industry standards. Ensure reasonable working hours and overtime compensation in line with applicable laws. <u>Non-Discrimination & Equal Opportunity</u> No discrimination based on race, gender, nationality, religion, age, disability, or any other protected characteristic. <u>Commitment to diversity and inclusion</u> Targets, funding, resourced programs within EPC KPIs <u>Respect, Fairness & Anti-Harassment</u>	Minor

Sensitive Receptor	Pre- mitigation	Mitigation and Management Measures	Residual Significance
		Treat all workers with dignity and respect. Zero tolerance for harassment, bullying, intimidation, abuse, or physical violence. Respect cultural norms and sensitivities. Obtain consent before taking photographs or videos of personnel. <u>GBVH Prevention</u> Mandatory respectful workplace and GBVH training for all workers. Supervision protocols and disciplinary actions for breaches. Clear restrictions on worker–community interactions. Special grievance reporting channel for any potential GBVH claims. <u>Migrant & Vulnerable Worker Protections</u> Contracts and safety materials translated into relevant languages. No retention of passports; no recruitment fees. Monitoring of subcontractors employing lower-wage migrant workers.	
Supply chain (construction stage)	Major	Masdar's Contracts/Procurement Team follow company procurement standards in Supplier Code of Conduct compliance, supply chain risk management and human resources management, Modern Slavery requirements/procedures, compliance with Business Partner Code of Conduct: "Know Your Customer" (KYC) checks, including verification of supplier identity and beneficial ownership. Advanced screening for adverse media, legal issues, sanctions, and modern slavery non-compliance. Human rights and labour questions included in Tender Schedules Human rights and modern slavery obligations included in Terms and Conditions with suppliers EPC Contract to include enhanced human rights and modern slavery obligations in contract; mitigation plan and annual reporting Conduct worker welfare assessments/audits at site during construction Grievance Mechanisms - apply worker grievance mechanism for Masdar, EPC and subcontractors; Maintain zero tolerance for retaliation against whistleblowers; Investigate all reported breaches promptly and take corrective action, which may include contract termination.	Minor
Construction workers in worker accommodation	Moderate	As part of the HSSE MS, implement labour management system – as above. <u>Worker Accommodation</u>	Minor

Sensitive Receptor	Pre- mitigation	Mitigation and Management Measures	Residual Significance
		• Construct or procure accommodation meeting IFC/EBRD Workers' Accommodation Standards. • Provide gender-segregated facilities, adequate heating, hygiene services, fire protection systems, and potable water. • Routine inspections by the Project and contractors.	

The following table summarises the mitigation and management measures proposed for identified receptors during operations phase activities.

Sensitive Receptor	Pre- mitigation	Mitigation and Management Measures	Residual Significance
General – applies to all Operations phase workers	-	As part of the HSSE MS, implement labour management system that contains at minimum: • Human Resources policy • Labour management plan • Working conditions and worker code of conduct • Gender Management Plan • Security and Human Rights Management Plan • GBVH Policy • Worker Grievance mechanism • Community Grievance mechanism • Stakeholder engagement plan • OHS management plan • Supply chain risk management plan Specific measures: <u>Labour Management and compliance</u> • Implement an Operations Labour and Working Conditions Management Plan aligned with Kazakh Labour Code and IFC PS2 and AIIB ESF. • Include labour standards in any contractor agreements • Apply Masdar's QHSE Requirements for all Contractors, specific QHSE obligations for contractors to follow (NB: only small numbers of specialist contractors are envisaged; QHSE provisions will still be required) • Conduct pre-employment verification to prevent child labour or forced labour.	-

Sensitive Receptor	Pre- mitigation	Mitigation and Management Measures	Residual Significance
		Occupational Health and Safety compliance • Occupational health and safety management plan • Hierarchy of controls to be applied in operations (Elimination; substitution; engineering controls; administrative controls; PPE) • Worker grievance mechanism • ESMMPs inc. monitoring, auditing and continuous improvement • Site-wide OHS Management System; inductions, toolbox talks, high-risk work permits. • Implement Life Saving Rules, Daily Job Hazard Analysis (JHAs). • Specific controls for high-risk activities and core work activities Recruitment, Equality & Non-Discrimination • Transparent recruitment processes, using local employment centres where possible. • Measures to promote women's access to roles in long-term, technical roles. • Prohibit discrimination in wages and working hours for all workers. Worker grievance mechanism Confidential, non-retaliatory mechanism available in Kazakh and Russian. Multiple channels (SMS, hotline, boxes, digital). • Special pathway for GBVH complaints, with confidential handling of GBVH cases, a survivor-centred protocol, commitment to provide external support services, no requirement for GBVH risk assessment scoring, a contractor-specific GBVH Action Plan. Emergency Preparedness & Response • Construction emergency response plan covering fires, turbine erection failures, electrocution, BESS chemical incidents, medical evacuation and other high risk scenarios. • Coordination with local akimats and responders. Monitoring & Reporting • Daily and weekly reporting of required KPIs • Contractor performance scoring • Regular labour compliance audits Stakeholder engagement • Include labour management in the CLO communication plan, disclosing and communicating simple fact sheet content explaining how the Project is managing its	

Sensitive Receptor	Pre- mitigation	Mitigation and Management Measures	Residual Significance
		labour force (both local and foreign labour) and what the rights and responsibilities of workers are (Code of Conduct), updated to the operations phase. • Provision for female CLOs in SEP/grievance mechanism implementation	
Supply chain (operations stage)	Major	Masdar's Contracts/Procurement Team follow company procurement standards in Supplier Code of Conduct compliance; supply chain risk management and human resources management; Modern Slavery requirements/procedures; compliance with Business Partner Code of Conduct: • "Know Your Customer" (KYC) checks, including verification of supplier identity and beneficial ownership. • Advanced screening for adverse media, legal issues, sanctions, and modern slavery non-compliance. • Human rights and labour questions (including OHS) included in Tender Schedules • Human rights and modern slavery obligations included in Terms and Conditions with suppliers • Grievance Mechanisms – allow access to corporate grievance mechanism; Maintain zero tolerance for retaliation against whistleblowers; Investigate all reported breaches promptly and take corrective action, which may include contract termination.	Minor
Vulnerable operations phase workers (women, migrant labour)	Major	As part of the HSSE MS, implement labour management system – as above. Compliance with Masdar human rights & labour practices requirements, primarily through: • Labour management plan • Worker grievance mechanism Incorporating provisions for: <u>Recruitment, Equality & Non-Discrimination</u> • Measures to promote women's access to roles in long-term, technical roles • Conduct gender-inclusive workforce planning • Prohibit discrimination in wages and working hours <u>Fair Wages and Working Hours</u> • Pay fair wages that meet or exceed legal and industry standards. • Ensure reasonable working hours and overtime compensation in line with applicable laws. <u>Non-Discrimination & Equal Opportunity</u>	Minor

Sensitive Receptor	Pre- mitigation	Mitigation and Management Measures	Residual Significance
		• No discrimination based on race, gender, nationality, religion, age, disability, or any other protected characteristic. <u>Commitment to diversity and inclusion</u> • Targets, funding, resourced programs within KPIs <u>Respect, Fairness & Anti-Harassment</u> • Treat all workers with dignity and respect. • Zero tolerance for harassment, bullying, intimidation, abuse, or physical violence. • Respect cultural norms and sensitivities. • Obtain consent before taking photographs or videos of personnel. <u>GBVH Prevention</u> • Updated code of conduct to reflect operational activities • Monitoring of lone-worker arrangements, especially where women technicians travel to remote towers/turbines. • Mandatory respectful workplace and GBVH training for all workers. • Supervision protocols and disciplinary actions for breaches. • Special grievance reporting channel for any potential GBVH claims.	

Overall, with the implementation of the proposed mitigation and monitoring measures, residual human rights, labour and working conditions impacts across all receptors are assessed as minor or negligible, and no significant adverse effects are expected during the operational phase of the Project.

9 Archaeology and Cultural Heritage

9.1 Introduction and Overview of Assessment Methodology

The Project area is located within a region characterised by a high density of archaeological, historical, cultural, and spiritual heritage sites. The cultural landscape reflects multiple historical periods, including the Early Iron Age Saka cultures and the later era when the region formed part of the Silk Road corridor. In addition to archaeological assets, the area contains several sacred and culturally significant places that continue to play an important role in local identity, traditional practices, and community values.

This chapter presents the assessment of potential impacts of the Jambyl 1 GW Wind Power Project and associated OHTLs on cultural heritage, encompassing archaeological sites, historical features, sacred places, and intangible heritage.

The assessment is based on:

1. desk studies and review of official heritage registers
2. archaeological surveys conducted in 2024–2025 across the wind farm area and both OHTL routes
3. field verification, GPS mapping, and documentation by licensed cultural heritage specialists
4. consultations with representatives of local communities and custodians of sacred sites; and
5. applicable national legislation and international standards, including IFC PS8 and AIIB ESS8.

The objectives of this chapter are to:

- establish the cultural heritage baseline within the Project area
- evaluate the heritage value and significance of identified resources
- determine their classification under IFC PS8, including the identification of nonreplicable and critical cultural heritage
- apply the mitigation hierarchy to avoid or minimise adverse impacts; and
- assess the significance of potential impacts during the construction and operation phases of the Project and recommend mitigation or management measures where necessary to ensure compliance with Good International Industry Practice (GIIP), national requirements, and lender standards.

9.1.1 Overview of Methodology

This section outlines the methodology applied to assess potential impacts of the Project on cultural, historical, and spiritual heritage. The assessment is based on the review of baseline information, applicable legislation, international standards, and field investigations conducted by a licensed cultural heritage organization.

Legislative and Institutional Framework

Applicable national legislation and international standards including the Law on the Protection and Use of Historical and Cultural Heritage of the Republic of Kazakhstan, the Land Code, and the IFC Performance Standard 8 (Cultural Heritage) were reviewed to establish the legal protection requirements. This review included determination of mandatory protection distances (buffer zones) around cultural heritage sites and procedures for the management of chance finds during construction.

9.2 Stakeholder and Community Participation

9.2.1 High level stakeholder engagement

Statutory engagement has been conducted to ensure that the Project is developed in line with National requirements as described in the following section 9.2.1. A formal notification letter was submitted to the Ministry of Culture and Information[146] informing the regulator about Project activities and requesting guidance on cultural heritage protection. The Ministry confirmed[147] that archaeological and cultural heritage management must comply with the Law on the Protection and Use of Historical and Cultural Heritage. The response reiterates mandatory requirements, including archaeological surveys prior to land allocation; suspension of works and notification of the Ministry and regional Akimat within three working days if cultural assets are discovered; temporary protection and registration of identified sites; and coordination with Jambyl Region Akimat should additional finds emerge. This correspondence establishes an official regulatory dialogue and ensures that the Project aligns with national heritage protection obligations.

9.2.2 Permitting procedure consultations

Engagement for permitting procedural matters has also been conducted as follows:

Table 9-1: Permitting procedure consultations

Parties	Type of communication	Received information
Department of Culture of Turkestan Region	Official letter	A formal request for information regarding potential intersections of the proposed Opornaya–Kentau OHTL with registered cultural heritage sites was submitted to the Turkestan Region Department of Culture[148]. This correspondence confirms the regulatory expectations for cultural heritage compliance and provides a clear framework for project permitting and construction planning. Specifically, the Department confirmed: • archaeological works must be undertaken prior to land allocation in accordance with Article 127 of the Land Code and Article 30 of the Law on the Protection and Use of Historical and Cultural Heritage • a licenced historical and cultural expertise must be conducted within the Project area • reiterated the legal requirement to suspend works and notify authorities in the event of chance finds • underlined administrative and criminal liability for damage to cultural heritage assets.
Department of Culture of Jambyl region	Consultation	A consolidated inventory of cultural heritage sites located within the wind farm area was provided by the regional cultural authority. This information was reviewed and incorporated into the ESIA baseline and assessment.
Kazarchaeology	Official letter	A formal request for clarification on protection measures around cultural heritage sites identified within the Project area was submitted to licenced agency, KazArchaeology LLP[149], who

[146] By letter, 21 January 2025 (Ref. JKZ-OUT-25-103),
[147] By letter 21 January 2025 (№ 3T-2025-00203334)
[148] By letter 14 March 2025 (Ref. JKZ-OUT-25-121 / №3T-2025-00700045)
[149] By letter 7 April 2025 (Ref. JKZ-OUT-25-131)

Parties	Type of communication	Received information
		confirmed[150] that a 120-metre combined buffer zone is aligned with national legal requirements and that archaeological excavations are not required if project works stay outside these boundaries. Further, KazArchaeology clarified that licensed bodies issue official expert conclusions which are then transferred to the competent heritage authority for oversight during construction, and additionally highlighted responsibilities regarding chance finds, emphasising the obligation to suspend works and notify authorities, as well as potential legal consequences for damage to cultural assets.
Kazarchaeology	Official letter	Clarification was sought from Kazarchaeology[151] on legislative compliance and acceptable cultural heritage protection measures where the adjusted Opornaya–Kentau OHTL route crosses the Berikkara burial mounds. Kazarchaeology confirmed[152] that the proposed mitigation approach aligns with national legislation and IFC Performance Standard 8. The organisation validated: (i) shifting the OHTL alignment closer to existing infrastructure; (ii) undertaking a joint pre-construction site inspection with heritage authorities and licenced agency such as KazArchaeology; and (iii) maintaining a minimum distance of at least 40 m between tower foundations and burial mounds. KazArchaeology further noted two legally acceptable options where cultural heritage assets remain within the project footprint (either in-situ preservation supported by fencing and protective signage, or controlled salvage excavation and removal from the State Register where preservation is not feasible).

9.2.3 Community consultations

Community-level engagement has been undertaken to incorporate local knowledge and perspectives into the cultural heritage baseline, particularly with respect to sacred and intangible heritage. A meeting was held with the Akim of the Khamar Aulie rural district (30 April 2025) to discuss the recognised sacred site Kamar Aulie, which is locally valued as a pilgrimage and healing destination. The meeting confirmed the cultural and spiritual importance of the site, community expectations regarding respectful project behaviour in the vicinity, and the need to avoid disturbance to associated paths, access routes and ritual spaces.

Outputs from the engagement have been incorporated into the baseline and inform the cultural heritage impact assessment and mitigation measures.

In addition to statutory engagement, community participation informed the heritage baseline. During community consultations and key informant interviews, local residents and custodians of sacred sites were asked to identify culturally important places and landscapes, including those not formally registered. Their feedback confirmed the value of known sacred sites and contributed to recognising intangible and community-held heritage, consistent with IFC PS8 expectations on participatory

[150] By letter 7 April 2025 (Ref. No. 09)
[151] By letter 17 December 2025 (Ref. JKZ-OUT-25-177)
[152] By letter 18 December 2025 (Ref. № 58)

assessment.

Baseline Review

Baseline information was collected through desk-based studies, review of available Archaeology and Cultural Heritage Survey Reports, site visits, and consultations with local communities. This information formed the basis for identifying known and potentially sensitive cultural heritage sites within and around the Project area.

Desktop research identified sites recorded in international and national registers. International sites documented as UNESCO World Heritage sites were described. The available State Registers of Cultural Heritage Sites of National and Local Importance, as well as academic publications and archival materials, were reviewed. The review included the identification, classification, and mapping of known archaeological, historical, cultural, and spiritual heritage sites within and around the Project area.

Field survey and data collection

On-site cultural and historical surveys were conducted at an early stage of the Project (i.e. the preliminary WPP layout for a 500MW Project, see also Chapter 22 Mitigation Through Design) to identify any previously unregistered or sensitive cultural heritage sites. The survey included ground inspection, photographic and written documentation, GPS mapping, and evaluation of potential impacts. The first site archaeological surveys began in October 2024, when a 500-megawatt project was being planned. The territory designated for the wind farm and OHTL connecting the wind farm to the Jambyl substation were surveyed. In 2025, in connection with the expansion of the Project to 1 GW, archaeological surveys were conducted along the Kentau OHTL route, as well as within additional areas along the Jambyl OHTL route and the WPP area. All surveys were conducted by experts from the licensed, local cultural heritage organization, Kazarchaeology.

Analysis

Findings from the field survey were integrated into the Project's GIS database for further analysis. For the OHTL routing analysis and feedback into WTG layout design, a precautionary buffer of 120 metres on each side of the centreline was applied as described further in this chapter. This corridor width reflects the cumulative extent of the three statutory protection zones, each of which requires a minimum width of 40 metres from the outer boundary of the cultural layer. Applying a 120-metre buffer on both sides of the OHTL alignment and around WTGs ensures that all identified and potentially undocumented archaeological sites situated within the legally prescribed protective zones are fully avoided during route selection, in line with national legislation and IFC PS8 requirements for avoidance of impacts on non-replicable cultural heritage.

Prevention Measures by route and layout adjustment

Based on baseline data and field survey results, the Project layout and design solutions were reviewed and, where feasible, adjusted to avoid direct and indirect impacts on identified heritage sites (see also Chapter 22). Avoidance measures are prioritized over mitigation, in accordance with national legislation, and the mitigation hierarchy adopted through IFC PS8 and AIIB ESS8. Where route modification was required, buffer zones and legal restrictions were applied to ensure compliance with cultural heritage protection standards.

Mitigation Measures and Impact Management

Potential impacts on archaeological, historical, cultural, and spiritual heritage were assessed for both construction and operation phases. In accordance with IFC Performance Standard 8, all identified cultural heritage receptors are categorised as 'critical', 'non-replicable' or 'replicable',[153] and this categorisation informs receptor sensitivity.

Criteria for determining sensitivity of receptors have been defined as follows:

Table 9-2: Criteria for receptor sensitivity

Receptor Sensitivity	Descriptor
High	Archaeological and historical sites of international or national significance that offer strong potential for further important discoveries, as well as cultural or sacred places regarded by the community as highly valuable. (May be considered Critical cultural heritage where sites are nationally or internationally legally protected. Heritage may be considered as Non-replicable where any losses of heritage values cannot be replaced. Kurgans and burial sites that have been identified but not excavated are assumed to have human remains, are categorised as non-replicable on a precautionary basis). Cultural and sacred sites long used by local communities for traditional purposes, including locations tied to oral histories or representing sites that no longer exist. These may include immovable features. Intangible cultural heritage practices that are central to individual and collective identity, and which may be especially vulnerable to social, demographic, or economic change. Such practices, knowledge, or behaviours can disappear entirely within a single generation.
Medium	Archaeological and historical sites of regional significance that have limited potential for additional discoveries. (May be considered Replicable cultural heritage if this can be moved elsewhere/replaced by a similar feature/documented through investigation; or Non-replicable if it is unique for the period that it represents or links several periods at the same site). Cultural and sacred places that may no longer be actively used but remain known within the community and are linked to local settlement history or oral traditions. These may include cultural or sacred resources that are relatively common and, in some cases, movable/can be transferred through appropriate measures.
Low	Archaeological and historical sites considered to be of local significance, including features that are either very common and well understood or those that are poorly preserved or heavily disturbed, offering limited value for future research. (May be considered Replicable cultural heritage, such as where values can be recovered or documented through investigation). Cultural and sacred resources that are widespread and potentially movable or cultural sites no longer in use and lacking lasting local importance or heritage value.

Criteria for determining magnitude of impact have been defined as follows:

[153] **Replicable cultural heritage** is defined as tangible forms of cultural heritage that can themselves be moved to another location or that can be replaced by a similar structure or natural features to which the cultural values can be transferred by appropriate measures. Archeological or historical sites may be considered replicable where the particular eras and cultural values they represent are well represented by other sites and/or structures.
Nonreplicable cultural heritage may relate to the social, economic, cultural, environmental, and climatic conditions of past peoples, their evolving ecologies, adaptive strategies, and early forms of environmental management, where the (i) cultural heritage is unique or relatively unique for the period it represents, or (ii) cultural heritage is unique or relatively unique in linking several periods in the same site.
Critical cultural heritage consists of one or both of the following types of cultural heritage: (i) the internationally recognized heritage of communities who use, or have used within living memory the cultural heritage for long-standing cultural purposes; or (ii) legally protected cultural heritage areas, including those proposed by host governments for such designation.

Table 9-3: Criteria for magnitude of impact

Magnitude of impact	Descriptor
Large	Archaeological or historical sites, or their settings, are altered to the extent that key characteristics are fundamentally changed and the overall value of the resource is entirely diminished or lost. Cultural, sacred, or intangible heritage resources or their component parts are removed, damaged, or significantly altered, resulting in a complete change or loss of their function, setting, or accessibility. Consequently, associated cultural values, traditional practices, beliefs, or behaviours can no longer continue or become severely constrained.
Medium	Archaeological or historical sites, or their settings, are altered in ways that modify important elements and reduce their value, including the loss of some information. Cultural, sacred, or intangible heritage resources or their component parts are changed such that their value, function, setting, or accessibility is affected. These changes lead to altered patterns of use or adjustments to traditional beliefs, practices, or behaviours.
Small	Archaeological or historical sites, or their settings, experience minor alterations but retain their overall integrity, or are affected in ways that do not result in the loss of information (e.g., through controlled archaeological excavation and recording). Cultural, sacred, or intangible heritage resources or their component parts may undergo slight changes in value, function, setting, or accessibility. These changes do not affect how the resource is used, nor do they alter traditional beliefs, practices, or behaviours.
Very small/negligible	Archaeological or historical sites, or their settings, remain unaltered, or any changes are so minimal that their integrity is fully preserved and no information is lost. Cultural, sacred, or intangible heritage resources or their component parts are either unaffected or altered so minimally that their value, function, setting, or accessibility remains unchanged. No changes occur in how the resource is used, and traditional beliefs, practices, and behaviours are not affected.

The impact magnitude and receptor sensitivity are combined to determine the significance of the effect, in accordance with the impact significance matrix in Chapter 4 Assessment Methodology. Additionally, sites are assigned IFC categorisation of 'critical', 'non-replicable' or 'replicable'. The effects of the Project on cultural heritage have been assessed and mitigation measures proposed where necessary, to avoid, reduce, or offset any anticipated direct or indirect impacts in accordance with the mitigation hierarchy outlined in PR8. Cumulative effects from the Project in combination with other developments in the vicinity have been considered, where appropriate.

9.3 Applicable Requirements & Standards

9.3.1 National Regulations

9.3.1.1 Legal framework

The 1972 United Nations Educational, Scientific and Cultural Organisation (UNESCO) World Heritage Convention was accepted by Kazakhstan in 1994. Each State Party to the Convention recognises that it has the primary obligation to ensure the "identification, protection, conservation, presentation and transmission to future generations of the cultural and natural heritage… situated on its territory" (Article 4).

Law of the Republic of Kazakhstan No. 207-III "On Culture" (dated 15 December 2006) outlines the

fundamental principles and mechanisms for the development, safeguarding, and transmission of cultural values within the country. The law defines cultural heritage as tangible and intangible assets passed from generation to generation, holding historical, artistic, scientific, spiritual, or social significance.

The Law of the Republic of Kazakhstan "On the Protection and Use of Historical and Cultural Heritage Objects" (No. 288-VI ZRK, 26 December 2019) is the primary legal Act regulating the protection, preservation, and use of cultural heritage. It establishes the institutional framework, responsibilities, and procedures for safeguarding heritage sites and aligns national requirements with relevant international conventions and IFI standards.

Article 28 of the law states that "each historical and cultural monument shall be assigned a protection zone, a zone of regulation of development and a zone of protected natural landscape". The boundaries of these zones shall be determined by local executive bodies and the national authorised cultural heritage body, for monuments of local importance and those of national and international importance respectively.

Article 29 specifies that relocation and alteration of a cultural heritage site shall be prohibited, although "an exception shall be allowed only in cases of destruction of more than seventy percent of the monument" or "if its relocation and change will entail an improvement in the conditions for its preservation".

In accordance with Article 30 of this Act, archaeological surveys must be carried out prior to land allocation to identify historical and cultural heritage sites, and In the event of discovery of cultural heritage sites, "individuals and legal entities shall be obliged to suspend further work and inform the authorised body and local executive bodies of regions, cities of republican status or the capital within three working days".

Article 30 further specifies that the positive conclusion of the historical-cultural (archaeological) expertise is the instrument that formally confirms that cultural heritage requirements have been satisfied and that a project may proceed, together with approval of the protection and buffer zones by the competent authority, which is specified through Articles 25-26.

The Positive Conclusion of Historical and Cultural Expertise is issued by a licensed archaeological/cultural heritage organisation following surveys and assessment, and it confirms whether:

- cultural heritage objects are present;
- protection measures are required;
- avoidance, buffer zones, or mitigation/excavation are necessary; or
- no constraints apply and works may proceed.

In addition to Articles 25-26, the Order of the Minister of Culture and Sports "On Approval of the Rules for Determining the Protection Zone, Development Regulation Zone, and Protected Natural Landscape Zone of a Historical and Cultural Monument" (No. 86, 14 April 2020), specifies that where cultural heritage objects are identified, a Protection Zone Project must be prepared and formally approved by the Akimat, who approves protection and buffer zone boundaries for monuments of local significance; and, ensures compliance during project implementation. For monuments of national or international significance, approval is coordinated with the authorised national body in the field of culture.

Project implementation is conditionally divided into two main stages: Feasibility Study and Detailed

Design. Archaeological investigations are carried out prior to land acquisition, in order to identify any valuable archaeological or cultural heritage sites and, if necessary, revise the design solutions accordingly. At the Detailed Design stage after project financing is secured, mitigation measures are implemented, or archaeological excavations are conducted where required.

Palaeontological resources are not regulated under a standalone legal framework in Kazakhstan and are instead managed through the general cultural heritage protection regime. Where palaeontological finds are identified during pre-construction surveys or construction works, procedures analogous to those for archaeological discoveries apply. Works in the affected area must be suspended, the authorised state bodies and relevant scientific or museum institutions must be notified, and subsequent actions including documentation, protection, or further investigation, are determined by the competent authorities in accordance with national cultural heritage requirements.

Cultural heritage sites of national or local significance

In Kazakhstan, cultural heritage sites are classified through a formal state process as being of national (also known as 'republican'), or local significance. Sites of national significance are nominated based on archaeological investigations undertaken by licensed organisations and submitted to the Ministry of Culture. A dedicated expert commission reviews each nomination and, through a formal decision-making and voting process, approves sites for inclusion in the State List of Monuments of National Significance.

Monuments of republican significance are individual buildings, structures and sites together with their historically established territory, memorial houses, necropolises, mausoleums and individual burials, works of monumental art, stone sculptures, rock carvings and archaeological monuments. These sites represent historical, scientific, architectural, artistic and memorial value and are of particular importance to the history and culture of the entire country. They are considered potential objects for conservation or restoration and are subject to mandatory state protection. The current official list is established by Order of the Minister of Culture and Information of the Republic of Kazakhstan dated 11 July 2025 No. 318-NK "On the approval of the State Register of Historical and Cultural Monuments of Republican Significance."

Monuments of historical and cultural heritage of local significance are state-protected cultural heritage assets (including archaeological sites, architectural monuments and works of monumental art) that are of local importance and located within a specific region, city or municipality. Examples include kurgans, historic buildings (such as the Almaty Museum or Puppet Theatre), churches and houses of notable figures.

Their inventory, protection and conservation are regulated by local authorities (Akimats), and the corresponding lists of monuments are approved through official regional or municipal decrees.

The official registers of cultural heritage monuments of local significance within the Project area are established through the following legal acts:

- Resolution of the Akimat of Jambyl Region dated 1 July 2020 No. 148 "On the approval of the State Register of Historical and Cultural Monuments of Local Significance of Zhambyl Region."
- Resolution of the Akimat of Turkistan Region dated 17 September 2020 No. 188 "On the approval of the State Register of Historical and Cultural Monuments of Local Significance of Turkistan Region."

These acts approve the full lists of archaeological, architectural and cultural sites recognised as protected heritage at the regional level and place them under the jurisdiction and protection of the respective regional authorities.

9.3.1.2 Institutional Roles and Responsibilities

Kazakhstan's legislation sets mandatory requirements for identifying, assessing, and protecting cultural heritage at all stages of project development, ensuring that adverse impacts are prevented or mitigated. The law applies to archaeological, architectural, urban, and artistic monuments of international, national, and local significance, all of which are subject to state protection.

The Project Initiator is responsible for the early identification of potential impacts on cultural heritage and for ensuring that heritage sites are protected throughout construction and operation. The Licensed Company is tasked with carrying out the required archaeological studies and preparing the formal buffer zone project in accordance with national heritage protection regulations. The Akimat is responsible for approving the protection and buffer zones, supervising compliance, and ensuring that preservation measures are upheld during project implementation. Under national law, protection zones must be established around heritage sites to safeguard their physical integrity and historical context, and any construction or land-use activity within these zones is permitted only with prior approval from the authorised cultural heritage body.

9.3.1.3 Applicable laws

Applicable laws and regulations are detailed in Table 9-4 below.

Table 9-4: Applicable cultural heritage laws and regulations

Title/Reference	Date/No.	Scope
Law on Ratification of the 2003 Convention for the Safeguarding of Intangible Cultural Heritage	No. 514-IV, 21 December 2011	Ratifies UNESCO's 2003 Convention. Commits Kazakhstan to international standards for protecting intangible heritage — traditions, rituals, oral history, performing arts, and knowledge systems. Promotes community participation and awareness of cultural diversity.
Constitution of the Republic of Kazakhstan	Adopted 30 August 1995	Provides the overarching legal foundation for cultural heritage protection. Article 37 obligates citizens to preserve historical and cultural heritage and protect monuments of history and culture. Establishes the civic and institutional responsibility for safeguarding the nation's heritage.
Law "On Culture"	No. 207-III, 15 December 2006	Defines principles for safeguarding and transmitting cultural values. Recognizes both tangible and intangible heritage as part of national identity. Outlines shared responsibility of the State, institutions, and individuals for identification, registration, and preservation.
Concept of Cultural Policy of the Republic of Kazakhstan	Government Resolution No. 250, 28 March 2023	Sets national priorities for 2023–2029 in cultural development. Integrates cultural heritage preservation into social and economic planning. Focuses on strengthening national identity, sustainable use of heritage resources, public access, and digital documentation.
Land Code of the Republic of Kazakhstan	No. 442, 20 June 2003	Regulates land relations, including lands designated for historical and cultural purposes. Chapter 13 defines "lands of historical and cultural significance," sets protection measures, and prohibits any activity threatening heritage

Title/Reference	Date/No.	Scope
		objects. Requires prior research before land development.
Law "On the Protection and Use of Historical and Cultural Heritage Objects"	No. 288-VI ZRK, 26 December 2019	Establishes the legal and institutional basis for preservation and use of heritage objects. Defines categories (archaeological, architectural, artistic, etc.) and levels of significance (international, national, local). Sets responsibilities of owners/users and introduces protective zones and activity restrictions.
Order of the Minister of Culture and Sports "On Approval of the Rules for Determining the Protection Zone, the Development Regulation Zone, and the Protected Natural Landscape Zone of a Historical and Cultural Monument"	No. 86, 14 April 2020	Establishes procedures for defining and managing protective zones: (1) Protection Zone; (2) Development Regulation Zone; (3) Protected Natural Landscape Zone. Requires these zones to be identified and respected during project planning and implementation.
National and Local Registers of Historical and Cultural Heritage Sites	Various acts (2020–2023)	Maintains official State and regional lists of heritage monuments.
Order of the Minister of Health of the Republic of Kazakhstan dated 19 August 2021. Sanitary and Epidemiological Requirements for Cemeteries and Burial Facilities	No. KP DSM-81	These Sanitary Rules establish sanitary and epidemiological requirements for the design, maintenance and operation of cemeteries, as well as for the organisation of burial and reburial of bodies and the operation of funeral facilities. They also stipulate requirements for the designation of protection (buffer) zones and related sanitary measures.

9.3.2 Lender Requirements

Within IFC Performance Standards (2012) the following are considered relevant:

- PS 1 – Assessment and Management of Environmental and Social Risks and Impacts: requires identification and evaluation of all project-related environmental and social risks, including those affecting the amenity and comfort of nearby communities.
- PS 8 – Cultural Heritage: obliges projects to identify, assess, and protect tangible and intangible cultural heritage by avoiding impacts where possible, applying mitigation where avoidance is not feasible, and engaging communities and authorities to ensure culturally appropriate management throughout the project lifecycle.

AIIB's Environmental and Social Framework (ESF) establishes the principle that environmental and social considerations, including cultural heritage, are to be integrated into project identification, preparation, decision-making and implementation. Projects are expected to balance economic development objectives with the protection of social and cultural values as part of sustainable development. The ESF provides for consideration of cultural resources, recognising that consultation may need to address impacts on land, natural resources and cultural resources. The Environmental and Social Standards (ESS) provide detail on specific aspects of cultural resources.

The following table provides a description of obligations on cultural heritage, with national

requirements and relevant international standards. The national standards and application of the precautionary principal are the primary evaluation criterion relevant for the Project, as there are no specific limits defined under relevant international Lender standards.

Table 9-5: Obligations on Cultural Heritage with national and international requirements

Responsible Party	Description	National requirements	International Standards
Obligation Identification of objects of historical and cultural heritage			
Project Initiator/Licensed Company	At the planning stage, the project proponent must identify, and document all known cultural heritage sites within and around the Project area to ensure early avoidance or minimization of potential impacts. This work must be carried out by a licensed organization in accordance with the established national procedures and regulations.	Land Code (Chapter 13, Article 166); Law on the Protection and Use of Historical and Cultural Heritage Objects (No. 288-VI ZRK, 2019, Articles 7–8)	IFC PS8 para. 6 – Identification and assessment of cultural heritage; AIIB Environmental and Social Framework, including ESS 8 para. 3–6 – Early identification and inventory of cultural heritage.
Obligation Modification of the project layout to avoid impacts on discovered heritage objects			
Project Initiator/Licensed Company	Where cultural heritage sites are identified, the project design and layout must be adjusted, where feasible, to avoid or minimize adverse impacts and ensure their preservation.	Land Code (Chapter 13, Articles 167–168); Law on the Protection and Use of Historical and Cultural Heritage Objects (2019, Article 25	IFC PS8 para. 8 – Avoidance through project design modification; AIIB Environmental and Social Framework, including ESS 8 para. 8–9 – Avoidance and minimization through design measures.
Obligation Comply with the established protection zones (buffers) during implementation			
EPC contractor	Construction and operational activities must fully comply with the restrictions and regimes established for officially designated protection and buffer zones surrounding heritage monuments.	Law on the Protection and Use of Historical and Cultural Heritage Objects (2019, Article 25); Order of the Minister of Culture and Sports No. 86 (14 April 2020)	IFC PS8 para. 11 – Compliance with national protection systems; AIIB Environmental and Social Framework, including ESS 8 para. 7 – Respect for national protection systems and buffer zones.
Obligation Immediately report any discovered objects during earthworks or construction activities			
EPC contractor/construction companies	If previously unknown archaeological or cultural objects are encountered, the project developer must immediately suspend works in the affected area and notify the authorized heritage body	Land Code (Chapter 13, Article 168); Law on the Protection and Use of Historical and Cultural Heritage Objects (2019, Article 26)	IFC PS8 para. 16 – Chance find procedure; AIIB Environmental and Social Framework, including ESS 8 para. 10–11 Chance find management and

Responsible Party	Description	National requirements	International Standards
	for examination and protection.		reporting requirements.

9.4 Baseline Conditions

9.4.1 Area of Influence and Receptors

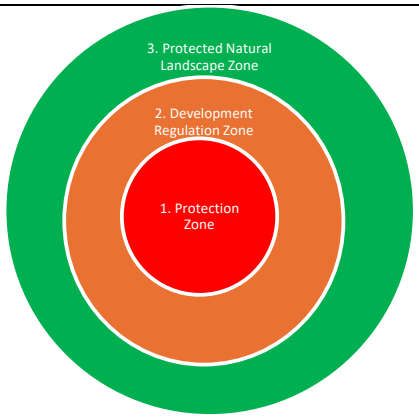
This section provides an overview of the context relevant to the assessment of cultural heritage, including the defined area of influence and the identification of sensitive receptors within and surrounding the WPP site and OHTLs. It summarises key features of the existing setting that influence the potential for Project impacts to cultural heritage.

The Area of Influence (AoI) for the cultural heritage assessment considers archaeological monuments and features located within a 120 m buffer that applies both to the WTG locations and the OHTL centreline. This AoI also includes associated project components such as internal access roads, underground collector cables, the project substation, BESS, O&M buildings, laydown areas and temporary construction facilities, where ground disturbance or setting changes may occur. The AoI definition ensures that potential direct and indirect impacts from all permanent and ancillary Project elements are captured in the cultural heritage assessment.

The archaeological surveys undertaken to date cover the Study Area with an appropriate margin and are considered sufficient for the current stage of Project development. However, minor adjustments to certain components (including access roads, underground cable routes, substation and BESS locations, O&M facilities and associated laydown areas) may arise during ongoing design optimisation and detailed engineering. In the event of any design changes, additional targeted surveys and consultations with the licensed archaeological organisation and competent heritage authorities will be undertaken as required. Preconstruction surveys will ensure that final siting and construction activities remain outside legally protected buffer zones and do not result in disturbance to archaeological or cultural heritage resources.

Protection zones established nationally by the Minister of Culture and Sports vary depending on the level of protection afforded to the site. Sites of historical and cultural significance are protected through a system of three types of protective zones with gradually decreasing levels of restriction. The protective zones are defined in the Order of the Minister of Culture and Sports of the Republic of Kazakhstan “On Approval of the Rules for Determining the Protection Zone, the Development Regulation Zone, and the Protected Natural Landscape Zone of a Historical and Cultural Monument, and the Regime for Their Use” (Order No. 86 dated 14 April 2020), as shown in Figure 9-1.

Figure 9-1: Boundaries of cultural heritage protection zones



1. Protection Zone: An area immediately surrounding a monument, intended to prevent any negative impacts on its physical condition.

2. Development Regulation Zone: A buffer area where construction and other activities are regulated to maintain the visual and spatial context of the monument.

3. Protected Natural Landscape Zone: A zone encompassing the natural landscape that contributes to the historical and cultural value of the site.

The boundaries of the zones are established through the preparation of a protective zone boundary, developed based on scientific data, historical sources, architectural and urban planning documentation, and results of research and field surveys, including natural and landscape analysis.

In accordance with Paragraph 7 of the "Rules for Determining the Protection Zone, Development Regulation Zone, and Protected Natural Landscape Zone of Monuments of History and Culture", archaeological monuments and sacred sites are surrounded by a protection zone of 40 meters from the outer boundaries of the identified cultural layers.

The development regulation zone and the protected natural landscape zone are established at the same width as the protection zone.

Following these provisions and guidance from licensed specialist archaeologists, and in line with the precautionary approach adopted within the ESIA, the total buffer zone for the identified archaeologically significant sites has been taken as the cumulative extent of the three protective zones defined by the Rules, corresponding to 120m.

9.4.2 Baseline Conditions

9.4.2.1 Tangible Heritage

UNESCO World Heritage Sites

There are six UNESCO World Heritage Sites in Kazakhstan and the Project site is located within 60km of four of these locations. The closest UNESCO World Heritage Site to the Project is the Kostobe Ancient Settlement, located approximately 20km north-east from Taraz city and 37 km south-east from the Jambyl substation. Kostobe, together with the Aktobe, Stepninskoye, Akyrtas, Kulan and Ornek archaeological sites, forms part of the UNESCO World Heritage serial property "Silk Roads: the Routes Network of Chang'an–Tianshan Corridor". This corridor, which was inscribed on the World Heritage list in 2014, emerged between the 2nd century BC and 1st century AD and remained in use until the 16th century. The trade routes comprised settlements, trade stations and caravanserais[154].

In the Turkistan Region, the Mausoleum of Khoja Ahmed Yasawi is situated in the centre of the city of Turkistan, around 120 km west of the Kentau substation. This site was built at the time of Timur

[154] https://whc.unesco.org/en/list/1442/

(Tamerlane) from 1389 to 1405 and is one of the largest and best-preserved constructions of the Timurid period. It was inscribed on the World Heritage List in 2003.

National and local registers of historical and cultural heritage sites

Within the Project area, several types of historical and cultural heritage sites are registered in the State List of Monuments of Republican and Local Significance across the Jambyl and Turkestan regions. These include archaeological, architectural, and monumental sites dating from the Paleolithic to the late 19th–early 20th centuries.

In the Jambyl region, the most prominent monuments of republican significance are the Aisha Bibi and Babaji Khatun Mausoleums (11th–12th centuries), which are among Kazakhstan's most valuable architectural landmarks. The region also contains numerous archaeological sites, such as burial mounds and fortresses from the Early Iron Age (e.g., Ushbas, Tiktarsai, Tamdy, and Aktaū sites) and Paleolithic sites (e.g., Akkol, Tänirqazghan, and Börıqazghan).

During the Early Iron Age, the Saryarka and Southern Kazakhstan regions were inhabited successively by tribes such as the Saka, Usuns, and Kangly, marking the rise of early state formations. Ancient writers, including Herodotus, describe horse-breeding nomads in Asia—sometimes referred to as "Turks," "Kimmerians," or "Scythians" (Saka). In Zhetysu and the Zhambyl Region, extensive Usun burial mounds have been excavated along river valleys and mountain foothills, with major sites such as Karasha I, Uzunbulak, Shashkan, and Tamlyn studied by researchers including Bernshtam and Maksimov. Most mounds are small earth structures, though elite mounds are monumental, containing wooden coffins and rich grave goods (gold ornaments, jewellery, and mirrors) indicating high social status.

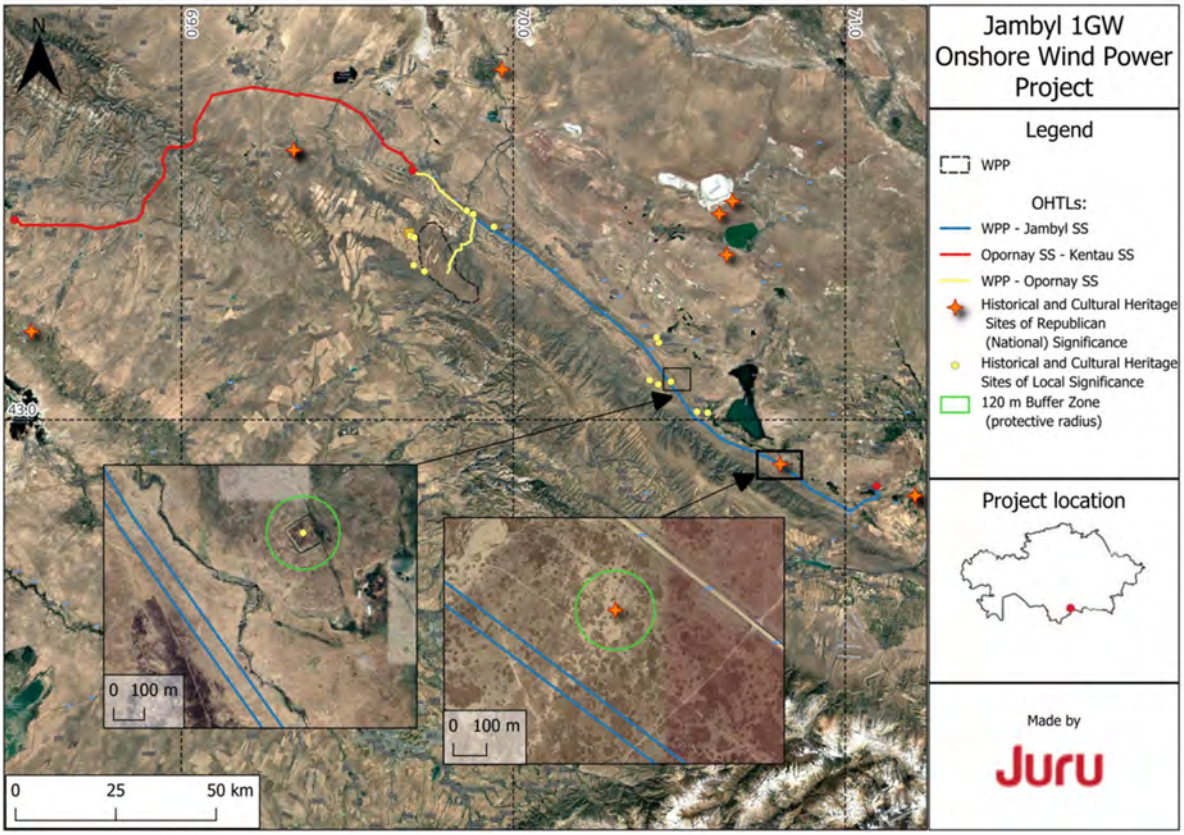
Chinese sources describe the Usun as nomadic pastoralists, with cattle-breeding central to their livelihood and only primitive agriculture. Elite burials such as those near Lugovaya reveal offerings of bronze, ceramics, glass, and stone. The Usun developed copper-smelting and ironworking technologies, producing weapons and tools. Social differentiation is evident, with wealthy clan leaders and ordinary tribespeople. More than 5,000 Usun burial mounds show evolving patterns of land ownership at both clan and individual levels. Most mounds have a diameter of 6–10 m and a height of 0.5–1.5 m[155].

In the Turkestan region, notable republican monuments include the Sozak Ancient Settlement (10th–18th centuries) and the Mausoleum of Zhusip Ata (12th–15th centuries). Several local heritage sites are also recorded, such as the Mausoleum of Baba Tukti Shashti Aziz, as well as ancient settlements and burial sites near Sauran.

One site of Republican significance falls within the AOI (along the Jambyl OHTL route) and four sites of Local significance fall within the AOI (one along the Jambyl OHTL route and three in or on the boundary of the WPP site). Existing historical and cultural heritage sites are shown in Figure 9-2, and a detailed list of all sites included in the State Register is presented in Annex A (for the WPP sites) and Annex B (for Jambyl OHTL route sites).

[155] "The Inventory of Historical and Cultural Monuments of the Republic of Kazakhstan. Jambyl Region." Almaty, 2012.

Figure 9-2: Cultural heritage sites of National and Local significance in the Study area



There are no paleontological resources identified within 50km of the study area; this resource is scoped out of the ESIA.

Site Studies

The cultural heritage study area comprised the 41,200ha WPP area identified for the 500MW WPP and the corridor for Jambyl OHTL. Additional areas were surveyed with the expansion of the WPP area to 1GW project and a further survey was conducted with the addition of the Kentau OHTL (a total of four surveys). The archaeological survey mainly identified burial-type tangible cultural heritage sites, including kurgans and burial sites. A kurgan is a type of tumulus (mound) constructed over a grave, often characterized by containing a single human body along with grave vessels, weapons, and horses, while a burial site (necropolis, cemetery) is a type of archaeological monument where graves are located and which is associated with memorial structures, which may also feature traces of burial and commemoratory rituals.

A total of 59 archaeological heritage finds were identified in the study area. This comprised 26 findings identified in the preliminary/previous WPP area (i.e. the area for the study of a 500MW project. See also Chapter 22 Mitigation Through Design); 22 findings identified in the Jambyl OHTL corridor; and 11 findings in the Kentau OHTL corridor. Table 9-6 summarises the finds identified during each of the site surveys.

Table 9-6: Summary of surveys and archaeological finds in the study area

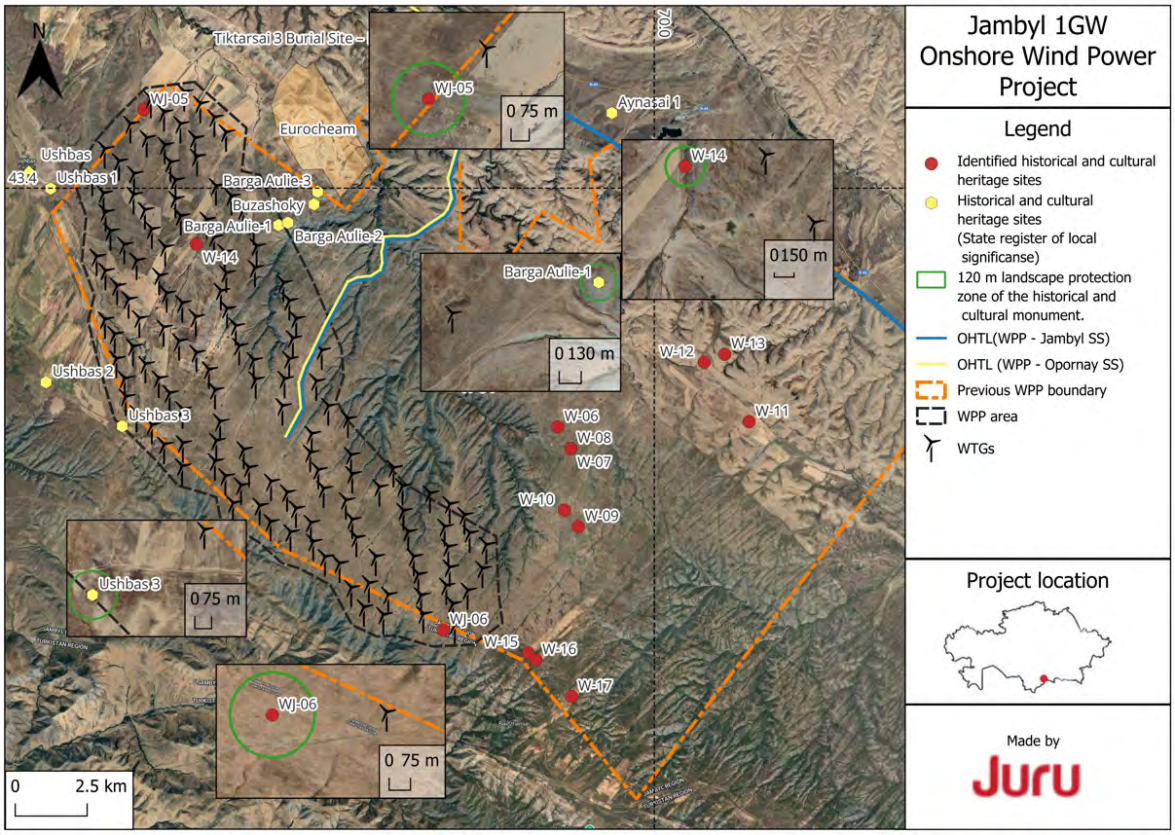
Surveys conducted	Project Component	No. of findings	Description
Historical and Cultural Assessment for the Project "Jambyl Wind Power Plant with a Capacity of 500 MW"	Jambyl OHTL	12	Within the OHTL corridor, a total of 12 archaeological heritage objects were identified, including 9 single kurgans and 1 burial site consisting of 3 kurgan.
	Preliminary WPP area	10	Within the Project area, a total of 10 archaeological objects were identified, represented by one single kurgan and three burial sites, each consisting of three kurgans.
Historical and Cultural Assessment for the Project "Jambyl Wind Power Plant with a Capacity of 500 MW.	Extension area of the preliminary WPP	14	These include four individual kurgans and three burial sites consisting of multiple kurgans (4, 3, and 3, respectively).
Historical and cultural assessment of the additional areas for OHTL, connecting the 1 GW "Jambyl" Wind Power Plant (WPP) in the Jambyl Region with the existing substations Opornaya and Kentau in the Turkistan Region.	Kentau OHTL	11	These include three individual kurgans and one burial site (Sholakkorgan) consisting of 7 kurgans.
Conclusion of the Historical and Cultural Expertise of Additional Territories under the Project for the Construction of OHTL connecting the "Jambyl" Wind Power Plant (WPP) with a Capacity of 1 GW in the Jambyl Region	Jambyl OHTL	10	These include four individual kurgans (burial mounds) and two burial site, consisting of 2 and 4 kurgans, respectively.
	WPP	2	2 kurgans of burial site
Total	**59 findings in the AOI, located across the following:** • **WPP: 19 sites in the Preliminary WPP + Extension area, of which:** ○ **3 sites are in the 1GW WPP area** • **Jambyl OHTL: 10 sites** • **Kentau OHTL: 4 sites**		

The following section maps and describes where these sites are located.

WPP

The locations of the sites in the study area of the WPP is shown in Figure 9-3. Note this figure indicates the WPP boundary (black dashed line) as well as the preliminary/'previous' WPP study area (orange dashed line).

Figure 9-3: Cultural Heritage and Archaeological Sites in the WPP area



Sensitive receptors identified in or on the immediate boundary of the WPP area are kurgans and burial sites identified through site investigations, and archaeological sites already identified in the 'List of Monuments of History and Culture of Local Significance' (the 'State Register'). Table 9-7 lists the sensitive receptors, a brief description, whether the site was identified during baseline fieldwork or via the State Register, and where a full description and photograph can be found in the Annex to this Chapter.

Table 9-7: Sensitive receptors in the WPP

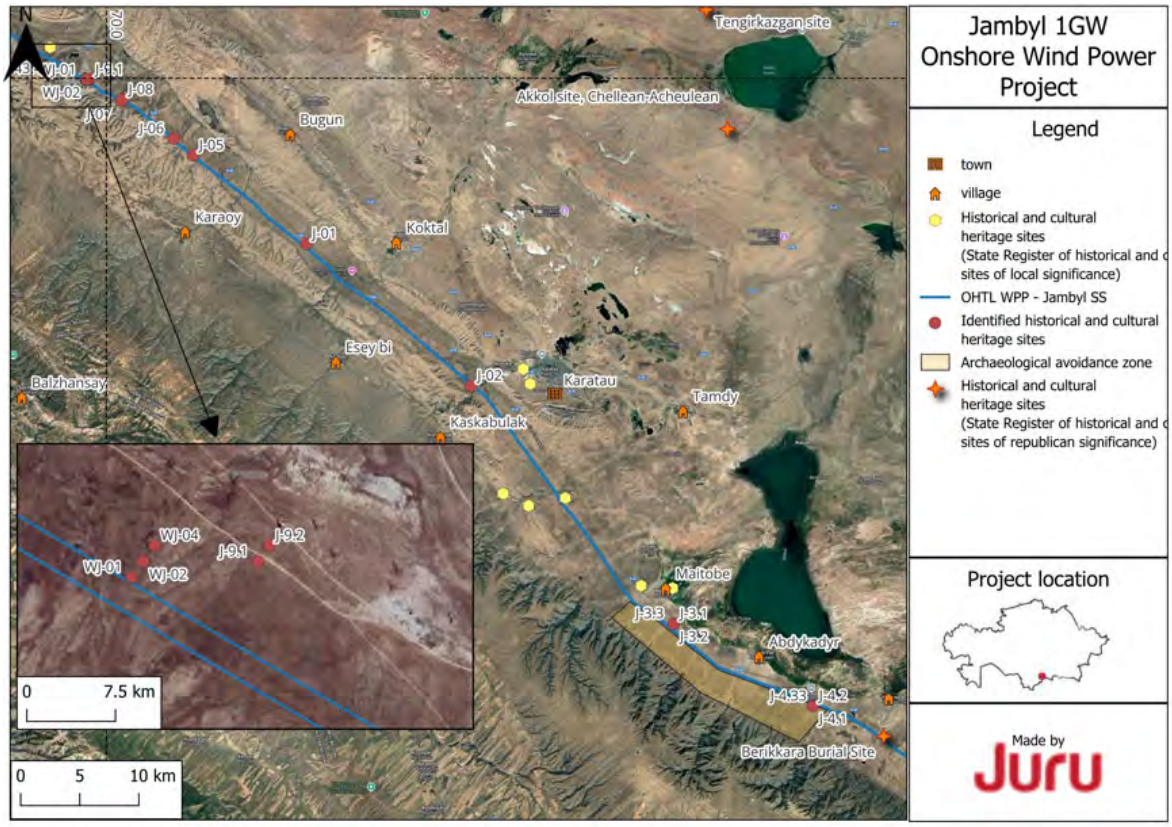
Sensitive Receptor Ref.	Brief description	Description in Annex	Identification
WJ-05	Burial site	Annex A – Table 1	Site visit
W-14	Single kurgan	Annex A – Table 1	Site visit
WJ-06	Burial site	Annex A – Table 1	Site visit
Barga Aulie-1	Early iron age site	Annex A – Table 2	State Register of Local Significance
Barga Aulie-2	Early iron age site	Annex A – Table 2	State Register of Local Significance
Ushbas-3	Early iron age site	Annex A – Table 2	State Register of Local Significance

Jambyl OHTL Route

Sites in the Jambyl OHTL route to the Jambyl substation are mapped in Figure 9-4. Detailed maps are

additionally presented in Figures 1-5 in Annex B.

Figure 9-4: Cultural Heritage and Archaeological Sites on the Jambyl OHTL Route



Sensitive receptors identified along the Jambyl OHTL alignment are kurgans and burial sites identified through site investigations, and archaeological sites already identified via the State Register. Table 9-8 lists the sensitive receptors, a brief description, whether the site was identified during baseline fieldwork or through the State Register, and where a full description and photograph can be found in the Annex to this Chapter.

Table 9-8: Sensitive receptors along the Jambyl OHTL route

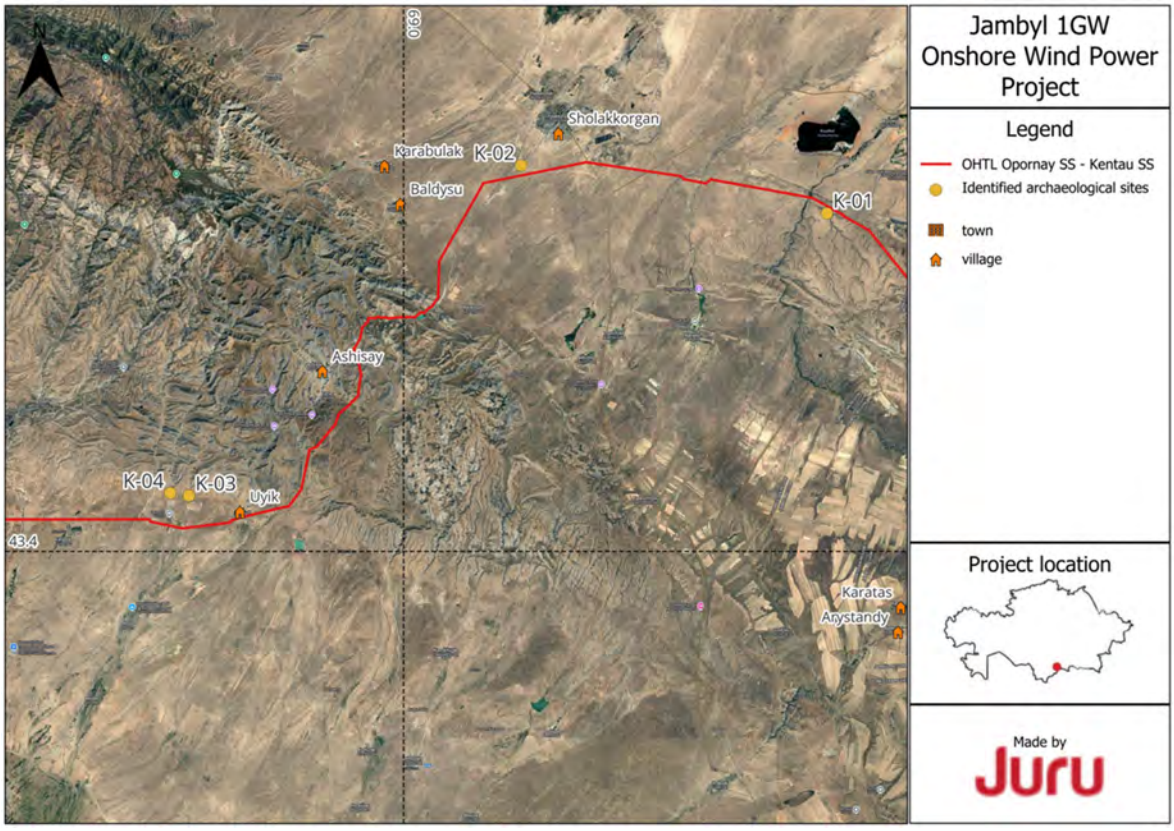
Sensitive Receptor Ref.	Brief description	Description in Annex	Identification
J-01	Single kurgan	Annex B – Table 1	Site visit
J-02	Burial site	Annex B – Table 1	Site visit
J-3.1	Single kurgan	Annex B – Table 1	Site visit
J-3.2	Single kurgan	Annex B – Table 1	Site visit
J-3.3	Single kurgan	Annex B – Table 1	Site visit
J-4.1	Single kurgan	Annex B – Table 1	Site visit
J-4.2	Single kurgan	Annex B – Table 1	Site visit
J-4.3	Single kurgan	Annex B – Table 1	Site visit
J-05	Single kurgan	Annex B – Table 1	Site visit
J-06	Single kurgan	Annex B – Table 1	Site visit
J-07	Single kurgan	Annex B – Table 1	Site visit

Sensitive Receptor Ref.	Brief description	Description in Annex	Identification
J-08	Single kurgan	Annex B – Table 1	Site visit
J-9.1	Burial site	Annex B – Table 1	Site visit
J-9.2	Burial site	Annex B – Table 1	Site visit
WJ-01	Single kurgan	Annex B – Table 1	Site visit
WJ-02	Single kurgan	Annex B – Table 1	Site visit
WJ-03	Single kurgan	Annex B – Table 1	Site visit
WJ-04	Single kurgan	Annex B – Table 1	Site visit
WJ-05	Single kurgan	Annex B – Table 1	Site visit
WJ-06	Single kurgan	Annex B – Table 1	Site visit
Maitobe	Early iron age site	Annex B – Table 2	State Register of Local Significance
Berikkara	Early iron age site	Annex B – Table 2	State Register of Republican Significance

Kentau OHTL Route

Sites on the Kentau OHTL route are mapped in Figure 9-5.

Figure 9-5: Cultural Heritage and Archaeological Sites on the Kentau OHTL Route



Sensitive receptors identified along the Kentau OHTL alignment are kurgans and burial sites identified through site investigations, and archaeological sites already identified via the State Register. Table 9-9 lists the sensitive receptors, a brief description, whether the site was identified during baseline fieldwork

or through the State Register, and where a full description and photograph can be found in the Annex to this Chapter.

Table 9-9: Sensitive receptors along the Kentau OHTL

Sensitive Receptor Ref.	Brief description	Description in Annex	Identification
K-1	Single kurgan	Annex C – Table 1	Site visit
K-2	Burial site	Annex C – Table 1	Site visit
K-3	Single kurgan	Annex C – Table 1	Site visit
K-4	Single kurgan	Annex C – Table 1	Site visit

9.4.2.2 Intangible Cultural Heritage

This section describes the intangible cultural heritage elements, comprising oral traditions, performing arts, social practices, knowledge, and craftsmanship. Practices undertaken in the study area include ceremonies, rituals and prayers undertaken at religious and sacred sites, such as at cemeteries and Aulie sites.

The UNESCO List of Intangible Cultural Heritage contains 13 elements of Kazakh culture, including: performing arts; oral history; falconry and traditional games; horse breeding; bread making and yurt construction.

Two sites of significance for intangible cultural heritage were identified in preparing this ESIA. Both sites are located near Ushbas village: Kamar Aulie and Barga Aulie (also known as Barsha Aulie). To varying degrees, both sites considered important by the local population.

In addition, ten contemporary cemeteries are located within the AoI, and while not identified on the State Register, these are listed here as sites of cultural significance for local communities.

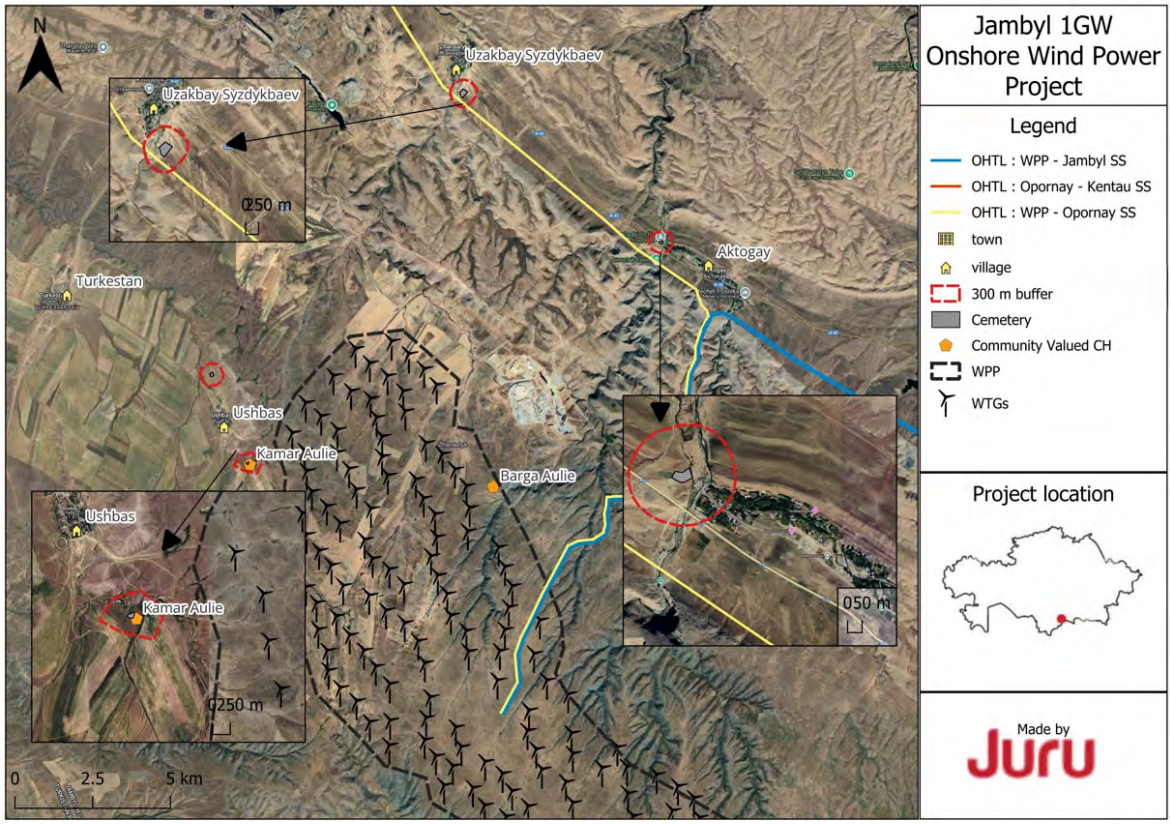
Photographs of intangible cultural heritage resources are provided in Annex D, Tables 1 and 2, and maps are provided in Annex D, Figures 1 and 2.

Kamar Aulie Sacred Site

Kamar Aulie is a religious and sacred site located to the west of the Project area, 1.2km to the south-east of Ushbas village. The site represents a physical place of worship and pilgrimage, comprising a holy cemetery and associated structures.

The location is shown in Figure 9-6. The Kamar Aulie cemetery is located 1,550m to the nearest WTG, while the grove is located 1,560m to the nearest WTG. The rest area located within the grove is located 1,620m to the nearest WTG.

Figure 9-6: Locations of intangible cultural heritage resources



There are two components to the site, as shown in Figure 9-7:

1. The holy cemetery, located within the Ushbas village cemetery; and
2. A grove and pilgrimage site, located approximately 50m northwest of the cemetery.

Figure 9-7: Kamar Aulie cemetery and grove site

Kamar Aulie cemetery (outside):



Kamar Aulie cemetery (inside):



Kamar Aulie grove – rest area located under the large tree:



Kamar Aulie holds substantial intangible cultural value for local communities. According to local legends, Kamar Aulie was a powerful woman and spiritual healer, and her spirit is believed to cure illnesses in both humans and animals.

Key intangible elements associated with the site include:

- Healing traditions: People visit the site seeking recovery from illness
- Fertility rituals: Women struggling to conceive traditionally spend the night at the grove site to receive spiritual blessings
- Livestock healing practices: Herders bring animals to stay overnight at the grove, believing the sacred energy will cure diseases
- Seasonal visits: Most rituals occur during the summer, when prayers and healing ceremonies are held
- Ceremonial practices: The traditional Tasattyk ceremony (collective prayer for rain) is occasionally performed near the site; and
- Guardianship: The site is cared for by Mr. Saulenbayev Kuatbay Ata, with evidence of offerings at and use of the site. Its cultural significance was confirmed by Mr. Duysenaly Agha, the Akim of the rural district.

These practices represent living cultural traditions passed orally across generations. For these reasons it is described as an active pilgrimage site.

Barga Aulie Sacred Site

The Barga Aulie-1 sacred site (also known as 'Barsha Aulie') is also situated near Ushbas village. Although it is less well-known and, as reported by the landowner, rarely visited, local residents confirm the existence of a physical sacred area associated with historical or spiritual figures. Limited physical

features are present, and the site is not formalized or maintained.

The location is shown in Figure 9-6. It is located 900m to the nearest WTG.

Figure 9-8: Barga Aulie-1 site



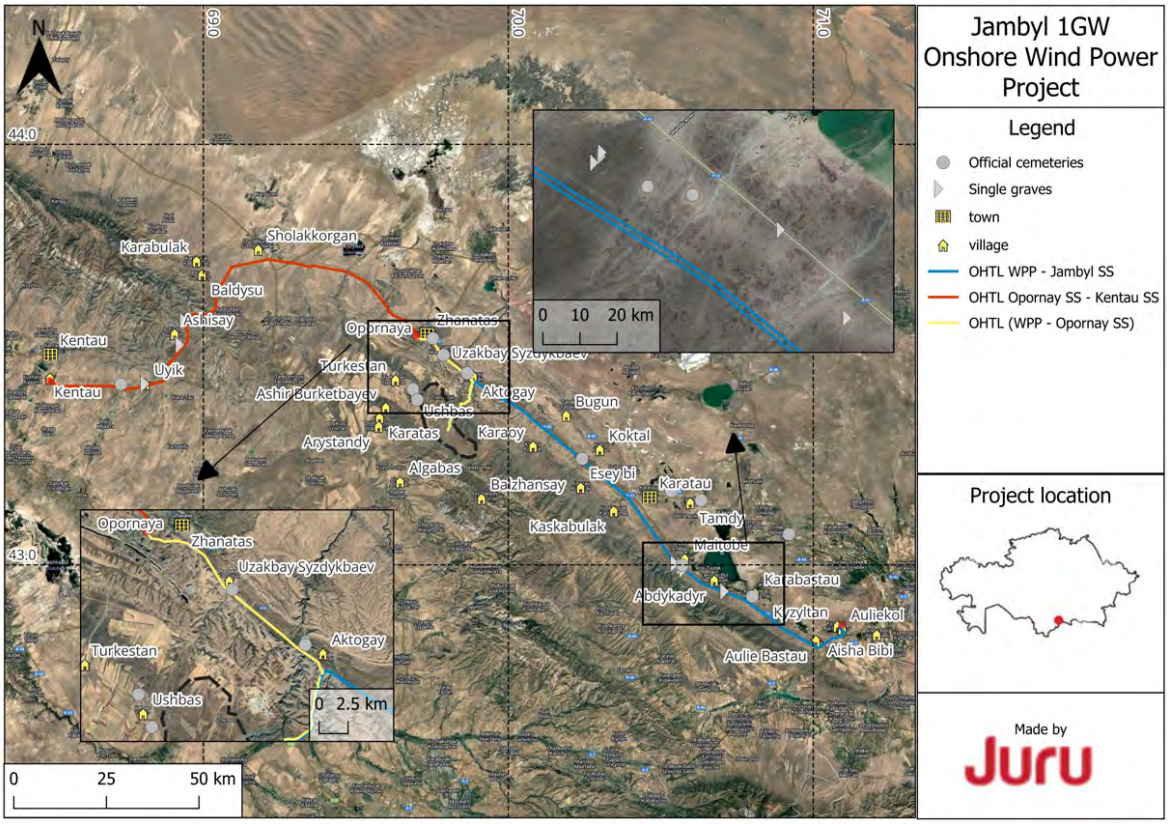
Barga Aulie-1 site is located 8.7 km southeast of Ushbas village and 9.6 km southwest of Aktogay village. It is a single kurgan from the Early Iron Age. Barga Aulie holds limited intangible cultural value for local communities. Information about intangible traditions related to the site is limited and the site has no guardianship or evidence of offerings or use. Local residents acknowledge the site's existence but note that it does not carry the same degree of spiritual or ritual significance as Kamar Aulie. For this reason it is described as a kurgan/inactive Aulie site.

Cemeteries and Individual Graves

Within the Project area and its vicinity, several contemporary cemeteries and individual graves were identified during the field survey. While these features are not included in the State List of Monuments of History and Culture, they are culturally significant for local communities and are therefore considered sensitive receptors under IFC PS8 and national legislation.

Cemeteries in the area are typically located at the outskirts of settlements and are used for active interments. These sites are associated with ongoing social and religious practices, including burial rites, prayers, and commemorative gatherings. In addition to established village cemeteries, several family or informal burial plots and single isolated graves were recorded across the landscape, including within grazing areas and foothill zones.

Figure 9-9: Nearby settlements and graves



Although these sites do not possess formal archaeological designation, they represent places of personal and community value, involving active traditions and continuing cultural meaning. As such, they are treated with the same level of protection as officially recognised cultural heritage assets in terms of avoidance, respect, and buffer implementation.

Photographs and locations of contemporary cemeteries are provided in Annex D, Table 2.

9.5 Summary of Sensitive Receptors

They key sensitive receptors identified are located within the WPP area, and along both the Jambyl and Kentau OHTL rights of way. Senstive receptors were identified through examination of UNESCO World Heritage Site listings; existing registers of sites of cultural heritage (local or national significance); and through observations from the cultural heritage site visits.

In or on the boundary of the WPP there are the following sensitive receptors described in Table 9-10. These sites have been included because they fall within the WPP site, or, in the case of Kamar Aulie and the Ushbas cemetery, these have been included because the setting may be affected due to the presence of WTGs. Distance is in metres to nearest WTG for those sites within the WPP area. The distance is in metres from heritage sites to the centreline of the OHTL rights of way for those along the Jambyl and Kentau OHTL corridors; the actual tower footprints will be microsited to meet 120m cumulative cultural heritage protection zone being applied by the Project.

Table 9-10: Summary of sensitive receptor sites

Site name ID	IFC category	Sensitivity	Type	Description	Distance (m) ^ #	AoI
WPP Site ^ *distance is to nearest WTG*						
Kamar Aulie	Non-replicable	**High**	Holy Cemetery and grove	Active pilgrimage site	1,600	Indirect
Cemetery	Replicable	**Medium**	Cemetery	Ushbas village cemetery	1,600	Indirect
Barga Aulie-1	Non-replicable	**Medium**	Sacred site	Kurgan/inactive Aulie site	900	Indirect
Ushbas-3	Replicable	Medium	Archaeological site	Early iron age burial mound (registered, of local significance)	523	Indirect
Kurgan WJ-05	Non-replicable	**High**	Archaeological site	Archaeological burial mound identified during the field survey	297	Indirect
Kurgan W-14	Non-replicable	**High**	Archaeological site	Archaeological burial mound identified during the field survey	576	Indirect
Kurgan WJ-06	Non-replicable	**High**	Archaeological site	Archaeological burial mound identified during the field survey	360	Indirect
Jambyl OHTL *# distance is to centreline of OHTL right of way (m)*						
J-01	Non-replicable	**High**	Single kurgan	Archaeological burial mound identified during the field survey	207	Indirect
J-02	Non-replicable	**High**	Burial site consisting of 3 kurgans	Archaeological burial mound identified during the field survey	62	Direct
J-3.1	Non-replicable	**High**	Kurgan 1 Maitobe Burial site	Archaeological burial mound identified during the field survey	443	Indirect
J-3.2	Non-replicable	**High**	Kurgan 2 Maitobe Burial site	Archaeological burial mound identified during the field survey	438	Indirect
J-3.3	Non-replicable	**High**	Kurgan 3 Maitobe Burial site	Archaeological burial mound identified during the field survey	420	Indirect
J-4.1	Non-	**High**	Kurgan 1	Archaeological	198	Indirect

Site name ID	IFC category	Sensitivity	Type	Description	Distance (m) ^ #	AoI
	replicable			burial mound identified during the field survey		
J-4.2	Non-replicable	**High**	Kurgan 2	Archaeological burial mound identified during the field survey	215	Indirect
J-4.3	Non-replicable	**High**	Kurgan 3	Archaeological burial mound identified during the field survey	238	Indirect
J-05	Non-replicable	**High**	Kurgan 1	Archaeological burial mound identified during the field survey	1.5	Direct
J-06	Non-replicable	**High**	Kurgan 2	Archaeological burial mound identified during the field survey	2.5	Direct
J-07	Non-replicable	**High**	Kurgan 3	Archaeological burial mound identified during the field survey	41	Direct
J-08	Non-replicable	**High**	Kurgan 4	Archaeological burial mound identified during the field survey	63	Direct
J-9.1	Non-replicable	**High**	Burial site **Kurgan 1**	Archaeological burial mound identified during the field survey	163	Indirect
J-9.2	Non-replicable	**High**	Burial site Kurgan 2	Archaeological burial mound identified during the field survey	200	Indirect
Berikkara	Critical	**High**	Burial site	List of Historical and Cultural Heritage Sites of Republican Significance	300	Indirect
WJ-01	Non-replicable	**High**	Kurgan 1	Archaeological burial mound identified during the field survey	10	Direct
WJ-02	Non-replicable	**High**	Kurgan 2	Archaeological burial mound identified during the field survey	50	Direct

Site name ID	IFC category	Sensitivity	Type	Description	Distance (m) ^ #	AoI
WJ-03	Non-replicable	**High**	Kurgan 3	Archaeological burial mound identified during the field survey	50	Direct
WJ-04	Non-replicable	**High**	Kurgan 4	Archaeological burial mound identified during the field survey	87	Direct
WJ-05	Non-replicable	**High**	Kurgan 5	Archaeological burial mound identified during the field survey	275 (to nearest WTG)	Indirect
WJ-06	Non-replicable	**High**	Kurgan 6	Archaeological burial mound identified during the field survey	407 (to nearest WTG)	Indirect
Kentau OHTL *# distance is to centreline of OHTL right of way (m)*						
K-1	Non-replicable	**High**	Single kurgan	Archaeological burial mound identified during the field survey	612	Indirect
K-2	Non-replicable	**High**	**Sholakkorgan Burial site**	Archaeological burial mound identified during the field survey	912	Indirect
K-3	Non-replicable	**High**	Single kurgan	Archaeological burial mound identified during the field survey	2,970	Indirect
K-4	Non-replicable	**High**	Single kurgan	Archaeological burial mound identified during the field survey	370	Indirect

^ distance is in metres to nearest WTG

 # distance is in metres to centreline of the OHTL right of way. The distance to OHTL tower footprint will be microsited to meet 120m cumulative cultural heritage protection zone being applied by the Project.

9.6 Potential Impacts

Effects on the resource have been determined by identifying the sensitivity (or cultural heritage value) of the resources within the baseline and assessing the magnitude of any potential impacts. Mitigation measures have been recommended to minimise the impact of the Project on cultural heritage, and a residual effect has been determined.

Potentially significant effects include direct physical alterations or indirect disturbances to cultural heritage receptors. The determination of the sensitivity of cultural heritage resources is based on national and regional designation and/or professional judgement against the characteristics and criteria expressed in PS8. The sensitivity levels assigned to resources are currently preliminary and assigned on

a conservative (i.e., worst-case) basis. These preliminary values may be verified during the pre-construction survey and evaluation to better characterise the condition, research value and sub-surface extent of any resources predicted to be impacted by the Project.

Potential project-related impacts are defined as direct, indirect or cumulative during construction and operations, where:

- Direct impacts are those where cultural heritage features are likely to be directly affected by Project activities within the proposed footprint of the Project
- Indirect impacts are those where the cultural heritage features themselves would not be affected but the environmental setting in which they are located may be altered. Indirect impacts may also arise where there are interruptions to intangible cultural heritage practices and/or access to cultural heritage resources; and
- Cumulative impacts may result where the cultural heritage features may be impacted by the combination of multiple impacts arising from existing projects or activities, and/or anticipated future projects or activities.

9.6.1 Construction Phase

Critical cultural heritage, as defined by IFC PS 8, which is cultural heritage that is internationally recognized heritage of communities who use, or have used within living memory the cultural heritage for long-standing cultural purposes; and/or legally protected cultural heritage areas, such as a World Heritage Site or under national protection. The Project is not deemed to directly impact on any international or nationally recognised heritage and thus no critical cultural heritage.

Replicable, tangible cultural heritage is defined in PS8 as items that can 'be moved to another location or that can be replaced by a similar structure or natural features to which the cultural values can be transferred by appropriate measures'. Specific to archaeological or historical sites, those where 'particular eras and cultural values they represent are well represented by other sites and/or structures' may be considered replicable. Applying a conservative approach, Aulie sites are considered non-replicable due to their spiritual significance and cemeteries are also considered non-replicable as relocation of such resources is not culturally acceptable. Archaeological features identified through existing registers are considered as non-replicable given their scientific value and status of sites of historical and cultural heritage of local significance. For those sites identified during field surveys, the same non-replicable status is applied as a precautionary approach, and appropriate avoidance, mitigation and management measures are proposed accordingly.

Avoidance measures are described in Chapter 22 – Mitigation by Design, which provides detail of where the area of the WPP footprint was reduced from the original study area due to, inter alia, cultural heritage finds. The Jambyl OHTL right of way was realigned to avoid extensive burial sites and kurgans, including along an estimated area of significant cultural and historical value and the Kentau OHTL to avoid known burial sites.

All known cultural heritage assets will be avoided by design, with statutory 120 m protection buffers applied as a minimum, unless otherwise agreed with the competent authority.

Tangible heritage

Based on specialist Archaeology reports of the study area, there are five potentially directly impacted heritage sites within the WPP; 20 potentially impacted along the Jambyl OHTL right of way; and four

potentially impacted along the Kentau OHTL right of way.

Project activities may directly disturb, truncate, or destroy archaeological and historical resources that have not yet been identified or documented. Such impacts could affect their material value through physical damage or destruction, or changes to their surrounding environmental context. In Kazakhstan, all historical and cultural monuments are subject to mandatory protection. In accordance with Article 3, Law 2019, any newly discovered resources identified during Project works must be temporarily added to the Preliminary Register of Sites until further assessment determines their official protection status.

The final siting of OHTL pylons will be carried out by the EPC. The distance between towers depends on the number of tower circuits of the proposed OHTL. Generally, 150-200 m is considered to be a standard distance in the case of a one-tower circuit OHTL, whereas 400m is more common for a two-tower circuit OHTL. Thus, it is anticipated that avoidance of tangible heritage sites by design and micrositing will be possible. Mitigation and management measures will be specified in the construction ESMMP to address chance finds.

There is the potential to discover chance finds throughout the construction areas, including monuments, surface artefacts or sub-surface sites, that have not yet been located. Chance finds may be accidently disturbed during construction-related activity and, as these are of unknown sensitivity, they are classified on a precautionary basis as high value (i.e. of national or international significance).

Direct impacts to previously unknown tangible cultural heritage or, of unmarked identified cultural heritage, could occur through ground disturbance activities during construction. These may include:

- Ground clearance and disturbance including vegetation clearance and grading for creation/expansion of access roads
- Heavy vehicle movements
- Accidental grading over small kurgans perceived as natural mounds
- Development of any associated infrastructure to support construction (such as a construction site office or other ancillary facilities); and
- Establishment of borrow pits

Specifically, in the WPP, these may include:

- Ground clearance and disturbance including vegetation clearance and grading for the creation of an access road and internal roads, which will include widening of existing tracks
- Heavy vehicle movements
- Burial of the collector system infrastructure/cabling (adjacent to internal roads)
- Sub-surface excavations for foundations of WTGs, BESS, onsite collecting substation and Control Building/O&M building; and
- Development of any associated infrastructure to support construction (such as a construction site office or other ancillary facilities).

Along the OHTLs, these may include:

- Ground clearance and disturbance including vegetation clearance and grading for the creation of access roads, which may include widening of existing tracks
- Heavy vehicle movements
- Sub-surface excavations for foundations of OHTL pylons; and

- Development of any associated infrastructure to support construction (such as construction site offices or other ancillary facilities).

Site preparation works will include clearing, grading and levelling of the WTG and building areas. Topsoil stripping is typically undertaken to a depth of 0.2m. Similarly, construction of access roads involves soil stripping, grading and excavation for berms and ditches where required. These actions can expose any archaeological remains that may be present, which can be affected by vehicle and plant movements through soil compaction and vibration.

Trenching for the collector system will be to a depth of approximately 0.7-1.0m, and is anticipated to lie alongside internal roads. Trenching can also expose previously unrecorded archaeological remains, which may be damaged or destroyed by excavation equipment.

Construction of foundations will involve excavation to a depth of approximately 3m (to be confirmed). For WTGs, there may be blasting required. Any archaeological remains within the footprint of each WTG would be removed as the foundations are excavated. For the OHTL foundations, conventional mechanical excavation is expected to be sufficient in most cases, estimated over an area of 5m x 5m. Any archaeological remains within the footprint of each tower would be removed as the foundations are excavated, or with pile driving. No disturbance of cultural heritage resources can occur without direction from appropriate authorities. Any heritage resource removal would need to be carried out by a licenced specialist; the development of the Project area would only be able to proceed after a thorough scientific examination of the identified historical and cultural heritage resources and their subsequent removal from the State Register, in accordance with the legal requirements for heritage protection and use in Kazakhstan.

The direct disturbance or loss of previously unidentified archaeological resources would, in the absence of mitigation, constitute a permanent and irreversible impact, potentially occurring at several localised points in the WPP and/or along the OHTL construction corridors. Although such impacts are considered unlikely, their occurrence could result in medium-magnitude effects on individual resources that may be moderate-highly sensitive, leading to a moderate-major impact significance before mitigation is applied.

A preconstruction survey will be undertaken to verify and map the extent of archaeological resources in all areas including along the segment of the Jambyl OHTL corridor located adjacent to the Berikkara burial landscape, where the alignment must follow existing infrastructure and engineered constraints. In such areas, ground disturbance will be carried out under the supervision of licensed archaeologists (e.g. KazArchaeology LLP) and in coordination with representatives of the State Cultural and Heritage Inspection. The purpose of monitoring is to identify, record and protect any previously unrecognised heritage features encountered during construction. Should pre-construction surveys confirm that avoidance and statutory buffers can be fully maintained elsewhere, archaeological monitoring may be scaled back in consultation with the competent authority.

Table 9-11: Pre-Mitigation Impact Assessment for Cultural Heritage Receptors

Activity/Impact/Aspect					
Damage, truncation or destruction of tangible cultural heritage resources from construction activities.					
Type	**Duration**	**Extent**	**Scale of Impact**	**Frequency**	**Likelihood**
Direct	Permanent	On-site/local	Distinguishable	One-off	Possible
Receptor		**Sensitivity**	**Magnitude**	**Significance of Impact**	
Kurgan WJ-05		**High**	Medium	Major	

Kurgan W-14	**High**	Medium	Major
Kurgan WJ-06	**High**	Medium	Major
Ushbas-3	Medium	Medium	Moderate
Chance finds	High	Medium	Major
Burial mounds: Jambyl OHTL corridor (J-01 – J-09; WJ-01 – WJ-06)	High	Medium	Major
Berikkara burial complex (multiple kurgans)	High	Large	Major
Burial mounds: Kentau OHTL corridor (K-01 – K-04)	High	Medium	Major

Intangible heritage

Aulie sites are non-replicable under PS 8 and should only be disturbed if unavoidable. In this case, the design has considered the locations of both the Kamar Aulie and Barga Aulie sites to prioritise avoidance, regardless of the status of their use for pilgrimage or evidence of other use for ongoing cultural practices (e.g. offerings, food, fabric ties). Kamar Aulie sacred site is considered to have high sensitivity due to its significance locally and regionally, with active use for spiritual purposes and strong cultural identity value. Barga Aulie is considered to be moderately sensitive with low/inactive use for spiritual purposes, in addition to its value as a kurgan of tangible heritage value. Local cemeteries are classified as highly sensitive, as relocation is not culturally acceptable. The Ushbas village cemetery is co-located with the Kamar Aulie site; avoidance of impacts has been prioritised for this site in the design process. The Kamar Aulie/Ushbas cemetery site is located 1,600m from the nearest WTG and the Barga Aulie-1 site is located 900m from the nearest WTG. Relocation is not required of any of these sites to implement the Project.

Construction of the project will result in changes to the environmental setting of intangible cultural heritage sites, due to visual disturbances. Chapter 13 – Landscape and Visual Impacts, describes the assessment undertaken of visual impacts of the WPP to the Kamar Aulie site. It has found that there is the potential for Project WTGs to be visible from the viewing area located above the grove component of the Kamar Aulie and Ushbas cemetery sites. As construction progresses, there will be increased visual disturbance to this site, prior to the implementation of any mitigation measures. It is noted that the viewing area of Kamar Aulie grove is somewhat shielded. It faces away from the WPP and looks north, into the grove; one of the viewing area benches has a shelter with a roof, shielding the viewer of the grove from dominant weather and the potential WPP. The Ushbas cemetery is not shielded from viewing the potential WPP.

Prior to the implementation of mitigation measures, other indirect Project impacts may result from the presence of the construction workforce. Depending on the background and experience of the workforce, they may not be aware of the significance of Aulie locations and practices and may disturb or attempt to clean up offerings at Aulie sites (as has been the case in other projects). This may also cause offence to users of the Aulie sites and consequently, negative perceptions toward the Project.

Construction activities are not anticipated to cause any disruption of access to these sites – Kamar Aulie and the Ushbas cemetery will remain accessible from the Ushbas village to the north, and the Barga Aulie site will remain accessible from the east – thus the usual intangible cultural heritage practices and cultural norms will be able to be continued. The Access road to the site has not been finalised; should the preferred location be modified, this assessment may need to be reviewed to ensure access to Aulie sites can be maintained.

The indirect disturbance to intangible cultural heritage and practices would result in an impact, prior to the implementation of mitigation measures, that are permanent (i.e. visual/environmental setting disturbance, increasing during the construction phase) to occur in a single location nearby the WPP. These impacts would be experienced at a high sensitivity site of medium impact, resulting in a major impact significance before mitigation is applied.

Activity/Impact/Aspect					
Disturbance to intangible cultural heritage practices from construction activities in WPP.					
Type	**Duration**	**Extent**	**Scale of Impact**	**Frequency**	**Likelihood**
Indirect	Short term	On-site/local	Distinguishable	Intermittent	Likely

Receptor	**Sensitivity**	**Magnitude**	**Significance of Impact**
Kamar Aulie and users	High	Medium	Major
Ushbas cemetery and users	High	Medium	Major
Barga Aulie	Medium	Medium	Moderate

9.6.2 Operations Phase

Tangible heritage

Any direct impacts on cultural heritage resources are expected to arise only during the construction phase, as no additional ground disturbance is anticipated during Project operation. In the event that such works are required, then the chance finds procedure should be reinstated for the operational phase and managed through the operational ESMMP.

Indirect impacts arising from changes to the visual environmental setting (from WTGs or pylons) are not expected to generate significant effects on tangible heritage once avoidance measures are in place. Thus, indirect impacts on these resources have been excluded from the operational phase assessment.

Activity/Impact/Aspect					
Damage, truncation or destruction of tangible cultural heritage resources from operations activities.					
Type	**Duration**	**Extent**	**Scale of Impact**	**Frequency**	**Likelihood**
Direct	Permanent	On-site/local	Distinguishable	One-off	Unlikely

Receptor	**Sensitivity**	**Magnitude**	**Significance of Impact**
Kurgan WJ-05	Medium	Medium	Moderate
Kurgan W-14	Medium	Medium	Moderate
Kurgan WJ-06	Medium	Medium	Moderate
Ushbas-3	Medium	Medium	Moderate
Chance finds	High	Medium	Major
Burial mounds: Jambyl OHTL corridor (J-01 – J-09; WJ-01 – WJ-06)	High	Medium	Major
Berikkara burial complex (multiple kurgans)	High	Large	Major
Burial mounds: Kentau OHTL corridor (K-01 – K-04)	High	Medium	Major

Intangible heritage

The Project activities during the operations phase that may result of impacts to intangible cultural heritage are from the temporary presence of maintenance workforce. The mitigation measures that will be proposed to manage these impacts will be similar to those at the construction phase for management

of workers, and are thus considered negligible after mitigation.

The enduring presence of OHTL pylons and WTGs have the potential to impact the wider environmental setting. The visual impact of the WTGs is described in Chapter 13 – Landscape and Visual impacts. For the WTGs impacting the cultural heritage setting of the Kamar Aulie and Ushbas cemetery sites, this site is highly sensitive and the impact will be permanent, resulting in a major impact significance prior to the application of mitigation measures.

Activity/Impact/Aspect					
Disturbance to intangible cultural heritage practices from operations activities in WPP.					
Type	**Duration**	**Extent**	**Scale of Impact**	**Frequency**	**Likelihood (unplanned events)**
Indirect	Permanent	On-site/local	Distinguishable	Intermittent	Likely

Receptor	**Sensitivity**	**Magnitude**	**Significance of Impact**
Kamar Aulie and users	High	Medium	Major
Ushbas cemetery and users	High	Medium	Major
Barga Aulie	Medium	Medium	Moderate

9.7 Mitigation, Management and Residual Impacts

Mitigation measures will be implemented to address the potential adverse impacts to cultural heritage during construction and operations phases, as follows.

9.7.1 All cultural heritage resources

The Project commits to conducting pre-construction cultural heritage field surveys across all areas of planned disturbance not fully covered by the current baseline studies. This commitment ensures that the mitigation hierarchy will continue to be applied and both statutory buffers (120m) and impact avoidance principles are maintained, including where there are any changes in layout of any project components.

A cultural heritage awareness program will be implemented for all on-site staff and contractors. This will be required prior to commencement of early works in pre-construction phase, such that all staff are aware of requirements prior to any site disturbance/as part of inductions, applicable during construction and operations phases. National specialists in archaeology and ethnography are recommended to be involved in the development of training material.

Mandatory training modules will cover aspects including but not limited to: identification of kurgans and burial mounds; why these are sensitive sites; explanation of why Aulie sites are to be avoided; roles and responsibilities for tangible and intangible heritage; prohibitions on climbing, stealing from and cleaning up of mounds/offerings thereon; and disciplinary actions in the event of any breaches.

9.7.2 Construction

The priority for tangible and intangible heritage is avoidance of direct impacts and physical preservation in-situ, as is embedded in the design of the Project. All kurgans and burial sites identified within the Project area, including those with Aulie status, will be avoided through design wherever technically feasible.

The Construction ESMMP will specify the actions and measures required to manage cultural heritage

risks and impacts effectively during the construction phase. It will define roles and responsibilities for implementing mitigation and management measures and set out procedures to protect known cultural heritage sites, such as clearly marking and demarcating existing features.

For the OHTL, the siting rule requires that the distance to the tower footing must be at least 40 m. This area is designated as a red buffer zone (strict protection zone). A burial mound or kurgan may be located between the OHTL towers, provided that the minimum distance of at least 40 metres from the nearest tower is maintained. If the kurgan falls within this distance, the area must be classified as a high-risk (red buffer) zone and subject to appropriate protection measures. Placement of OHTL tower footings within this minimum distance is to be avoided wherever technically feasible, such as through increase in line spans.

Physical protection measures will be applied. Protection buffers of 120 m will be applied to all archaeological sites with no-go zones delineated and integrated into construction planning; the EPC will receive GIS constraints maps for final design, the ESMMP and land entry processes. Additionally, fencing, stakes or rope barriers with warning signs will be applied around burial mounds at a close distance to the burial mounds, as a 'last resort' physical barrier. Traffic routes will be delineated to avoid potential interactions with sensitive sites. Where any buffer zones cannot be determined or are in doubt, local Akimats and elders are to be consulted to confirm appropriate buffer distances.

In accordance with the Sanitary Rules "Sanitary and Epidemiological Requirements for Cemeteries and Burial Facilities" (Order of the Minister of Health No. RoK DSM-81 dated 19 August 2021), sanitary protection zones must be established around cemeteries. The Sanitary Rules specify that the construction and placement of residential buildings and public facilities is prohibited within a 300-metre radius of a cemetery boundary. The Rules do not include restrictions for overhead transmission lines (OHTLs) or other linear infrastructure, and therefore the installation of power transmission facilities within this distance is not expressly prohibited under national sanitary legislation. However, in line with international good practice and community sensitivities, the Project has applied avoidance and minimisation measures, and the OHTL alignment avoids direct physical intrusion into the known cemetery boundaries/contemporary burial areas. Any activities within proximity to burial sites will be managed under the Cultural Heritage Management Plan and Chance Finds Procedure.

Prior to construction, targeted pre-construction surveys will be undertaken for any new or revised infrastructure footprints, including new or widened access roads, underground cable routes, the substation area, the BESS platform, O&M facilities, laydown areas and any other areas not previously subject to field investigation. These surveys will verify whether archaeological or other tangible cultural heritage resources are present and will inform avoidance decisions.

Findings from these surveys will be integrated into the Project's GIS constraints mapping, ESMMP updates and final design, ensuring that legally protected buffer zones are respected, and that micro-siting and construction planning are adjusted where necessary to avoid impacts on archaeological and cultural heritage receptors.

Chance finds monitoring is to be conducted by a licenced archaeologist, who is to be present during earthworks in sensitive areas. Monitoring will include a watching brief for unexpected chance finds and documentation of any features exposed during foundation, cable trenching, road cuts or other earthworks.

A Chance Finds Procedure must be prepared pre-construction and remain in place for the lifetime of the

Project. The Procedure will document the necessary mitigations in the event of any accidental damage of both surface and sub-surface tangible cultural heritage resources, including possible human remains. The ESMMP will require that all staff receive cultural heritage induction which will include essential messages on how to address cultural heritage discoveries during Project activities when a cultural heritage expert is not present. In the event of a chance find, an immediate stop-work order will be applied, with notifications to site supervisors, the cultural heritage specialist and Akimat. Controlled access to the site will be put in place to ensure potential damage to the site is minimized, while cultural heritage specialists determine the significance and required mitigation measures to be applied. Approval from the cultural heritage authority must be obtained before works can recommence, as to be documented in the Procedure.

Full avoidance of archaeological sites is expected to be achievable through micrositing of WTGs and OHTL towers, or line span changes for OHTL towers, as necessary. Salvage excavations are only to be conducted as a last resort, and under formal authorization from the regional Akimat cultural heritage department. Where ground disturbance is unavoidable, any salvage excavation must be conducted by a licenced archaeological organization with a detailed excavation, recording and artefact custody plan in place.

Kamar Aulie sacred site is recognised as one of the most culturally significant heritage places within the Project area. It is an actively used pilgrimage site associated with living religious and spiritual practices, community identity and oral tradition. Under IFC Performance Standard 8, Kamar Aulie is categorised as *critical* and *non-replicable* heritage due to its spiritual role, continuing cultural use, and the cultural sensitivity of the associated Ushbas cemetery. As such, avoidance and respectful management are prioritised for this site, and engagement with local custodians, village representatives and Akimat authorities is required throughout construction and operation. Landscape and visual impacts are further assessed in Chapter 13 (Landscape and Visual). Cultural Heritage Impact Assessment incorporates relevant output from that study, particularly viewpoints relevant to Kamar Aulie.

Specific to the Kamar Aulie site where impacts at the grove viewing platform may be experienced, a program of engagement to determine specific mitigation measures are to be implemented after any removal of WTGs has been completed in design, once the WTG layout is finalized. This should be conducted by the CLO with support of a national cultural heritage expert, and may include engagement with the site caretaker, Akimat, users of the Aulie site and other interested stakeholders, in designing appropriate mitigation measures (e.g. tree planting on the south side of the viewing area, to create a quiet buffer zone; documenting oral histories of the use of the site by appropriately qualified specialists; design and installation of interpretation boards/signage about the site, if deemed appropriate).

Ongoing engagement with local communities will be required to confirm predicted Project effects and to identify and address any unforeseen cultural heritage impacts that may arise during implementation, such as impacts on local intangible heritage or visual disturbance, or where access roads may change and consequently, impact access by Aulie users to those sites. This continued engagement will be undertaken in alignment with the Project's Stakeholder Engagement Plan (SEP) and Grievance Mechanism, and is to monitor and confirm that mitigation actions are respectfully conducted and meet acceptable practices within the community, and address these where improvements are required.

9.7.3 Operations Phase

It is unlikely that excavation works will be conducted during the operations phase, thus no additional mitigation measures are proposed. The Chance Find Procedure must continue to be applied for the

operations phase activities and managed through the Operations ESMP.

Ongoing engagement in line with the Stakeholder Engagement Plan should continue during operations; this engagement should verify that mitigation measures continue to be appropriate to the impact experienced. Where necessary, additional or modified site-specific mitigation measures should be implemented, e.g. planting to screen particular project features, which may be recommended by stakeholders.

The following Table 9-12 summarises the mitigation and management measures proposed for identified receptors during construction phase activities.

Table 9-12: Summary of Mitigation and Management Measures for Cultural Heritage Receptors During Construction

Sensitive Receptor	Pre- mitigation	Mitigation and Management Measures	Residual Significance
General – applies to all cultural heritage receptors during the construction phase	-	• Include cultural heritage in the CLO communication plan, disclosing and communicating simple fact sheet content explaining how the Project is managing potential impacts to tangible and intangible cultural heritage. • Conduct regular engagement and sensitisation of the Project grievance mechanism to monitor that the Project's mitigation actions are respectfully conducted and meet acceptable practices within the community, and address any areas where improvements are required • Preparation and implementation of the Construction ESMMP, specifying roles and responsibilities for mitigation and management measures. The ESMMP will include: the requirement to conduct pre-construction surveys (of previously unsurveyed areas only) prior to ground clearance, constraints maps and applicable buffer areas, Chance Find Procedure, Cultural Awareness Training programme, ongoing stakeholder engagement (with both statutory agencies and communities) • Preparation of a cultural awareness programme for all on-site staff and contractors, to be prepared by national specialists and delivered to all staff prior to commencement of early works in pre-construction phase/as part of inductions. • Avoidance through design applied to final placement of WTGs and OHTLs by the EPC, including application of micrositing and adjustment of line spans where technically feasible • Ongoing engagement with Akimat as the responsible entity for approving the protection and buffer zones, supervising compliance, and ensuring that preservation measures are upheld during project implementation. • Application of physical protection measures: no-go zones incorporated into GIS constraints maps, the ESMMP and land entry processes • Preparation and implementation of a Chance Finds Procedure bespoke to the Project to remain in place for the life of the Project; the Chance Finds Procedure shall be included in the project ESMMP, and will include, inter alia, legislative requirements, chain of custody information for any finds.	-

Sensitive Receptor	Pre- mitigation	Mitigation and Management Measures	Residual Significance
Kurgans WJ-05, W-14, WJ-06 and Ushbas-3	Moderate	• Avoidance through design applied to final placement of WTGs and OHTLs by the EPC, including application of micrositing and adjustment of line spans where technically feasible • Preparation and implementation of the Construction ESMMP, specifying roles and responsibilities for mitigation and management measures • Fencing, stakes or rope barriers as last resort physical barriers • Delineation of traffic routes to avoid interaction with sites • Engagement with Akimats, local elders or other key informants where any appropriate buffer distances are in doubt or unclear • Archaeological monitoring by licenced archaeologist during earthworks in sensitive areas and a watching brief for chance finds during foundation, cable trenching, road cuts and other earthworks	Minor
Burial mounds in Jambyl and Kentau OHTL corridors, and any Chance Finds (worst-case scenario of high sensitivity sites)	Major	• Avoidance through design applied to final placement of WTGs and OHTLs by the EPC, including application of micrositing and adjustment of line spans where technically feasible; avoidance through micrositing of OHTL footings must be achieved in the Berikkara burial complex area given site sensitivity. • Preparation and implementation of the Construction ESMMP, specifying roles and responsibilities for mitigation and management measures • Fencing, stakes or rope barriers as last resort physical barriers • Delineation of traffic routes to avoid interaction with sites • Engagement with Akimats, local elders or other key informants where any appropriate buffer distances are in doubt or unclear • Archaeological monitoring by licenced archaeologist during earthworks in sensitive areas and a watching brief for chance finds during foundation, cable trenching, road cuts and other earthworks	Minor
Kamar Aulie and Ushbas Cemetery and users	Major	• With support from a national cultural heritage expert, CLO to implement a program of engagement with the site caretaker, Akimat, identified site users and other key informants to determine specific mitigation measures once the WTG layout has been finalised and construction completed (e.g. tree planting to establish a quiet buffer zone; taking oral histories; preparing and installing interpretation boards). • CLO to maintain periodic engagement with residents villages in the WPP vicinity, particularly Ushbas, and any identified site users to allow reporting of any concerns.	Moderate

Sensitive Receptor	Pre- mitigation	Mitigation and Management Measures	Residual Significance
Barga Aulie	Moderate	• CLO to maintain periodic engagement with residents of villages in the WPP vicinity and any identified site users to allow reporting of any concerns.	Negligible - Minor

The following Table 9-13 summarises the mitigation and management measures proposed for identified receptors during operations phase activities.

Table 9-13: Summary of Mitigation and Management Measures for Cultural Heritage Receptors During Operations

Sensitive Receptor	Pre- mitigation	Mitigation and Management Measures	Residual Significance
General – applies to all cultural heritage receptors during the operations phase	-	• Include cultural heritage in the CLO communication plan, disclosing and communicating simple fact sheet content explaining how the Project is managing potential impacts to tangible and intangible cultural heritage. • Conduct regular engagement and sensitisation of the Project grievance mechanism to monitor that the Project's mitigation actions are respectfully conducted and meet acceptable practices within the community, and address any areas where improvements are required. Where identified, specific site-based mitigations may be implemented in consultation with stakeholders, e.g., planting or screening of particular project features • Implementation of a cultural awareness programme for all on-site staff and contractors, to be prepared and implemented as part of site-based inductions prior to operations activities. • Preparation and implementation of the Operations ESMP, specifying roles and responsibilities for mitigation and management measures • Preparation and implementation of a Chance Finds Procedure to remain in place for the life of the Project, updated appropriately to operations phase activities.	-
Tangible cultural heritage sites	Major	• Enforce buffer zones and no-go areas for operations phase maintenance activities including maintenance laydown areas (e.g. demarcation in GIS systems, O&M maps, field markers as necessary during physical maintenance activities) • Development and implementation of OHTL maintenance procedures that explicitly restrict off-track vehicle movement, prohibit ground disturbance near	Minor

Sensitive Receptor	Pre- mitigation	Mitigation and Management Measures	Residual Significance
		cultural heritage sites, and require use of existing access tracks where these are available • Use of low-impact techniques as far as practicable, e.g. drone based inspection to reduce ground presence • Avoid vegetation clearance that exposes sites to erosion and maintain natural screening where feasible	

Overall, with the implementation of the proposed mitigation and monitoring measures, residual cultural heritage impacts across all receptors are assessed as minor or negligible, and no significant adverse effects are expected during the operational phase of the Project except at Kamar Aulie and Ushbas Cemetery which is assessed as moderate due to intrusion of WTGs. Layout refinement of WTGs is expected to reduce the intrusion of WTGs at this site and participatory processes to identify culturally appropriate, ongoing mitigations measures - with inputs from cultural heritage experts, CLO, Kamar Aulie site caretaker and site users as appropriate - that are agreed and implemented upon finalization of the WTG layout.

10 Biodiversity assessment[156]

10.1 Applicable Requirements & Standards

10.1.1 National Regulations

This section summarises the key national legal requirements relevant to biodiversity and ecosystem protection in the Republic of Kazakhstan.

The environmental legislation of the Republic of Kazakhstan is based on the Constitution of the Republic of Kazakhstan and consists of Environmental Code and other regulatory legal acts of the Republic of Kazakhstan.

Environmental Code

The Environmental Code of the Republic of Kazakhstan[157] (No. 400-VI, 2 January 2021) establishes the national framework for environmental protection and regulates environmental assessment, environmental permitting and related compliance requirements. The planned activity must follow the procedures and documentation requirements set by the Code and relevant implementing orders adopted under it.

Biodiversity, fauna and flora protection

Biodiversity protection obligations are set out in sectoral legislation covering flora, fauna, and the conservation regime for rare and endangered species and their habitats, including:

- Law "On the Plant World"[158] (No. 183-VII, 2 January 2023) – protection, use and restoration of wild plants and their habitats, including restrictions for rare and endangered species.
- Law "On Protection, Reproduction and Use of the Animal World"[159] (No. 593-II, 9 July 2004) – requirements for activities affecting wildlife, including protection of habitats, breeding sites, migration routes and aggregation areas.
- Law "On Specially Protected Natural Territories"[160] (No. 175-III, 7 July 2006) – categories of protected areas and applicable protection regimes.
- Government Resolution approving the Red Book of the Republic of Kazakhstan[161] (Resolution No. 734, 31 October 2012) – national list of rare and endangered species; any handling (capture, relocation, disturbance) requires authorisations under applicable legislation.

International conventions relevant to biodiversity

Kazakhstan is a Party to international agreements relevant to biodiversity, including:

- Convention on Biological Diversity (CBD)[162]. Kazakhstan has been a Party to the CBD since 5 December 1994.

[156] Please note that this Biodiversity ESIA Chapter was revised by Milvus – Consultancy in Nature Protection, while the Critical Habitat Assessment (CHA) was prepared by Turnstone Ecology. These documents constitute specialist inputs developed by the respective firms.
[157] Environmental Code (No. 400-VI, 02.01.2021): https://adilet.zan.kz/eng/docs/K2100000400
[158] Law "On the Plant World" (No. 183-VII, 02.01.2023): https://adilet.zan.kz/eng/docs/Z2300000183
[159] Law "On the Animal World" (No. 593-II, 09.07.2004): https://adilet.zan.kz/eng/docs/Z040000593_
[160] Law "On Specially Protected Natural Territories" (No. 175-III, 07.07.2006): https://adilet.zan.kz/eng/docs/Z060000175_
[161] Red Book approval (Resolution No. 734, 31.10.2012): https://adilet.zan.kz/rus/docs/P1200000734
[162] CBD (Kazakhstan profile): https://www.cbd.int/countries/profile/?country=kz

- CMS/Bonn Convention (migratory species). Kazakhstan is listed as a CMS Party[163] (since 1 May 2006). CMS provides a global framework for conserving migratory species and their habitats; Parties are expected to protect listed migratory species and address threats including obstacles along migration routes.
- Ramsar Convention on Wetlands[164]. Kazakhstan has been a Contracting Party since 2 May 2007.
- UNECE Aarhus Convention (access to info, public participation, justice). [165] Kazakhstan ratified the Aarhus Convention on 11 January 2001.

10.1.2 Lender Requirements

International Finance Corporation (IFC)

IFC Policy on Environmental and Social Sustainability (2012) sets out a series of Performance Standards (PS). The PS relating to biodiversity is PS6, summarized below:

PS 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources

This PS addresses how clients can sustainably manage and mitigate impacts on biodiversity and ecosystem services based on the Convention on Biological Diversity. It requires adequate assessment of local biodiversity and living natural resources, including the identification of protected areas, habitats and species. Where appropriate, ecological management measures should be implemented to ensure the avoidance, minimisation or restoration of impacts on local biodiversity and ecosystem services.

Development projects should also adopt a practice of adaptive management in which the implementation of mitigation and management measures are responsive to changing conditions and the results of monitoring throughout the project's lifecycle.

Based on our initial review of the Project, we consider that it would be categorized as Category A Project: "Business activities with potential significant adverse environmental or social risks and/or impacts that are diverse, irreversible, or unprecedented." As defined by IFC under IFCs Policy on Environmental and Social Sustainability.

World Bank Group Guidelines

The IFC PSs refer to the World Bank Group (WBG) Environment, Health and Safety (EHS) Guidelines as general guidance for implementing GIIP. The EHS Guidelines applicable to the Project include the following:

- WBG General EHS Guidelines (April 2007) – cover the four areas of the environment; Occupational Health & Safety (OHS); Community Health & Safety (CHS); construction and decommissioning;
- WBG EHS Guidelines for Wind Energy (IFC, 2015);
- WBG EHS Guidelines Electric Power Transmission and Distribution (April 2007).

[163] CMS (Bonn Convention) – CMS legal instrument list (shows Kazakhstan as Party since 01 May 2006): https://www.cms.int/legalinstrument/cms
[164] Ramsar (Kazakhstan profile): https://www.ramsar.org/country-profile/kazakhstan
[165] Aarhus Convention parties (UN Treaty Collection entry showing Kazakhstan): https://treaties.un.org/Pages/ViewDetails.aspx?chapter=27&mtdsg_no=XXVII-13&src=IND

The WBG EHS Guidelines for Wind Energy define the environmental impacts associated with the construction, operation, and decommissioning of wind energy facilities activities including impacts on the physical environment (such as landscape, visual impacts, noise, shadow flicker, water quality) and biodiversity (affecting birds and bats).

Asian Infrastructure Investment Bank (AIIB)

The AIIB applies its Environmental and Social Framework (ESF, 2024), which sets out the environmental and social requirements applicable to AIIB-financed projects through a set of Environmental and Social Standards (ESS).

The ESF does not include a standalone standard specifically dedicated to biodiversity conservation. Biodiversity-related risks and impacts are addressed primarily under ESS 1 - Environmental and Social Assessment and Management, which requires the identification, assessment, and management of environmental risks and impacts, including those related to habitats, species, and ecosystem services.

Equator Principles

The Equator Principles (EP) is a risk assessment framework used by financial institutions to determine, assess and manage the environmental and social risk in Projects financing.

The purpose of the Equator Principles is to enable the Equator Principles Financial Institution ('EPFI') signatories to encourage their clients to address potential or actual adverse risks and impacts identified during the Project development lifecycle, and to ensure projects are developed in a manner that is socially responsible and reflects sound environmental management practices. The Equator Principles are intended to serve as a common baseline and framework for EPFIs to identify, assess and manage environmental and social risks when financing Projects. 131 financial institutions globally are Signatories to the Equator Principles.

The EP4 represents the latest update which was released on 18/11/2019 and came into force on all mandated transactions on 01/10/2020. EP4 comprises 10 core principles, as follows:

- Principle 1: Review and categorization;
- Principle 2: E&S Assessment;
- Principle 3: Applicable E&S Standards;
- Principle 4: E&S Management System and EP Action Plan;
- Principle 5: Stakeholder Engagement;
- Principle 6: Grievance Mechanism;
- Principle 7: Independent Review;
- Principle 8: Covenants;
- Principle 9: Independent Monitoring and Reporting;
- Principle 10: Reporting and Transparency.

The Project is considered a Category A Project under the Equator Principles version 4: "Projects with potential significant adverse environmental and social risks and / or impacts that are diverse, irreversible or unprecedented."

As such, it must apply the requirements of the applicable IFC PS and WBG EHS Guidelines as defined above. The project must also implement effective stakeholder engagement, grievance management and an Environmental and Social Management System (ESMS).

10.2 Biodiversity receptors and sensitivity

10.2.1 Definition of biodiversity receptors

For the purposes of this assessment, a biodiversity receptor is defined as a discrete ecological unit that may be affected by the Project within the Area of Influence (AoI). Receptors are identified based on baseline findings and the ecological context of the site.

Receptors may be defined as:

- Species, where the assessment concerns the species occurring within the AoI;
- Populations, where a distinct local, regional, or national population is relevant to impact evaluation;
- Functional population units, such as breeding populations, migratory populations, wintering aggregations, lekking groups, or roosting colonies, where ecological function within the AoI differs;
- Habitats or ecological features, including priority habitats, ecological corridors, wetlands, or specific habitat features of conservation importance.

Receptors are defined at the ecological level most relevant to the predicted impact, ensuring that demographic and functional relevance are appropriately captured.

10.2.2 Receptor sensitivity

Sensitivity reflects the intrinsic ecological value and vulnerability of the defined receptor, independent of the characteristics of the Project or the likelihood of interaction with specific infrastructure components.

Sensitivity is determined through consideration of:

- Conservation value, including global and national conservation status, legal protection, and Critical Habitat (CH) status under IFC PS6;
- Ecological vulnerability, including biological resilience, reproductive rate, recovery potential, and population structure;
- Site dependence, reflecting the importance of the AoI to the receptor's population or lifecycle (e.g. breeding, migration, wintering, corridor function).

Receptors triggering Critical Habitat under IFC PS6 are assigned High sensitivity.

In this step, receptors that haven't been recorded during the baseline studies have been screened out from the detailed impact assessment, as no evidence of use of the AoI and no plausible functional role was identified; these receptors are therefore not expected to be affected by Project-related impacts beyond negligible levels. Additionally, to ensure a proportionate assessment, common species recorded in very low numbers during baseline surveys were screened prior to the detailed impact assessment. Where the number of individuals recorded within the AoI represents an extremely small fraction of the species' national or global population (e.g. well below 0.01%), and no breeding sites, roosts, leks, or other key ecological functions were identified within the Project area, the site is not considered to support a population of ecological significance.

Such species are reported in the baseline but were not carried forward into the detailed sensitivity

and impact significance assessment, allowing the analysis to focus on receptors for which the Project area may represent a meaningful ecological resource.

Sensitivity is assigned once per receptor and remains constant across all impact pathways (e.g. habitat loss, collision risk, disturbance). Project-specific factors such as collision probability, flight height, spatial overlap with infrastructure, or predicted fatalities are considered under impact magnitude. All sensitivity scores are presented in the Annex B

This separation ensures methodological clarity, avoids double-counting of risk, and supports a transparent and proportionate evaluation of impact significance.

Receptor magnitude scoring is described in Chapter 4.

10.3Baseline Conditions

10.3.1 Protected areas and Key Biodiversity Areas (KBA)

Kazakhstan's national system of designated conservation areas covers approximately 29.3 million hectares, equivalent to more than 10% of the country's terrestrial surface. This broad figure includes all areas that have been identified or delineated at the national level for conservation purposes, regardless of their legal status or management regime.

Within this broader system, a subset of areas holds formal legal protection under national legislation — these are classified as legally protected areas (LPAs) in line with the definition used in IFC Performance Standard 6. LPAs in Kazakhstan span about 8 million hectares, or 2.9% of the country’s land area, and include the following site types:

- 10 state nature reserves,
- 14 national parks,
- 7 nature reserves,
- 50 state wildlife sanctuaries,
- 5 protected zones,
- 6 state botanical gardens,
- 1 dendrological park, and
- 25 local natural monuments.

In addition to its national protected area network, Kazakhstan also recognizes the importance of bird conservation through the identification of Important Bird and Biodiversity Areas (IBAs). A total of 127 IBAs have been identified, covering 15,414,627 hectares or approximately 6% of Kazakhstan’s land area. These areas are critical for the protection of globally threatened and biome-restricted species, with 117 IBAs meeting the criteria for globally threatened species and 58 for biome-restricted species. IBAs represent one type of internationally recognized Key Biodiversity Area (KBA), as defined by the IUCN KBA Standard. Other types of KBAs include Alliance for Zero Extinction (AZE) sites, UNESCO World Heritage sites (biodiversity and mixed values), and RAMSAR wetlands, many of which are recognized and considered by international financial institutions.

The Project’s infrastructure footprint in relation to a variety of LPA, KBA, and other sensitive biodiversity areas is shown in Figure 1.

The cluster of overlapping grey circles (wind turbine locations) shows the location of the wind farm (WPP), itself. The blue, yellow, and red lines extending to the southeast and to the north and west of the WPP area show the locations of the Project OHTL interconnection segments. The IBAT polygon was hand-drawn to include the entire wind farm plus the entirety of these OHTL segments. Various protected areas, including Important Bird Areas (IBA), Legally Protected Areas (LPA), and several other areas delineated for biological protection are also shown (see legend and text).

Eighteen areas designated either as LPA, KBA, or both were identified within 50 km of the WPP site (Figure 2, Figure 3).

The Project does not overlap any KBAs. The nearest KBA is the Arystandy Important Bird Area (IBA KZ073), located approximately 14 km to the west of the wind farm area. This KBA has been designated by BirdLife International on the basis of supporting wintering concentrations of 123-500 Great Bustards (*Otis tarda*, IUCN EN, Kazakh CR/EN).

The small IBA located to the north of the northern portion of Kentau OHTL is the Kyzylkol Lake IBA[166], which has been designated by BirdLife International on the basis of this reservoir supporting migratory (stopover) concentrations of up to 70,000 Common Pochards (*Aythya ferina*, IUCN VU, Kazakh unlisted), 1,500 Eared Grebes (*Podiceps nigricollis*, IUCN LC, Kazakh unlisted), 2,500 White-headed Ducks (*Oxyura leucocephala*, IUCN EN, Kazakh Endangered), 10,000 Garganey (*Spatula querquedula*, IUCN LC, Kazakh unlisted), 3,000 Ruddy Shelduck (*Tadorna ferruginea*, IUCN LC, Kazakh unlisted), 50,000 Eurasian Coot (Fulica atra, IUCN LC, Kazakh unlisted), 1,000 Dalmatian Pelican (*Pelecanus crispus*, IUCN NT, Kazakh Vulnerable), and 20,000 waterbirds. More precise measurement indicates that the OHTL segment (red line in Figure 1) comes no closer than 2.5 km to the boundary of this IBA, as defined by BirdLife International., and no closer than 4.5 km to Kyzylkol Lake, itself. At this distance, this OHTL option has little likelihood of significantly impacting the birds that utilize this IBA, though some risk of collision impacts is possible, particularly for migrating waterbirds passing through the area.

No AZE sites are located near the Project area.

[166] https://datazone.birdlife.org/site/factsheet/kyzylkol-lake accessed 9 April 2025

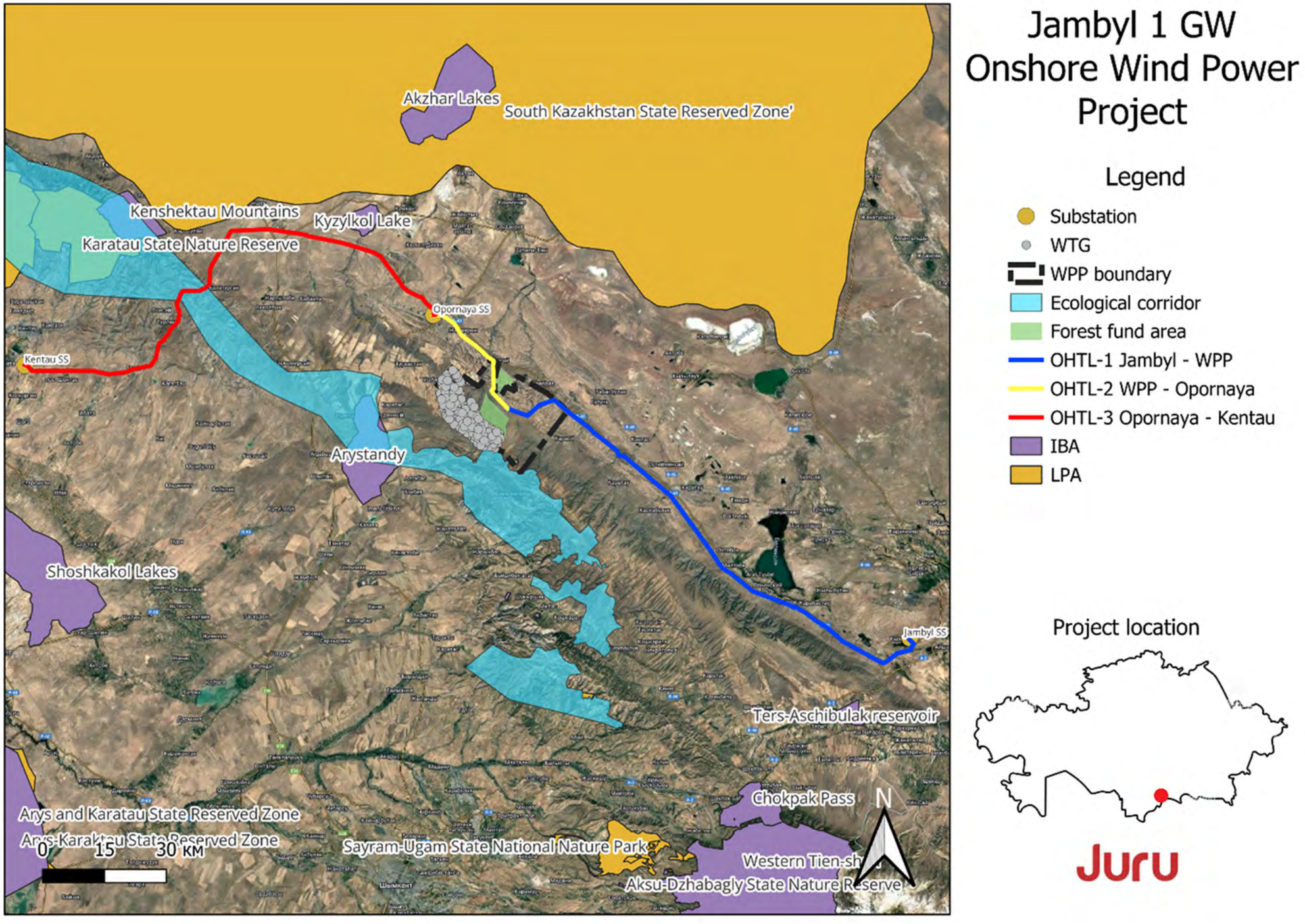


Figure 10: Location of Jambyl Wind Project infrastructure in relation to Biodiversity Protection Areas

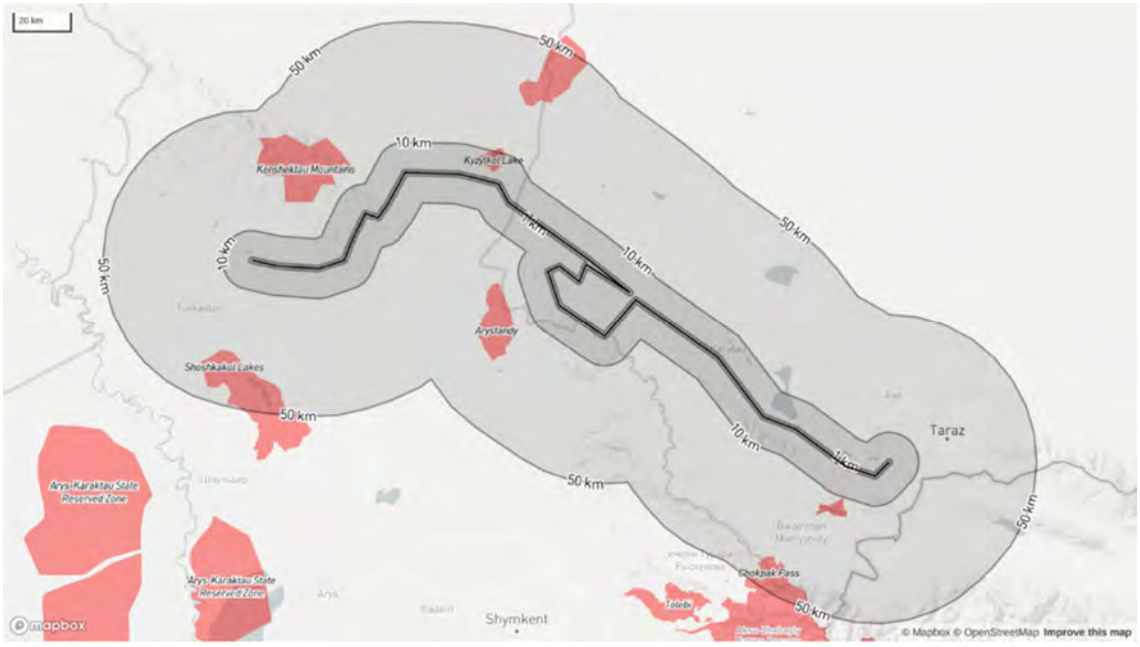


Figure 11: Location of the Jambyl wind project area plus OHTL interconnection segments (dark gray polygon) in relation to internationally recognized Key Biodiversity Areas (KBA, pink areas), according to the IBAT database (from IBAT report dated 2 April, 2025)

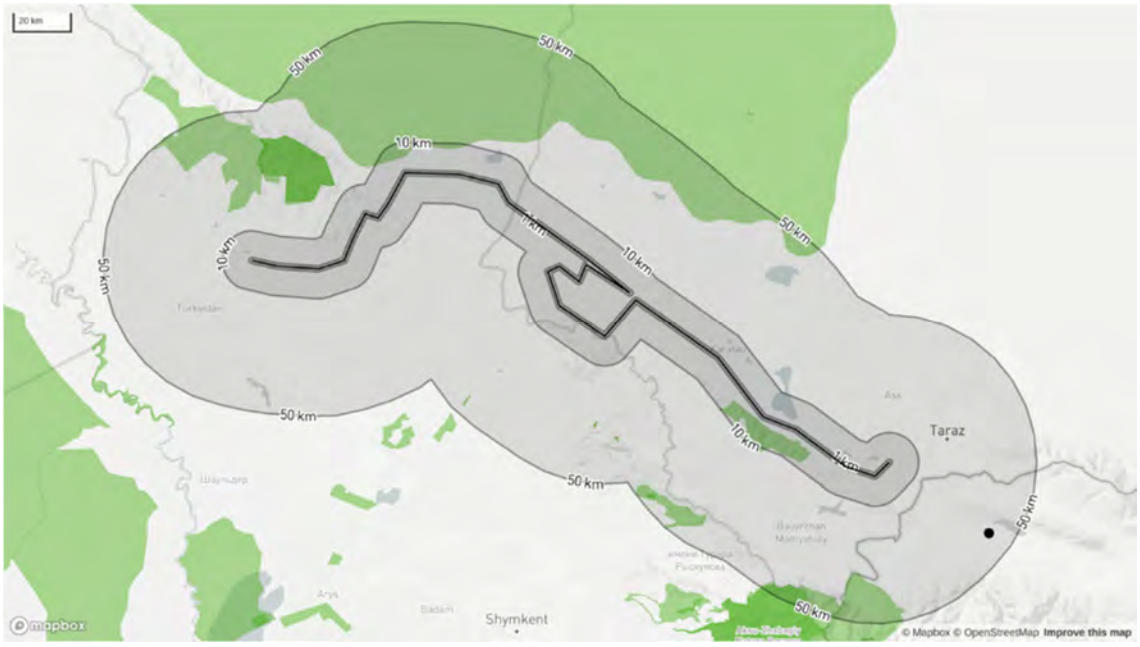


Figure 12: Location of the Jambyl wind project area and OHTL interconnection segments (dark gray polygon) in relation to Legally Protected Areas (LPA, green areas), according to the IBAT database (from IBAT report dated 2 April, 2025).

The Project does not overlap with any LPAs (see Figure 3 above). The nearest LPA is the "Berkara tract" State Nature Sanctuary, which comes within roughly 2 km of one stretch of the Project's southern

OHTL segment. This LPA, classified as a class IV LPA according to the IUCN rubric, is located > 40km from the wind farm area, and encompasses a portion of Karatau mountain range highlands. It is a complex protected area designated for the conservation of natural landscapes and biodiversity as a whole, rather than for a single species. The OHTL will pass along a major road along the lowland plain that lies immediately to the east of this reserve, and will not impact this LPA, as it will not impact any of the highland areas of the Karatau mountains within, or in the vicinity of the LPA.

In addition to the internationally recognized protected areas and biodiversity designations identified through the IBAT database, several areas with national or local regulatory or land-use designations are located in close proximity to, or partially overlapping with, the Project area. The location of these areas in relation to the Project infrastructure is shown in Figure 1. These include an ecological corridor designated for migratory movements of the Karatau mountain subspecies of Argali (Ovis ammon nigrimontana; blue polygon in Figure 1) and a Forest Fund area comprising two separate polygons immediately north of the WPP area (light green polygons in Figure 1). Information on the status and function of these areas has been obtained through consultations with relevant regional environmental and land-use authorities and is summarized below.

- Ecological corridor (blue polygon in Figure 1): The ecological corridor was established in 2017 by local authorities (Resolution No. 149) to facilitate seasonal migratory movements of the Karatau Argali and is recognized under Articles 80 and 81 of the Law of the Republic of Kazakhstan “On Specially Protected Natural Areas” as an element of the national ecological network. In accordance with this legislation, ecological corridors are subject to site-specific management and use requirements defined through an officially approved passport. To date, such a passport has not been adopted for this corridor, and no specific land-use restrictions or formal regulatory requirements are currently in force beyond the general provisions of national environmental legislation.

- Forest Fund area (light green polygons in Figure 1): The Forest Fund area represents a land-use classification applied by Kazakh authorities and does not constitute a legally protected area. No forested habitats are currently present within these polygons, with vegetation limited to narrow strips of shrubs and scattered trees confined to canyon bottoms. According to information provided by local residents and the local biodiversity expert (Igor Karyakin), extensive wildfires in the 1990s resulted in the loss of forest cover across this area, and forest regeneration has not occurred since that time. Consequently, the current Forest Fund classification reflects historical land-cover conditions rather than the present ecological state of the area.

10.3.2 Avifauna (birds)

In the Republic of Kazakhstan, about 530 bird species nest and are encountered during migration, 32 of which are globally threatened. 57 species are included in the Red Book of Kazakhstan. With its vast territory of 2.8 million km² and diverse landscapes, Kazakhstan hosts a wide variety of breeding and wintering bird species, and is also a region where two important migratory bird flyways converge: namely the Central Asian-Indian and the West Asian-African (Figure 4). Millions of birds flying along these routes use Kazakhstan's territory for moulting and stopovers during migration[167].

[167] Research on Important Bird Areas in Kazakhstan and Middle Asia. / Ed. S.L. Sklyarenko. - Almaty, 2006. - 227 p.

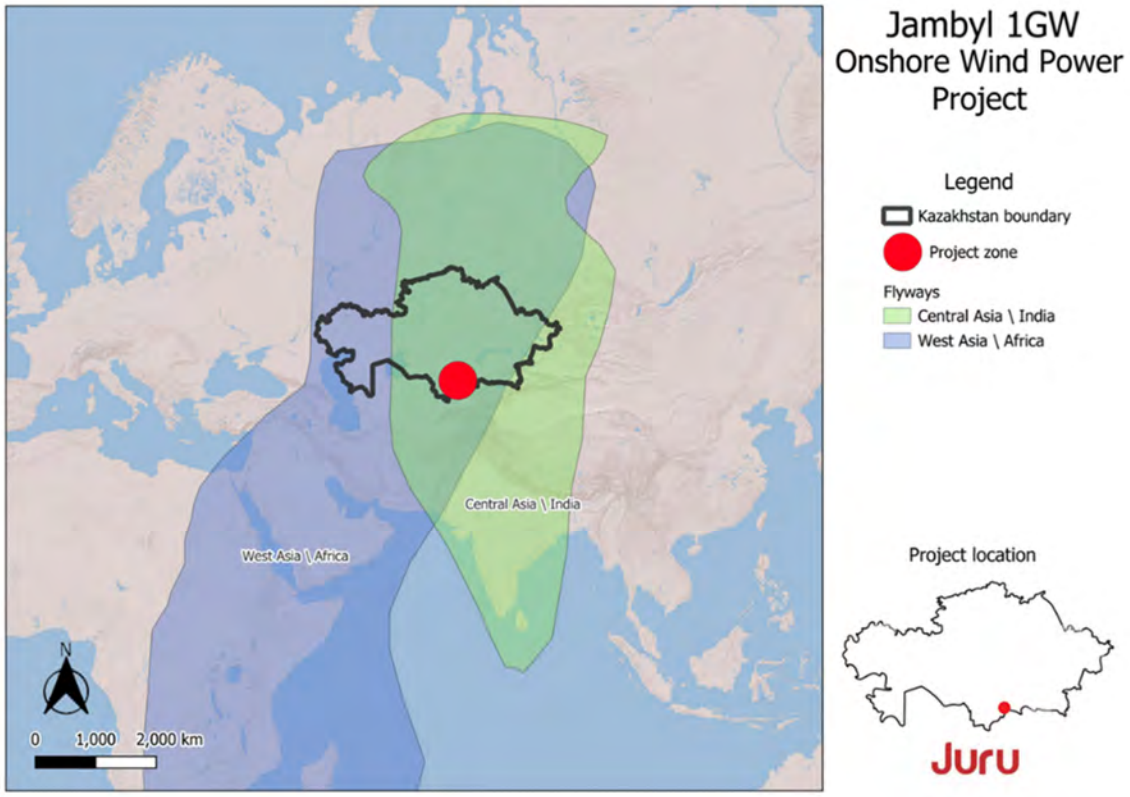


Figure 13: Central Asian-Indian and the West Asian-African flyways in relation to Kazakhstan and the Project site[168]

Rigorous characterization of the avifauna of the Project area was a major focus of the biodiversity baseline studies that support this ESIA, as certain groups of birds, including a variety of sensitive species that occur within the Project region, are known to be susceptible to adverse impacts generated by wind energy and powerline projects[169], especially direct mortality of birds during projects' operational phase, when birds may be killed either when they collide with project infrastructure (wind turbine rotors, towers, and OHTL) or they may be electrocuted when they perch on overhead powerlines[170]. Birds may also experience additional impacts from wind energy projects, including displacement, habitat loss, harassment/poaching, direct mortality from collision with vehicles, and others.

In order to characterize potential exposure and evaluate risk of birds' collisions with the Project's wind turbines, a variety of specific baseline survey methodologies targeted at priority bird taxa, especially bustards, raptors, vultures, other large soaring birds, and large-bodied migratory waterbirds, was implemented.

The primary baseline survey methodology that was implemented to characterize use of the Project's

[168] Conservation of Arctic Flora and Fauna, CAFF 2013 - Akureyri. Arctic Biodiversity Assessment. Status and Trends in Arctic biodiversity. - Birds (Chapter 4) page 146
[169] Karyakin I. V., K. I., Khizhov, E. G. Nikolenko, E. P. Shnayder, G. I. Pulikova, A. G. Kaptyonkina, 2024. Golden Eagle in Karatau and Chu-Ili Mountains (Kazakhstan) and assessment of risks to its populations from developing wind energy. Raptors Conservation 48:11-98. DOI:10.19074/1814-8654-2024-48-11-99.
[170] Lehman, R. N., Kennedy, P. L., & Savidge, J. A. (2007). The state of the art in raptor electrocution research: A global review. Biological Conservation. https://doi.org/10.1016/j.biocon.2006.09.015

airspace by priority bird species is Vantage Point (VP) surveys. The VP surveys conducted within the wind turbine concession area were aligned with good international practice for methodology and effort level[171], and spanned 6 continuous seasons (or 1.5 years, from Spring, 2024 through summer, 2025) and 20 VP survey locations, with some variation in which locations were surveyed in which seasons based on evolving Project design during the survey period. A set of 11 VP locations provided comprehensive coverage of the current wind turbine layout, and these were all surveyed for a continuous year (autumn 2024 through summer 2025) with a minimum of 36 hours of survey at each point in each of the three highest risk seasons (spring, summer, autumn), and 6 hours of survey per point during winter, when risk is lower because abundance and density of collision-susceptible birds is lower. Nine additional VP locations that are situated outside of the current wind turbine layout area were also surveyed in some seasons between Spring 2024 and summer 2025, and provide additional information regarding birds' use of the airspace in the area immediately surrounding the wind turbine area. The set of VP locations surveyed within the broader wind turbine concession area for the baseline study is shown in relation to the current wind turbine layout in Figure 5. The seasonal sampling of each VP location is shown in Table 1.

[171] Scottish Natural Heritage (now "NatureScot"), 2017. Recommended bird survey methods to inform impact assessment of onshore wind farms

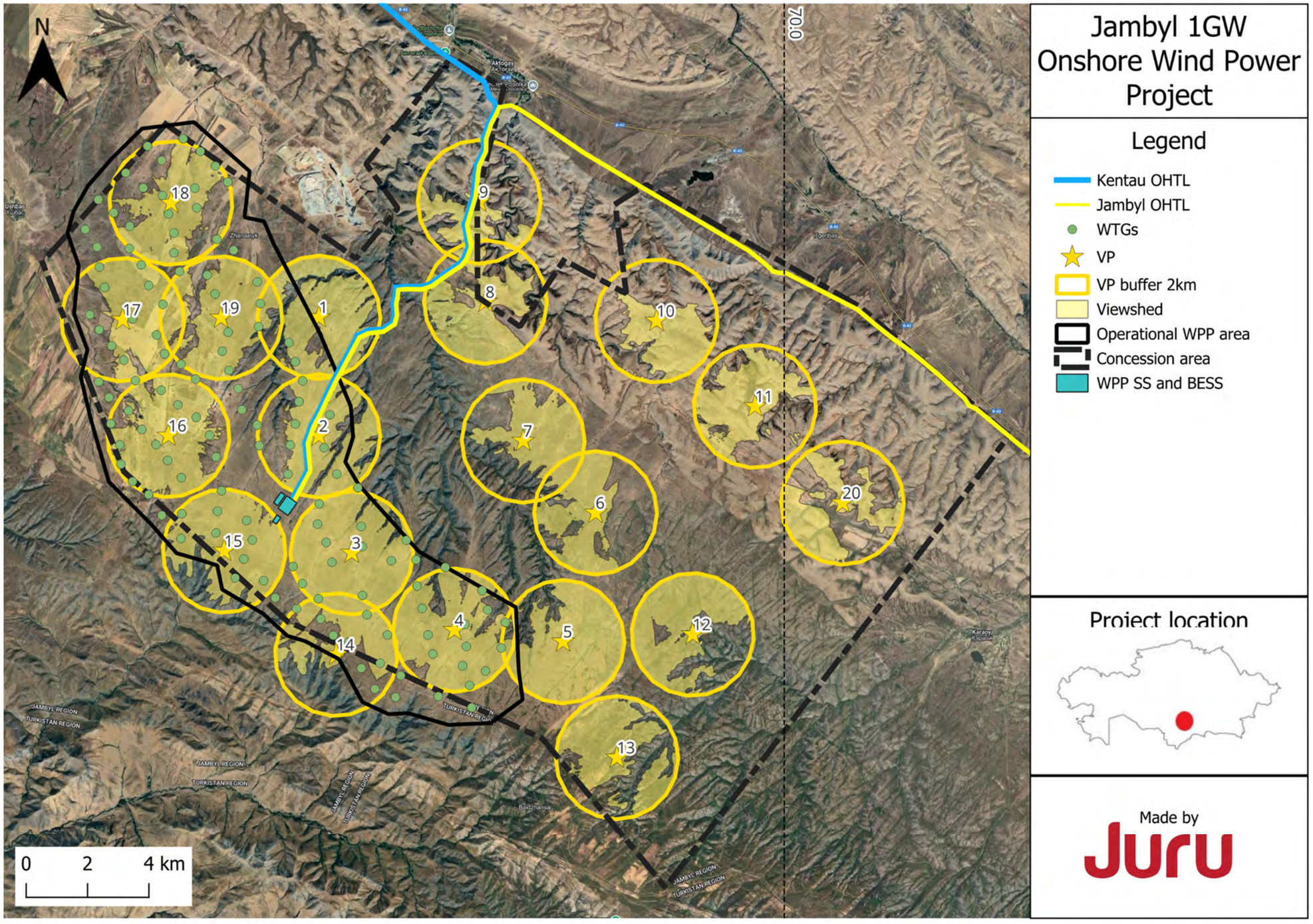


Figure 14. Bird Vantage Point (VP) locations (stars) surveyed for the Jambyl Wind Project baseline study, shown in relation to the turbines in the current layout (dots). Yellow areas indicate estimated viewsheds surveyed by the observers at each point, up to a maximum observation radius of 2 km. VP locations are numbered as in Table 1.

Table 14. Seasonal distribution of Vantage Point (VP) survey effort across 20 total VP locations sampled over six consecutive seasons to characterize birds' use of airspace in and around the wind turbine area for the JWP. The VP locations covering the final wind turbine layout are #s 1-5 and 14-19, numbered here as they are in Figure 5.

Vantage point	Hours of survey effort per season					
	Spring 2024	Spring 2025	Summer 2024	Summer 2025	Autumn 2024	Winter 2024-2025
1	36	36	36	36	36	6
2	36	36	36	36	36	6
3	36	36	36	36	36	6
4	36	36	36	36	36	6
5	36	36	36	36	36	6
6	36	Not surveyed	36	Not surveyed	36	6
7	36	Not surveyed	36	Not surveyed	36	6
8	36	Not surveyed	36	Not surveyed	36	6
9	36	Not surveyed	Not surveyed	Not surveyed	36	6
10	Not surveyed	Not surveyed	Not surveyed	Not surveyed	36	6
11	Not surveyed	Not surveyed	Not surveyed	Not surveyed	36	6
12	Not surveyed	Not surveyed	Not surveyed	Not surveyed	36	6
13	Not surveyed	Not surveyed	Not surveyed	Not surveyed	36	6
14	Not surveyed	36	Not surveyed	36	36	6
15	Not surveyed	36	Not surveyed	36	36	6
16	Not surveyed	36	Not surveyed	36	36	6
17	Not surveyed	36	Not surveyed	36	36	6

Vantage point	Hours of survey effort per season					
	Spring 2024	Spring 2025	Summer 2024	Summer 2025	Autumn 2024	Winter 2024-2025
18	Not surveyed	36	Not surveyed	36	36	6
19	Not surveyed	36	Not surveyed	36	36	6
20	Not surveyed	Not surveyed	Not surveyed	Not surveyed	36	6
Total	288	396	388	396	720	120

The results of the VP surveys in the wind turbine concession area were used to conduct Collision Risk Modelling (CRM), following a novel, spatially-explicit refinement of the method developed by William Band and colleagues[172], in order to inform the bird collision risk characterization incorporated within this ESIA (see below).

In addition to the VP surveys within the wind turbine concession area, a variety of additional bird baseline survey elements were implemented, collectively designed to characterize the baseline condition of the avifauna for the entire Project area, with a focus on species that were identified as Priority Biodiversity Values[173] on the basis of their sensitivity and/or susceptibility to potential adverse impacts from the Project. The methodologies applied, spatio-temporal extent, and effort levels are summarized below, and full detail on methods, effort, and results are presented within the individual baseline survey reports annexed to this ESIA (Annex E):

- Bird Vantage Point (VP) surveys, targeted at flight activity of large migratory birds along the OHTL
    - Jambyl OHTL route
        - Spring, 2024 surveys, 10 hours per VP x 4 original VPs
        - Autumn, 2024 surveys, 10 hours per VP x 4 original VPs
        - Spring, 2025 surveys, 10 hours per VP x 4 new VPs
        - Autumn, 2025 surveys, 10 hours per VP x 4 new VPs
    - Kentau OHTL route
        - Spring, 2025 surveys, 10 hours per VP x 8 VPs
        - Autumn, 2025 surveys, 10 hours per VP x 8 VPs
- Breeding bird surveys, all species, but survey selection focus on Great and Little Bustards
    - 2024: 500 MW WPP area, between 1 May and 15 June: 8 points surveyed 3 hours each, plus 96.2 km walking transects

[172] Band, B. 2012. Using a collision risk model to assess bird collision risks for offshore windfarms. Produced for the Crown Estate, Strategic Ornithological Support Services programme, project SOSS-02, including accompanying Collision Risk spreadsheet and worked example.
[173] International Finance Corporation (IFC), 2019. Guidance Note 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources. June 27, 2019, World Bank Group, Washington, DC

    - 2025: 1GW WPP area, between 6 and 14 May: 8 points surveyed twice each with 3-hour walking transects within 2 km of points, plus 283.84 km of driving transects driven within 2 km of the points
- Raptor/Vulture/Stork nest surveys
    - 2024: 500 MW WPP area buffered by 5 km, surveys conducted between March-August
    - 2025: 1 GW WPP area buffered by 5 km plus 95 km length of Kentau OHTL buffered by 500 m on each side, surveys conducted in April and May
- Great Bustard winter surveys
    - 1 GW WPP area plus Arystandy IBA, Kentau OHTL route, 10 days of driving and telescope point count surveys in December, 2024 (5 days) and March, 2025 (5 days)
- Great and Little Bustard breeding surveys
    - May, 2025: plains portions of Kentau OHTL plus 5 km buffer; agricultural habitats in the NW portion of the 1 GW wind farm plus 3 km buffer, 530 km of driving transects surveyed, opportunistic stops, supplemented with observations from breeding bird and VP surveys
    - July, 2025: agricultural habitats in the NW portion of the 1 GW wind farm plus 3 km buffer, plus extreme southeastern end of Kentau OHTL, 194 km driving transects surveyed, 65 points surveyed with 10-30-minute counts, supplemented with observations from breeding bird and VP surveys

The bird baseline surveys conducted for the JWP produced a very large and multi-faceted set of observations of priority and non-priority bird species. The total numbers of baseline survey observations of all priority bird species, including species included within multi-species groupings that were classified as Priority Biodiversity Values, are shown in Table 2.

Table 15. Summary of baseline survey observations of priority bird species for the Jambyl Wind Power Project. Data presented the presence (green) or absence (white) of each species for each survey report (see footnotes). Redlist categories are as follows: CR = Critically Endangered, or Kazakh status I; EN = Endangered, or Kazakh status I; VU = Vulnerable, or Kazakh status II; NT = Near Threatened, or Kazakh status III; DD = Data Deficient, or Kazakh status IV; R = Recovered (Kazakh status V). Blank = Least Concern or unlisted

Species	IUCN status[174]	Kazakh status[175]	CH/ PBV[176]	Baseline Survey Source[177]															
				1	2	3	4	5	6	7	8	9	10	11[178]	12[17]	13	14	15[179]	16[180]
Lesser White-fronted Goose	VU	VU	PBV																
Red-breasted Goose	VU	VU	PBV																
Marbled Duck	NT	CR/EN	PBV																
Common Pochard	VU		PBV																
Ferruginous Duck	NT	CR/EN	PBV																
White-headed Duck	EN	CR/EN	PBV																
Yellow-eyed Pigeon	VU	NT	PBV																
European Turtle-Dove	VU		PBV																
Great Bustard	EN	CR/EN	CH													[181]			
Asian Houbara	VU	VU	PBV																
Little Bustard	NT	VU	PBV																

[174] https://www.iucnredlist.org/ accessed 12 December, 2025

[175] For animals: Ministry of Education and Science of the Republic of Kazakhstan, 2010. Republic of Kazakhstan Red Data Book. 4th edition revised and supplemented.; for plants: Red Book of Kazakhstan. 2014. Vol. 2, Part. 1: Plants. Almaty: ArtPrint XXI. 605 p. [in Russian].

[176] CH = Critical Habitat trigger, PBV = Priority Biodiversity Value, per IFC Performance Standard 6

[177] Project-specific survey sources are numbered as follows (per column headers)

1 = bird Vantage Point Surveys, Spring 2024, 500 MW WPP area; 2 = bird Vantage Point Surveys, Summer 2024, 500 MW WPP area; 3 = bird Vantage Point Surveys, Autumn 2024, 500 MW WPP area; 4 = bird Vantage Point Surveys, Winter 2024-2025, 1 GW WPP area; 5 = bird Vantage Point Surveys, Spring 2025, 1 GW WPP area; 6 = bird Vantage Point Surveys, Summer 2025, 1 GW WPP area; 7 = bird Vantage Point Surveys, Spring 2024, southeastern OHTL segment; 8 = bird Vantage Point Surveys, Autumn 2024, southeastern OHTL segment; 9 = bird Vantage Point Surveys, Spring 2025, southeastern and northwestern OHTL segments; 10 = bird Vantage Point Surveys, Autumn 2025, southeastern and northwestern OHTL segments; 11 = Raptor/vulture nest survey, Spring-Summer, 2024, 500 MW WPP area buffered by 5 km; 12 = Raptor/vulture nest survey, Spring, 2025, 1 GW WPP area buffered by 5 km, plus entire NW OHTL segment buffered by 500 m; 13 = Breeding bird survey, Spring, 2024, 500 MW WPP area; 14 = Breeding bird survey, Spring, 2025, 1 GW WPP area; 15 = Great Bustard winter survey, Winter 2024-2025, 1 GW WPP area plus Arystandy IBA area, plus northern and western OHTL segments; 16 = Great/Little bustard breeding survey, spring-summer 2025, 1 GW WPP area buffered by 3 km, plus northern and western OHTL segments

[178] Numbers presented in both raptor nest survey columns represent number of active nests documented during the survey, excluding nests that were abandoned during the season

[179] Winter Great Bustard survey results include observations of Great Bustards recorded within the Arystandy IBA and other agricultural field areas lying to the west of the WPP area, as Great Bustards wintering in these areas are presumed to migrate across the route of the Kentau OHTLsegment, thus are considered to occur within the Project's EAAA (see text)

[180] Only includes observations not reported in other survey reports

[181] Of the Great Bustards documented during the breeding bird survey in 2024, 6 were engaged in courtship behaviors, indicating breeding activity, and 6 were observed feeding in agricultural fields with no indication of behaviors associated with breeding activity

Species	IUCN status[174]	Kazakh status[175]	CH/ PBV[176]	Baseline Survey Source[177]															
				1	2	3	4	5	6	7	8	9	10	11[178]	12[17]	13	14	15[179]	16[180]
Demoiselle Crane		R		■		■		■		■		■							
Common Crane		NT				■	■	■			■		■						
Sociable Lapwing	CR	CR/EN	PBV																
White Stork		CR/EN	PBV							■									
Black Stork		NT		■				■	■		■	■	■		■				
Great White Pelican[182]		CR/EN	PBV	■		■		■		■	■		■						
Dalmatian Pelican	NT	VU	PBV					■				■							
Osprey		CR/EN	PBV										■						
Bearded Vulture	NT	NT				■													
Egyptian Vulture	EN	NT	PBV	■	■	■		■	■			■	■		■				
Cinereous Vulture	NT			■	■	■	■	■	■		■	■	■						
Himalayan Griffon	NT	DD																	
Eurasian Griffon				■	■	■		■	■			■	■						
Short-toed Snake-Eagle		VU	PBV	■	■	■		■	■	■	■	■	■	■	■				
Greater Spotted Eagle	VU		PBV	■		■		■		■	■	■	■						
Booted Eagle		NT		■	■	■		■	■			■	■	■	■				
Steppe Eagle	EN	R	PBV	■		■	■	■	■		■	■	■						
Imperial Eagle	VU	NT	PBV	■		■	■	■			■		■						
Golden Eagle		NT		■	■	■	■	■	■				■		■				
Pallas's Fish-Eagle	EN	CR/EN	PBV																
White-tailed Eagle		VU	PBV			■	■	■			■		■						
Eurasian Eagle-Owl		VU	PBV										■	■					
Red-footed Falcon	VU		PBV									■							
Saker Falcon	EN	CR/EN	PBV	■		■							■						
Peregrine Falcon		CR/EN	PBV			■							■						
"Barbary" (Peregrine) Falcon		CR/EN			■									■					
Mute Swan											■								
Ruddy Shelduck						■	■	■	■	■	■	■	■			■	■		
Common Shelduck													■						

[182] Includes observations of "unidentified pelican"

Species	IUCN status[174]	Kazakh status[175]	CH/ PBV[176]	Baseline Survey Source[177]															
				1	2	3	4	5	6	7	8	9	10	11[178]	12[17]	13	14	15[179]	16[180]
Garganey													■						
Gadwall													■						
Mallard								■	■		■	■	■						
Tufted Duck											■								
Eurasian Coot													■						
Northern Lapwing	NT			■		■	■	■		■	■	■				■	■		
Common Redshank																■			
Black-headed Gull										■	■								
Caspian Gull											■								
Lesser Black-backed Gull						■		■		■		■							
Gull-billed Tern								■		■									
Caspian Tern										■		■							
Common Tern						■										■			
Great Crested Grebe													■						
Eared Grebe													■						
Pygmy Cormorant												■							
Great Cormorant						■		■		■	■		■						
Eurasian Spoonbill		VU									■								
Great Egret										■	■		■						
Gray Heron								■		■	■								
Oriental Honey-buzzard				■		■		■			■								
Eurasian Sparrowhawk					■	■		■	■	■	■	■	■						
Levant Sparrowhawk								■											
Shikra													■						
Eurasian Goshawk						■	■	■		■			■						
Western Marsh-Harrier				■	■	■	■	■	■	■	■	■	■		■				
Hen Harrier				■		■	■	■					■						
Pallid Harrier	NT			■		■		■					■						
Montagu's Harrier				■	■	■		■	■	■		■							
Black Kite						■					■		■						
Rough-legged Hawk							■												

Species	IUCN status[174]	Kazakh status[175]	CH/ PBV[176]	Baseline Survey Source[177]															
				1	2	3	4	5	6	7	8	9	10	11[178]	12[17]	13	14	15[179]	16[180]
Common Buzzard				■		■	■	■			■	■	■						
Long-legged Buzzard				■	■	■	■	■	■	■	■	■	■	■	■				
Lesser Kestrel				■		■				■	■		■						
Eurasian Kestrel				■	■	■	■	■	■	■	■	■	■		■				
Merlin						■	■						■						
Eurasian Hobby				■	■	■		■		■	■		■						

Avifaunal baseline summary and risk characterization

Interaction with the Karatau Mountain/Chokpak Pass Migratory Bottleneck. The Karatau Mountain Range constitutes a peninsula of high mountains that extends several hundred kilometers to the northwest from the larger cordilleras of the Himlayas/Tien Shan mountains to the south, into the plains and steppes of central Kazakhstan. Likely as a function of this topographic and geographic position, this mountain range is well-known as a migratory bottleneck, concentrating much of the migratory activity within the broad migration corridors of central Asia into a more concentrated stream. This migratory concentration effect has been best characterized in satellite telemetry studies of migratory eagle species (Figure 6), but this phenomenon also extends to a wide variety of other migratory raptors, waterbirds, corvids, and other migratory bird species.

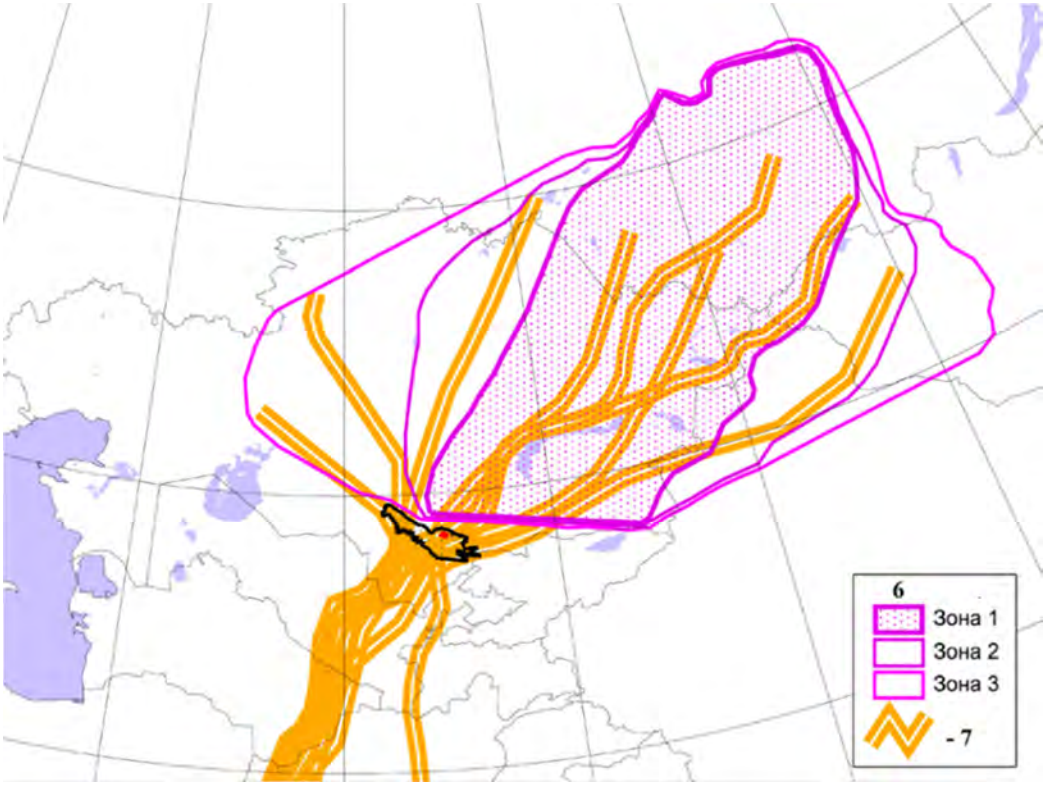


Figure 15. Map reproduced from Karyakin et. al., 2021 showing general migratory corridors (yellow lines) of Greater Spotted Eagles, Steppe Eagles, and Imperial Eagles (all combined) in relation to the Karatau Mountains (black polygon), and in relation to breeding

The most well-known bottleneck[183] within the Western Circum-Himalayan Migration Corridor (WCHMC) is Chokpak Pass (Figure 7). This area is located roughly 97 km from the WPP and 39 km from the Project's OHTL at the nearest points in the Western Tien Shan at the junction of the Talas Alatau

[183] Following typical usage in technical literature, the term "migratory bottlenecks" refers to specific and limited zones where migratory activity of birds is highly concentrated relative to the surrounding landscape, usually as a result of topographic features such as mountain ridges and/or coastlines of large lakes, seas, or oceans. By contrast, the terms "migratory flyway" or "migration corridor" refer to much broader zones, covering substantial proportions of the land area in many regions, and within which much of the bird migration activity occurs in a more spatially diffuse or "broad front" pattern.

and Boroldaу (a spur of the Karatau range)[184]. The pass has been designated as a key ornithological area of international significance (IBA Chokpak Pass KZ077[185]). According to 2001 data, the number of raptors migrating through the pass was estimated at slightly more than 67,000 individuals, including 11,015 eagles, among which the Steppe Eagle (*Aquila nipalensis*) was dominant (10,000 individuals), and the Greater Spotted Eagle (*Clanga clanga*) is also well represented[186]. Chokpak Pass also receives heavy passage of a dozen or more additional migratory raptor/vulture species including Cinereous and Egyptian Vultures, Common and Demoiselle Cranes, migratory corvids, and others, especially during autumn migration[187]. Peak migration periods at Chokpak Pass are late March through mid-May in spring, and early September through mid-October in autumn[188].

The Project's site selection process specifically considered this key migratory bottleneck during macro-siting, and the wind farm was intentionally sited a significant distance away from Chokpak Pass to avoid direct impacts on the concentrated migratory flows observed there. Nonetheless, because of its very long extent, its position, and its orientation roughly perpendicular to the primary axis of migratory flow during spring and fall migrations in the region, the Project-associated OHTL segments cut across the migratory path of virtually all birds migrating through Chokpak Pass, as well as most birds that pass through the Karatau Mountains during migration. Furthermore, the concentrated migratory activity of eagles is not limited to Chokpak Pass, but is distributed in a broad-front across the Karatau Mountains, including the wind project area (Figure 6). Based on globally documented patterns of impact susceptibility, the most significant Project-associated risk to migrating raptors and vultures is expected to be wind turbine collision impact, as **OHTL risks to raptors (electrocution) are expected to be negligible on high voltage OHTL, particularly in this case, as "raptor-friendly" electrocution-minimizing designs will be used for the OHTL**. Further information on the Project associated risks associated with this migratory bottleneck is provided in species- and receptor-specific subsections below.

The project design accounted for risks to breeding and migratory raptors, and the wind project as well as OHTL were sighted to reduce risks to raptors. Design measures were further implemented to reduce collision risks for both wind turbines and OHTLs during the development stage utilising baseline data. Please refer to the Alternatives Section of this document.

[184] For example, see: Karyakin, I.V., Nikolenko, E.G., Schneider, E.P., Zinevich, L.S., Pulikova, G.I., Andreenkova, N.G., Bartoshuk, K., Horvat, M., Yuhash, T., Prommer, M. Wind Power Development in Eastern Kazakhstan Threatens Migration of Eagles. — Raptors Conservation. 2021. No. 43. Pp. 108-213. DOI: 10.19074/1814-8654-2021-43-108-213, or; Watson, R. T., Kolar, P. S., Ferrer, M., Nygård, T., Johnston, N., Hunt, W. G., ... & Katzner, T. E. (2018). Raptor interactions with wind energy: case studies from around the world. *Journal of Raptor Research*, *52*(1), 1-18.
[185] BirdLife International (2024) Important Bird Area factsheet: Chokpak Pass. Downloaded from https://datazone.birdlife.org/site/factsheet/chokpak-pass-iba-kazakhstan on 01/05/2024.
[186] Gavrilov E. I., Gavrilov A. E. The Birds of Kazakhstan. Almaty, 2005.
[187] eBird https://ebird.org/home accessed 6 May 2024
[188] https://ebird.org/home seasonal bar charts for for Zhambyl region, accessed 5 June, 2024

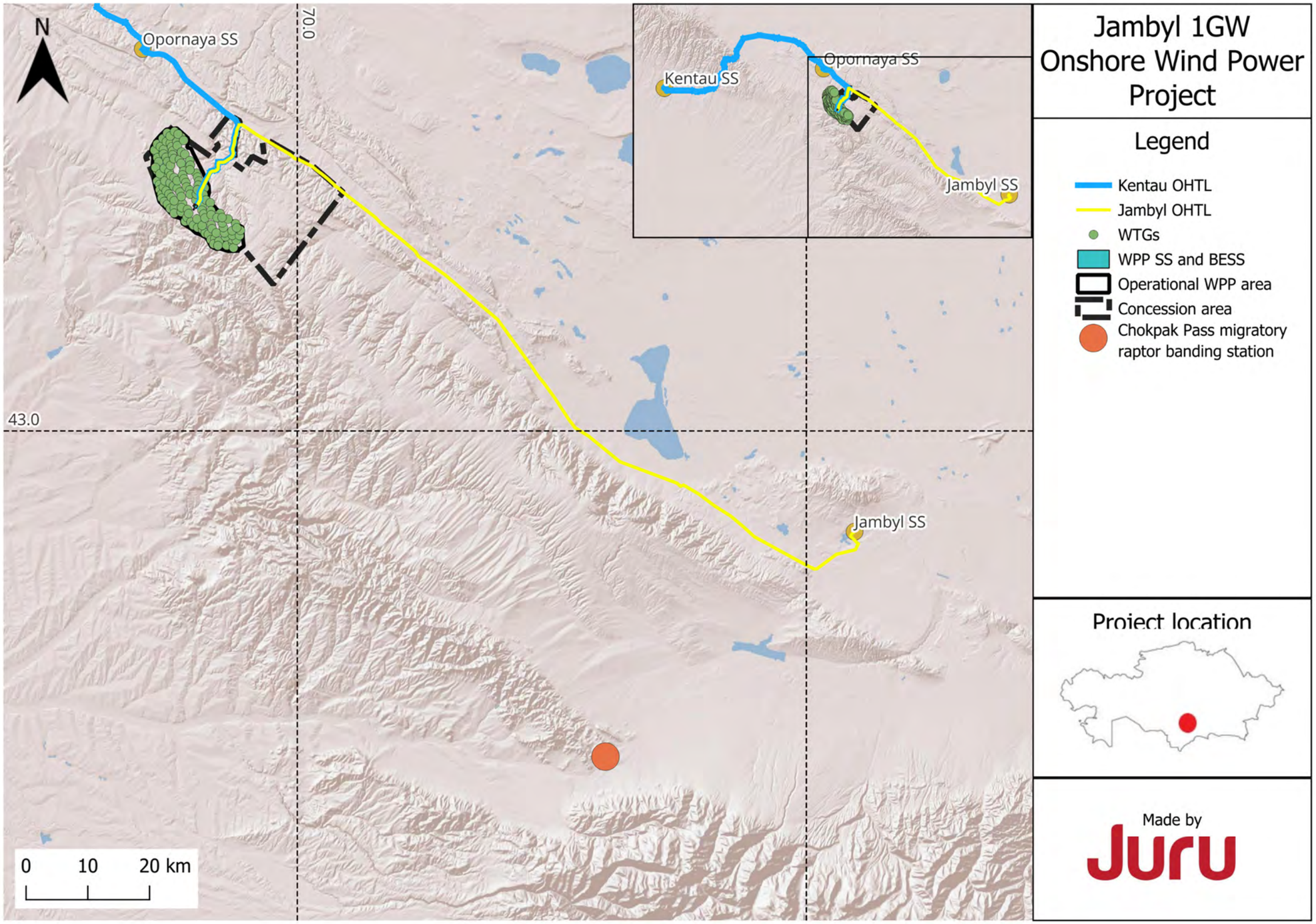


Figure 16. Chokpak Pass in relation to the Project site

Risks to breeding, wintering, and migrating bustards. While collision of raptors and vultures with the Project's wind turbines represents a primary biodiversity risk consideration for the Project, and focus of the baseline survey program and ESIA, a second bird risk issue of comparable significance is risk of bustards, especially Great Bustard, colliding with the Project's OHTL. As a group, bustards are known to be highly sensitive to collisions with overhead powerlines, and such collisions are currently regarded to be one of the most significant anthropogenic threats to bustard populations, worldwide[189].

Three migratory species of bustards may occur in the Project region, as follows: Great Bustard (IUCN EN, Kazakh CR/EN), Asian Houbara (IUCN VU, Kazakh VU) and Little Bustard (IUCN NT, Kazakh VU). All of these species are known to be susceptible to OHTL collision impacts[190,191,192], and such impacts are considered to be the primary Project-associated risk to bustards, though bustards may also be subject to wind turbine collision impacts and temporary or permanent displacement effects from wind energy development, as well as poaching/harassment impacts and/or disturbance from human presence in the area. Project-associated risks to three bustard species are discussed in greater detail in species-specific subsections below.

The project design accounted for risks to bustards and the wind project as well as OHTL were sighted to reduce risks to bustards. Design measures were further implemented to reduce risks for both wind turbine and OHTL sighting during the development stage as baseline data were collected. Please refer to the Alternatives Section of this document

Collision risk for migratory waterbirds. In addition to bustards, another group of birds that are known to be susceptible to collisions with overhead powerlines are large-bodied waterbirds, including cranes, waterfowl, long-legged waders, pelicans, and others. The Project region experiences substantial migration of many species in this category, including both Common and Demoiselle Cranes, which are known to migrate through this region, especially in autumn, but also during spring migration. During migration, cranes and other migratory waterbirds may occur broadly throughout the region, utilizing a wide variety of wetlands as stopover habitat, depending on species-specific habitat affinities. They are also known to concentrate their migratory pathways in response to topographic features such as mountain ranges and coastlines, similar to large soaring birds, and the Chokpak Pass migratory bottleneck site is known to host concentrations of migrating cranes, as well as raptors. Some species in this category, including cranes, may utilize upland habitats as well as wetlands during migratory stopovers, including extensively overgrazed pasturelands which comprise one of the primary habitat types along the OHTL routes. Nonetheless, because of the concentration of most migratory waterbird species within wetlands and waterbodies, several specific wetlands and waterbodies are potentially significant for the Project, migratory waterbird OHTL collision risk is likely to be concentrated in the

[189] Silva JP, Marques AT, Bernardino J, Allinson T, Andryushchenko Y, Dutta S, Kessler M, Martins RC, Moreira F, Pallett J, Pretorius MD, Scott HA, Shaw JM, Collar NJ (2022). The effects of powerlines on bustards: how best to mitigate, how best to monitor?. Bird Conservation International, 1–14 https://doi.org/10.1017/S0959270922000314

[190] Burnside, R. J., N. J. Collar, M. A. Koshkin, P. M. Dolman, 2015. Avian powerline mortalities, including Asian Houbaras *Chlamydotis macqueenii*, on the Central Asian flyway in Uzbekistan. Sandgrouse 37:161-168.

[191] Collar, N. and E. Garcia (2020). Great Bustard (*Otis tarda*), version 1.0. In Birds of the World (J. del Hoyo, A. Elliott, J. Sargatal, D. A. Christie, and E. de Juana, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bow.grebus1.01 accessed 12 April, 2025

[192] Silva JP, Marques AT, Bernardino J, Allinson T, Andryushchenko Y, Dutta S, Kessler M, Martins RC, Moreira F, Pallett J, Pretorius MD, Scott HA, Shaw JM, Collar NJ (2022). The effects of powerlines on bustards: how best to mitigate, how best to monitor?. Bird Conservation International, 1–14 https://doi.org/10.1017/S0959270922000314

vicinity of these areas.

The largest of these is lake Bilikol, situated approximately midway along the Jambyl OHTL and lying roughly 3 km to the east of the OHTL (Figure 8). This lake supports regionally important populations of waterbird species, including White Storks and various common heron species as reported by local ornithological experts Igor Karyakin. Lake Bilikol is not designated as an Important Bird Area (IBA) and because it is positioned no closer than three kilometers from the OHTL across the main highway, waterbird OHTL collision risk is not likely to be very high along the nearest stretch of OHTL, though the portion of Project-associated OHTL within close proximity to this lake is considered a zone of elevated OHTL-waterbird collision risk.

The project design accounted for risks to waterbirds and OHTL were sighted to reduce risks to waterbodies. Design measures were further implemented to reduce risks for both wind turbine and OHTL sighting during the development stage as baseline data were collected. Please refer to the Alternatives Section of this document.

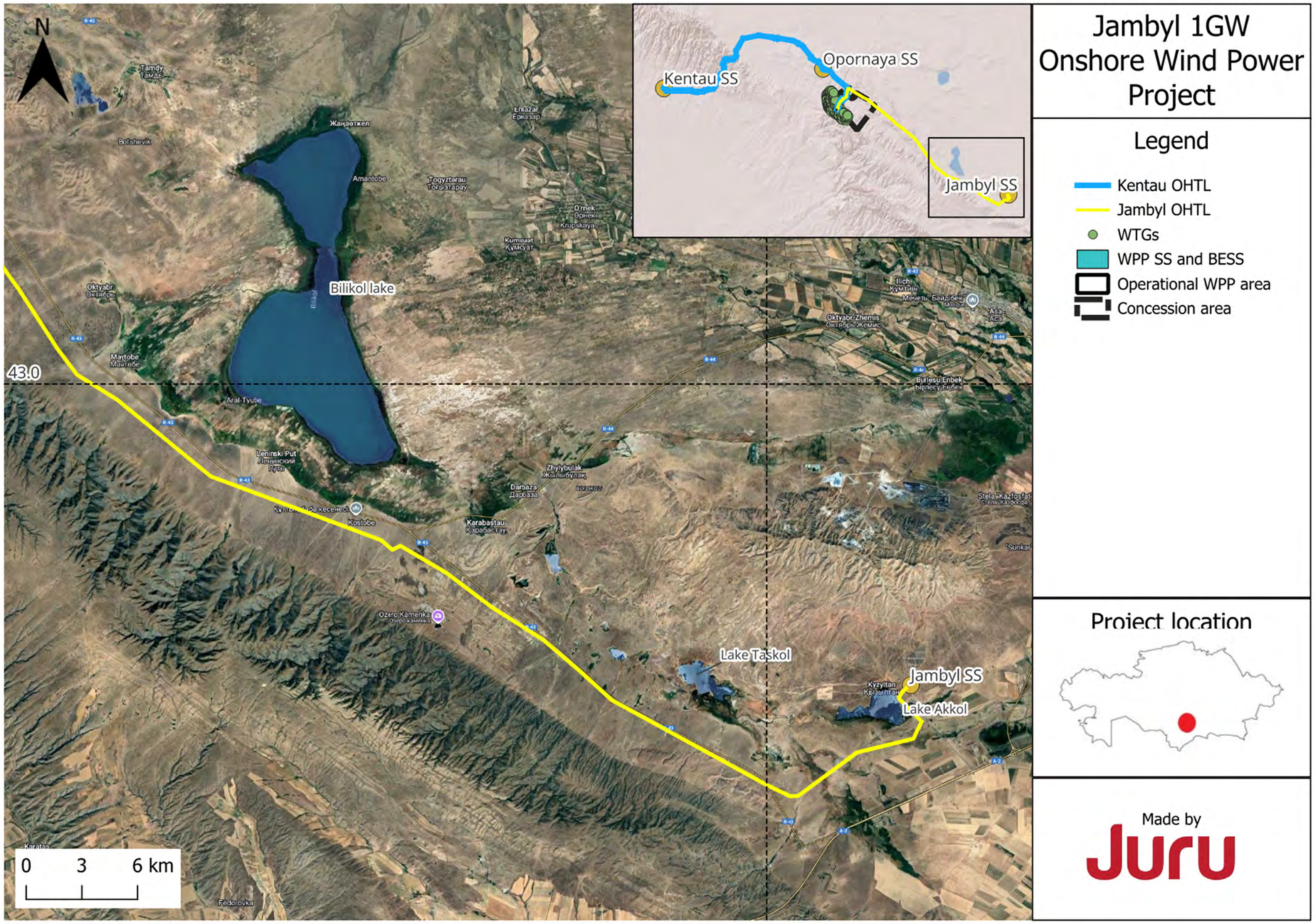


Figure 17. Bilikol and Akkol lakes in proximity to the southern part of Jambyl OHTL

Another significant risk-related wetland/waterbody along the OHTL is Lake Akkol, located approximately 0.7 km west of the Jambyl substation (Figure 9). This water body is distinguished as posing a significant risk for elevated waterbird collision rates because it is located substantially closer to the Project's OHTL, with peripheral reedbeds as close as 140 m from the OHTL, whereas all other waterbodies along the OHTL are situated at least 1.7 km away from the OHTL. It is important to note that the Jambyl substation, itself, lies roughly 400 m from this lake on the east side, hence proximity of 400 m cannot be avoided with an OHTL connection to this substation. During the early April 2024 site visit, Akkol Lake contained an area of open water approximately 1 km x 1 km, surrounded by an equal area of Phragmites reedbeds with smaller water patches. Water levels in this lake may vary substantially based on seasonal precipitation patterns. The pond likely hosts high concentrations of ducks during the peak of waterfowl migration in March and could attract significant flocks of cranes during the spring and/or fall migrations (when the high occurrence of fog is increasing the risk of collisions). For this reason, the portions of the Project's associated OHTL that are located within close proximity to Lake Akkol are considered a zone of elevated waterbird collision risk.

Project design accounted for this risk and the routing of the OHTL was altered to reduce risks for birds at Lake Akkol during the development stage. Please refer to the Alternatives Section of this document.

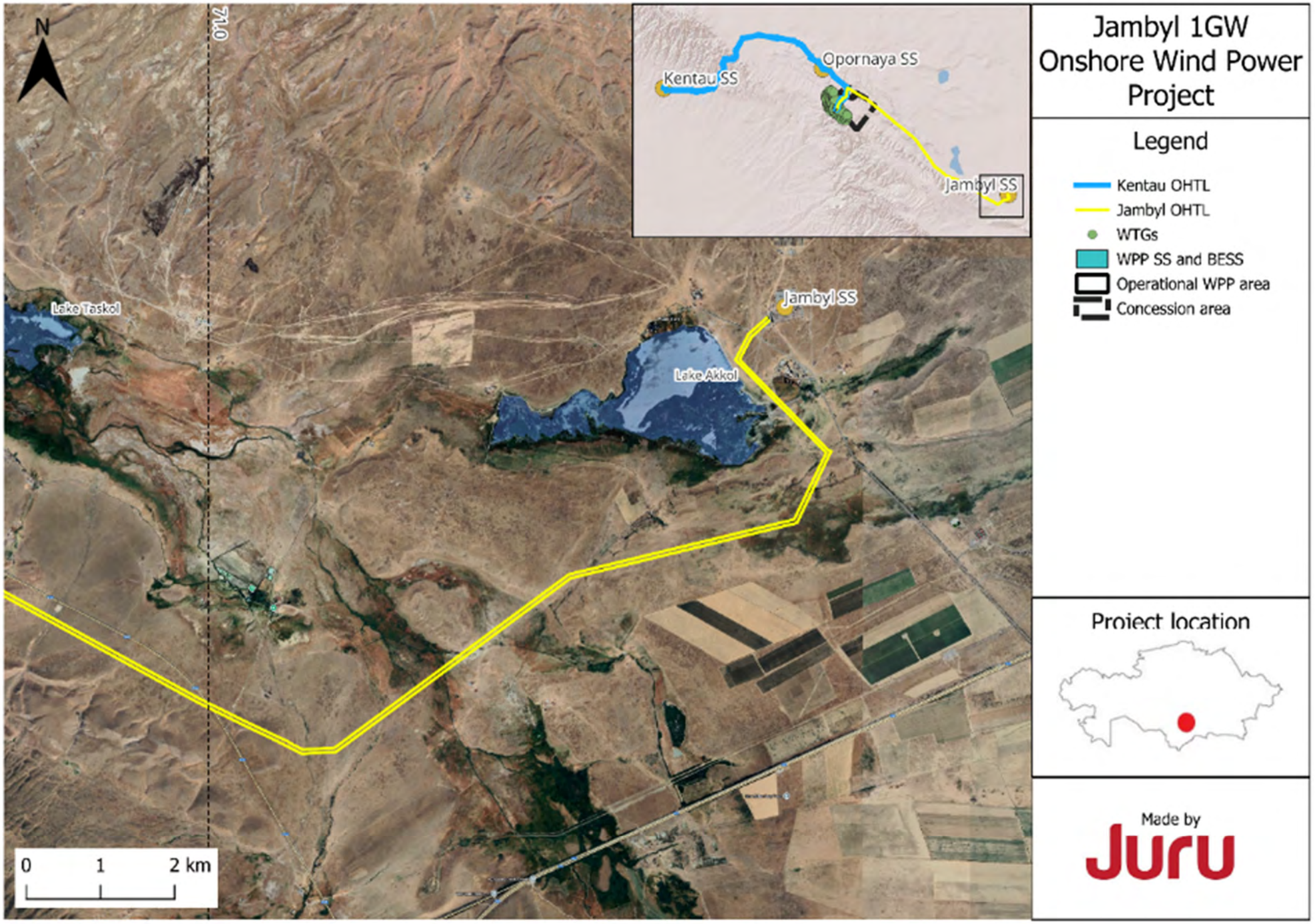


Figure 18. Map figure showing a close-up view of Lake Akkol in relation to the OHTL and the Jambyl Substation



Figure 19: Pygmy Cormorant and Gray Heron on the Akkol Lake

One additional waterbody of significance for the Project is Lake Kyzylkol, a reservoir which is designated as an IBA because it is known to host migratory (stopover) concentrations of up to 70,000 Common Pochards (*Aythya ferina*, IUCN VU, Kazakh unlisted), 1,500 Eared Grebes (*Podiceps nigricollis*, IUCN LC, Kazakh unlisted), 2,500 White-headed Ducks (*Oxyura leucocephala*, IUCN EN, Kazakh Endangered), 10,000 Garganey (*Spatula querquedula*, IUCN LC, Kazakh unlisted), 3,000 Ruddy Shelduck (*Tadorna ferruginea*, IUCN LC, Kazakh unlisted), 50,000 Eurasian Coot (*Fulica atra*, IUCN LC, Kazakh unlisted), 1,000 Dalmatian Pelican (*Pelecanus crispus*, IUCN NT, Kazakh Vulnerable), and 20,000 waterbirds (Figure 2). As with Lake Bilikol, the minimum distance of the Project's OHTL of 2.5 km from the IBA boundary, and 4.5 km from the reservoir, imply that OHTL collision risk for waterbirds using this reservoir is not likely to be severe, as such activity is likely to be highly concentrated within 1 km of the reservoir. Nonetheless, the portion of the Project's OHTL that is located within 5km of the IBA is considered a zone of elevated waterbird collision risk for the Project.

Project design accounted for this risk and the routing of the OHTL was altered to reduce risks for birds at Lake Kyzylkol during the development stage. Please refer to the Alternatives Section of this document.

A final waterbody of significance is a small unnamed pond located 800 m from Jambyl OHTL, just south of where OHTL 1 emerges from the Karatau mountains and heads southeast toward the Jambyl substation (Figure 11). This pond is significant because breeding activity of White-headed Duck (IUCN EN, Kazakhstan CR/EN) was documented on it during the baseline surveys (see White-headed Duck species account, below). The portion of the Project's OHTL that is located within close proximity to this pond is considered a zone of elevated waterbird collision risk for the Project.

Project design accounted for this risk and the routing of the OHTL was altered to reduce risks for birds at this pond during the development stage. Please refer to the Alternatives Section of this document.

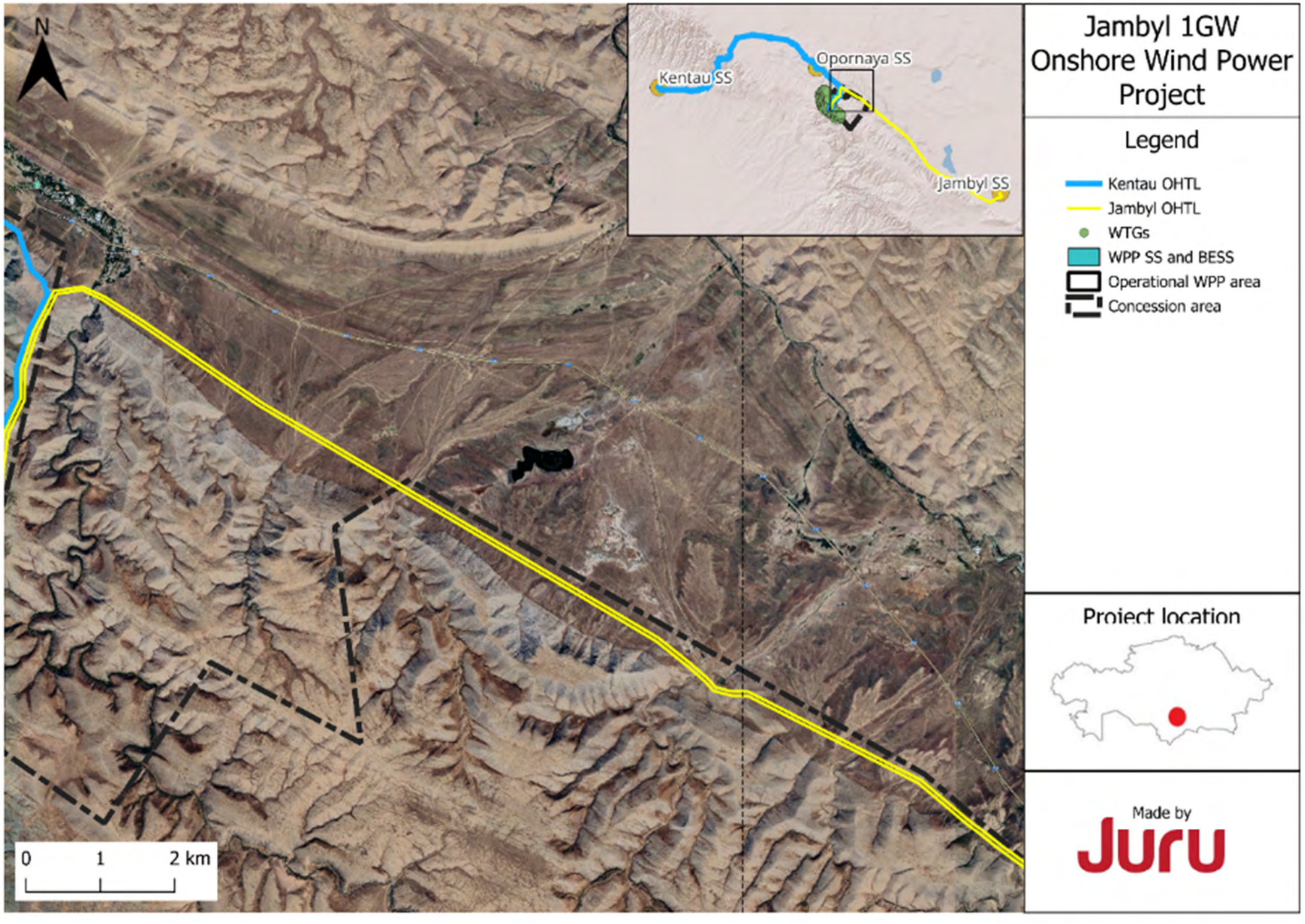


Figure 20. Unnamed pond near the northernmost part of the Jambyl OHTL

Risk summaries and sensitivity scoring for priority bird species and multispecies groups Project-associated risks to individual species and multi-species groupings of birds identified as Project-associated priorities are presented in subsections below, based on synthesis of all baseline survey results and other information reviewed for the preparation of this ESIA, including collision risk modelling results[193], which are noted in the sections below for each species that was modelled[194].

Species which were not observed during baseline surveys were scoped out.

White-headed Duck (IUCN EN; Kazakhstan CR/EN, receptor sensitivity: medium) Collision susceptibility is presumed to be similar to that of other large-bodied waterbirds. This species in a rare breeder on small ponds/lakes in the region. There are recent eBird records of up to 25 individuals on Kyzylkol Lake, and BirdLife International lists White-headed Duck as a trigger species for the Kyzylkol Lake IBA, indicating that concentrations of up to 2,500 individuals of this species have been recorded there[195]. As with other waterbirds, the absence of large water bodies[196] within 1 km of Project infrastructure limits the potential impacts of the Project on this species, particularly in winter and migration, when this species generally prefers to utilize larger water bodies. However, there is a small lake within 800 m of Jambyl OHTL, where observations of waterbirds on the lake were included among the OHTL VP survey data (OHTL VP point J8), where White-headed Ducks were found breeding during the 2025 autumn VP surveys. This survey effort yielded two separate observations of White-headed Ducks, both consisting of ducks swimming on the waters of the lake at this VP location. One of these observations was of 22 individuals and the other of was of 35 individuals, including young of the year, indicative of successful breeding activity in the late summer of 2025. In its current location, Jambyl OHTL could impact this species, including disturbance/displacement impacts during construction, and OHTL collision impacts during construction, though both impacts are likely to be minor due to species' limited flight activity, and likely confinement to the immediate vicinity of the lake during the breeding season.

Great Bustard (IUCN EN, Kazakhstan CR/EN, receptor sensitivity: high). According to the 2024 Great Bustard Action Plan (UNEP/CMS/COP14 2014), southern Kazakhstan (Turkmenistan and Jambyl regions) contains the most important wintering concentration of Great Bustards in all of Asia, with a wintering population estimated at 400-500 individuals (out of a total Asian wintering population of 513-1117 individuals). This region is also known to host a breeding population of 50-70 individuals, and migratory concentrations of 180-200 individuals, thus southern Kazakhstan is important for Great Bustards year-round, but its primary importance is in winter, when it may hold the majority of this species' Asian population.

Baseline surveys conducted for the JWF, has shown that Great Bustards are present virtually year-round in the Project area in a pattern indicative of this species' regional scale migratory movements. Additionally, there are several recent eBird records of Great Bustard from the breeding and migratory

[193] Based on interim, CRM analysis, assessing three-season (autumn-winter-spring) collision risk for a near-final wind turbine layout, based on a preliminary turbine model selection. These results to be updated with four-season analysis (adding summer) for the final wind turbine layout and final turbine technology selection in the ESIA addendum

[194] Collision risk was modelled for all priority bird species recorded during VP surveys in the wind farm concession area from spring, 2024 through spring, 2025.

[195] https://datazone.birdlife.org/site/factsheet/kyzylkol-lake accessed 9 April, 2025

[196] For the purpose of this ESIA, "large" waterbodies are classified as those that consistently have a surface area of open water greater than 1 km^2

seasons within ca 5 km of the wind turbine area, and wintering concentration of up to 500 Great Bustard is the single trigger for the Arystandy IBA (KZ073), located ca 14 km to the west of the wind farm[197]. This IBA is located in cereal crop field habitat, and although the boundaries of this IBA, as delineated by BirdLife International are no closer than ca. 12 km to the WPP area[198], the cereal crop fields preferred by the bustards both for wintering habitat and for breeding extend northward and eastward from the IBA, reaching, and overlapping the western boundary of the WPP area. Baseline surveys within this area have produced numerous observations of Great Bustard in both winter and breeding seasons (Figure 12-A, Table 2), suggesting that substantial concentrations of Great Bustard may extend continuously from the Arystandy IBA into the western portion of the WPP area and the surrounding landscape. The baseline surveys conducted for the JWF, have produced a total of 594 observations of Great Bustards (Table 2), in concentrations of up to 60 birds in the largest single observation (presumed migratory flock of 60 individuals observed in Autumn 2024 wind farm VP survey). The majority of these observations have been during autumn migration, when small-moderate flocks of birds have been observed at locations scattered widely across much of the WPP area (Figure 12, Table 2**Error! Reference source not found.**). A maximum winter concentration of 50 birds was observed in crop fields roughly 20 km WNW of the WPP area and roughly 5 km north of the Arystandy IBA (Figure 12-A), with smaller concentrations of wintering birds observed just west of the WPP boundary in crop field habitat (Figure 12). Several observations of birds engaged in courtship behaviors indicative of breeding activity have been documented over the course of the Project's baseline studies, including an observation of a group of 10 birds with displaying males in the western portion of the WPP area on 24 February, 2025. Courtship displays of male Great Bustards were also recorded at 5 separate points in this same general area during the breeding bird surveys conducted in May, 2024 (Figure 12). Extensive surveys conducted in spring and summer of 2025 in all suitable Great Bustard habitats located within the wind farm and OHTL areas yielded 396 total observations of this species, and an overall estimate that there are 18 breeding pairs or territories of Great Bustards within the WPP area (Figure 12). Summarizing the observations of Great Bustards collected in the baseline surveys and analyses conducted we conclude the following:

- Great Bustards breed in substantial numbers (estimate of 18 breeding pairs) in the western portion of the WPP area, particularly where the WPP area overlaps cereal crop field habitats.
- Great Bustards overwinter in larger numbers (aggregations of up to 50 observed) within the crop field habitats extending from the western portion of the WPP area, WNW more than 20 km and then southward, within crop field habitats, and including the Arystandy IBA, where winter concentrations of up to 500 Great Bustard have been recorded historically.
- The broader Jambyl-Turkmenistan region of southern Kazakhstan is known to be the most important wintering area for Great Bustard in all of Asia, sometimes hosting 400-500 individuals, constituting most of the Asian population of this species (513-1117 individuals).

[197] https://datazone.birdlife.org/site/factsheet/arystandy accessed 10 April, 2025

[198] As described in the Alternatives Section of this document, during the design phase of this Project, the developer setback from the IBA and sought to reduce overlap between project infrastructure and the IBA as well as crop fields to the extent feasible. Such measures continued throughout the development stage as additional baseline data were collected.

- During autumn migration, migrating Great Bustards occur in small-moderate-sized flocks widely across the WPP area and the surrounding landscape (flocks of up to 60 individuals observed).
- None of the Project's associated OHTL segments are sited within suitable breeding or wintering habitat for Great Bustards, and no Great Bustards were observed in winter surveys along the Kentau OHTL route.[199]
- Great Bustards are nocturnal migrants (A. Ten, personal communication), hence baseline survey observations collected during daylight hours are unlikely to produce a comprehensive characterization of migratory activity of this species within the Project's EAAA.
- The Project's OHTL segments extend for over 300 km and generally run perpendicular to the presumed direction of most Great Bustard migratory flight paths, hence a very large portion of the Great Bustard population that overwinters in southern Kazakhstan (400-500 birds), including presumably all birds wintering in the Arystandy IBA (up to 500 birds) and surrounding crop field habitats, has the potential to migrate across the Project's OHTL segments twice per year, when they would be exposed to OHTL collision risk[200].
- The preliminary CRM analysis using the most realistic collision avoidance parameter predicts that 0.508 Great Bustard wind turbine collisions will occur per year, noting that this figure does not include summer, when some additional wind turbine collision risk is likely to occur, and also noting that nocturnal migratory flight activity is not captured in the VP survey data set, thus is not incorporated into the CRM analysis.

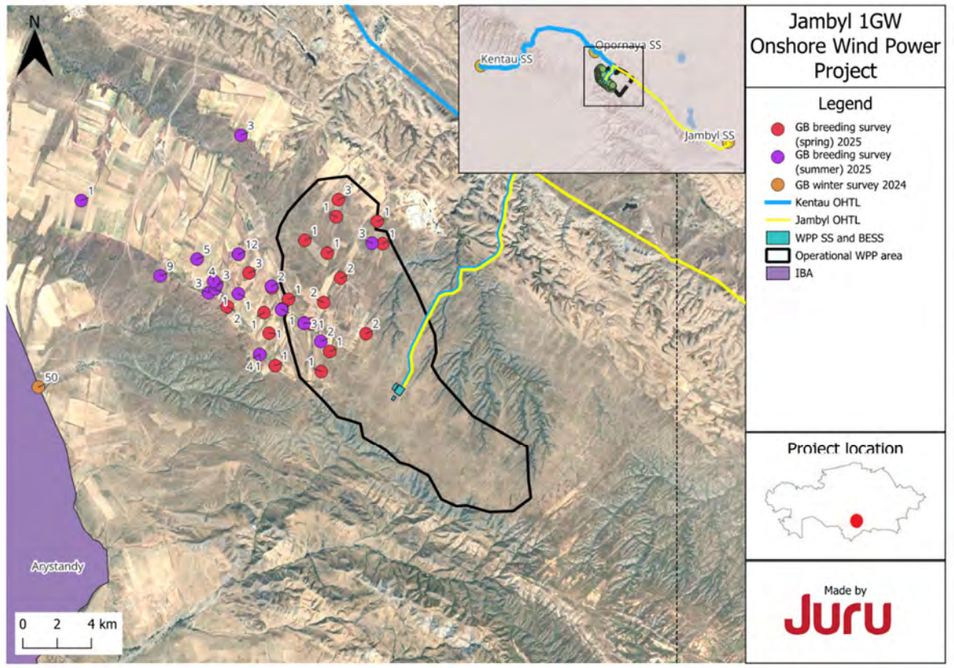
Project-related impacts to Great Bustard may include collisions of bustards with the Project's OHTL and/or wind turbines (see CRM result summary bullet point, above), as well as temporary or long-term displacement effects. The Great Bustard is known to be extremely sensitive to collisions with powerlines (Collar and Garcia, 2020, Silva et. al., 2022, UNEP/CMS/COP14 2024). The Project-associated OHTL that extend north and west of the WPP area and terminate at the Kentau substation are considered especially likely to generate some level of collision impact, particularly when Great Bustards are engaged in nocturnal migratory flights. Susceptibility to wind turbine collisions is not well-known. Turbine collisions could occur virtually anywhere within the wind farm and are most likely during autumn migration, when significant migratory activity of Great Bustards has been observed within the WPP area. Displacement impacts from wind farms and OHTL have also been noted for bustard species, including Great Bustard[201], likely due to their general preference for open habitats that lack tall structures, and high sensitivity to disturbance by human activity. Because the Project-associated OHTL have been sited outside of suitable wintering or breeding habitats for Great Bustard,

[199] As described in the Alternatives Section of this document, during the design phase of this Project, the developer sought to reduce potential risks to bustards through siting project infrastructure. Such measures continued throughout the development stage as additional baseline data were collected. Additionally, based on site discussions with the local team, no instances of OHTL collision mortality have been reported in the region to date, including anecdotal observations.
[200] As described in the Alternatives Section of this document, existing HV OHTLs are found along the route of the project-affiliated OHTL. Collision risks with OHTLs are pre-existing, and current OHTLs were not observed to be equipped with collision reducing Bird Flight Diverter devices.
[201] United Nations Environment Programme (UNEP)/CMS/COP14/Doc.28.5.3/Rev.1, 2024. Action plan for the Great Bustard in Asia. Prepared by the Mongolian Government, along with the Eurasian Bustard Alliance and Wildlife Science and Conservation Center of Mongolia.

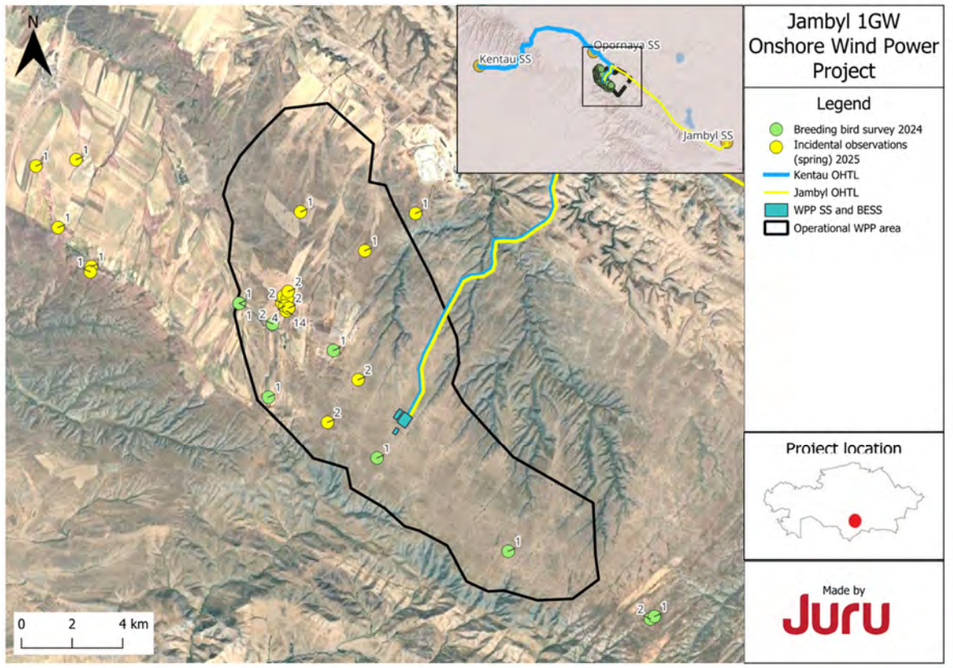
displacement impacts from Project-associated OHTL are considered unlikely. The greatest potential for the Project to generate some long-term or temporary displacement impacts is in the western portion of the WPP area, where several of the Project's turbines overlap agricultural fields where significant Great Bustard breeding activity has been observed. A flock of 18 Great Bustards was recorded feeding in agricultural fields. The birds were later seen flying west at a height of approximately 10 m. This record indicates that, despite the absence of Great Bustard registrations during the targeted Great Bustard Winter Survey and the Great Bustard Breeding Survey in this area, the species does use the agricultural landscape here during autumn movements.

It is considered likely that any construction activity that occurs in this zone of the Project area during the Great Bustard's breeding period (roughly mid-February through mid-June, with egg-laying in southern Kazakhstan from mid-April through late May[202]) could cause, at minimum, temporary displacement impact on breeding Great Bustards, affecting on the order of 18 breeding pairs.

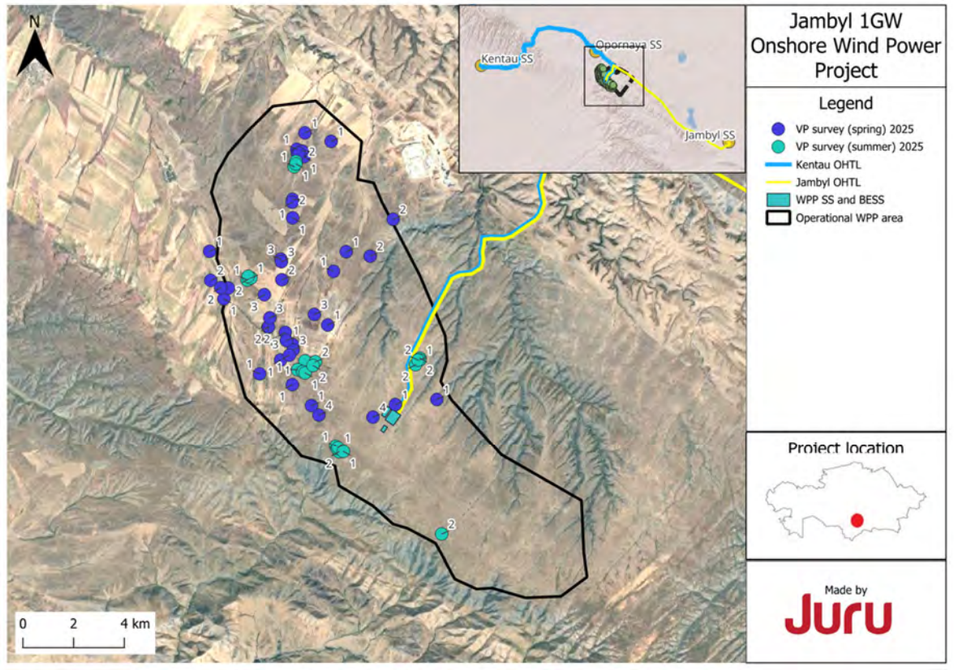
[202] United Nations Environment Programme (UNEP)/CMS/COP14/Doc.28.5.3/Rev.1, 2024. Action plan for the Great Bustard in Asia. Prepared by the Mongolian Government, along with the Eurasian Bustard Alliance and Wildlife Science and Conservation Center of Mongolia.



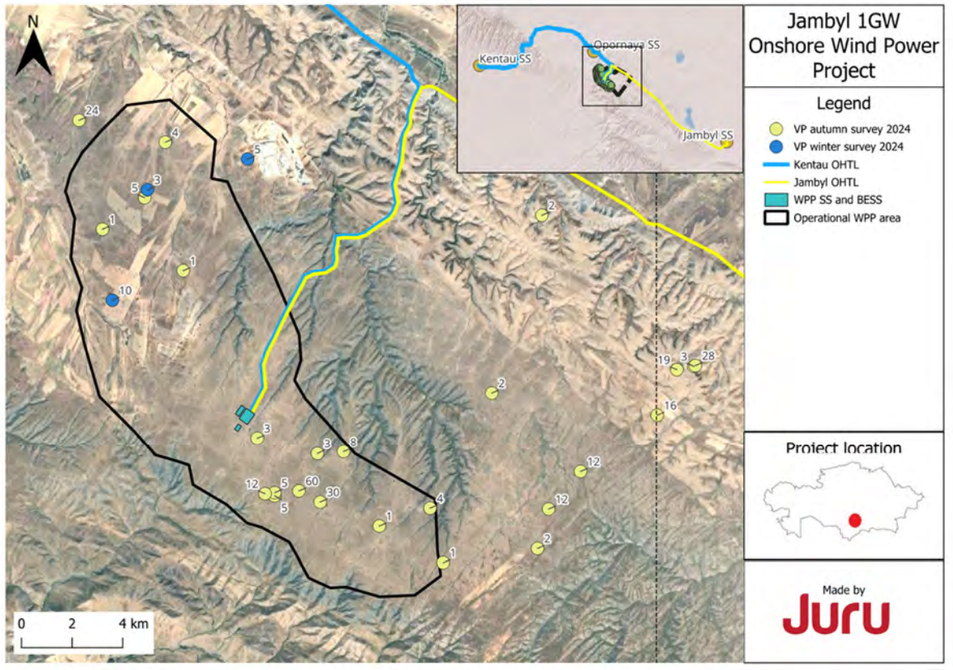
A



B



C



D

Figure 21: Locations where Great Bustards have been recorded during the baseline surveys for the Jambyl WPP. Numbers on the map indicate the number of individuals recorded at each point. A - GB breeding and winter surveys 2025; B - Breeding bird survey and incidental observations during spring 2025; C - VP surveys in spring and autumn 2025; D - VP surveys in autumn 2024 and winter 2024-2025.

Little Bustard (IUCN NT, Kazakhstan VU, receptor sensitivity: high). Collision susceptibility likely follows the general pattern for bustards (Silva et al., 2022, and see previous species). This species is considered an uncommon migrant in the Project region whose breeding range generally starts just north of the Project region and continues northward[203]. The observations of Little Bustards within the WPP area of the Project, most notably including 336 total observations collected during the spring, 2025 breeding bustard surveys, mostly of single birds or pairs engaged in apparent courtship/breeding activity, (Table 2) suggest that this species has a substantial breeding population on the plateau where the wind turbines are sited. Smaller numbers of presumed migrants have been recorded during spring and fall baseline surveys, but these observations did not include any large migratory flocks. These observations generated an interim CRM prediction of one wind turbine collision every 84 years for this species, a figure likely to increase marginally with the addition of summer 2025 data in the final CRM analysis. The baseline survey observations suggest that the Project has potential to generate minor collision fatalities with the OHTL, as well as displacement of breeding activity from the WPP area.

Demoiselle Crane (IUCN LC; Kazakhstan recovered, receptor sensitivity: medium). As a general rule, cranes are one of the bird taxa known to be highly susceptible to collisions with OHTL (Bernardino et al., 2018). There is also some susceptibility to collisions with wind turbines, though it may be less than for powerlines, especially during migration (AWWI, 2019). The Demoiselle Crane occurs in the Project region primarily as a migrant, but also breeds in small numbers, and it is one of the trigger species for the Ters-Ashchibulak Reservoir IBA (KZ079), located roughly 13 km southwest of the southern end of the Project's southern OHTL segment. During the Project's baseline surveys, a total of 454 observations have been recorded, primarily during spring and autumn migrations, both within the WPP area and along Project-associated OHTL routes (Table 2). VP survey observations in the wind farm area generated an interim CRM prediction of one wind turbine collision every 11 years for this species, a figure likely to increase marginally with the addition of summer 2025 data in the final CRM analysis. Therefore, we conclude that the Project has the potential to generate some fatality impacts to this species, through collisions with the Project's OHTL and/or wind turbines, with the former considered more likely, based on general collision susceptibility patterns of cranes, as reported in technical literature, and the extent of Project-associated OHTL.

Common Crane (IUCN LC, Kazakhstan NT, receptor sensitivity: medium). Collision susceptibility is presumably similar to that of cranes, in general, as discussed for the previous species. Baseline survey observations showed slightly higher numbers of this species (1,020 total observations) recorded than the previous one (454 total observations), especially during autumn migration. Similar to Demoiselle Crane, it also occurs in the region only as a migrant. Based on the limited numbers of cranes of either species documented in the Project's baseline studies, it is unlikely that the Project could generate high impacts to cranes. Nonetheless, some fatality impacts on this species may be generated through collisions with the Project's OHTL and/or wind turbines, with the former considered more likely, based on general collision susceptibility patterns of cranes, as reported in technical literature, as well as the

[203] Collar, N., E. Garcia, and E. de Juana (2020). Little Bustard (*Tetrax tetrax*), version 1.0. In Birds of the World (J. del Hoyo, A. Elliott, J. Sargatal, D. A. Christie, and E. de Juana, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bow.litbus1.01 accessed 12 April, 2025

Project-associated OHTL.

Northern Lapwing (IUCN NT, Kazakhstan unlisted, receptor sensitivity: medium). This large shorebird is a widespread breeder and migrant throughout much of Eurasia. In the Project region, it occurs as a fairly common migrant, when it may be exposed to risk of collision with the Project's wind turbines and/or OHTL. A total of 1,137 observations of this species was collected during the Project's baseline surveys, with most of these (895 observations) coming during the autumn, 2024 VP surveys along the Jambyl OHTL segment, which were concentrated in the southern portion of this segment, in the vicinity of Lakes Bilikol and Akkol, whose shoreline wetland habitats may have attracted concentrations of migrating Northern Lapwings. The moderate abundance of this species in the Project area indicates that the Project has some potential to generate adverse impacts, especially through collisions with the Project's OHTL, which are likely to be concentrated within elevated risk zones (close to large and small water bodies), and also possibly wind turbine collisions. All such impacts could occur primarily or exclusively during spring and autumn migration periods. The significance of collision impacts is limited by the moderate sensitivity of this abundant and widespread species, as well as its behaviour around wind farms typically avoiding).

White Stork (IUCN LC, Kazakhstan CR/EN, receptor sensitivity: medium) As a general rule, storks have low collision susceptibility with wind turbines (De Lucas et al., 2008) though they often attract concern, as they are large, charismatic birds, and migrating flocks frequently fly within rotor swept height. OHTL collision risk may be higher, though it has not been well-characterized. In the Project region, White Stork is a very rare breeding species and migrant, which is corroborated by relatively small numbers observed in the Project's baseline surveys (a single observation of a single bird). Collected data suggest that the Project has limited potential to adversely impact this species. This species is known to breed around Lake Bilikol, located roughly 3 km to the east of the Jambyl OHTL segment (I. Karyakin, pers. comm.). The Project has some potential to cause fatalities of this species through collisions with the Project's wind turbines, though this risk is considered to be very low for the wind farm, due to the rarity of this species at the site and the generally low wind turbine collision susceptibility of storks reported in technical literature. The potential for collision impacts along the OHTL is marginally higher, due to the very large extent of Project-associated OHTL, the proximity of OHTL 1 to a known breeding area, and the known susceptibility of White Storks to OHTL collision impacts, but still quite limited due to the rarity of the species in the Project area, as well as the 3 km minimum distance between the Project's OHTL and Lake Bilikol.

Black Stork (IUCN LC, Kazakhstan NT, receptor sensitivity: high) As noted for the previous species, storks have low collision susceptibility with wind turbines (De Lucas et al., 2008) though they often attract concern, as they are large, charismatic birds, and migrating flocks frequently fly within rotor swept height. OHTL collision risk may be higher, though it has not been well-characterized. In the Project region, Black Stork is an uncommon breeding species and migrant, as corroborated by relatively small numbers observed in the Project's baseline surveys (64 total observations). VP survey observations in the wind farm area generated an interim CRM prediction of one wind turbine collision every 19 years for this species, a figure likely to increase with the addition of summer 2025 data in the final CRM analysis. No active nests were found in the 2024 raptor/vulture nest surveys, which also included searching for Black Stork nests, but two active nests, both located within 500 m of the Kentau OHTL segment, plus a third located 1.8 km from this OHTL were documented in the 2025 nest surveys.

The Project has some potential to cause fatalities of this species through collisions with the Project's wind turbines and/or OHTL, though this risk is considered to be relatively low for the wind farm, due to the low abundance of this species at the site and the generally low wind turbine collision susceptibility of storks reported in technical literature, and moderate for the OHTL, due to the very large extent of Project-associated OHTL, and the proximity of at least 3 nests to the OHTL.

Great White Pelican (IUCN LC, Kazakhstan CR/EN, receptor sensitivity: medium) As a general rule, pelicans are highly susceptible to collisions both with wind turbines and with OHTL (Bernardino et al., 2018, AWWI 2019), likely due to their large size and bulk, as well as their soaring flight style, thus the Project is considered to have some potential to cause fatalities in this species through collisions with the Project's wind turbines and/or OHTL segments. The Great White Pelican is present in the Project region only as a migrant, when migrating flocks may fly through the area. The category 1 status (rough equivalent of IUCN CR or EN) of this species in Kazakhstan is largely based on this species' highly limited breeding distribution in the country, limited to a few large lakes scattered across eastern and southern Kazakhstan. Flocks of up to 228 birds have been recorded in the Project's baseline surveys. Such birds may represent individuals from the highly sensitive Kazakh breeding populations, or they may be drawn from breeding populations in other neighbouring countries. These numbers, along with the absence of any large waterbodies within 1 km of any Project infrastructure, indicate that the potential for the Project to adversely impact this species is limited, though some collision impacts with wind turbines and/or OHTL may occur during migration seasons, especially on portions of the Project's OHTL that are in elevated risk zones, defined as being within close proximity to large, or smaller water bodies.

Dalmatian Pelican (IUCN NT, Kazakhstan VU, receptor sensitivity: medium) As mentioned in the previous species account, pelicans, as a group, are known to be highly susceptible to collisions both with wind turbines and with OHTL (Bernardino et al., 2018, AWWI 2019), likely due to their large size and bulk, as well as their soaring flight style. The Dalmatian Pelican is present in the Project region only as a migrant, when migrating flocks may fly through the area. It is one of the trigger species for the Kykylkol Lake IBA. The only observations of this species collected in the baseline surveys were observations of 77 and 6 individuals on the spring, 2025 VP surveys in the WPP area and Kentau OHTL, respectively. These numbers, along with the absence of any large waterbodies within 1 km of any Project infrastructure, indicate that the Project's potential to adversely impact this species is limited, though there is some potential to cause fatalities in this species through collisions with the Project's wind turbines and/or OHTL segments during migration seasons, especially on portions of the Project's OHTL that are located close to large or small waterbodies.

Eurasian Spoonbill (IUCN LC, Kazakhstan VU, receptor sensitivity: low) This species is a rare and localized breeder in scattered localities, especially large wetland complexes, across Kazakhstan, and a rare migrant throughout most of the country. There was only a single detection of this species during the baseline surveys for the Project, an observation of a flock of 13 birds flying through the Jambyl OHTL corridor, detected during an autumn, 2024 OHTL VP survey (Table 2). The susceptibility of spoonbills to collision and/or electrocution impacts from wind turbines and powerlines is not well-characterized, but presumed similar to that of other long-legged waders (e.g. herons), indicating that the Project has some potential to generate such impacts, especially along the Project's extensive OHTL, where it is likely to be concentrated in the immediate vicinity of large and small water bodies,

but the potential for such impacts is low, due to this species' rarity as a migrant in the region.

Osprey (IUCN LC, Kazakhstan CR/EN, receptor sensitivity: medium). This is an eagle-sized raptor that feeds exclusively on fish, hence it is generally found near water, though it can be observed flying over upland habitats during migration. It is an abundant, cosmopolitan species, but in the Project region, it is an extremely rare migrant. Like many large raptors, it is highly susceptible to wind turbine collisions (AWWI 2019), but risk at the Project is likely low, not only because of this species' extreme rarity in the region, but also because the wind farm consists entirely of upland habitats and there are no significant water bodies located within 1 km of any Project infrastructure, hence there is nothing to attract an Osprey to engage in the sustained foraging flights that may expose it to more collision risk. There was only a single observation of this species collected during the baseline surveys, a presumed migrant observed in autumn migration, 2025, along the Jambyl OHTL (Table 2). This data indicates that the Project has limited potential to impact this species, though some impacts are possible during migration seasons, especially wind turbine collision impacts.

Bearded Vulture (IUCN NT, Kazakhstan NT, receptor sensitivity: medium) This is a very large vulture, and while wind turbine collision susceptibility of this species is not well-known, it is presumably high, similar to other old world vulture species. In the Project region, this species is largely restricted to the higher mountains north and south of the Project area. The Project's baseline studies produced a single record of this species, a bird that flew through the WPP area during an autumn VP survey (Table 2), which generated a prediction of one wind turbine collision every 92 years for the wind farm in the interim CRM analysis. These observations and results generally indicate that the Project has limited potential to impact Bearded Vulture,.

Egyptian Vulture (IUCN EN, Kazakhstan NT, receptor sensitivity: high) This is a smaller vulture, still quite a large bird, with known wind turbine collision susceptibility (de Lucas et al., 2008). It has a wider dietary range than many other vultures, often feeding at rubbish dumps as well as on drier carrion, and often relying to a significant degree on live prey, including tortoises[204]. It is present in Kazakhstan only during the warmer months, when it nests on bluffs and cliffs in low-lying desert mountains. No active nests were discovered during the Project's raptor/vulture nesting baseline surveys within the wind farm area, and summer VP surveys in the wind farm area yielded small numbers of total observations of this species (12 and 9 total observations in summers of 2024 and 2025, respectively), with comparable numbers recording in spring and autumn migrations. Spring and autumn VP observations generated a prediction of one Egyptian turbine collision fatality every 32 years in the interim CRM analysis, a figure that is likely to go marginally upward with the addition of summer 2025 VP data in the final CRM analysis. Three active nests were documented in 2025 along, and within 500 m of the Kentau OHTL segment, as well as evidence of a possible fourth breeding territory in the same general vicinity. This species' combination of conservation sensitivity, collision susceptibility and the habitat suitability of the Project area makes this species a significant biodiversity risk concern for this Project, in particular for potential displacement/disturbance due to powerline constructions. Collision is also possible, though data collected for the Project suggest that the potential for the Project to impact this species is limited due to the scarcity of this species in the Project area, and particularly the

[204] Orta, J., G. M. Kirwan, D. A. Christie, E. Garcia, and J. S. Marks (2020). Egyptian Vulture (*Neophron percnopterus*), version 1.0. In Birds of the World (J. del Hoyo, A. Elliott, J. Sargatal, D. A. Christie, and E. de Juana, Editors). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bow.egyvul1.01 accessed 12 April, 2025

absence of recent nesting activity within the wind farm area.

Cinereous Vulture (IUCN NT, Kazakhstan not listed, receptor sensitivity: high) This is a very large vulture with presumed high wind turbine collision susceptibility and high sensitivity. This species migrates through the Project region, and may also breed within it. Breeding is more likely to occur within the higher mountains to the north and south of the Project area, and no evidence of nesting activity within the vicinity of the Project area was recorded during the Project's raptor/vulture nesting surveys, but moderate numbers of observations of this species during summer VP surveys in the WPP area (93 and 97 total observations in summers of 2024 and 2025, respectively, Table 2) indicate that there could be breeding activity near the wind farm. During migration, the small numbers recorded at the Chokpak Pass eBird hotspot (irregularly reported during autumn migration, maximum number of 8 in any one day) provided an initial indication that migratory passage of this species through the region was not very concentrated. However, the 277 observations of this species recorded during autumn 2024 VP surveys, and 207 observations during spring, 2025 VP surveys in the Project's WPP area (Table 2) indicate that migratory passage of this species through the wind farm area may be considerably higher than it is through Chokpak Pass. These observations generated a prediction of roughly 1.69 Cinereous Vulture collisions per year in the interim CRM analysis, a figure likely to go marginally upward with the addition of summer, 2025 data in the final CRM analysis. Based on this information, the Project is considered to have moderate potential to impact this species, particularly though wind turbine collisions.

Eurasian Griffon (IUCN LC, Kazakhstan not listed, receptor sensitivity: high) This species is similar in most respects to the previous two species. The conservation sensitivity is one tick lower than Cinereous Vulture at the international level. This species has been recorded in small numbers at the JWF in the Project's baseline studies, in which a total of 143 observations of this species has been collected in all baseline surveys, combined, with a maximum of 49 observations in one baseline survey element (Spring VP surveys in the wind farm area, Table 2). This species is known to have nested historically within the Project area (I. Karyakin, pers. comm.) and a steep decline in this species' breeding population in the Karatau mountains has recently been documented, largely attributed to the use of diclofenac and/or other medications given to domestic livestock (Kaptyonkina et al., 2023). This species' susceptibility to wind turbine collision fatalities is well-known (de Lucas et al., 2008), and the interim CRM analysis generated a prediction of roughly one Eurasian Griffon collision every 5 years, a figure likely to go marginally upward with the addition of summer, 2025 data in the final CRM analysis. Based on this information, the Project is considered to have moderate potential to cause wind turbine collision fatalities of birds flying through the wind farm, especially in the warmer months (spring through autumn).

Short-toed Snake-Eagle (IUCN LC, Kazakhstan VU, receptor sensitivity: medium) This is a small eagle with known wind turbine collision susceptibility (de Lucas et al., 2008). It is an uncommon breeder and migrant in the region. Breeding activity of this species in the vicinity of the WPP area was confirmed with a single active nest documented during the 2024 raptor/vulture nesting surveys. 2025 raptor nest surveys documented another active nest within 500 m of the northwestern OHTL segment, where it passes through the Karatau mountains. VP surveys conducted within the WPP area yielded a total of

307 observations, with peaks in spring migration and summer. These observations generated an interim CRM prediction of 0.36 wind turbine collisions per year for this species, a figure likely to increase with the addition of summer 2025 data in the final CRM analysis. VP surveys along the Project's OHTL during spring and autumn migration seasons yielded 79 additional observations of this species, indicating a moderate level of migratory activity in the vicinity of these lines in both seasons (Table 2). These observations indicate a moderate level of migratory passage of this species through the wind farm area and across the Project's OHTL routes, with potential to generate minor impacts to this species, through turbine collision fatalities, but also potential displacement of nesting activity.

Greater Spotted Eagle (IUCN LC, Kazakhstan not listed, receptor sensitivity: medium) This is a wetland-associated eagle that occurs in the Project region only as an uncommon migrant. Its wind turbine collision susceptibility is presumably high, similar to other eagles, though collision susceptibility has not been well-characterized for this species. Autumn 2024 VP surveys in the wind farm area documented 87 observations of this species, and an additional 17 observations along the Jambyl OHTL segment. These observations generated an interim CRM prediction of one wind turbine collisions every 34 years for this species, a figure not likely to increase with the addition of summer 2025 data in the final CRM analysis. Autumn, 2025 VP surveys along both OHTL segments yielded an additional 12 observations of this species. These observations are all presumably migratory transits of the area, and are hence likely to include little or no double counting of individuals. Furthermore, it is important to note that VP sampling effort along the OHTL was substantially lower, hence OHTL VP surveys presumably documented only a small fraction of the individuals passing through these areas during migration. The Project is considered to have some potential to generate wind turbine collision impacts, but they are considered to be insignificant.

Booted Eagle (IUCN LC, Kazakhstan NT, receptor sensitivity: high) This small eagle species is an uncommon breeder and migrant in the region. Wind turbine collision susceptibility has been documented for this species (de Lucas et al., 2008), and is presumably similar to that of other eagle species. The Project's baseline surveys yielded a total of 238 observations of this species, with flight activity through the WPP area most concentrated during the summer, and smaller levels of flight activity recorded during spring and autumn migration (Table 2). These observations generated an interim CRM prediction of one wind turbine collision every 6 years for this species, a figure likely to increase substantially with the addition of summer 2025 data in the final CRM analysis. Two active nests of this species and an additional occupied breeding territory were documented in the vicinity of the WPP area during the Project's raptor/vulture nesting surveys in 2024, and occupied nests were documented at all three of these territories (third nest also documented) in the 2025 raptor nest survey (Table 2). The levels of activity of this species recorded within the Project's EAAA indicate that the Project has potential to generate moderate impacts to this species, both through turbine collision fatalities, as well as potential displacement of nesting activity, especially during the summer season, but also during migration seasons.

Steppe Eagle (IUCN EN, Kazakhstan recovered, receptor sensitivity: high) This large, migratory eagle has presumably high wind turbine collision susceptibility, similar to other *Aquila* eagles, though collision susceptibility has not been well-characterized for this species. The highest level of Steppe Eagle activity in the Project area was documented during the autumn 2024 VP surveys in the wind farm concession area, when 1,991 observations of this species, all presumed to be different individuals

passing through the area during autumn migration, were recorded (Table 2). Autumn migratory transits were also substantial along the Project's OHTL segments, with 109 and 405 observations recorded in OHTL VP autumn surveys in 2024 and 2025, respectively, with considerably lighter survey effort than applied in the wind farm VP surveys. Spring migratory activity of Steppe Eagles through the Project area was lower than during autumn migration, but still substantial, with 233 and 71 observations during the spring VPs in the wind farm area in 2024 and 2025, respectively, and 0 and 11 observations of Steppe Eagles in the OHTL VP surveys in the springs of 2024 and 2025, respectively (Table 2). Following the CRM results, the project layout was changed to minimise potential impacts on this species. New CRM results are currently awaited.

Imperial Eagle (IUCN VU, Kazakhstan NT, receptor sensitivity: medium) A congener of the previous species, this large eagle has a similar risk profile for the Project in most respects, including the likelihood that it will occur in the Project area exclusively during migration seasons. Baseline surveys indicated that the highest level of activity of this species in the Project area occurs during autumn migration, when 36 VP observations of this species were documented within the WPP area in 2024, 12 VP observations were recorded along the Jambyl OHTL segment in autumn 2024, and 19 VP observations were recorded along both OHTL segments, combined, in 2025, all presumably of autumn migratory transits, therefore including little or no double counting of individuals (Table 2). Spring migratory activity of Imperial Eagles through the WPP area was lower than during autumn migration, but still substantial, with 5 observations during the spring, 2024 VPs and 7 observations during the spring, 2025 VPs (Table 2). VP survey observations within the wind farm area generated an interim CRM prediction of one wind turbine collision every 10 years for this species, a figure not likely to increase with the addition of summer 2025 data in the final CRM analysis. The levels of activity of this species recorded within the Project's EAAA indicate that the Project has some potential to generate wind farm collision impacts to this species during migratory seasons, but the impact is considered to be minor.

With regard to potential OHTL-related impacts on Imperial Eagles that may be generated by the Project, it is important to take into account the distribution of a keystone prey resource for this species, colonial rodents, along the Project's OHTL segments. The eastern piedmont and plains of the Karatau Mountains, where the OHTL is proposed, represent the southern extremity of the breeding range for the Imperial Eagle (IUCN VU, Kazakh NT). It is estimated that there are between 5 to 10 breeding pairs in this area (I. Karyakin, pers. comm.). These eagles heavily rely on colonies of colonial ground squirrels found locally (I. Karyakin, pers. comm.). The locations of these ground squirrel colonies were mapped as part of the biodiversity baseline surveys and are shown in Figure 14 and Figure 15. The potential impact of OHTL is limited due to its design, which was mentioned earlier in the chapter.



Figure 22. Ground squirrel along the OHTL route

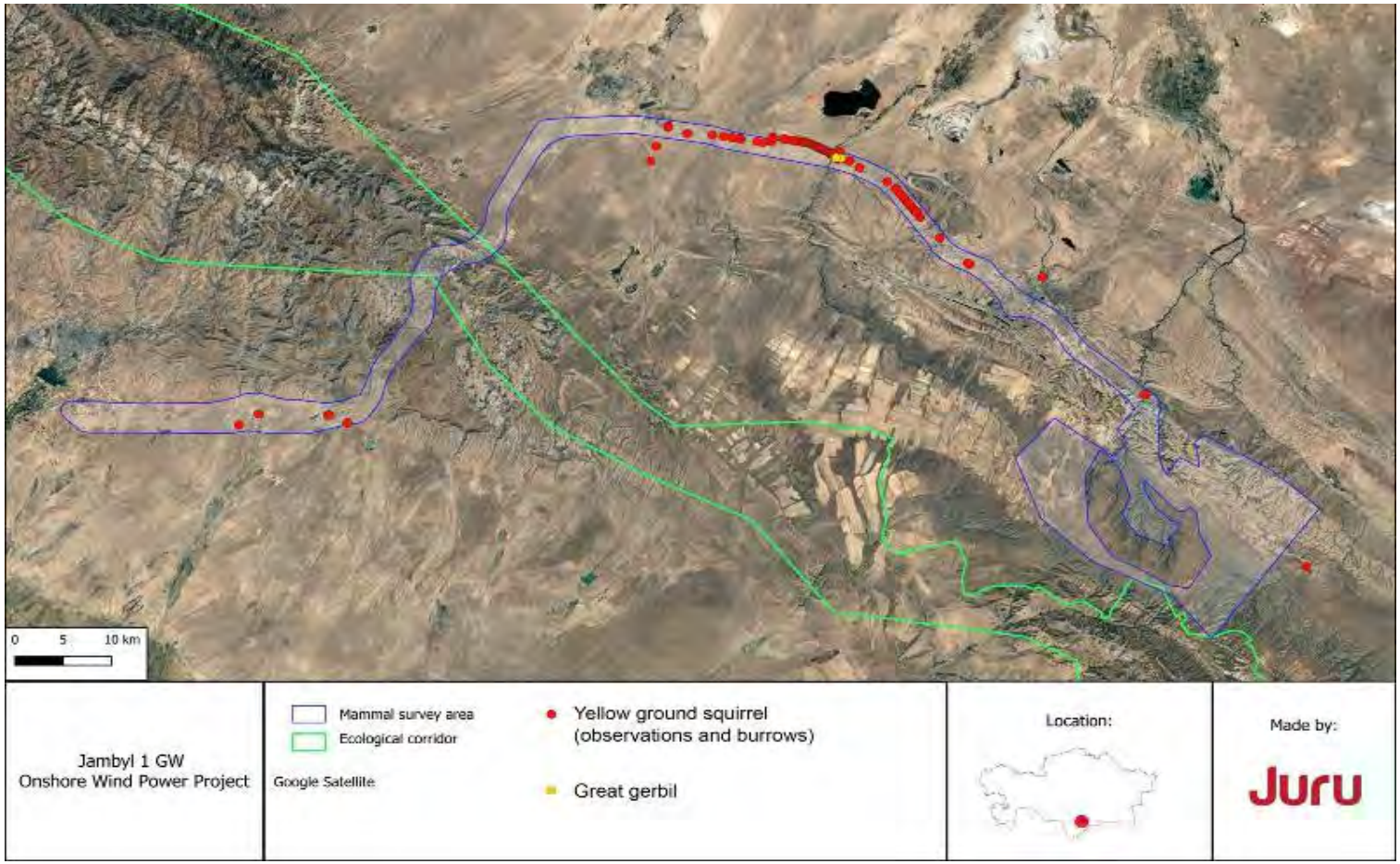


Figure 23. Locations of gerbil and yellow ground squirrel colonies documented along OHTL 2 during the 2025 mammal baseline surveys for the Jambyl Wind Project

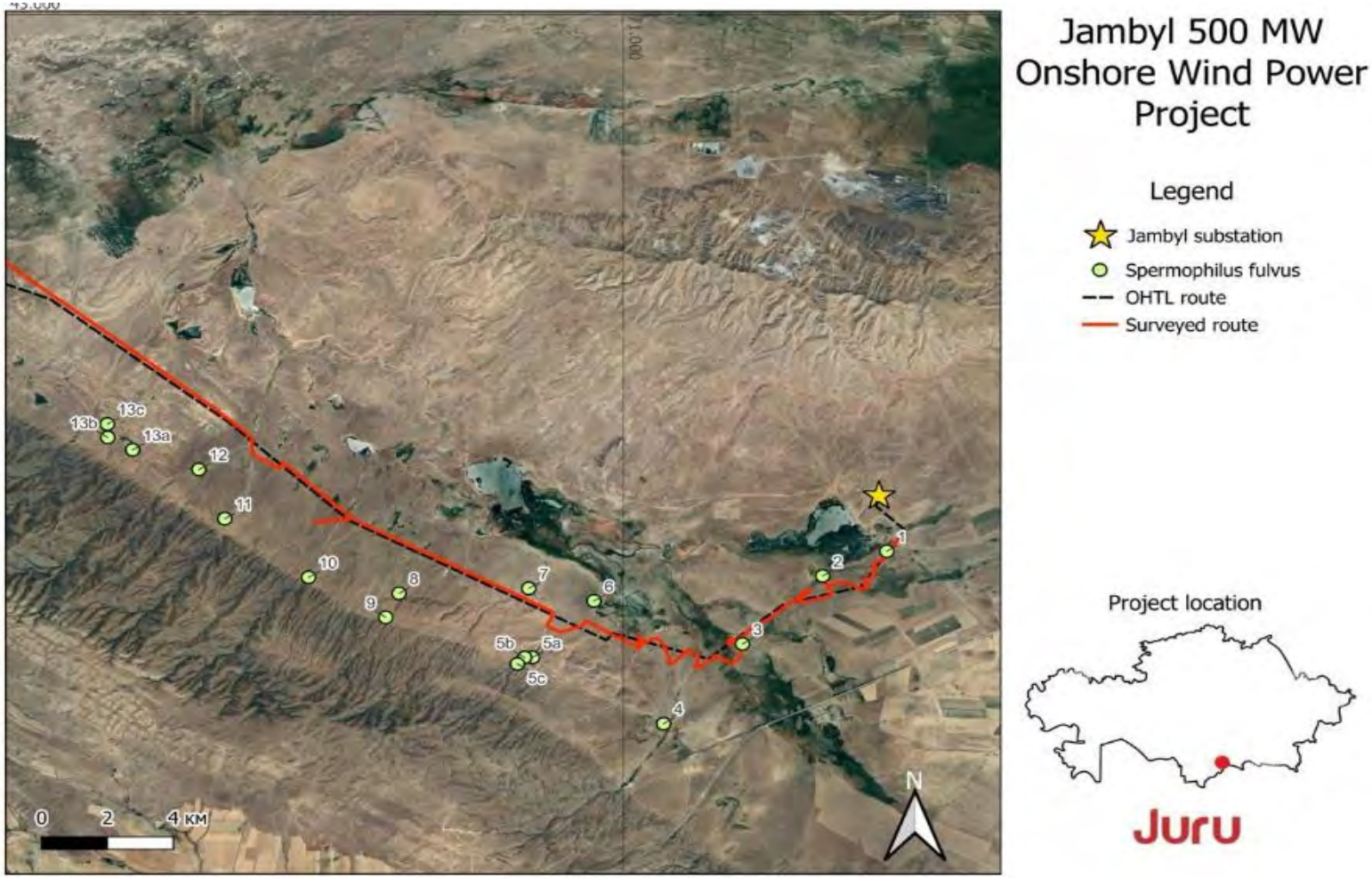


Figure 24. Locations of yellow ground squirrel colonies documented along OHTL 1 during the 2024 mammal baseline surveys for the Jambyl Wind Project

Golden Eagle (IUCN LC, Kazakhstan NT, receptor sensitivity: high) A congener of the previous two species, this is the most globally widespread of the three, with the largest global population size (85,000) and the lowest conservation sensitivity. However, unlike the previous two species, wind turbine collision susceptibility of Golden Eagles is well-known, both globally and locally (AWWI 2019, Karyakin et al., 2024), and it is a year-round resident within the Project region. Golden Eagles have historically bred within the Project's WPP area, and the 2024 raptor/vulture nesting survey documented three pairs attempting to nest in the area in the 2024 breeding season, but all three failed, likely due to recent crashes in prey populations in the area (I. Karyakin, pers. comm.). A similar pattern was shown in the 2025 raptor nest surveys, with two active nests discovered within 5 km of the wind turbine area, another two active nests discovered within 10 km, but nest failure documented in three of these nests, and success unknown in the fourth. In nesting surveys conducted in potentially suitable cliff/bluff habitats along the Kentau OHTL segment in 2025, only a single empty nest was discovered, but various individuals and presumed breeding territories were observed, suggesting that some additional nests may be present in these areas. These observations indicate that while there is some potential for the Project to displace some nesting activity in Golden Eagles, similar to what has been documented at the Zhanatas/Chokpar wind farm to the north (Karyakin et al., 2024), the potential for such displacement impact is lower at the JWF due to lower levels of breeding activity, and a pattern of nest failures in recent years, presumably due to low availability of prey.

The level of flight activity of Golden Eagles within the WPP area was low during spring and summer of 2024, with only 29 and 14 total observations recorded during VP surveys in these seasons, respectively (Table 2). A similar pattern was seen in 2025, with 18 and 16 observations of this species recorded during spring and summer VP surveys, respectively, in the wind farm area. VP survey observations within the wind farm area generated an interim CRM prediction of one wind turbine collision every 6 years for this species, a figure likely to increase marginally with the addition of summer 2025 data in the final CRM analysis. The highest level of flight activity of Golden Eagles recorded within the Project area in the baseline surveys was documented during the autumn VP surveys, with 114 Golden Eagle observations recorded during autumn, 2024 VP surveys in the wind farm area, and 59 observations recorded during the autumn, 2025 VP surveys along the Project's associated OHTL (Table 2). These autumn observations presumably including some migratory transit flights, in addition to activity of local resident birds. In summary, the Project is considered to have moderate potential to generate wind farm collision impacts displacement during construction activities, due to the generally low-moderate level of activity of this species in the Project area.

Pallid Harrier (IUCN NT, Kazakhstan unlisted, receptor sensitivity: medium). This raptor is a widespread, though relatively uncommon breeder across much of the north temperate latitudes of Eurasia, wintering primarily in India, Africa, and the Arabian Peninsula. In the Project region, its occurrence is limited to migratory periods. Harriers have a relatively unique foraging style among raptors, characterized by low altitude, slow, buoyant flight, during which they scan the ground to hunt for small birds and mammals, which they capture by pouncing upon them. This flight style is associated with low susceptibility to OHTL collisions, but harriers' highly aerial hunting style is associated with moderate to high wind turbine collision susceptibility, though risk is limited by the tendency of harriers to spend most of their time foraging below rotor swept altitudes. Migratory flights including higher elevation flights, including thermal soaring behaviours similar to other raptors, which brings them

within, or above rotor swept altitudes more frequently. A total of 53 observations of this species was collected during the Project's baseline surveys with the majority of these (36 observations) recorded during autumn 2024 VP surveys within the wind farm concession area (Table 2). The interim CRM analysis for this species yielded a prediction of one turbine collision every 152 years, a number not likely to increase with the addition of the summer 2025 season in the final CRM analysis. At this rate, collision impacts to this species are not predicted to reach serious or concerning levels, particularly in light of this species' limited conservation sensitivity and widespread, abundant global status.

White-tailed Eagle (IUCN LC, Kazakhstan VU, receptor sensitivity: medium). This eagle is a congener of the previous species, and is known to have high susceptibility to wind turbine collisions in Europe (especially the Smøla wind farm in Norway [May et al., 2013]). It occurs in the Project region only during winter and migration, when it is a scarce visitor, especially at larger lakes and reservoirs. The absence of large water bodies in the Project area limits the level of risk for this species. Baseline studies yielded a total of 63 observations of this species in the Project area, with 41 records recorded in the WPP area during VP surveys (30 in winter, 10 in autumn, 1 in spring) and another 22 records from the autumn VP surveys that were conducted along the Project's OHTL segments (4 in 2024 and 18 in 2025, Table 2). VP survey observations within the wind farm area generated an interim CRM prediction of one wind turbine collision every 10 years for this species, a figure not likely to increase with the addition of summer 2025 data in the final CRM analysis. In summary, the information collected and reviewed for the ESIA indicates that the Project does have some potential to generate wind turbine fatalities and/or OHTL-related fatalities in this species, especially in winter and migration seasons, though such impacts are limited by the relatively low abundance of this species in the Project area.

Eurasian Eagle-Owl (IUCN LC; Kazakhstan VU, receptor sensitivity: medium). This large, nocturnal owl species is rare but regular year-round in the Project region. This species could be impacted by the Project, most likely through collisions with wind turbines, as this species is known to have some susceptibility to such impact (de Lucas et al., 2008), and also including OHTL-related fatalities. Most of the Project's bird baseline surveys are focused on documenting diurnal bird activity, hence the scarcity of records of this species documented in the baseline surveys (Table 2) does not necessarily indicate that it is scarce on the site, though the personal observations of I. Karyakin in the area indicate that it is a very scarce breeder in the wind farm area, and such breeding activity has declined in recent years, potentially due to declines in prey resources. One active nest of this species was documented on the site during the 2024 raptor nest surveys, and no nests or nesting activity was documented during the 2025 raptor nest surveys (Table 2), hence the Project does have some, though limited potential to impact this species through displacement of breeding activity, as well as collision impacts.

Red-footed Falcon (IUCN VU, Kazakhstan not listed, receptor sensitivity: low) This is a medium-sized, relatively slow-flying falcon species that only occurs in the Project region as a very rare migrant. Baseline surveys yielded only a single observation of this species; a presumed migrant seen during spring surveys along the Kentau OHTL segment (Table 2). Its wind turbine collision susceptibility is not well-known, but is presumed to be similar to that of other falcons, which is generally moderate-high. Risk for the Project is limited by this species' rarity in the region, but a migrant could occasionally pass through the wind farm and be exposed to wind turbine collision risk.

Saker Falcon (IUCN EN, Kazakhstan CR/EN, receptor sensitivity: medium) This species has the highest

conservation sensitivity of any falcon potentially occurring in the Project area, and is relatively scarce, though regular in the Project region, where it may occur either as a breeder or during migration. Baseline surveys in the Project area yielded 13 observations of this species, with ten coming during autumn, 2024 VP surveys within the WPP area, one in spring, 2024 wind farm VP surveys, and two observations in autumn, 2025 OHTL VP surveys (Table 2). Raptor/vulture nesting surveys did not produce any indication of current Saker nesting activity in the area in either 2024 or 2025, though two empty, old Saker nests were found along the Kentau OHTL during the 2025 raptor nest survey. Sakers are known to have bred historically in the vicinity of the Project area, but their breeding population in the Karatau mountains has crashed in recent years, possibly due to poaching of nestlings by falconers (I. Karyakin, pers. comm.). Sakers, like other falcons, are known to be susceptible to wind turbine collisions. VP survey observations within the wind farm area generated an interim CRM prediction of one wind turbine collision every 141 years for this species, a figure not likely to increase with the addition of summer 2025 data in the final CRM analysis. Sakers are also known to be susceptible to electrocution impacts on powerlines, though there is less risk of this with high voltage lines, such as the Project's OHTL interconnection line.

Peregrine Falcon (IUCN LC, Kazakhstan CR/EN, receptor sensitivity: medium) This is a cosmopolitan species with a large global population (minimum estimate 100,000, requiring 1,000 to be present within the EAAA to trigger CH under IFC criterion 3), but it is quite rare in the Project region. Breeding is likely to be restricted to higher mountains to the north and south of the wind farm, but it could pass through as a rare migrant, when it would be exposed to turbine collision risk. Baseline surveys yielded 20 observations of this species, including two single individuals presumed to be migrating through the area recorded during autumn, 2024 VP surveys in the WPP area and 18 observations documented during the autumn 2025 OHTL VP surveys (Table 2, and see also "Barbary" Falcon below). VP survey observations within the wind farm area generated an interim CRM prediction of one wind turbine collision every 306 years for this species, a figure not likely to increase with the addition of summer 2025 data in the final CRM analysis. Based on this evidence, we conclude that the potential for the Project to impact this species is extremely limited.

Barbary (Peregrine) Falcon (IUCN not listed, Kazakhstan CR/EN, receptor sensitivity: high). The Barbary Falcon is considered to be a subspecies of the Peregrine Falcon, according to international taxonomic authorities, and is therefore not included in the IUCN global red list. In Kazakhstan, it is classified with CR/EN status (redbook category I), hence it is considered a sensitive receptor and PBV for the Project, but it is not considered a potential CH trigger under IFC CH criterion 1c, as it is not a distinct species. Baseline survey observations of Barbary Falcon included documentation of an active nest in the vicinity of the WPP area during the 2024 nesting season, but none during the 2025 nest survey, as well as 8 observations of birds in flight in the WPP area during the summer, 2024 VP surveys, but none during the summer, 2025 VP surveys (Table 2). Collision risk was not modelled separately for this subspecies in the CRM, but observations of Barbary Falcon were included in the CRM analysis for Peregrine Falcon, cited in the previous species account. In summary, we conclude that the Project has limited potential to impact Barbary Falcons both through displacement of breeding activity, and through turbine collision fatalities, as well as OHTL-related impacts (electrocution).

Other migratory waterbirds (receptor sensitivity: low). In addition to the migratory waterbird species individually considered, a wide variety of additional waterbird species is known to occur, or could

potentially occur within the Project area, and these species are collectively considered a PBV, as substantial collision fatality levels would be of concern to a broad set of scientific and conservation stakeholders, were they to occur. Included in this multispecies category are many species of shorebirds in the order Charadriiformes, as well as numerous ducks, geese and swans (order Anseriformes), gulls and terns (order Charadriiformes), grebes (order Podicipediformes), rails and allies (order Gruiformes), and storks, herons, ibis, cormorants, and allies (order Pelecaniformes). Such species generally have low susceptibility to wind turbine collisions (AWWI 2019), but some collisions are possible, and many species in this category are known to have high susceptibility to collisions with power transmission lines (Bernardino et al., 2018), such as the Project's OHTL interconnection segments. Most species in this category are restricted to, or highly associated with wetlands and waterbodies, thus limiting exposure of this group to risk from the upland and inland habitats of the Project area, but many species' migratory flights can occur anywhere over land or water, and some species have more affinity for inland and/or upland habitats. In the Project's baseline surveys, in addition to the species classified individually as PBVs for the Project and discussed separately, a total of 21 water bird species has been documented within the Project's EAAA in all baseline survey types, combined. The total baseline survey observations of these species are summarized in Table 2. Only one species in this category had total numbers of observations over 1000 (Eurasian Coot, 1,550 total observations). Only seven species in this category were observed during VP surveys conducted in the wind farm area, most with very few such observations recorded, likely reflecting the lack of significant wetlands or waterbodies in this area (Table 2). One notable exception was Lesser Black-backed Gull, for which 483 observations were documented in the wind farm area during spring migration in 2025 (Table 2). With regard to OHTL collision risk, a more likely impact to species in this category, risks are considered highest in the seven species for which at least 100 observations were collected during the OHTL VP surveys (Table 2), though risk is not considered to be major for any of them, primarily because of the minimum 3 km distance between the Project's OHTL segments and any large waterbodies. Nonetheless, some migratory waterbird collision risk may occur in the portions of the OHTL that are within close proximity to larger waterbodies, such as Lake Bilikol and Lake Kyzykol, as well as smaller waterbodies in closer proximity to the OHTL, such as Lake Akkol and a small, unnamed lake located along the northern part of the Jambyl OHTL segment, where White-headed Ducks were found breeding.

Other migratory upland birds (receptor sensitivity: low) In addition to the upland bird species individually considered PBV for the Project and listed above, a wide variety of additional upland migratory bird species occur, or could potentially occur within the Project area, and are collectively considered a PBV, as substantial collision fatality levels would be of concern to a broad set of scientific and conservation stakeholders, were they to occur. Included in this multispecies category are many species of songbirds (order Passeriformes), as well as numerous raptors with low conservation sensitivity (orders Accipitriformes, Falconiformes), owls (order Strigiformes), nightjars (order Caprimulgiformes), swifts (order Apodiformes), woodpeckers and allies (order Piciformes), kingfishers and allies (order Coraciiformes), cuckoos (order Cuculiformes), upland fowl (order Galliformes) and others.

Most such species generally have low susceptibility to wind turbine collisions, particularly for species that tend to remain on, or near the ground as a function of their behavior/ecology, but some collisions

are possible, especially among highly aerial species such as swifts and swallows, but even among ground-loving birds, who may occasionally collide with the bases of turbine towers, even if such birds rarely or never fly within rotor swept altitudes.

Raptors generally have higher wind turbine collision susceptibility than most other upland bird species, and all raptor species with elevated conservation status that could potentially occur within the Project area have been individually identified as CH features or PBV for the Project and are discussed in species-specific sections above. However, a variety of less sensitive species, most of them widespread and abundant species, are included within this multispecies category, including some species with known susceptibility to wind turbine collisions (e.g. Common Buzzard, Eurasian and Lesser Kestrels [De Lucas et al., 2008]). The bird species in this category exhibit a wide range of habitat affinities, and many species are highly associated with forests, or other habitats that are not represented within the Project area. Others, such as Long-legged Buzzard, and two species of kestrels are known to breed within the Project region. Even for common and widespread species with generally lower conservation sensitivity, the Potential for Project specific impacts can become a significant concern if impacts are high enough. All baseline survey observations for all raptor species observed during the baseline studies are summarized in Table 2. Notable among these observations are three species for which overall totals of greater than 1,000 observations were collected, Black Kite, Long-legged Buzzard, and Lesser Kestrel. Black Kite occurs in the Project region strictly as a migrant, and baseline observations indicate that it is regular only during autumn migration, when two large flocks were observed during VP surveys along the OHTL, and smaller numbers were observed in autumn 2024 wind farm VP surveys and autumn 2025 OHTL VP surveys (Table 2). All raptor species observed during VP surveys within the wind farm concession area were included within the CRM analysis, and this included ten “other raptor” species, plus several unidentified raptor categories. Interim CRM results for these species/groups are presented in Table 3, and more detail is provided in the Interim CRM report. None of these species was predicted to have wind turbine collision rates of one collision per year, hence while some collisions are likely to occur during the Project’s operations phase, particularly for the more abundant, and breeding or seasonally resident species such as Long-legged Buzzard and Eurasian Kestrel, such risks are not likely to reach levels that would likely jeopardize any species’ population or conservation status, or raise significant conservation concerns. In addition to wind turbine collision impacts, species in the “other raptor” category may experience some level of OHTL-related impacts from the Project (e.g electrocution, collision) though such risks are limited by the generally low susceptibility of raptors to OHTL collision impacts, and the generally low level of raptor electrocution risk on high voltage OHTL, such as the Project’s, compared with lower voltage OHTL.

*Table 16. Estimated rates of collisions per **3-season period** (spring 2025, autumn, and winter) for bird species in the “other raptor” category at the Jambyl Wind Energy Project, predicted by Band Collision Risk Modeling analysis, under a range of Collision Avoidance (CA) parameter values (see CRM report for season-specific collision rate predictions and CRM input parameters used for each species). These results were generated using data only from the vantage points to which turbines in the proposed windfarm layout were assigned (VP2-4 and 14-19).*

English Common Name	Using lower bound CA value		Using most realistic CA value		Using upper bound CA value	
	Collisions/3 season period	3-season periods to 1 collision	Collisions/3 season period	3-season periods to 1 collision	Collisions/3 season period	3-season periods to 1 collision
Oriental Honey-Buzzard	0.334	2.99	0.0759	13.1	0.0152	65.8
Eurasian Sparrowhawk	0.223	4.48	0.112	8.96	0.0223	44.8
Eurasian Goshawk	0.00758	132	0.00379	264	0.000758	1320
Western Marsh Harrier	0.199	5.01	0.0399	25.0	0.00399	250
Hen Harrier	0.0645	15.4	0.0129	77.4	0.00129	774
Unidentified Harrier	0.0107	93.6	0.00214	468	0.000214	4680
Common Buzzard	0.176	5.66	0.0401	24.9	0.00802	124
Long-legged Buzzard	2.86	<1	0.649	1.54	0.130	7.70
Unidentified Buzzard	0.0344	29.0	0.00783	127	0.00157	638
Lesser Kestrel	1.00	<1	0.245	4.08	0.00789	126
Eurasian Kestrel	1.90	<1	0.463	2.15	0.0149	66.9
Eurasian Hobby	0.0352	28.3	0.0141	70.9	0.00705	141

10.3.3 Bats

Though birds' collisions with wind turbines often get more attention, bat fatality rates due to collisions or near-collisions of bats with wind turbines are often higher than are bird fatality rates, and such fatalities are one of the prevailing biodiversity risk considerations for wind farm projects, worldwide[205]. Accordingly, the biodiversity baseline studies for the Project were scoped with a major emphasis on characterizing use of the wind turbine area, and rotor swept airspace, by bats.

The bat fauna of Kazakhstan is still poorly known, and reliable information on seasonal abundance patterns, migratory activity, and flight heights of bats in the Project region is limited.

A list of 18 bat species potentially occurring in the region was developed based on a comprehensive review of technical literature and publicly available data. These species are listed in Table 4, along with their national international redlist status, and known or presumed susceptibility to wind turbine collisions. There are no potentially occurring species with redlist status of VU or higher.

Table 17. Bat species potentially occurring within the Project Area, their collision susceptibility and conservation status under

[205] Rodrigues, L., L. Bach, M. -J. Dubourg-Savage, B. Karapandža, D. Kovac, T. Kervyn, J. Dekker, A. Kepel, P. Bach, J. Collins, C. Harbusch, K. Park, B. Micevski, J. Minderman, 2015. Guidelines for consideration of bats in wind farm projects – Revision 2014. EUROBATS

the IUCN Red List, the Red Data Book of Kazakhstan. Redlist categories are as follows: CR = Critically Endangered, or Kazakh status I; EN = Endangered, or Kazakh status I; VU = Vulnerable, or Kazakh status II; NT = Near Threatened, or Kazakh status III; DD = Data Deficient, or Kazakh status IV; R = Recovered (Kazakh status V). Blank = Least Concern or unlisted

Common name	Latin name	Wind farm collision risk level[206]	IUCN Red list[207]	KzRDB[208] (2010)
Bukhara Horseshoe Bat	*Rhinolophus bocharicus*	Low		
Greater Horseshoe Bat	*Rhinolophus ferrumequinum*	Low		
Lesser Horseshoe Bat	*Rhinolophus hipposideros*	Low		
Kyrgyz Horseshoe Bat[209]	*Rhinolophus kirghisorum*	Low		
Lesser Mouse-eared Bat	*Myotis blythii*	Low		
Geoffroy's Bat	*Myotis emarginatus*	Low		
Steppe long-eared bat	*Myotis davidii*	Low		
Asian Barbastelle	*Barbastella leucomelas*	Medium		DD
Strelkov's Long-eared Bat	*Plecotus strelkovi*	Low		
Common Noctule	*Nyctalus noctula*	High		
Common pipistrelle bat	*Pipistrellus pipistrellus*	High		
Savi's Pipistrelle	*Hypsugo savii*	High		
Serotine Bat[210]	*Eptesicus serotinus*	High		
Botta's serotine[211]	*Eptesicus ognevi*	High		
Gobi serotine[212]	*Eptesicus gobiensis*	Medium		NT
Particoloured Bat	*Vespertilio murinus*	High		
Turkestani Long-eared Bat	*Otonycteris leucophaea*	Unknown	DD	NT
European Free-tailed Bat	*Tadarida teniotis*	High		NT

In order to characterize the potential exposure an evaluate risk of bats' collisions with the Project's wind turbines, a variety of specific baseline survey methodologies aligned with good international practice, and following the specific recommendations of McEwan et al., 2020[213] was implemented.

The primary baseline survey methodology that was implemented to characterize the use of the

[206] Rodrigues, L., L. Bach, M. -J. Dubourg-Savage, B. Karapandža, D. Kovac, T. Kervyn, J. Dekker, A. Kepel, P. Bach, J. Collins, C. Harbusch, K. Park, B. Micevski, J. Minderman, 2015. Guidelines for consideration of bats in wind farm projects – Revision 2014. EUROBATS

[207] https://www.iucnredlist.org/ accessed 13 December, 2025

[208] The Red Data Book of the Republic of Kazakhstan, 2010

[209] *Rhinolophus kirghisorum* was previously considered a synonym of *Rhinolophus lepidus*. At present, it is not listed in the IUCN Red List.

[210] Since 2025, it has been listed on the IUCN Red list under the name *Cnephaeus serotinus*

[211] Since 2025, it has been listed on the IUCN Red list under the name *Cnephaeus ognevi*

[212] Since 2025, it has been listed on the IUCN Red list under the name *Cnephaeus gobiensis*

[213] MacEwan, K., S, Sowler, Aronson, J., & Lotter, C. (2020). South African Best Practice Guidelines for Pre-construction Monitoring of Bats at Wind Energy Facilities

Project's airspace, including airspace within rotor swept altitudes, was passive, or static acoustic recording and analysis, including with microphones at elevated locations within rotor swept airspace, as this is known to be the optimum methodology for characterizing the species and risk levels associated with bat – wind turbine collision risk. This was supplemented with a variety of additional survey methods, spanning two consecutive warm seasons (2024, 2025). The methodologies applied, spatio-temporal extent, and effort levels are summarized below, and full detail on methods, effort, and results are presented within the individual baseline survey reports annexed to this ESIA:

- Bat passive acoustic surveys
    - 2024: 6 detectors in 500 MW WPP area (all low elevation detectors starting 23 May, 2 elevated at 40 m on Aug 6, all decommissioned November 18; 179 total detector-nights
    - 2025: 9 detectors in 1GW WPP area. 3 elevated detectors (33-52m) with recording initiated 22 June-1 July; 6 low elevation detectors starting 30 April; all 9 detectors decommissioned 15 October: 1053 total detector-nights
- Bat active acoustic surveys
    - 2024: 23 short transects (ca 1 km each) in 500 MW WPP area, each surveyed 6x, roughly on monthly basis, May-October
    - 2025: 4 long transects (ca 10 km each), each with 12 sampling points (48 total points). Each point sampled for 5 minutes 6x between May 4 and September 27
- Bat roost surveys
    - 2024: Opportunistic and targeted searches and netting of potential roost sites 4 days in June, covering 1 GW WPP area
    - 2025: Opportunistic and targeted searches and netting of potential roost sites 4 days in May, covering 1 GW WPP area plus Kentau OHTL

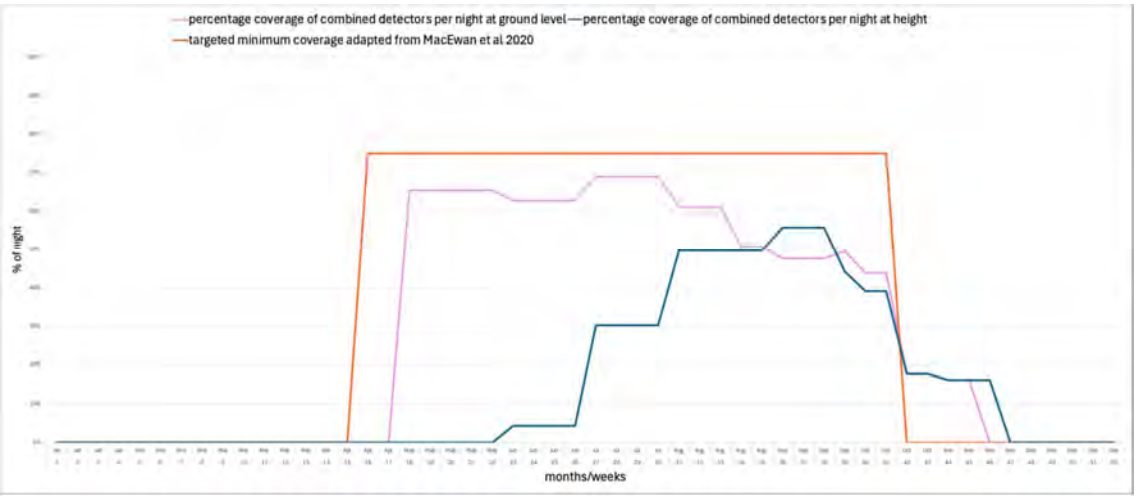


Figure 25 The area under the lines represents a combined survey effort for both years of survey for passive detectors at ground level (pink) and at height (blue). The orange line is the 75% target of the night in the warm season adapted from MacEwan et al 2020

For additional information on bat species and survey methodologies, please refer to Annex E

(Biodiversity Baseline Survey reports).

The bat baseline surveys conducted for the JWP produced a very large and multi-faceted set of observations of bats and confirmed or potential bat roost sites. The total numbers of observations of all bat species are shown in Table 5. These observations, and the variation in total call numbers recorded in the passive acoustic recordings, specifically, indicate that 10 species account for almost all of the bat activity at the site, with heavy dominance by *Vespertilio murinus*, *Eptesicus serotinus* and *Pipistrellus pipistrellus*, with *Myotis blythii*, *Nyctalus noctula*, and *Tadarida teniotis* comprising a second tier of acoustic abundance (Table 5). Among these species, *M. blythii* is considered to have low susceptibility and *E. serotinus* is known to have medium susceptibility to wind turbine collisions but the other four species are all known or presumed to have high susceptibility to wind turbine collisions based on patterns documented at European wind farms[214]. The high acoustic abundance of highly collision susceptible bat species within the wind turbine area indicates that bat collision risk during the operations phase of the wind farm is substantial.

The bat survey effort covered a greater portion of the total warm season in 2025 compared with 2024, and the passive detectors were more numerous (9), and located within the current layout, compared with 2024, when a smaller number of detectors (6) was deployed in the original 500 MW wind farm area, hence in the discussion below, we put greater emphasis on the 2025 data, also noting that the spatial and temporal patterns of acoustic activity were roughly consistent across these two seasons.

[214] Rodrigues, L., L. Bach, M. -J. Dubourg-Savage, B. Karapandža, D. Kovac, T. Kervyn, J. Dekker, A. Kepel, P. Bach, J. Collins, C. Harbusch, K. Park, B. Micevski, J. Minderman, 2015. Guidelines for consideration of bats in wind farm projects – Revision 2014. EUROBATS

Table 18. Bat species recorded in baseline surveys for the Jambyl Wind Power. Global and national redlist status is LC (IUCN) or unlisted (national) unless otherwise indicated

Species	Turbine collision susceptibility[215]	IUCN status	Kazakh Red Book status	2024			2025		
				Passive Acoustic Survey (total calls recorded)	Active Acoustic Survey (total calls recorded)	Roost Search (number seen or captured)	Passive Acoustic Survey (total calls recorded)	Active Acoustic Survey (total calls recorded)	Roost Search (number seen or captured)
Rhinolophus ferrumequinum	low			139	6	9	320		2
Myotis blythii	low			46		300-400	652	3	3
Myotis emarginatus[216]	low			16		1	147		4
Myotis sp.	low			236					
Barbastella leucomelas	medium		IV (DD)	6	1				
Plecotus strelkovi	low			24			1		
Nyctalus noctula	high			172			631	13	
Eptesicus serotinus	medium			932	6		1,435	27	3
Eptesicus ognevi	medium						201	4	
Eptesicus sp.	medium			263	16				
Vespertilio murinus	high			1,698	7		4,134	39	8
Pipistrellus pipistrellus	high			1,487	126	1	1,261	19	
Hypsugo savii	high			195	3		329	10	
Otonycteris hemprichii	unknown		III (NT)	2					
Otonycteris leucophaea	unknown	DD					9		1
Tadarida teniotis	high		III (NT)	83			409	3	

[215] Rodrigues, L., L. Bach, M. -J. Dubourg-Savage, B. Karapandža, D. Kovac, T. Kervyn, J. Dekker, A. Kepel, P. Bach, J. Collins, C. Harbusch, K. Park, B. Micevski, J. Minderman, 2015. Guidelines for consideration of bats in wind farm projects – Revision 2014. EUROBATS Publication Series No. 6 (English Version). UNEP/EUROBATS Secretariat, Bonn, Germany, 133 pp.
[216] May also include some calls of *Myotis davidii*

Spatial patterning of bat acoustic activity across the current wind turbine area was fairly uniform (Figure 17), noting that the nine passive recording locations surveyed in the 2025 warm season yield a widespread, though rough depiction of spatial variation in bat activity across the site.

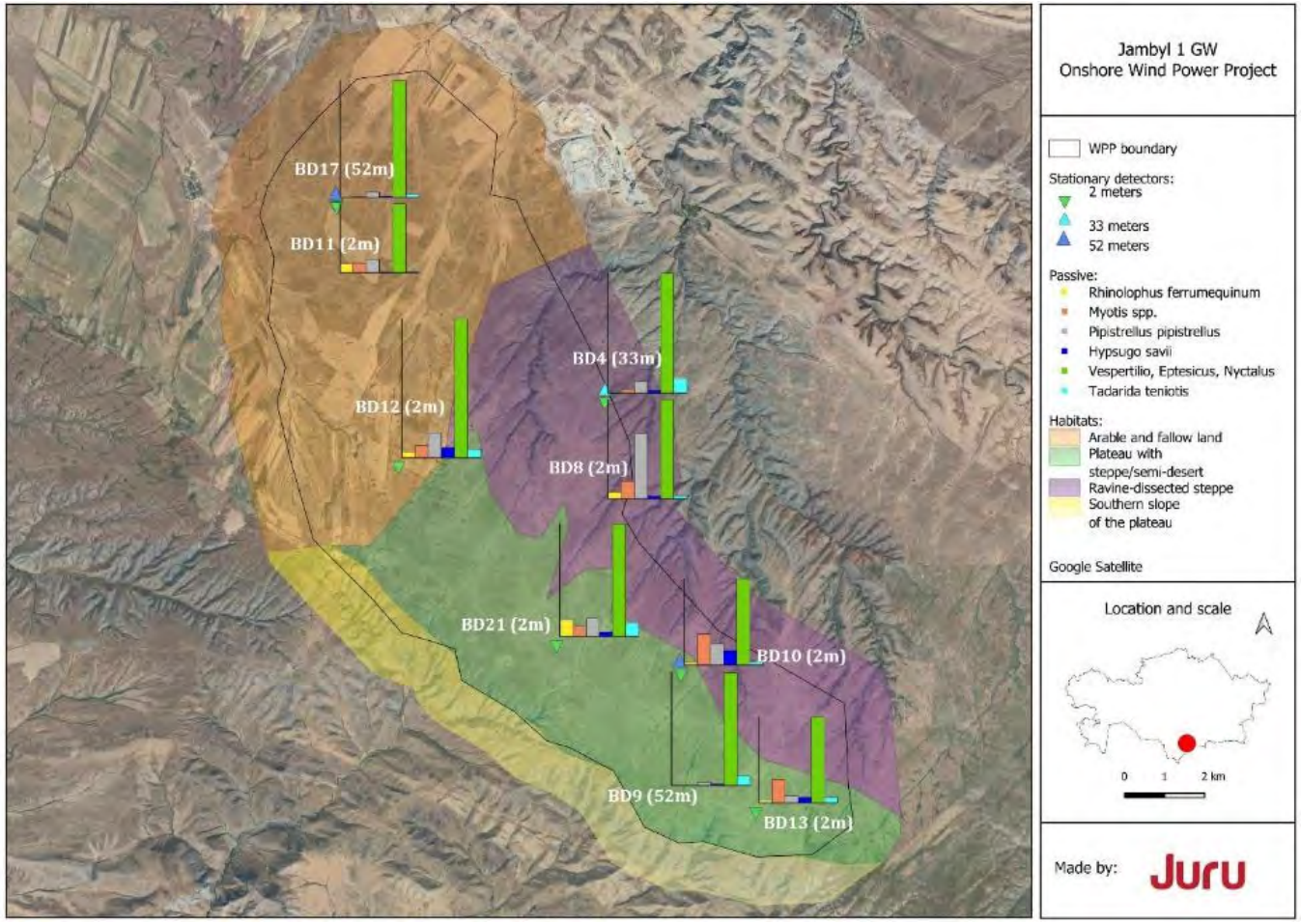


Figure 26. Bat acoustic activity by passive acoustic detector for the entire 2025 warm season, in relation to the current wind turbine layout of the Jambyl Wind Farm

Roost surveys provided an additional indication of spatial concentrations of bat collision risk, with two bat roosts positively documented during the roost surveys, and several other caves or crevices with possible or suspected bat roosting activity documented, particularly within the steep walled ravines that cut through the plateau within the wind turbine concession area. Of these, the Aktogai cave, located near the exit point of the Kentau OHTL segment is the most significant, as it contained at least a thousand bats of at least seven species, including at least one individual of the IUCN DD species, *Otonycteris leucophaea*. This cave is located roughly 8 km from the nearest wind turbine in the current layout, and bats roosting in this cave may be exposed to wind turbine collision risk at this distance. An additional concern are potential impacts from any blasting or construction activity that may occur in the vicinity of this cave for the construction of the OHTL, as this could potentially cause temporary or permanent disturbance or displacement impacts, or potential more intense impacts if blasting impacts affect the structure of the cave, itself. The distance from the cave to the nearest section of the OHTL where blasting activities may be required is approximately 1,350 m. No bat roosts were identified within the area identified for the current WTG layout. The nearest roost to a turbine is located 1181 m away.

Comparison of passive acoustic data collected at the Project's elevated (33-52 m) versus low elevation (ca 2 m) detectors yielded insight into taxonomic patterns of collision risk as a function of flight altitude. Acoustic activity within rotor swept altitudes was dominated by species with known high susceptibility to wind turbine collisions, including *Nyctalus noctula*, *Vespertilio murinus*, *Pipistrellus pipistrellus*, and *Tadarida teniotis*, as well as *Eptesicus serotinus*, which has medium collision susceptibility (Figure 18). Accordingly, these are the species for which the highest collision impacts are predicted during the operations phase of the JWP.

Seasonal activity of bats showed a somewhat bimodal pattern, with the peak occurring in the late summer/early autumn, which is typical for sites in temperate Eurasia[217] (Figure 19), with corresponding implications for the expected seasonal distribution of bat collision risks at the wind farm.

[217] Rodrigues, L., L. Bach, M. -J. Dubourg-Savage, B. Karapandža, D. Kovac, T. Kervyn, J. Dekker, A. Kepel, P. Bach, J. Collins, C. Harbusch, K. Park, B. Micevski, J. Minderman, 2015. Guidelines for consideration of bats in wind farm projects – Revision 2014. EUROBATS Publication Series No. 6 (English Version). UNEP/EUROBATS Secretariat, Bonn, Germany, 133 pp.

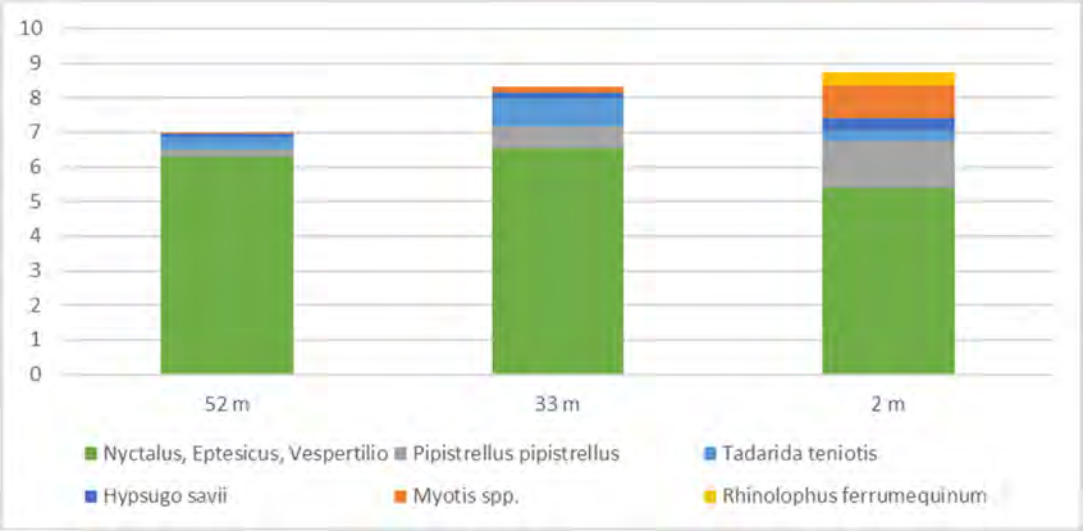


Figure 27. Comparison of bat acoustic activity (reflected by Bat index per detector-night, shown on the Y axis) at different recording heights, from passive acoustic data collected during the 2025 warm season within the wind turbine area at the Jambyl Wind Project

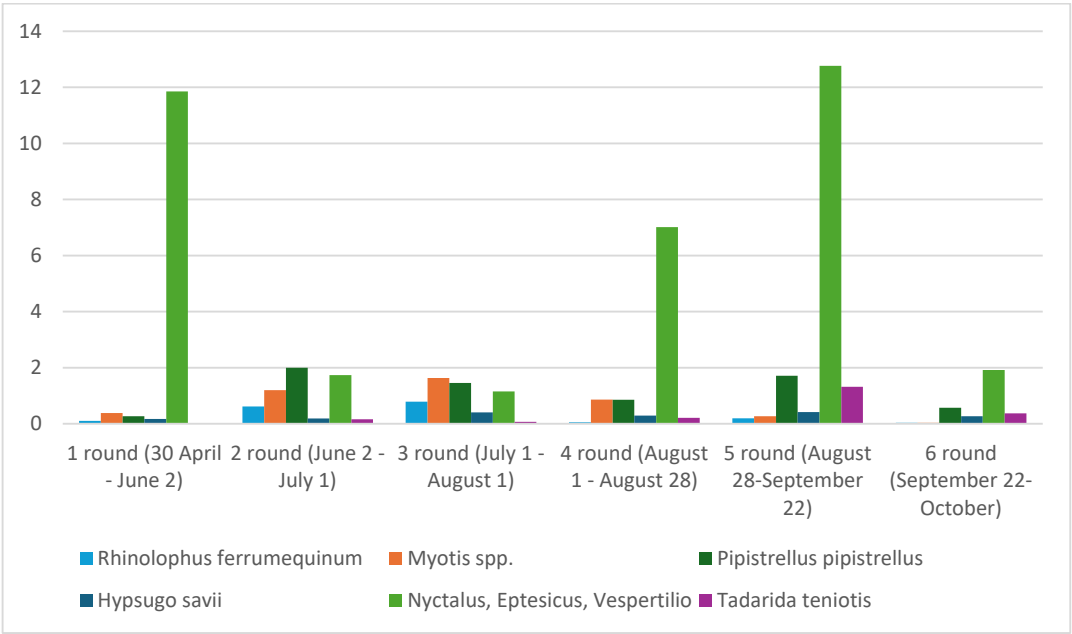


Figure 28. Seasonal variation in bat acoustic activity (Bat Index[218]) for different ecological species groups in the Jambyl Wind Project wind turbine area, as indicated by data collected during passive acoustic recordings over the course of the 2025 warm season

Hourly patterns of bat acoustic activity over the course of the night were roughly consistent over the course of the warm season, and also showed a bimodal pattern, with a larger peak just after sunset,

[218] Bat Index is defined as the ratio of the total number of registered bat passes per round to the number of active detector-days in that round

and a smaller activity peak just prior to sunrise (Figure 20).

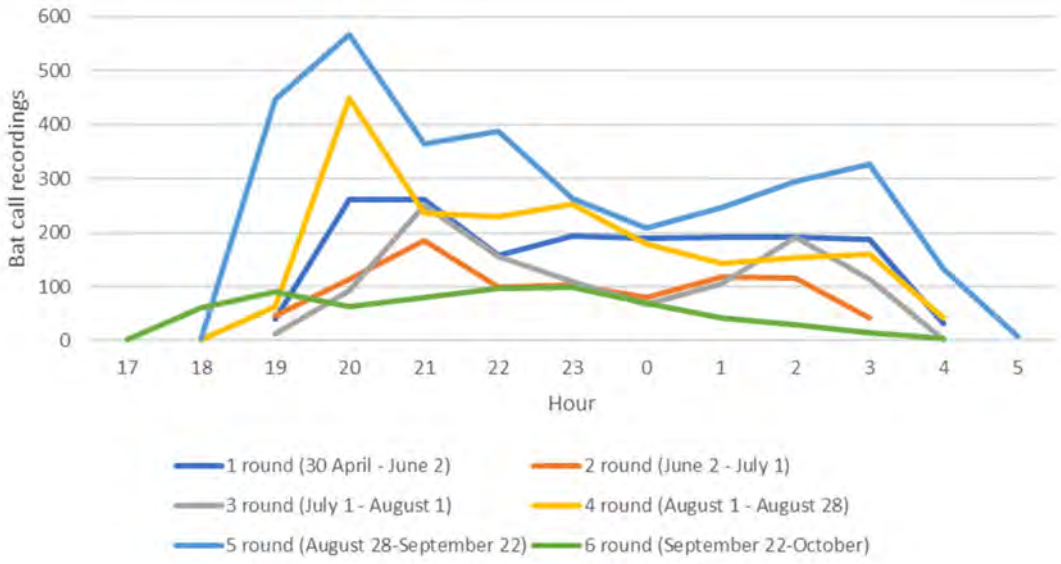


Figure 29. Variation in bat acoustic activity over the hours of the night, shown for all species, combined across the different survey rounds from the passive acoustic recordings gathered within the wind turbine area of the Jambyl Wind Project during the 2025 warm season

European free-tailed bat, *Tadarida teniotis* (receptor sensitivity: medium): information reviewed for the ESIA suggests that this species is moderately abundant at the site, and is likely to be exposed to large collision impacts from the Project. This migratory insectivorous bat species in the free-tailed bat family (Molossidae) is known to have high sensitivity to collisions with wind turbines[219]. This susceptibility is likely related to this species' tendency toward high altitude flights, as they forage for insects above treetop level. This species roosts in caves or under bridges, and is quite wide-ranging. 83 and 409 calls of this species were identified in the passive ultrasound acoustic surveys conducted within the WPP site during the 2024 and 2025 warm seasons, respectively, representing 1.5% and 4.3% of the total bat calls recorded during these surveys, respectively. Passive acoustic recordings collected at higher elevation detectors positioned on meteorological masts in the wind farm area confirmed that this species focus a substantial portion of its flight activity within rotor swept altitudes, with 30% of total *T. teniotis* calls recorded at the elevated detectors, which represented 33% of the passive detectors. *T. teniotis* calls were not recorded on the 2024 active acoustic transect surveys, but 3 calls of this species were recorded during active acoustic surveys in 2025. This species was not found during bat roost surveys conducted within the WPP site and vicinity (2024), or within the wind farm and along the Kentau OHTL route (2025). These baseline survey results indicate that this species is present, potentially in moderate abundance in the Project area, where its activity is concentrated in late summer and early autumn, and within rotor swept altitudes. Accordingly, we conclude that this species is at risk of wind turbine mortality, particularly during the peak seasonal activity period in late summer/early autumn.

[219] Rodrigues, L., L. Bach, M. -J. Dubourg-Savage, B. Karapandža, D. Kovac, T. Kervyn, J. Dekker, A. Kepel, P. Bach, J. Collins, C. Harbusch, K. Park, B. Micevski, J. Minderman, 2015. Guidelines for consideration of bats in wind farm projects – Revision 2014. EUROBATS Publication Series No. 6 (English Version). UNEP/EUROBATS Secretariat, Bonn, Germany, 133 pp.

Parti-coloured bat, *Vespertilio murinus* (receptor sensitivity: low): This species is a long-range migratory and capable of flying at heights that overlap with rotor blades, and this was detected during baseline surveys. This species is also significantly susceptible to wind turbine collisions. *Vespertilio murinus* was also highly active in the WPP area. Shelters for this species are usually human-made structures and tree hollows. It hunts flying insects at high altitudes, usually over open spaces, less often over forests or water bodies. *Vespertilio murinus* was found during 2025 bat roost survey conducted along the northwestern OHTL segment of the Jambyl Wind Energy Project. During the 2024 bat passive and active acoustic surveys, this species showed the highest activity. *Vespertilio murinus* and two other bat species collectively accounted for roughly 78% of all bat calls recorded, and are presumed to be the most abundant species at the site. Out of those, *Vespertilio murinus* accounted for 32% of calls. During the 2025 acoustic survey, the results were similar, where the same three species accounted for 71% of all bat calls recorded and are presumed to be the most abundant species at the site. *Vespertilio murinus* accounted for 43% of those calls. Passive acoustic recordings collected at elevated detectors confirmed that a substantial proportion of *V. murinus* activity occurred within rotor swept altitudes, with approximately 35–45% of calls recorded at higher elevation microphones. These baseline survey results indicate that *V. murinus* is one of the dominant species in the Project area, with frequent activity at rotor-swept height.

Common pipistrelle, *Pipistrellus pipistrellus* (receptor sensitivity: low): Pipistrellus species are among the most numerous bat casualties at wind farms due to open-air flight and high activity around turbines[220]. This is one of the most widespread and common species of bats in Kazakhstan, whose habitats are mainly confined to human buildings, less frequently observed in caves. It forms rather large colonies, sometimes together with other species. It emerges to hunt in early twilight, preying on small flying insects at low altitudes over forest edges, clearings, alleys, streets, and similar areas. Its flight is fast and agile. The species was found during 2024 bat roost survey carried out within the Jambyl Wind Energy Project, but it was not detected during visual inspection of the cave, which is related to its way of life. Pipistrelle bats use crevices for roosting. One male was caught in a net. It was also recorded during the 2024 bat passive and active acoustic surveys. *Pipistrellus pipistrellus* with *Vespertilio murinus* and *Eptesicus serotinus* accounted for roughly 78% of all bat calls, out of which *P. pipistrellus* accounted for 28% of calls. The species was also recorded during the 2025 acoustic survey, the results were similar, and the same three species accounted for 71% of all bat calls recorded. *Pipistrellus pipistrellus* accounted for 13% of those calls. Elevated detector data show that approximately 15–25% of *P. pipistrellus* calls were recorded at rotor-swept altitudes.

Serotine bat, *Eptesicus serotinus* (receptor sensitivity: medium): This species typically roosts in human structures, less often in rock crevices. It emerges to hunt in deep twilight. The flight is unhurried, calm, but manoeuvrable. Feeds on insects, catching them both in the air, sometimes at very high altitudes, and on surfaces. *Eptesicus serotinus* is a moderately frequent casualty because of open-air flight behaviour and overlap with rotor area. This species was active in the WPP area according to baseline surveys, present in moderate abundance. It was detected across multiple survey rounds in 2024 and 2025. Passive acoustic surveys recorded represent approximately 4–6% of total bat activity. *Eptesicus*

[220] Salguero, M., De la Cruz, A., Muñoz, A . et al. Bat mortality in wind farms of southern Europe: temporal patterns and implications in the current context of climate change. Biodivers Conserv 32, 3953–3971 (2023). https://doi.org/10.1007/s10531-023-02674-z

serotinus was recorded at both ground-level detectors and elevated microphones (~40 m), confirming use of rotor-swept airspace. Elevated detectors recorded approximately 20–30% of calls at rotor-swept height. Activity of this species was seasonal, increasing in mid-summer. This species was not confirmed roosting within the WPP footprint, however, it was recorded during surveys near Aktogai Cave.

Geoffroy's Bat, *Myotis emarginatus* (receptor sensitivity: low): This is a clutter-adapted Myotis species that prefers riparian corridors, caves and rocky habitats. Forages low over vegetation and near water, using manoeuvrable flight. Baseline survey indicates that this species occurs in low acoustic abundance within the turbine footprint, but is confirmed at Aktogai Cave in 2025. This species was primarily recorded at low-level detectors (2–3 m). It was rare at 40 m, indicating low rotor-swept exposure.

Arabian barbastelle, *Barbastella leucomelas* (receptor sensitivity: medium): This is a steppe and semi-desert adapted barbastelle species. It typically forages in open or semi-open habitats and may roost in rock crevices. In 2024, no passive acoustic calls attributable to this species were recorded, and it was not detected during active transect surveys. In 2025, 5 passive acoustic calls were recorded, representing <0.1% of total bat calls that year. The species was not recorded during active transect surveys in 2025. Elevated mast detectors did not record a meaningful proportion of activity for this species; the very limited detections were from ground-level passive units, indicating that activity occurred primarily below rotor-swept altitudes.

Turkestani long-eared bat, *Otonycteris leucophaea* (receptor sensitivity: medium): This is a desert-adapted vespertilionid bat associated with rocky outcrops, escarpments, and sparsely vegetated semi-desert terrain. Similar to other long-eared desert bats, it forages primarily by low, manoeuvrable flight close to the ground, gleaning large arthropods from substrate surfaces. It is generally considered non-migratory and sedentary, with relatively localized home ranges. Given its typical low flight height, ground-oriented hunting strategy, and lack of evidence of high-altitude commuting behaviour, its susceptibility to turbine collision is considered low. This species was recorded at very low levels within the WPP footprint during baseline surveys. In 2025, 7 passive acoustic calls were recorded during stationary detector monitoring. The species was not detected during active acoustic transects, and it was not confirmed during roost inspections within the WPP site, OHTL corridor, or wider project survey area. Considering the absence of acoustic detections at elevated detectors during baseline surveys, overlap with rotor-swept altitudes is likely limited.

Greater Horseshoe Bat, *Rhinolophus ferrumequinum* (receptor sensitivity: low): This s a large horseshoe bat strongly associated with caves, karst systems, and occasionally large buildings. It typically forages along hedgerows, woodland edges, and riparian corridors, flying at low to medium heights (generally below rotor-swept altitudes, which is consistent with rare detection at 40 m during baseline survey), using clutter-adapted echolocation suited to structured habitats. In 2024, 112 passive acoustic calls were recorded, representing approximately 0.9% of total bat calls that year. The species was recorded 9 times during active transect surveys in 2024. In 2025, activity increased substantially, with 287 passive acoustic calls, representing approximately 1.2% of total bat calls, and 41 active transect detections. Elevated (mast) detectors recorded only a small proportion (<10%) of total calls for this species, indicating that most activity occurs below rotor-swept altitudes. Crucially,

this species was confirmed during roost surveys at Aktogai Cave in both 2024 and 2025. The cave supports a significant colony and is located approximately 7.5 km from the nearest turbine and approximately 300 m from the planned OHTL.

Lesser Mouse-eared Bat, *Myotis blythii* (receptor sensitivity: low): *Myotis blythii* is a cave-roosting, ground-foraging species often associated with steppe and agricultural mosaics. It typically hunts low over open ground, capturing large insects and occasionally gleaning from surfaces. While generally flying below rotor-swept heights during foraging, commuting movements between cave roosts and feeding areas may involve higher altitude transit. In 2024, 436 passive acoustic calls were recorded, representing approximately 3.6% of total bat calls that year. The species was recorded 28 times during active acoustic transects. In 2025, activity increased markedly, with 1,124 passive acoustic calls, representing approximately 4.7% of total bat calls, and 96 active transect detections. Elevated detectors recorded a limited proportion (approximately 10–15%) of total calls, suggesting that the majority of activity occurs below rotor-swept height, although some commuting flights occur within turbine-relevant altitudes. The species was confirmed during roost surveys at Aktogai Cave in both 2024 and 2025, forming part of the mixed cave colony.

Savi's pipistrelle, *Hypsugo savii* (receptor sensitivity: low): This is a fast-flying aerial insectivore associated with rocky terrain and open habitats. It frequently forages at moderate heights and is capable of sustained flight within turbine-relevant altitudes. While not strongly migratory in Kazakhstan, the species exhibits wide-ranging movements and seasonal peaks in late summer. In 2024, 154 passive acoustic calls were recorded, representing approximately 1.3% of total bat calls that year. The species was recorded 11 times during active transect surveys. In 2025, activity increased to 214 passive acoustic calls, representing approximately 0.9% of total bat calls, and 18 active transect detections. Elevated mast detectors recorded approximately 25–30% of total calls in both years, indicating that a substantial proportion of activity occurred within rotor-swept altitudes.

Ognev's serotine, *Eptesicus ognevi* (receptor sensitivity: medium): This is an open-steppe and semi-desert aerial hawker that typically forages at moderate altitudes and undertakes direct commuting flights across open terrain. Although not considered a long-distance migratory species, its flight ecology is consistent with species known to experience turbine collision mortality. In 2024, 503 passive acoustic calls were recorded, representing approximately 4.1% of total bat calls that year. The species was recorded 37 times during active transect surveys. In 2025, activity increased to 842 passive acoustic calls, representing approximately 3.5% of total bat calls, and 65 active transect detections. Elevated mast detectors recorded approximately 30–35% of total calls across both years, confirming regular activity within rotor-swept altitudes.

Common noctule, *Nyctalus noctula* (receptor sensitivity: medium): This is a fast-flying, open-air aerial insectivore in the family Vespertilionidae. It typically forages at high altitudes above treetop level and is well documented internationally as one of the bat species most frequently recorded as turbine collision fatalities. The species is migratory across much of its range and capable of long-distance seasonal movements. High-altitude commuting and foraging behaviour are strongly associated with turbine exposure risk. Baseline surveys' results indicate that this species is present within the WPP footprint at low to moderate levels but exhibits ecological traits associated with high collision susceptibility at wind farms. In 2024, 96 passive acoustic calls were recorded, representing

approximately 0.8% of total bat calls that year. The species was recorded 6 times during active transect surveys. In 2025, activity increased to 183 passive acoustic calls, representing approximately 0.8% of total bat calls, and 14 active transect detections. Elevated mast detectors recorded approximately 45–50% of total calls in both years, confirming that a substantial proportion of activity occurred within rotor-swept altitudes.

Strelkov's long-eared bat, *Plecotus strelkovi* (receptor sensitivity: low): This is a slow-flying, clutter-adapted bat that typically forages at low heights within structured habitats and woodland edges. It does not exhibit migratory behaviour and is not known to forage at high altitudes in open landscapes. Baseline data indicate that *P. strelkovi* is extremely rare within, the Project footprint. Given its low flight height and low recorded activity, collision risk are considered to be very low.

Baseline acoustic monitoring conducted during the 2024 and 2025 warm seasons indicates that the Jambyl WPP area supports a moderate level of bat activity. Although bat activity was confirmed at elevated detectors positioned above ground level, indicating that bats regularly use the airspace within turbine rotor-swept heights, the overall activity levels recorded do not indicate the presence of a major bat concentration area. The available data also suggests that the wind farm area is used by migrating bats passing through the wider landscape, but does not indicate important migration corridor.

While the bat baseline program for the Project included roost surveys, passive acoustic monitoring, and active transect surveys conducted over two survey seasons, several limitations affect the level of certainty that can be assigned to the quantitative interpretation of the acoustic data and the resulting collision risk assessment.

First, although the acoustic monitoring program broadly followed international good practice in terms of spatial coverage, seasonal coverage was limited for the period from May to mid-November, covering the end of the spring migration season, summer and the autumn migration season (Figure 16)[221].

Second, rotor-height monitoring coverage varied during the survey period due to the later installation of some elevated detectors due to vandalization and met mast collapse. As a result, the dataset provides only partial seasonal coverage of bat activity within the rotor-swept zone, which is the airspace most relevant for turbine collision risk assessment (Figure 16, MacEwan et al 2020).

Third, several bat species expected to occur in the Project region have poorly described echolocation parameters in the scientific literature, which increases uncertainty in species-level classification and limits the precision of activity estimates for some taxa.

Given these limitations, the present ESIA adopts a precautionary approach in the assessment of potential impacts on bats. Impact magnitude for collision risk has been conservatively estimated based on the presence of species groups known to be sensitive to wind turbine collisions globally, combined with the activity patterns observed during baseline surveys. Consequently, the predicted impact significance for some species may represent an overestimation of actual collision risk until additional analysis of the acoustic dataset is completed.

[221] Limitations to the bat study design include constraints on site access during the spring period due to prevailing winter conditions, as well as disruptions to data collection resulting from met mast collapses and vandalism of acoustic detectors.

10.3.4 Non-flying Mammals

Though not usually as significant as potential to impact flying wildlife, wind farms can also generate adverse impacts on non-flying biodiversity, including mammals, for example by causing displacement, disturbance, direct habitat loss, direct fatality from collisions with vehicles and/or poaching, and harassment[222]. The Kazakh part of the Western Tian Shan is home to 59 mammal species. This region is predominantly inhabited by desert fauna (15 species), forest species (11), and species widely spread across the Palearctic (10). This is followed by mesophilic species common in southern countries (8), mountain species living in rocky biotopes (5) and mountain steppes (3); the list concludes with representatives of steppe fauna (1) and acclimatized species (1). Notable mammals in the region include the fox (*Vulpes vulpes*), wolf (*Canis lupus*), jackal (*Canis aureus*), stoat (*Mustela erminea*), weasel (*Mustela nivalis*), and steppe polecat (*Mustela eversmanni*). Among the ungulates are the mountain goat (*Capra sibirica*), Karatau mountain sheep (or Argali sheep) (*Ovis ammon nigrimontana*), Siberian roe deer (*Capreolus pygargus*), and wild boar (*Sus scrofa*).



Figure 30. Golden Jackal in a gorge in the north of the WPP territory

The most sensitive terrestrial mammal in the area is likely to be the Karatau argali, which is considered one of the most endangered subspecies of Argali sheep[223]. The Karatau argali is endemic to the Syrdarya Karatau. In the southeastern Karatau, hybrids with the Tian Shan argali are found. The IUCN red list does not provide a separate account or status for this subspecies, hence the pertinent IUCN redlist status is for the entire species, which is classified as globally Near Threatened by IUCN. In the Red Book of Kazakhstan, the Karatau mountain subspecies of argali is classifed in category I (rough equivalent of IUCN CR/EN). This subspecies' critical status is a result of severe declines in population

[222] Helldin, J.O. (2010). The impacts of wind power on terrestrial mammals. Swedish Environmental Protection Agency Report.
[223] Ministry of Education and Science of the Republic of Kazakhstan, 2010. Republic of Kazakhstan Red Data Book. 4th edition revised and supplemented.

due to habitat loss, poaching, and competition with livestock[224]. The argali and the marbled polecat (IUCN VU, Kazakhstan NT) were the only two non-flying mammal species qualifying as PBV for the Project.

In order to characterize the baseline condition and evaluate risk to Karatau argali, marbled polecat, and other potentially affected species of non-flying mammals, a comprehensive set of mammal baseline surveys was scoped into the baseline survey workplan, focused on priority species, and integrated with review of desktop / public data, and information from stakeholder consultation for the ESIA. The mammal baseline surveys collectively covered two successive warm seasons, with most field survey effort conducted during the spring seasons (2024 and 2025), and covering the entire extent of the wind farm and OHTL areas. These surveys included a combination of transect-based methodologies to discover animals and traces of their presence, as well as installation of game cameras, which is a highly effective method for documenting the presence of animals such as argali, that are cryptic, and highly sensitive to the presence of humans. The methods and spatio-temporal extent of the non-flying mammal baseline surveys conducted to support this ESIA are summarized as follows:

- Camera traps (mammals and other animals)
    - 2024: 21 camera traps covering 500 MW WPP area operated continuously May-November, 1548 total trap-days
    - 2025: 3 camera traps covering selected portions of the Kentau OHTL within the mountainous area that overlaps the Argali migration corridor, operated from 10 March to 21 March (one trap) or 10 May (two traps), 133 total trap-days
- Mammal surveys
    - 2024: 204.1 km walking transects covering 500 MW WPP area and Jambyl OHTL segment surveyed on 20 days in April-June
    - 2025: Seven days (5-11 May) of transect surveys, including ca. 37 km of walking transect surveys targeted in strategic portions of the Kentau OHTL (mountainous areas, ground squirrel colonies), plus more extensive driving transect surveys along entire Kentau OHTL, plus previously unsurveyed portions of the 1 GW WPP area

For additional information on non-flying mammal species and survey methodologies, please refer to Annex E (Biodiversity Baseline Survey reports).

Mammal baseline surveys resulted in documentation of 19 species of non-flying mammal within the Project Area. The only priority species of non-flying mammal recorded during these surveys was the Karatau argali.

Karatau Argali (IUCN NT, Kazakhstan CR/EN, receptor sensitivity: high) According to the Kazakhstan red book, five distinct subspecies of Argali are present in the country, each recognized with distinct national status classification. The one that is pertinent to the Project is the Karatau Argali, *Ovis ammon nigrimontana*, which is endemic to the Karatau Mountains, and nationally listed as CR/EN (category I). IUCN does not recognize distinct subspecies of Argali on the global red list of threatened species,

[224] Ministry of Education and Science of the Republic of Kazakhstan, 2010. Republic of Kazakhstan Red Data Book. 4th edition revised and supplemented.

hence the global NT designation refers to the species, *Ovis ammon*, as a whole, which has a fairly broad distribution in mountain ranges of central Asia.

The EAAA evaluated for the Karatau Argali encompassed the entire migratory corridor, roughly equivalent to the entire Karatau mountain range, and the population of argali within this area was recently estimated at 1,300 individuals by the Kazakhstan Ministry of Ecology, based on their aerial surveys. Aerial surveys conducted in Winter, 2023 by Ohotzooprom, yielded a total of 66 individual observations of Argali within the Project area. The majority of these observations occurred within the WPP area, but in 2025, one of the camera traps located along the Kentau OHTL captured a photo of two argali, as well. These observations included adult males, adult females, and lambs, with a maximum number of 8 individuals counted in any single observation event, and have occurred in 7 different months of the year, from February through October, indicating that Argali may be present in the Project area year-round, and that reproduction may occur within the WPP area.

The Project is considered to have potential to generate a variety of impacts on Argali, including vehicle collisions from construction traffic, and increased illegal poaching during construction, but the potential impact of greatest concern is displacement, which may occur due to this species' extreme sensitivity to, and avoidance of human activity. Once the Project is operating, the low level of human activity in the wind turbine and OHTL areas that will be sited within mountainous Argali habitat may enable this species to make normal use of these areas, thus avoiding a permanent displacement impact, but this is not well-known. One factor that limits the potential displacement impact on Argali is the fact that the only portion of the Project's associated OHTL segment that passes through mountainous terrain (Argali habitat) will be located along an existing roadway which also has pre-existing aerial powerlines along it, hence the additive displacement of the Project's OHTL segment in this area is likely to be marginal.

10.3.5 Reptiles and Amphibians

Potential impacts of the Project on reptiles and amphibians are similar to those potentially affecting non-flying mammals, and encompass a variety of habitat-mediated, behavioral., and direct impacts, especially concentrated during the Project's construction phase.

Kazakhstan is home to 50 species of reptiles and 13 species of amphibians. The Red Book of Kazakhstan includes 10 species of reptiles and 3 species of amphibians with elevated status though no species with national status I (rough equivalent to IUCN CR/EN) are encountered within the Project region.

The Central Asian Tortoise, *Testudo horsfieldii* (IUCN VU, KzRDB unlisted, receptor sensitivity: medium), was the only reptile or amphibian species classified as a PBV for the Project, based on consideration of species' status on the IUCN redlist and geographic distributions. The Project site is located within the known range of this species, and within potentially suitable habitat for this wide-ranging habitat generalist. According to information from local specialists (I. Karyakin, pers. comm.), there has been a decline in the tortoise population in recent years, likely due to a shift in the focus of predatory birds from ground squirrels to tortoises. This shift may have occurred following a significant die-off of ground squirrels in 2018, which drastically reduced their numbers.

In order to characterize the baseline condition and evaluate risk to Central Asian Tortoise and other potentially affected species of reptiles and amphibians, a comprehensive set of herpetological

baseline surveys was scoped into the baseline survey workplan, focused on priority species, and integrated with review of desktop / public data, and information from stakeholder consultation for the ESIA. The herpetological baseline surveys collectively covered two successive warm seasons, with most field survey effort conducted during the spring seasons (2024 and 2025), and covering the entire extent of the wind farm and OHTL areas. These surveys included a combination of transect-based methodologies to discover animals and traces of their presence, as well as installation of game cameras, which is a highly effective method for documenting the presence of reptiles, including the Central Asian Tortoise that are cryptic, and can be difficult to detect during brief field survey periods. The methods and spatio-temporal extent of the herpetological baseline surveys conducted to support this ESIA are summarized as follows:

- Reptile surveys (focus on Central Asian Tortoise)
    - 2024: 24 survey transects covering 1 GW WPP area and Jambyl OHTL segment surveyed 21-26 May
    - 2025: 10 survey transects covering Kentau OHTL route surveyed 19-23 April
- Camera traps (reptiles, amphibians, and other animals)
    - 2024: 21 camera traps covering 500 MW WPP area operated continuously May-November, 2024, 1548 total trap-days
    - 2025: 3 camera traps covering selected portions of the Kentau OHTL within the mountainous area that overlaps the Argali migration corridor, operated from 10 March to 21 March (one trap) or 10 May (two traps), 133 total trap-days

For additional detail on the baseline survey methodologies that have been designed to characterize the use of the site by reptiles and amphibians for the purpose of the ESIA and subsequent Project documents and plans, please see Annex E.

Herpetological baseline surveys resulted in documentation of 7 species of reptiles and no species of amphibians within the Project area. These included one individual of Central Asian Tortoise found during the 2024 surveys along the Jambyl OHTL segment, roughly 20 km east of the wind farm area, and 16 individuals found during the 2025 surveys, all at two sampling localities in the vicinity of Chulakkurgan village, along the Kentau OHTL(Figure 22). As a terrestrial species that digs burrows in which it roosts, it could be impacted through direct mortality, habitat loss, and/or displacement within the Project's soil/vegetation disturbance footprint, especially during construction. The Project's potential to impact this species is limited by its apparent absence from the WPP area at present, and limited distribution along the Project's OHTL routes.

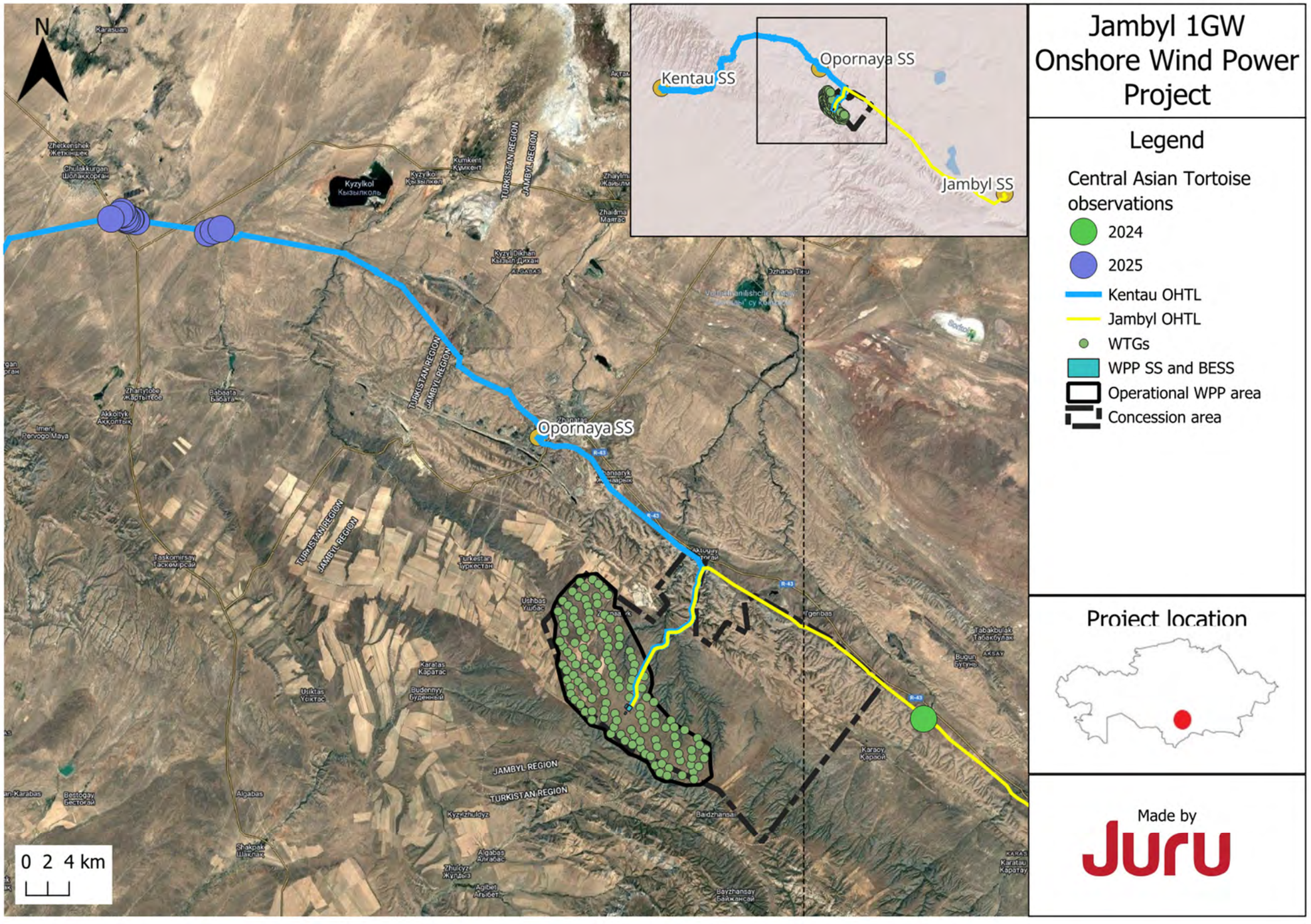


Figure 31. Map figure showing the locations of Central Asian Tortoise records in 2024 and 2025.

10.3.6 Aquatic Ecology

The project area is located within a generally dry-arid climate zone, and does not overlap any permanent watercourses or waterbodies, hence the potential for the Project to generate adverse impacts on aquatic biodiversity is limited. It is important to note that early in the project design phase, specific efforts were made to avoid impacts to sensitive aquatic features, including not only streams and rivers, but also naturally occurring springs. The Project area does include several seasonal streams, primarily in the northern and southern sections, with characteristics that vary considerably. In the north, streams are ephemeral, originating from the Karatau mountains and demonstrating high flow during spring from heavy rains, but drying up in the summer months. In the south, the streams near the Jambyl OHTL's southern terminus, in the vicinity of a larger marshy area surrounding Lake Akkol, have been channelized and converted into agricultural land, bordered today by croplands and lined with narrow Phragmites marsh strips. Even during periods of high rainfall, these streams remain shallow (generally less than 2 m wide) (Figure 23) and are prone to drying out, severely limiting suitable habitat for a handful of potentially sensitive fish species that were identified as potential risk receptors for the Project in the IBAT report, but whose presence is considered highly unlikely due to the ephemeral, and highly modified nature of the OHTL stream crossings in this area.



Figure 32. Small, channelized ephemeral stream channel along the southernmost section of the OHTL

Given the channelization and the agricultural transformation of these habitats, along with the streams' ephemeral nature and the avoidance of significant waterbodies and rivers in the initial site design/selection, there is minimal risk of the OHTL project impacting sensitive fish populations significantly. Therefore, fish surveys were not scoped into the baseline survey workplan or ESIA for the Project.

Three sensitive fish species whose geographic distributions overlap the southern portion of the Jambyl OHTL segment were classified as PBV for the Project. Project-associated risks to each of these species is discussed in species-specific sections below.

Triplophysa coniptera (IUCN EN, Kazakhstan unlisted, receptor sensitivity: high) This is a river-dwelling fish species known from only 5 locations in the upper Ters River and several tributaries of the Syr Darya. The IUCN redlist describes its global distribution (EOO) as encompassing 18,056 km^2 thus it is considered a restricted-range species under IFC PS6. There is no overlap of this species' range with the wind farm, but the southern end of the Jambyl OHTL segment does overlap the range, and crosses several small tributaries where this fish could, in principle, occur. The potential suitability of habitats

for representatives of the genus *Triplophysa* within the Project AoI is supported by data from the global biodiversity observation platform iNaturalist, which contains a geo-referenced photographic observation of *Triplophysa coniptera* within the Project area (iNaturalist, 2025). However, given the known taxonomic complexity of the genus and the limitations of species-level identification based solely on photographs, this observation cannot be used to reliably confirm the presence of *Triplophysa coniptera*. Accordingly, iNaturalist data are interpreted as indicative of potential habitat suitability and regional occurrence of *Triplophysa* spp., rather than as confirmation of species presence, abundance, population structure, or habitat stability within the Project AoI.

10.3.7 Habitats

Kazakhstan encompasses a diverse range of habitats, which are broadly classified into four major ecological systems. Forests cover a mere 2% of the country, primarily confined to the northern and eastern regions. The vast expanses of steppe, comprising 28% of the national territory, serve as a significant ecological belt that transitions gradually into desert areas, which constitute 32% of Kazakhstan's landscape. Mountain ecosystems, accounting for 7% of the country, are predominantly found in the southeast, providing a range of altitudinal zones that support unique biodiversity. The remainder of the land is utilized for various agricultural and pastoral activities, with 8% designated as pastures, 4% as fallow lands, and the rest devoted to agricultural use. These diverse ecosystems contribute to Kazakhstan's rich biological diversity and complex environmental framework.

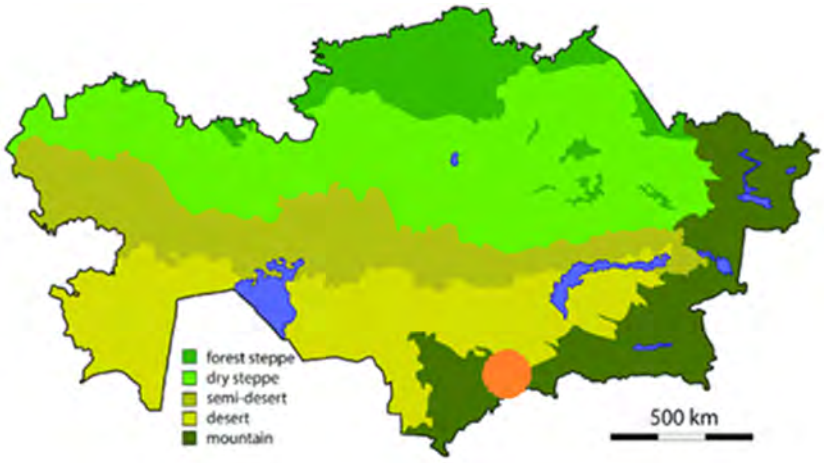


Figure 33. Ecological zones of Kazakhstan, showing forest steppe, dry steppe, semi-desert, desert, and mountain areas; orange dot showing the project location

The planned wind farm is located in the Small Karatay area, which is the southern part of the Karatay mountain range. This range, in turn, is the northeastern part of the Tien Shan Mountains. The Small Karatay mountain range consists of two parallel ridges - north and south, separated by the Boraldai and Ters rivers, both seasonal streams, which flow in opposite directions. The wind farm's territory is situated at the peak of the northern ridge, which features a broad plateau.

In order to characterize the vegetation/habitat types that cover the Project area, a habitat/vegetation mapping effort was scoped into the biodiversity baseline survey workplan and implemented to

support this ESIA. Habitat mapping was performed for the entire wind farm concession area and all Project-associated OHTL routes buffered by 5 km, using automated spectral classification of vegetation based on Landsat 8 OLI imagery, available from USGS, ground-truthed and verified with floristic field surveys conducted in spring, when the highest number of plants are growing and can be surveyed and identified. The 2024 habitat mapping and vegetation surveys covered the entire wind farm concession area and the Jambyl OHTL segment, all buffered by 5 km. The 2025 effort encompassed the entire wind farm concession area plus the Kentau OHTL segment, all buffered by 5 km. The methods and results of these surveys and habitat mapping efforts are provided in the vegetation/botany baseline survey reports (Annex E), which contain fine-grained maps of over 20 different habitat/vegetation types that were identified within the Project area and the habitat maps resulting from these surveys. More coarse-grained distillations of these habitat maps are provided in separate subsections below, describing the vegetation and habitats of the wind farm area, Jambyl OHTL and Kentau OHTL.

Natural Habitat Assessment. The concept of Natural Habitat (NH), as defined by IFC Performance Standard 6 (PS6), refers to areas composed of viable assemblages of largely native plant and/or animal species, or where human activity has not essentially modified the area's primary ecological functions and species composition. In practice, IFC applies this concept broadly, including habitats that are utilised by humans for various activities, such as domestic livestock grazing, provided that the fundamental vegetation structure, basic ecosystem functions, and species composition largely resemble natural conditions.

In order to evaluate the general distribution of NH within the Project area, a NH assessment was undertaken as part of the Project's CHA. This analysis concluded that the WPP area is almost entirely covered by habitats that would qualify as NH under the PS6 definition, but with anthropogenic influences on the habitats nonetheless significant throughout, ranging from low to high, and consisting primarily of vegetation grazing/browsing during the warmer months by domestic livestock. By contrast, habitats along the Project's OHTL segments generally show significantly higher levels of human impact, especially due to domestic livestock grazing, and are likely to be classified as Modified Habitat (MH), per IFC PS6, though some areas may qualify as NH, especially in a few spots where the OHTL run through more hilly terrain further from major roads or existing powerlines, which parallel the OHTL segments over most of their length. More detail on the methods, data, and criteria applied in this review is provided in the Project's CHA (Annex F). However, it is important to note that while the baseline surveys and information reviews summarized in the NH assessment provide a general indication of the extent and distribution of NH within the Project area, botanical survey plots covered a very small proportion of the entire Project area and were selected prior to finalization of the locations of wind turbines, OHTL towers, access roads, and other Project infrastructure. As a result, the precise delineation of NH and quantification of the extent of NH loss that will be caused by Project construction cannot be derived from this analysis, and will rely on pre-construction NH/vegetation surveys to be conducted within the Project's soil/vegetation disturbance footprint, once it is finalized.

Wind farm area

The Project Wind Power Plant (WPP) area is predominantly classified as Natural Habitat under the IFC PS6 definition. The area is characterised by naturally treeless plains dominated by cereal steppe

habitats. While the landscape remains largely natural in structure and function, it is subject to ongoing human influence, primarily in the form of seasonal grazing by domestic livestock during the warmer months.

Full cartographic information on the habitat map is provided in Annex E of the botanical survey reports for 2024 and 2025.

The majority of the territory, where the WTGs are planned to be placed, consists of a steppe plateau, crisscrossed by gorges of seasonal streams. The local vegetation is characterized by low grasses and very low-growing shrubs. The main terrain here, excluding the stream gorges, is a plateau with occasional depressions and hills with rocky tops. In addition to seasonal streams, a number of permanent springs occur within the plateau system. These springs represent important water sources that remain active throughout the year and are of high importance for biodiversity, particularly during the dry season, as well as for local herders and their livestock.



Figure 34. Typical landscape of the north-eastern part of the plateau (N43.349581, E69.892995)

In the central part of the WPP territory, the plateau is intersected by a system of deep gorges. This network of streams crosses the entire project area from the southern border to the northern border, where it flows into the Shabakty River. Depending on the season, many streams dry up completely; however, some remain perennial., providing year-round water flow. The depth of the gorges can reach 100 meters or more. Most of the streams here dry up during the summer period. The slopes of the gorges are occupied with intrazonal riparian vegetation typical for Central Asian rivers (so-called tugay vegetation). In the past, until the 1990s, these gorge slopes were used by forestry enterprises and were forested; however, in the 1990s, almost all the woody vegetation here burned down, and currently, it is absent everywhere except along the stream banks at the bottom of the gorges.

The steep slopes with vertical sections provide potential bird nesting habitat features, including those

suitable for birds of prey. In addition, the presence of permanent springs and streams in this zone makes the gorges a key refuge for many mammal species, as they represent the only reliable water sources during the hot summer and autumn periods. Raptor nest surveys will be conducted to characterise and identify nesting habitats and identify nest sites within and around the WPP.



Figure 35. Central erosional gorge system (N43.341591, E69.892346)



Figure 36. Stream in a gorge with tugai vegetation (N43.389031, E69.821916)

In the north-eastern part of the territory lies a belt of arid low mountains with rugged terrain, featuring rather steep slopes composed of clay, gravel, stones, or rocks, and dissected by numerous ravines and valleys of permanent or temporary streams. In the place of transition of this zone to the valley, where the Zhanatas – Taraz highway passes, the depth of gorges can reach 50 meters or more. At the tops

of the gorges, vegetation is mostly absent. The slopes are moderately steep and covered with a mix of low-growing shrubs and patches of grass. The valley area, more sheltered and likely to retain moisture longer, shows slightly denser vegetation, which could support a different set of species compared to the exposed hilltops.

This north-eastern mountainous zone is also an important source of thermal uplift. Such conditions are frequently used by migrating soaring birds during the autumn migration period to gain altitude for ridge crossing. To reduce collision risks, this part of the WPP area was excluded from WTG development.

Along the southern border of the WPP, where the plateau sharply drops into the gorge system, favorable orographic conditions are also formed. These are particularly important for soaring birds during the spring migration.

In addition to natural habitats, several small agricultural plots occur within the western part of the WPP polygon, with a combined area of approximately 2 hectares. These lands are mainly used for cultivation of barley, wheat, sunflower, and alfalfa. Although the total area is limited, these agroecosystems provide habitat for certain bird species (e.g., Great Bustards, Little Bustards), as well as attract small mammals that may in turn support local predators.

Growth of the vegetation peaks in the spring and late autumn when melted or fallen snow provides sufficient moisture. During the summer, high temperatures prevail on the plateau. These phenological characteristics are also related to the use of the area by shepherds: livestock are brought to graze on this territory only during the period from May to June in the spring and from October to November at the end of autumn. During these intervals, active grazing occurs, while in the rest of the summer, the area is less used, mainly only along the gorges by the stream beds.



Figure 37. Upper part of the slope to the north-east of the territory (N43.419060, E69.873987)



Figure 38. A valley with a road through an area of low mountains (N43.429211, E69.874644)

OHTL-1 Jambyl SS – WPP

Habitats along the Jambyl OHTL route generally show significantly high levels of human impact, especially due to extensive domestic livestock grazing, and are therefore predominantly classified as Modified Habitat (MH) per IFC PS6. However, some portions of the OHTL routes, particularly in more hilly terrain further from major roads or existing powerlines, may still retain characteristics that qualify them as Natural Habitat.

Full cartographic information on the habitat map is provided in Annex E of the botanical survey reports for 2024 and 2025.

The OHTL route mainly passes along the northern foothills of the Small Karatay, turning northeast towards the substation after crossing the Taraz-Zhanatas highway.

The majority of the route from the Karatau settlement to the crossing of the highway is predominantly characterized by heavily grazed pastures. The lowland plain lying east of the Karatau Mountains, through which most of the OHTL passes, is densely occupied by livestock, especially sheep, but also horses and cattle, and contains many permanent farms on which these cattle ranches are based. The condition of the vegetation itself is characterized by densely contiguous low grass vegetation with areas of open ground. Along the line the topography is flat with a gentle rise towards the mountains, with a few more rocky areas in the foothills. Shrubs were generally very short (<50 cm), and shrub cover ranged from almost non-existent to light to moderate.



Figure 39. Heavily grazed pastures at middle part of the OHTL route (N42.938711, E70.726532)

The second section of the OHTL, from the WPP to the Karatau settlement, consists of a heavily grazed shrubby hilly steppe. This part of the route encounters more varied topography, from flat lowlands to rolling hills, with occasional rocky foothill extensions. Shrub coverage in this area is sparse to moderate, generally not exceeding 50 cm in height. Despite the presence of shrubs, the overwhelming impact of grazing is evident, with a virtual absence of any grass or herbaceous vegetation taller than a few centimetres.

In the southern section of the line, from the trail crossing to the substation, the line runs through a relatively flat lowland depression, covered primarily with a mix of active and fallow ploughed cropfields, with small patches of reedbeds and small, channelized streams interspersed. Several existing OHTLs run adjacent to the planned route.



Figure 40. Heavily grazed shrubby hilly steppe (N43.351735, E70.076750)



Figure 41. Fallow cropfields on the south part of the OHTL route (N42.821796, E71.066243)

At the 4 km section near the substation, the line has been sited as far as possible from Lake Akkol and its surrounding reed beds, in contrast to some of the pre-existing OHTLs, which run in very close proximity to the lake, including one that crosses open water at the southeastern corner of the lake (Figure 9). The Project's proposed OHTL approaches no closer than approximately 140 m to the lake shoreline and associated reed beds. The shores of Lake Akkol are characterised by heavily grazed open pastures, and the village of Auliekol is located along the lakeshore.

The Jambyl OHTL crosses several small rivers and streams along the route. These streams flow from the Small Karatau in a north-eastern direction. Their floodplains are occupied with intrazonal riparian vegetation typical for Central Asian rivers (so-called tugay vegetation). This vegetation is composed of willows (Salix turanica, S. wilhelmsiana, S. tenujulis), tamarisk (Tamarix ramosissima), Semenov's maple (Acer tataricum subsp. semenovii), Caragana halodendron (Halimodendron halodenron), reed (Phragmites australis), and other mesophytic plants (Calamagrostis epigejos, Equisetum arvense, Mentha longifolia var. asiatica, Rubus caesius, Clematis orientalis, etc.), and solitary large trees of Salix alba and Fraxinus sogdiana. The siting of the OHTL was adjusted to avoid or minimize overlap with these riparian habitats, reducing potential impacts on tugay vegetation.

In line with the Project's design principles, the OHTL alignment was selected to run in proximity to existing linear infrastructure, including other OHTLs, thereby reducing additional landscape fragmentation. Where alternative routing options were considered, priority was given to avoiding areas of higher biodiversity value, such as wetlands and natural habitats, and to routing through already modified landscapes.



Figure 42. An existing powerline running along the edge of Lake Akkol, in the southeastern end of the Lake, The route location of the planned OHTL is roughly 500 m to the left (east) of the powerline shown in the image. (N42.843919, E71.092530)



Figure 43. Heavily grazed pastures around the Lake Akkol transitioning to fallow lands. (N42.840642, E71.103763)



Figure 44. A small river that lies along the Project's OHTL route, between Karatau and Maitobe villages. (N42.840642, E71.103763)



Figure 45. Koktal River, lying along the Project's OHTL route between Karatau and Zhanakush villages. (N42.840642, E71.103763)

OHTL-2 WPP – Kentau

The 162 km WPP – Kentau OHTL trends broadly east-to-west. It departs the wind-power plant (WPP) platform and follows the Taraz – Zhanatas highway to Opornaya substation on the eastern outskirts of Zhanatas, then swings north-west toward Sholakkorgan, before turning south-west to traverse the southern flank of the Greater Karatau Range and emerging onto the plains to reach Kentau substation on the edge of Kentau settlement.

Full cartographic information on the habitat map is provided in Annex E of the botanical survey reports for 2024 and 2025.

Habitats along the Kentau OHTL route generally show significantly high levels of human impact, especially due to extensive domestic livestock grazing, and are therefore predominantly classified as Modified Habitat (MH) per IFC PS6. However, some portions of the OHTL routes, particularly in more hilly terrain further from major roads or existing powerlines, may still retain characteristics that qualify them as Natural Habitat.

From the WPP to Opornaya substation and a further ~26 km westwards (total ~ 72 km) the line crosses arid low mountains comprised of stony ridges and dissected terraces. Vegetation is sparse: low, summer-parched grasses intermingle with scattered dwarf shrubs rarely exceeding 50 cm. Shrub cover varies from almost absent to light-moderate, and extensive areas of bare, angular scree interrupt the soil mantle. Approximately 5 km west of Opornaya the corridor intersects the heavily industrialised Kazphosphate mining complex, where open pits, spoil heaps, haul roads and rail sidings dominate the landscape. Here the habitat value is already markedly degraded by long-term extraction activities.



Figure 46. Existing OHTL on the east part of route, near Zhanatas town



Figure 47. Railway bridge located near the heavily industrialized Kazphosphate area

West of the Ushbas River, the line runs through a heavily overgrazed sagebrush semi-desert plain that stretches for approximately 20 km to the first foothills of the Greater Karatau. The terrain here is completely flat, and the line crosses the main road several times. Grazing pressure is very high, the vegetation is severely degraded, and shrubs are sparse and very low. There are a few suitable habitats for the Central Asian tortoise, and burrows of this species were also observed along the route.

After turning south, the line then climbs into the Karatau mountain segment, which extends for approximately 25 km. The first 10 km run adjacent to the KX-56 road, where the route traverses steep mountain slopes with numerous rocky outcrops and rugged terrain. South of this point, the line diverges from the road by approximately 2 km and continues along the crest of the ridge, following the elevated edge of several small valleys. In this southern part of the mountain section, the alignment passes through semi-arid steppe, with rolling ridgelines supporting short, summer-parched grasses interspersed with rocky patches and evidence of light-to-moderate grazing.



Figure 48. Overgrazed sagebrush semi desert habitat



Figure 49. North part of mountain section



Figure 50. Steppe valleys in the middle part of mountain section

South of the mountains, the OHTL descends onto a broad plain dominated by heavily grazed pastures. The terrain here is flat, crisscrossed by gravel roads, and the vegetation is heavily disturbed. In one segment, the route intersects a sizeable stream and passes through cultivated agricultural land for approximately 2.5 km. The line concludes at the Kentau substation, where surrounding habitats are similarly degraded due to overgrazing and multiple human influences, including existing OHTLs and rural infrastructure. In the central part of this section, a small patch of agricultural fields is located on the bank of a larger stream.

The route crosses several rivers and streams of varying sizes, including the Ushbas, Shabakty, Aktogay (a tributary of Shabakty), Berkutty, Khantagi, Kursai, Sookasu, Kokkiya, and Baba. The largest among these is the Ushbas River, whose floodplain is lined with characteristic Central Asian intrazonal riparian vegetation (tugay). This includes willows (Salix turanica, S. wilhelmsiana, S. tenujulis), tamarisks and other hydrophilic species.

Although the route does not directly impact major water bodies, Lake Kyzylkol lies approximately 4.5 km from the line near the Ushbas River crossing. Designated as an Important Bird Area (IBA), Kyzylkol serves as a key stopover site for migratory birds crossing the narrow pass between the Greater and Lesser Karatau ranges. Additionally, a small artificial reservoir (approx. 400 m x 800 m) is located in the northern part of the Karatau section. This reservoir is unlikely to function as a significant bird aggregation site.



Figure 51. West part of OHTL route, south from the Karatau range



Figure 52. Kentau substation

The OHTL route was refined in accordance with the Project's biodiversity design principles, which

emphasize co-location with existing OHTL corridors where feasible and the avoidance of high-value habitats. In particular, options that would have crossed relatively undisturbed natural areas or important bird concentration zones were rejected in favor of alignments through more modified landscapes.



Figure 53. Kyzylkol lake



Figure 54. Artificial Pond in a northern part on mountain section

Habitat loss

The habitat impact table (Table 6) identifies several habitat categories that will be affected by permanent loss and/or temporary disturbance.

Permanent habitat loss will occur at turbine foundations, crane hardstands, access roads, the BESS footprint, substations, and OHTL tower bases. Temporary disturbance will occur at laydown areas and construction access routes, with potential for post-construction rehabilitation.

The impact significance has been determined based on the total area of permanent footprint relative to the overall habitat availability within the concession and the wider landscape, the dispersed nature of turbine placement, which avoids contiguous block conversion, the linear and localised nature of OHTL tower footprints, and the permanence of infrastructure components such as turbine bases and substations.

The most affected habitat type is cereal steppe, but the overall area affected represents a small proportion of the available steppe habitat within both the concession area and the broader region. Moderate impacts could occur within the habitat type Valleys of rivers and streams, resulting from potential hydrological changes as well as overall habitat quality degradation due to potential sediment input.

Table 19 Habitat loss calculations

Habitat	Internal roads		WPP SS and BESS		WTG foundations		Total		
	Direct	Indirect (out to 10m)	Direct	Indirect (out to 100m)	Direct	Indirect (out to 100m)	Direct	Indirect	Both
Cereal steppe	59.89	136.01	30.94	38.47	156.61	1021.53	247.44	1196.00	1443.45
Farm land	9.12	20.34			25.49	157.59	34.61	177.93	212.54
Shrub land on Piedmont Slopes	2.64	7.41		0.12	1.75	28.60	4.39	36.14	40.53
Valleys of rivers and streams	0.37	0.83			1.00	6.95	1.37	7.78	9.15

10.3.8 Vegetation and Flora

The plant life of Kazakhstan comprises around 6,000 species, not counting over 500 species of introduced, cultivated, and accidentally introduced plant species. While overall species diversity is moderate at the national level due to soil and climate constraints, certain regions stand out for their richness, including areas within the Karatau range.

The flat steppe areas, stretching from north to south for over 1500 km, are covered with steppe and semi-desert vegetation. Here you can find species such as saxaul, turanga, sand acacia and others.

Forested areas in Kazakhstan are limited, covering almost 3% of the country's area. In the north, they are represented by isolated groves of aspen and birch, as well as stands of pine trees. The main forested areas are concentrated in the mountainous regions of Altai, Jungar Alatau, and the eastern part of Tian Shan.

The project is located on the northern slopes of the Karatau Range, also known as Syrdarya Karatau. One notable feature of the vegetation in Syrdarya Karatau is its richness and uniqueness of flora; no floristic region in Kazakhstan has such a high level of floral diversity[225]. The Syrdarya Karatau region is home to around 1,000 plant species, with 150 being characteristic of this floristic district. Relic plants grow in the region (*Spiraeanthus schrenkianus, Calophaca tianschanica, Rosa kokanica, Amigdalis petunnikovii, Cerssus tianschanica, C.erythrocarpa, Lonicera olgaea, L.korolkovii* and others.), as well as extensive coniferous forests consisting of spruce, fir, larch, and cedar. In the highlands, numerous shrub meadows and herbaceous-grassland plants can be found.

Review of technical literature and publicly available data on plant species' distributions in the Project region resulted in the classification of three sensitive plant species as high priority biodiversity receptors for the Project, including two species that triggered CH determinations and one that is classified as a PBV.

In order to characterize the baseline condition and evaluate risk to these three sensitive plant species, other potentially affected sensitive plant species, and to evaluate the prevalence of exotic, alien plant species and other species indicative of anthropogenic disturbance, a comprehensive set of floristic baseline surveys was scoped into the baseline survey workplan, focused on priority species, and integrated with review of desktop / public data for the ESIA. The floristic baseline surveys collectively covered two successive warm seasons, with most field survey effort conducted during the spring seasons (2024 and 2025), and covering the entire extent of the wind farm and OHTL areas. These surveys focused on complete floristic species inventory within a set of 100 x 100 m or 200 x 200 m plots, following established floristic survey methodologies. The methods and spatio-temporal extent of the botanical baseline surveys conducted to support this ESIA are summarized as follows:

- Botany surveys
    - 2024: 62 sample plots (1 ha or 4 ha), covering 1 GW WPP area and Jambyl OHTL surveyed May 6-10

[225] Tojibaev, Komiljon & Jang, Chang-gee & Lazkov, Georgy & Chang, Kae & Sitpaeva, Gulnara & Safarov, N. & Beshko, Natalya & Muktubaeva, Saule & Vesselova, Polina & Turakulov, Isakul & Nure e, Na & Park, Minsu & Choi, Kyung & Choi, Hyeok Jae & Un, Oh & Oh, Seung Hwan. (2020). An Annotated Checklist of Endemic Vascular Plants of the Tian-Shan Mountains in Central Asian Countries. Phytotaxa. 464. 117-158.

- 2025: 56 sample plots (1 or 4 ha) covering 1 GW WPP area and Kentau OHTL surveyed 8-15 June

For additional information on plant species and survey methodologies, please refer to Annex E (Biodiversity Baseline Survey reports).

Botanical baseline surveys resulted in documentation of 144 vascular plant species in 2024 and 197 species in 2025 within the survey areas. Among these were two of the plant species classified as priority biodiversity receptors for the Project, as well as eight exotic alien plant species. Exotic plant species had limited distributions within the Project area, and were highly prevalent and abundant only in limited, highly disturbed habitats, such as roadsides, human settlements, and agricultural areas. Species-specific summaries of baseline condition and risk characterization for the plant species identified as priority biodiversity receptors for the Project are provided below.

Spiraeanthus schrenkianus (IUCN EN, Kazakhstan category 1 [CR], receptor sensitivity: high). This is a small shrub species endemic to Kazakhstan and Kyrgyzstan whose geographic distribution, ecology, and global population size have not been well-characterized[226]. According to a recent assessment of angiosperm extinction risk, cited in Kew Gardens' Plants of the World database[227], the status of this species is "not threatened" (Bachman et al., 2024). This species was documented during the spring, 2024 botanical baseline surveys on 2 sample plots, and in the spring, 2025 botanical baseline surveys on 5 of the 56 plots. In 2025, one of the recorded localities was situated on foothills along the planned transmission line, within degraded wormwood–cereal pastures containing patches of *Spiraeanthus schrenkianus*, while the second locality was located in a large gorge near a recreation centre. In the 2025 surveys, the five new localities for this species documented along the Kentau OHTL segment spanned a somewhat broader range of habitat types, including low ridges and dry valleys, within shrub-steppe vegetation and rocky outcrops. Based on the recently published extinction risk assessment and the limited distribution of this plant within the Project area, the Project is considered to have minimal potential to impact this species.

[226] https://www.iucnredlist.org/species/63489/12668305#assessment-information accessed 15 April, 2025.
[227] https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:742618-1/general-information#source-AERP accessed 15 April, 2025

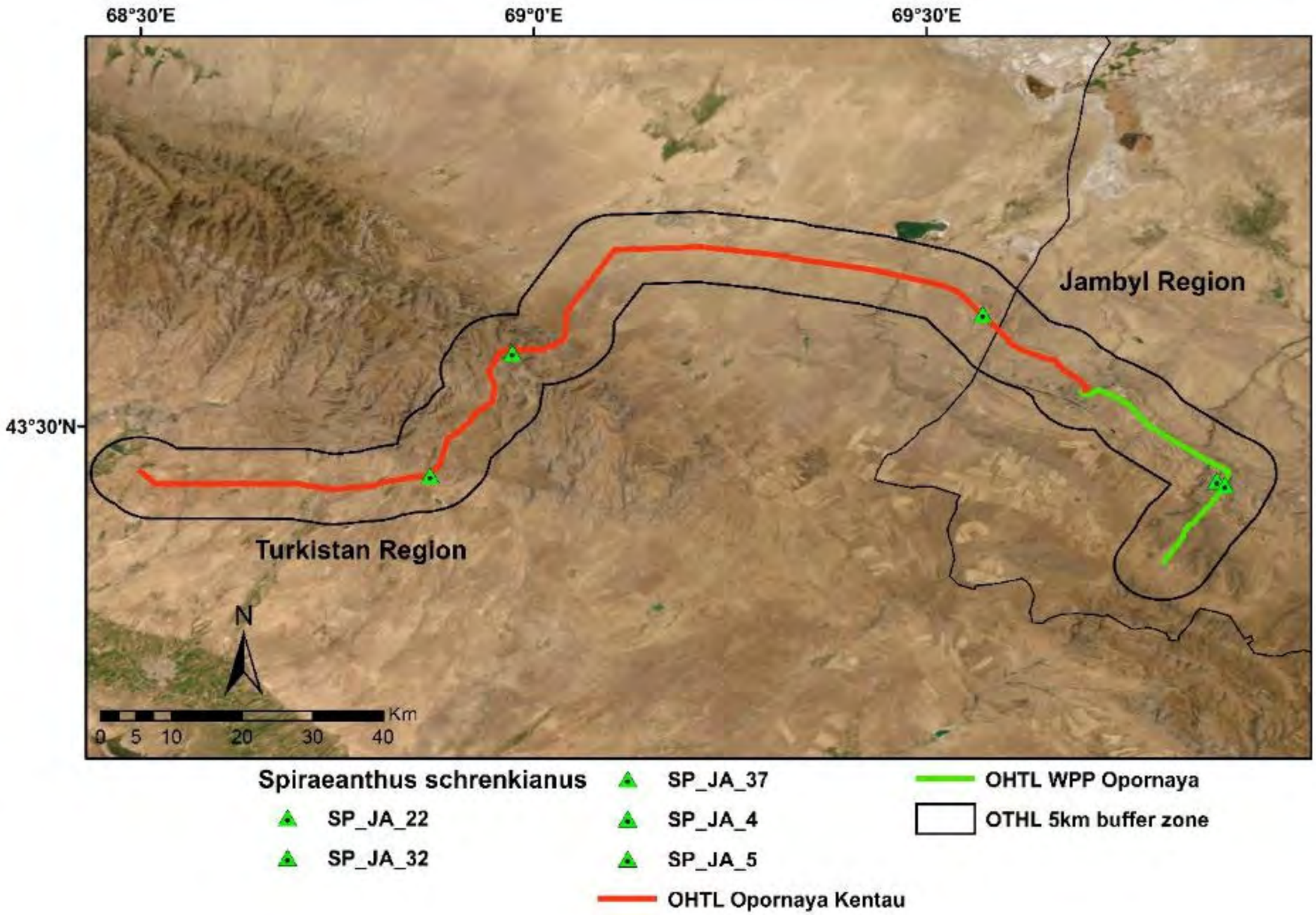


Figure 55. Locations of Spiraeanthus schrenkianus along the Projected OHTL, documented during the 2025 botanical surveys

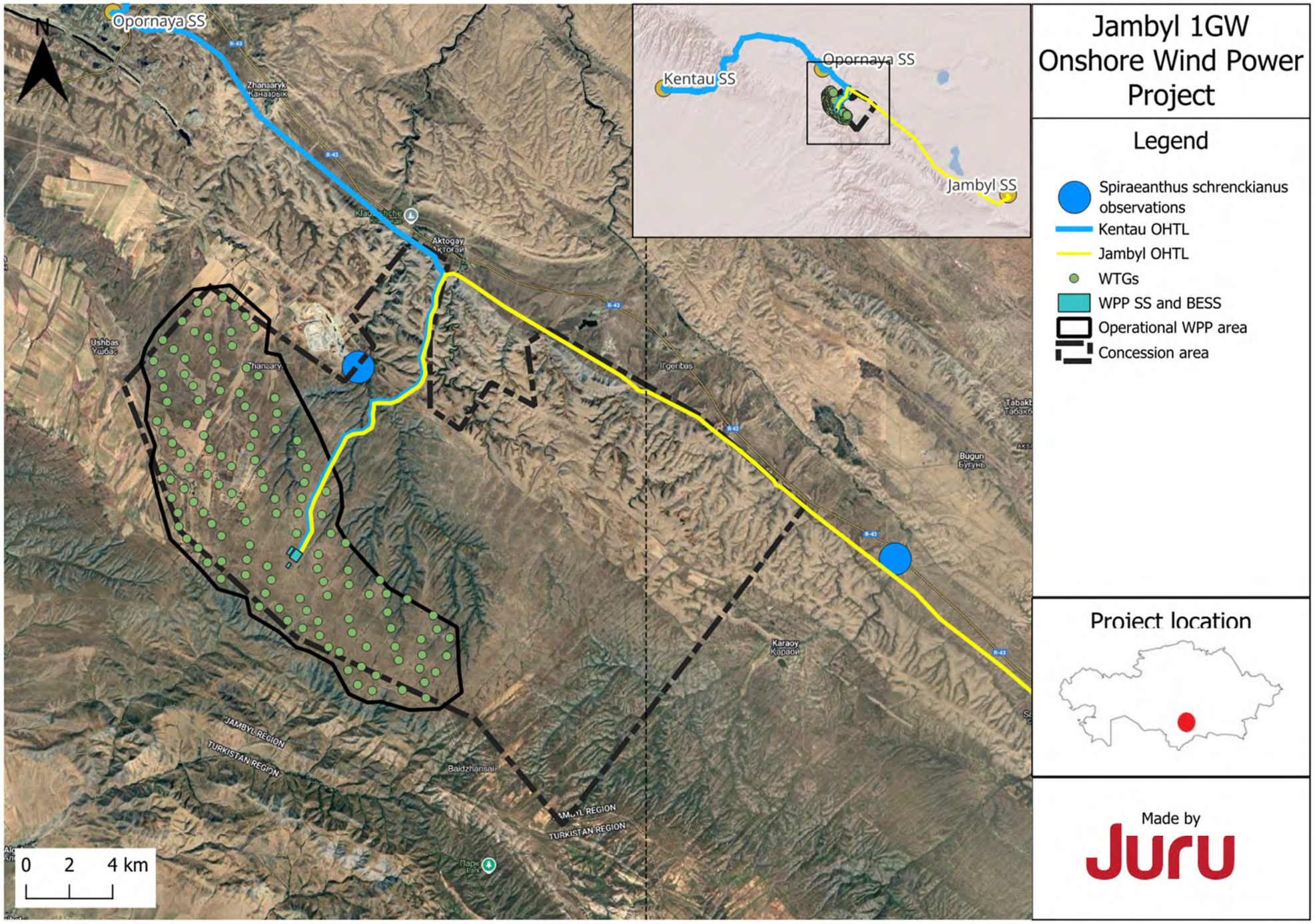


Figure 56. Locations of Spiraeanthus schrenkianus along the Projected OHTL, documented during the 2024 botanical surveys

Tulipa orthopoda (IUCN VU, Kazakhstan not listed, receptor sensitivity: high). This tulip species is endemic to the Karatau mountains of Kazakhstan, where it is known from rocky slopes in the foothills, within shrubland and grassland biomes. It was not detected during the Project's baseline surveys, thus the potential for the Project to impact this species are considered to be limited.

Iris orchioides (also known as *Juno orchioides*) (IUCN not assessed, Kazakhstan category 2 [EN], receptor sensitivity: medium). This is a small, herbaceous tuberous geophyte that is native to Kazakhstan, Uzbekistan, Kyrgyzstan, and Tajikistan[228] that has not been assessed by the IUCN[229]. According to a recent assessment of angiosperm extinction risk, cited in Kew Gardens' Plants of the World database[230], the status of this species is "not threatened" (Bachman et al., 2024). This species was documented during the spring, 2024 botanical baseline surveys on 3 of the 62 sample plots. All of these locations were at least 3 km from where any Project infrastructure will be sited: two of them on the eastern portion of the main plateau, to the east of the wind turbine area, and one of them in the middle of one of the large gorges that cut through the plateau. This species was not detected in the 2025 botanical surveys. The Project is considered to have minimal potential to impact this species, but some impacts are possible in areas where soil and vegetation will either be permanently removed or covered with Project infrastructure, or temporarily disturbed during construction, as this species may occur within the alpine steppe habitats where the wind turbines, access roads, and substation will be located, as well as in gorges.

[228] https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:438931-1/general-information accessed 15 April, 2025
[229] https://www.iucnredlist.org/ accessed 15 April, 2025.
[230] https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:742618-1/general-information#source-AERP accessed 15 April, 2025

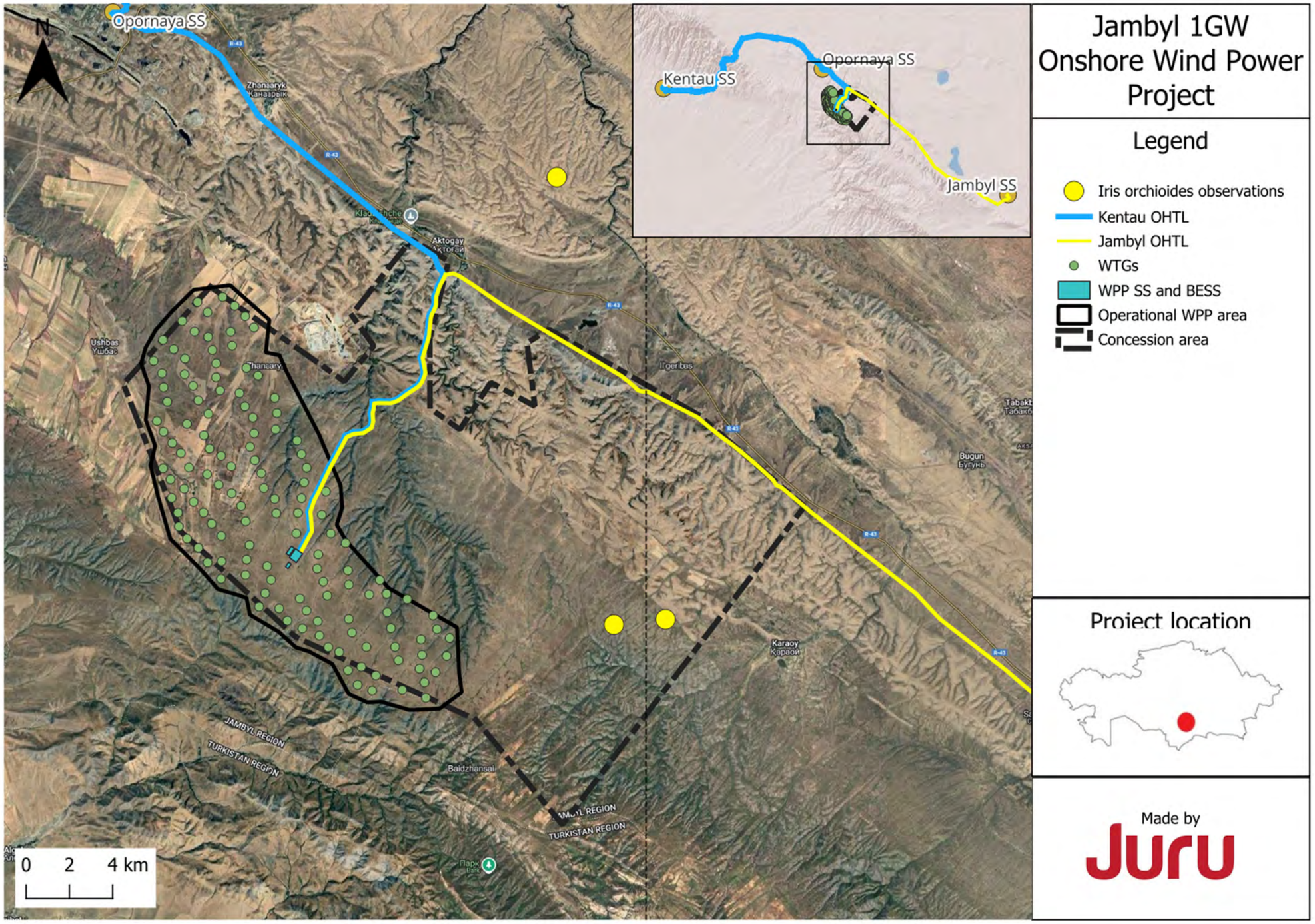


Figure 57. Locations of Iris orchioides along the Projected OHTL, documented during the 2024 botanical surveys

10.3.9 Ecosystem Services

Under IFC's Performance Standard 6, Ecosystem services are the benefits that people, including businesses, derive from ecosystems. Based on the framework used for the Millennium Ecosystem Assessment (2006), Ecosystem services are organized into four types:

- provisioning services, which are the products people obtain from ecosystems (for example these may include food, freshwater, timber, fibres, medicinal plants);
- regulating services, which are the benefits people obtain from the regulation of ecosystem processes (for example, regulating services can be surface water purification, carbon storage and sequestration, climate regulation, protection from natural hazards);
- cultural services, which are the non-material benefits people obtain from ecosystems (for example, these could be natural areas that are sacred sites and areas of importance for recreation and aesthetic enjoyment);
- supporting services, which are the natural processes that maintain the other services (such as soil formation, nutrient cycling, primary production);
- The following is preliminary baseline ecosystem services review for the Project area;

Provisioning Services provided by the Project site include grazing land for livestock. In addition, small patches of cropland are present along the southwestern edge, and small-scale beekeeping activity was also observed, representing another form of local land use.

Regulating Services include access to the natural streambed channels, springs and gullies that convey runoff and floods during the spring rainfall events.

Cultural Services; there are no cultural services identified within the Project site area.

Supporting Services provided by the Project area are few. Rainfall events in the spring may provide supporting services such as sediment transport, nutrient cycling and primary production into the river which may feed wider catchments.

10.4Critical Habitat Assessment

A Critical Habitat Assessment (CHA) was performed for the Project, following the methodology, guidance, and criteria for such outlined in IFC PS6[231], including guidance notes[232], and additional guidance[233] that is generally regarded by IFC and similar lenders as current good practice for CHA for wind energy facilities. This CHA identified a set of five biodiversity receptors classified as CH triggers, as well as set of 33 additional biodiversity receptors classified as Priority Biodiversity Values (PBV) for the Project, following IFC definitions and criteria. In addition, the CHA also encompassed an assessment of the extent and distribution of Natural vs. Modified Habitats within the Project area, following IFC PS6 definitions and criteria. The list of biodiversity receptors identified as CH triggers and PBV in this CHA is presented in Table X. The complete methodology and results of this CHA, including assessment and identification of CH, PBV and Natural Habitat (NH) is presented in the CHA report annexed to this ESIA.

Table 20 Table of all CH and PBV Species

Scientific Name	Common Name	IUCN	KAZ RDB	CH / PBV
Vanellus gregarius	Sociable Lapwing	CR	CR	PBV
Oxyura leucocephala	White-headed Duck	EN	CR	PBV
Haliaeetus leucoryphus	Pallas's Fish-eagle	EN	CR	PBV
Neophron percnopterus	Egyptian Vulture	EN	NT	PBV
Falco cherrug	Saker Falcon	EN	CR	PBV
Triplophysa paradoxa	Talas Stone Loach	EN	n/a	PBV
Triplophysa coniptera*	**A stone loach species**	**EN**	**n/a**	**CH – Criteria 1a**
Leuciscus lindbergi	Talas Dace	EN	n/a	PBV
Otis tarda	**Great Bustard**	**EN**	**CR**	**CH – Criteria 1a and 1c/3**
Aquila nipalensis	Steppe Eagle	EN	R	PBV
Anser erythropus	Lesser White-fronted Goose	VU	VU	PBV
Aythya ferina	Common Pochard	VU	n/a	PBV
Columba eversmanni	Yellow-eyed Pigeon	VU	VU/NT	PBV
Clanga clanga	Greater Spotted Eagle	VU	n/a	PBV
Aquila heliaca	Eastern Imperial Eagle	VU	NT	PBV
Gazella subgutturosa	Goitered Gazelle	VU	EN	PBV

[231] International Finance Corporation (IFC), 2012. Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources. January 1, 2012, World Bank Group, Washington, DC
[232] International Finance Corporation (IFC), 2019. Guidance Note 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources. June 27, 2019, World Bank Group, Washington, DC
[233] Memorandum Determining Biodiversity Management Requirements Related to Airspace around Wind Energy Facilities (EBRD, June 2023)

Scientific Name	Common Name	IUCN	KAZ RDB	CH / PBV
Vormela peregusna	Marbled Polecat	VU	VU/NT	PBV
Streptopelia turtur	European Turtle-dove	VU	VU	PBV
Chlamydotis macqueenii	MacQueen's Bustard	VU	VU	PBV
Tulipa orthopoda	**A tulip species**	**VU**	**n/a**	**CH – Criteria 1b/2**
Branta ruficollis	Red-breasted Goose	VU	VU	PBV
Marmaronetta angustirostris	Marbled Duck	NT	CR/EN	PBV
Aythya nyroca	Ferruginous Duck	NT	CR/EN	PBV
Tetrax tetrax	Little Bustard	NT	VU	PBV
Ciconia ciconia	White Stork	LC	CR/EN	PBV
Pelecanus onocrotalus	Great White Pelican	LC	CR/EN	PBV
Pelecanus crispus	Dalmatian Pelican	NT	VU	PBV
Pandion haliaetus	Osprey	LC	CR/EN	PBV
Circaetus gallicus	Short-toed Snake-eagle	LC	VU	PBV
Haliaeetus albicilla	White-tailed Eagle	LC	VU	PBV
Bubo bubo	Eurasian Eagle-owl	LC	VU	PBV
Falco vespertinus	Red-footed Falcon	VU	?	PBV
Falco peregrinus	Peregrine Falcon	LC	CR/EN	PBV
Ovis ammon nigrimontana	**Karatau Argali**	**NT**	**CR/EN**	**CH – Criteria 1c /2**
Testudo horsfieldii	Central Asian Tortoise	VU	n/a	PBV
Spiraeanthus schrenkianus	**-**	**EN**	**CR**	**CH – Criteria 1a**
-	Bats	-	-	PBV
Iris orchioides	Iris species	NA	EN (2)	PBV

* - TBC – awaiting confirmation of presence within the Project AoI and updated CHA.

10.5Collision Risk Assessment

A Collision Risk Modeling (CRM) analysis was undertaken to support the characterization of operations-phase wind turbine collision risk to birds, presented within this ESIA. This CRM was based on the methodology developed by William Band and colleagues[234], with bird risk determined as a function of bird Vantage Point (VP) survey data collected over the course of six consecutive seasons within the Project's wind farm area, following the methodological guidance for VP surveys provided by NatureScot[235] (formerly Scottish Natural Heritage) that has generally been adopted by many lenders and experts as the current standard representing good international practice for wind farm CRM. This analysis included a novel refinement of the original methodology, developed for this Project for the purpose of providing spatially-explicit information on the variation of collision risk across the space of the wind farm, as well as surrounding areas where additional VP survey data were collected. The interim CRM analysis summarized in this ESIA incorporated VP data from five consecutive, 3-month seasons of VP surveys, including three consecutive seasons in which the near-final wind farm layout was comprehensively covered by the surveyed VP points (autumn 2024, winter 2024-2025, spring 2025), and using a preliminary, representative wind turbine technology. The total predicted collision risk for all priority bird species resulting from this three-season CRM analysis is summarized in Table 8, below. For the final analysis, CRM results from the summer 2025 VP surveys will be added, and the final wind turbine layout and turbine technology will be incorporated, rendering comprehensive predictions of annual wind turbine collision risk for the final wind turbine design. Further detail is provided in the interim CRM report, annexed to this ESIA (Annex G).

*Table 21. Estimated rates of collisions per **3-season period** (spring 2025, autumn 2024, and winter 2024-2025) for bird species at the Jambyl Wind Energy Project, predicted by Band Collision Risk Modeling analysis, under a range of Collision Avoidance (CA) parameter values (see CRM report for predicted seasonal collision rates and CA values for each species. These results were generated using data only from the vantage points to which turbines in the near-final windfarm layout were assigned (VP2-4 and 14-19, see CRM report).*

English Common Name	Using lower bound CA value		Using most realistic CA value		Using upper bound CA value	
	Collisions/3 season period	3-season periods to 1 collision	Collisions/3 season period	3-season periods to 1 collision	Collisions/3 season period	3-season periods to 1 collision
Great Bustard	2.54	<1	0.508	1.96	0.254	3.93
Bearded Vulture	0.0540	18.5	0.0108	92.6	0.00540	185
Egyptian Vulture	0.0730	13.7	0.0306	32.6	0.00730	137
Cinereous Vulture	3.39	<1	1.69	<1	0.847	1.18
Eurasian Griffon	0.387	2.58	0.193	5.17	0.0967	10.3
Short-toed Snake-Eagle	1.63	<1	0.361	2.76	0.0860	11.6
Greater Spotted	0.130	7.71	0.0286	34.9	0.00682	146

[234] Band, W. (2012). Using a collision risk model to assess bird collision risks for offshore windfarms. Produced for the Crown Estate, Strategic Ornithological Support Services programme, project SOSS-02, including accompanying Collision Risk spreadsheet and worked example.
[235] Scottish Natural Heritage. (2017). Recommended bird survey methods to inform impact assessment of onshore wind farms. V2, March, 2017.

English Common Name	Using lower bound CA value		Using most realistic CA value		Using upper bound CA value	
	Collisions/3 season period	3-season periods to 1 collision	Collisions/3 season period	3-season periods to 1 collision	Collisions/3 season period	3-season periods to 1 collision
Eagle						
Booted Eagle	0.671	1.48	0.148	6.73	0.0353	28.2
Steppe Eagle	14.2	<1	3.15	<1	0.749	1.33
Imperial Eagle	0.420	2.38	0.0928	10.7	0.0221	45.2
Golden Eagle	0.689	1.45	0.152	6.56	0.0363	27.5
Unidentified Eagle	0.138	7.23	0.0306	32.7	0.00928	137
White-tailed Eagle	0.195	5.12	0.0977	10.2	0.00879	113
Saker Falcon	0.0177	56.4	0.00709	141	0.00354	282
Little Bustard	0.0590	16.9	0.0118	84.7	0.00590	169
Demoiselle Crane	0.433	2.30	0.0866	11.5	0.0433	23.0
Northern Lapwing	0.0105	94.9	0.00105	949	0.000526	1890
Black Stork	0.261	3.82	0.0522	19.1	0.0261	38.2
Oriental Honey-Buzzard	0.334	2.99	0.0759	13.1	0.0152	65.8
Eurasian Sparrowhawk	0.223	4.48	0.112	8.96	0.0223	44.8
Eurasian Goshawk	0.00758	132	0.00379	264	0.000758	1320
Western Marsh Harrier	0.199	5.01	0.0399	25.0	0.00399	250
Hen Harrier	0.0645	15.4	0.0129	77.4	0.00129	774
Pallid Harrier	0.0328	30.5	0.00655	152	0.000655	1520
Unidentified Harrier	0.0107	93.6	0.00214	468	0.000214	4680
Common Buzzard	0.176	5.66	0.0401	24.9	0.00802	124
Long-legged Buzzard	2.86	<1	0.649	1.54	0.130	7.70
Unidentified Buzzard	0.0344	29.0	0.00783	127	0.00157	638
Lesser Kestrel	1.00	<1	0.245	4.08	0.00789	126
Eurasian Kestrel	1.90	<1	0.463	2.15	0.0149	66.9

English Common Name	Using lower bound CA value		Using most realistic CA value		Using upper bound CA value	
	Collisions/3 season period	3-season periods to 1 collision	Collisions/3 season period	3-season periods to 1 collision	Collisions/3 season period	3-season periods to 1 collision
Eurasian Hobby	0.0352	28.3	0.0141	70.9	0.00705	141
Peregrine Falcon	0.00815	122	0.00326	306	0.00163	613

10.6Potential Impacts

Habitat loss and/or degradation

Habitat loss during construction arises from permanent land take associated with turbine foundations, crane pads, access roads, OHTL towers, and the BESS platform. These activities result in the direct removal and conversion of natural or semi-natural habitats within the infrastructure footprint. This impact is spatially defined, measurable in area, and permanent. It may reduce the availability of nesting, foraging or shelter habitat and, where species are territory-limited or habitat specialists, may lower local carrying capacity or breeding success. This impact includes the loss of plant species present in the habitat.

Habitat degradation differs from habitat loss in that the habitat remains physically present but its ecological quality is reduced. During both construction and operation, fragmentation, edge effects, vegetation management, soil compaction, or altered predator–prey dynamics may diminish habitat suitability without complete removal (Bennun L. et al, 2021). In such cases, species may continue to use the area, but under sub-optimal conditions. The impact is typically long-term but may be partially reversible, depending on management and restoration measures.

Displacement

Displacement refers to behavioural avoidance of otherwise suitable habitat due to disturbance or the presence of infrastructure, without physical habitat removal. During pre-construction and construction, disturbance from noise, vehicle movement, vegetation clearance and human activity may cause fauna to temporarily avoid areas adjacent to works. This impact is localised, temporary, and generally reversible once disturbance ceases.

During operation, some species may exhibit longer-term avoidance of turbines or transmission lines due to turbine movement, noise, visual disturbance, or perceived collision risk. Although the habitat remains intact, it may become functionally unavailable to sensitive species. Avoidance distances are species-specific and may extend beyond the physical footprint of infrastructure. In such cases, displacement can lead to an effective reduction in usable habitat, redistribution of territories, or increased competition in adjacent areas. Unlike direct habitat loss, displacement is driven by behavioural response and may vary between species and over time.

Collisions with vehicles

Fauna may be subject to mortality risk as a result of increased vehicle movements associated with the Project. This risk arises primarily within the Project footprint (e.g. internal access roads and construction areas), but may also extend to external site access roads used for the transport of materials, equipment and personnel.

The risk of vehicle-related collisions is expected to be highest during the construction phase, when traffic volumes are substantially elevated. During operation, vehicle movements will be limited to routine inspections and maintenance activities, and collision risk will therefore be considerably lower.

This impact is localised to road corridors and is largely confined to the construction period. Given its limited spatial extent and temporary nature, it is not anticipated to result in significant population-level effects for most fauna species, although isolated mortality events may occur.

Barrier effect

The presence of wind turbines and associated infrastructure may alter animal movement patterns by introducing obstacles within previously unobstructed landscapes. Migratory species are particularly sensitive to such changes. For example, migratory birds, including raptors, may adjust their flight paths to avoid wind farms, especially where turbines are located along established migration corridors. These deviations may increase flight distance and energy expenditure, and in some cases may reduce access to traditional stopover or foraging areas.

Barrier effects may also occur for terrestrial fauna by restrict movement across the landscape. This is of particular relevance for wide-ranging or migratory mammal species that depend on landscape connectivity (Bennun L. et al, 2021).

The barrier effect is typically long-term, persisting for the operational life of the Project. While individual behavioural adjustments may not necessarily translate into major impacts, cumulative effects may arise where multiple wind farms or linear infrastructure are developed within the same region, potentially affecting migratory species at a broader scale..

Collisions of birds and bats with the wind turbines

Birds flying within the rotor-swept zone are at risk of collision with turbine blades, which may result in serious injury or mortality. Collision risk is generally highest for large, soaring species that rely on updrafts and prolonged gliding flight, particularly during migration or daily movements. Species such as vultures, large raptors and storks are often considered more vulnerable due to their flight behaviour, body size and limited manoeuvrability (Bennun et al., 2021). Because these species frequently have long generation times, delayed maturity and relatively small or slowly recovering populations, sustained collision mortality may have population-level implications where exposure is high. The impact is long-term, persisting throughout the operational life of the wind farm.

Bats are also susceptible to turbine-related mortality. Risk is typically higher for species that forage or commute in open habitats, exhibit fast and direct flight, and use long-range, low-frequency, high-intensity echolocation calls adapted to open-air hunting. In many regions, migratory bat species are particularly vulnerable, especially during seasonal movements when activity at rotor-swept height increases. As with birds, the magnitude of impact depends on species-specific behaviour, activity levels within the rotor-swept zone, and overall exposure to operating turbines.

Collisions of birds with the power line

Birds may collide with overhead transmission lines, particularly with earth wires, which are often thinner and less visible than conductors. Such collisions can result in injury or mortality and, for certain species, may represent a significant source of impact.

Species considered more vulnerable include large-bodied birds with relatively low manoeuvrability, such

as bustards, cranes, storks, geese, swans, eagles and vultures. These species are especially at risk when flying at heights intersecting with the wire profile or when undertaking regular commuting movements between roosting and foraging areas.

Collision risk may increase during flocking behaviour, migration, or nocturnal movements, when visibility is reduced and reaction time is limited. However, these factors are species- and context-specific and do not uniformly result in high mortality across all taxa. The impact is long-term, persisting for the operational life of the transmission line, and its significance depends on species sensitivity, local abundance, and frequency of exposure.

Electrocution

Electrocution risk primarily affects raptors and other large perching birds. These species frequently use electricity pylons and poles as hunting perches or nesting structures. Due to their large wingspan, they may inadvertently bridge the gap between live and earthed components, resulting in a short circuit and fatal injury.

Electrocution events occur predominantly on low- and medium-voltage distribution lines (typically <15 kV), where conductor spacing and pole configurations allow simultaneous contact with energised and grounded elements. In contrast, high-voltage transmission lines generally present a much lower electrocution risk, as the spacing between live components and earthed structures is typically sufficient to prevent birds from contacting both at the same time.

For the present Project, the transmission line design ensures adequate separation between live and grounded components, and therefore the likelihood of electrocution is considered negligible. **On this basis, electrocution risk is not carried forward for further detailed assessment in subsequent chapters**.

The following table summarises the key impacts by Project phase. Although the Project is formally divided into three phases, the assessment of impacts on biodiversity receptors combines the pre-construction and construction phases for clarity, as the nature and pathways of impacts during these stages are generally comparable.

Table 22 Impacts on biodiversity by project phases

Project activities	Pre-construction	Construction	Operation
Site preparation	During site preparation, clearing, grading and levelling of the wind turbine and building areas will occur, leading to vegetation clearing. Also, the establishment of temporary site facilities and construction compounds will require vegetation clearing and soil degradation, leading to **habitat loss and degradation**, impacts on protected flora species, as well as disturbance of fauna, leading to **displacement**.	During construction, major-vegetation clearing will occur, leading to **habitat loss and degradation** within the project footprint. This activity also results in disturbance of fauna, especially ground-nesting species, which can lead to **displacement**.	-
Powerline corridor clearing	During the pre-construction phase, the preparation of the powerline site consists of the construction of platforms for pylons and the	During construction, major vegetation clearing will occur, leading to **habitat loss and degradation** and disturbance of	During maintenance, vegetation will be trimmed around the powerline corridor, which can lead to minor

	delivery of materials along the OHTL route, causing **habitat loss and degradation**, as well as species **displacement**.	fauna, especially ground-nesting species, which would cause fauna **displacement**.	**habitat degradation.**
Earthworks, excavations, concrete works	-	During the construction phase, completion of 150 foundation excavations, the main control building, and substation levelling, as well as cable trenching, will result in major habitat disruption, leading to permanent **habitat loss**. Impacts associated with this activity also include direct impacts on fauna in the form of disturbance and causal fauna **displacement**. Pouring of concrete for foundations will lead to substantial impacts on the soil, as well as habitat loss.	-
Access and internal roads	The development of site access roads (to enable WTG delivery and maintenance access from the main road) will lead to **habitat loss and degradation** of surrounding flora due to impacts from vehicles in motion (dust, runoff, etc). also, impacts on fauna are possible due to collision with vehicles (**fauna fatalities**).	Road upgrades and widening, as well as construction of the internal road network, will lead to additional **habitat loss and degradation**. Due to increased transport during construction, the impacts of access roads in this phase include **fauna fatalities** caused by the collision of fauna and vehicles.	During maintenance of WFF and OHTL, some **fauna fatalities** are possible.
Wind turbine operation	-	-	During operation, the main impacts include **collision of birds and bats with turbines**, **barrier effects** affecting migration of birds and large mammals, **habitat degradation**, and **displacement** of fauna. These impacts are long-term, persisting throughout the operational life of the Project, and may have lasting effects on sensitive species populations.
Powerline operation	-	-	During operation, the main impacts are **collision**. These impacts are long-term (duration of the project life), and those impacts can have long-lasting effects on species populations for bird species (especially collisions). **Displacement** due to avoidance of OHTL is also a possible impact during this phase.

10.6.1 Evaluation of impact significance

The following table presents the evaluated significance of all predicted impacts on relevant biodiversity receptors in the absence of additional, impact-specific mitigation measures. Receptor sensitivity and impact magnitude have been assigned in accordance with the methodology and criteria set out in Chapter 4. It should be noted that this assessment reflects the mitigation hierarchy at the design stage. Avoidance measures embedded within the Project design — such as infrastructure macro-siting and layout optimisation — are considered integral components of the Project and are therefore incorporated within the "pre-mitigation" significance ratings.

Additional mitigation measures applied to reduce impacts further, and used to determine residual (post-mitigation) impact significance, are presented in Table 12.

Table 23 Impact assessment

Taxonomic group	Receptor name	English name	Possible impacts	Receptor sensitivity	Impact magnitude	Impact significance	Explanation
Bird	*Falco pelegrinoides*	Barbary Falcon	Displacement during construction	High	Negligible	Insignificant	Baseline survey observations of Barbary Falcon included documentation of an active nest in the vicinity of the WPP area during the 2024 nesting season, but none during the 2025 nest survey, thus the impact of displacement on breeding population is very limited
Bird	*Falco pelegrinoides*	Barbary Falcon	Collision with wind turbines	High	Negligible	Insignificant	Collision risk was not modelled separately for this subspecies in the CRM, but observations of Barbary Falcon were included in the CRM analysis for Peregrine Falcon (one wind turbine collision every 306 years)
Bird	*Falco pelegrinoides*	Barbary Falcon	OHTL electrocution	High	Negligible	Insignificant	Taking into account current OHTL design this impact is considered negligible

Bird	*Gypaetus barbatus*	Bearded Vulture	Collision with wind turbines	Medium	Negligible	Insignificant	The Project's baseline studies produced a single record of this species, a bird that flew through the WPP area during an autumn VP survey, which generated a prediction of one wind turbine collision every 92 years for the wind farm in the interim CRM analysis
Bird	*Gypaetus barbatus*	Bearded Vulture	OHTL electrocution	Medium	Negligible	Insignificant	Lack of observations along the OHTL route and considering the habitats this species prefers, but also the fact the design of this OHTL, it is unlikely that Bearded Vulture will be affected by OHTL electrocution
Bird	*Ciconia nigra*	Black Stork	Collision with wind turbines	High	Small	Minor	VP survey observations in the wind farm area generated an interim CRM prediction of one wind turbine collision every 19 years for this species.
Bird	*Ciconia nigra*	Black Stork	Collision with OHTL	High	Medium	Moderate	Two active nests, both located within 500 m of the Kentau OHTL segment, plus a third located 1.8 km from this OHTL, were documented in the 2025 nest surveys. Two breeding pairs documented in the AoI translate to the potential impacts on 1.3% of a national population (150 pairs)
Bird	*Hieraaetus pennatus*	Booted Eagle	Displacement during construction	High	Small	Minor	Two active nests of this species and an additional occupied breeding territory were documented in the vicinity of the WPP area during the Project's raptor/vulture nesting surveys in 2024, and occupied nests were documented at all three of these territories (third nest also documented) in the 2025 raptor nest survey. This data indicated potential negative impacts due to displacement of breeding acitvity (caused by disturbance)

Bird	*Hieraaetus pennatus*	Booted Eagle	Collision with wind turbines	High	Medium	Moderate	Observations of this species generated an interim CRM prediction of one wind turbine collision every 6 years
Bird	*Aegypius monachus*	Cinereous Vulture	Collision with wind turbines	High	Medium	Moderate	Observations of this species generated a prediction of roughly 1.69 Cinereous Vulture collisions per year in the interim CRM analysis
Bird	*Grus grus*	Common Crane	Collision with wind turbines	Medium	Negligible	Insignificant	Common Crane occurs within the Project area only during migration, with no evidence of breeding or other key ecological functions. Although recorded in moderate numbers during autumn, observations do not indicate concentrated use of the site. As such, while some collision risk with wind turbines cannot be excluded, the magnitude of impact is considered insignificant at the population level.
Bird	*Grus grus*	Common Crane	Collision with OHTL	Medium	Small	Minor	Collision risk with the OHTL is considered more likely for Common Crane, consistent with known susceptibility of large-bodied crane species. However, despite regular occurrence during migration, the Project area does not represent a key concentration area, and recorded numbers remain low in the context of the wider population. Therefore, while some fatalities may occur, the magnitude of impact is considered minor at the population level.

Bird	*Pelecanus crispus*	Dalmatian Pelican	Collision with wind turbines	Medium	Negligible	Insignificant	The only observations of this species collected in the baseline surveys were observations of 77 and 6 individuals on the spring, 2025 VP surveys in the WPP area and Kentau OHTL, respectively. These numbers, along with the absence of any large waterbodies within 1 km of any Project infrastructure, indicate that the Project's potential to adversely impact this species is limited
Bird	*Pelecanus crispus*	Dalmatian Pelican	Collision with OHTL	Medium	Small	Minor	There is some potential to cause fatalities for this species through collisions with the portions of the Project's OHTL that are located relatively close to large or small waterbodies
Bird	*Grus virgo*	Demoiselle Crane	Collision with wind turbines	Medium	Small	Minor	VP survey observations in the wind farm area generated an interim CRM prediction of one wind turbine collision every 11 years for this species
Bird	*Grus virgo*	Demoiselle Crane	Collision with OHTL	Medium	Small	Minor	Based on general collision susceptibility patterns of cranes this is a more likely impact, but expected to be minor considering the height at which birds were observed during OHTL VP surveys
Bird	*Aquila heliaca*	Eastern Imperial Eagle	Collision with wind turbines	Medium	Small	Minor	Baseline surveys indicated that the highest level of activity of this species in the Project area occurs during autumn migration. VP survey observations within the wind farm area generated an interim CRM prediction of one wind turbine collision every 10 years for this species

Bird	*Neophron percnopterus*	Egyptian Vulture	Displacement during powerline construction	High	Medium	Moderate	Three active nests were documented in 2025 along, and within 500 m of the Kentau OHTL segment, as well as evidence of a possible fourth breeding territory in the same general vicinity. Due to these findings, it is possible that this species is disturbed during construction, causing it to leave the nesting teritory.
Bird	*Neophron percnopterus*	Egyptian Vulture	Collision with wind turbines	High	Small	Minor	Spring and autumn VP observations generated a prediction of one Egyptian turbine collision fatality every 32 years in the interim CRM analysis
Bird	*Bubo bubo*	Eurasian Eagle-owl	Displacement during construction	High	Small	Minor	One active nest of this species was documented on the site during the 2024 raptor nest surveys, and no nests or nesting activity was documented during the 2025, thus the impact od displacement is possible but limited
Bird	*Bubo bubo*	Eurasian Eagle-owl	Collision with wind turbines	High	Negligible	Insignificant	It is possible that WPP generates collision impacts, but the magnitude is considered insignificant as the species is scarcely present at the Project area.
Bird	*Gyps fulvus*	Eurasian Griffon	Collision with wind turbines	High	Medium	Moderate	The interim CRM analysis generated a prediction of roughly one Eurasian Griffon collision every 5 years
Bird	*Platalea leucorodia*	Eurasian Spoonbill	Collision with wind turbines	Low	Negligible	Insignificant	Considering that there was only one observation of a flock of 13 birds flying through the Jambyl OHTL corridor, detected during an autumn, 2024 OHTL VP survey, it is not likely that collision with WPP turbines could pose a threat to this species

Bird	*Platalea leucorodia*	Eurasian Spoonbill	Collision with OHTL	Low	Negligible	Insignificant	Project has some potential to generate collision impacts along the Project's extensive OHTL, where it is likely to be concentrated within the vicinity of large and small water bodies, but the potential for such impacts is low, due to this species' rarity as a migrant in the region
Bird	*Aquila chrysaetos*	Golden Eagle	Displacement during construction	High	Small	Minor	Lower levels of breeding activity and a pattern of nest failures in recent years suggest that displacement during construction would not pose a threat to this species
Bird	*Aquila chrysaetos*	Golden Eagle	Collision with wind turbines	High	Medium	Moderate	VP survey observations within the wind farm area generated an interim CRM prediction of one wind turbine collision every 6 years
Bird	*Otis tarda*	Great Bustard	Vehicle fatalities during construction	High	Small	Minor	As the species actively uses the western part of WPP area, vehicle fatalities are possible during construction
Bird	*Otis tarda*	Great Bustard	Displacement during construction	High	Medium	Moderate	This species is highly sensitive to disturbance by human activity, which was also observed during the surveys. Displacement impacts are expected to be the highest in the western part of the WPP area, where several turbines overlap agricultural fields where significant Great Bustard breeding activity has been observed
Bird	*Otis tarda*	Great Bustard	Collision with wind turbines	High	Medium	Moderate	The preliminary CRM analysis using the most realistic collision avoidance parameter predicts that 0.508 Great Bustard wind turbine collisions will occur per year

Bird	*Otis tarda*	Great Bustard	Collision with OHTL	High	Medium	Moderate	During the autumn bird survey, Great Bustards were recorded in the southern sector of VP K1, flying at a height of approximately 10 m. Night activity of this species was not surveyed so the identification of impact magnitude needs to take that into account
Bird	*Otis tarda*	Great Bustard	Habitat loss and degradation	High	Medium	Moderate	Regional population estimated at 50–70 individuals and increasing (Kessler & Batbayar 2023). Four male territories recorded within the Project site in already degraded agricultural and grazed habitats. Given small population size and CH trigger status, additional habitat loss or degradation may result in moderate impacts, not affecting the whole subpopulaiton.
Bird	*Pelecanus onocrotalus*	Great White Pelican	Collision with wind turbines	Medium	Negligible	Insignificant	Observed numbers of individuals, along with the absence of any large waterbodies within 1 km of any Project infrastructure, indicate that the Project's potential to adversely impact this species is limited
Bird	*Pelecanus onocrotalus*	Great White Pelican	Collision with OHTL	Medium	Small	Minor	There is some potential to cause fatalities for this species through collisions with the portions of the Project's OHTL that are located relatively close to large or small waterbodies
Bird	*Clanga clanga*	Greater Spotted Eagle	Collision with wind turbines	Medium	Negligible	Insignificant	Observations of this species generated an interim CRM prediction of one wind turbine collisions every 34 years for this species
Bird	*Tetrax tetrax*	Little Bustard	Vehicle fatalities during construction	High	Small	Minor	It is possible that some fatalities happen during construction, as the WPP plateau is used by this species

Bird	*Tetrax tetrax*	Little Bustard	Displacement during construction	High	Medium	Moderate	This species has a substantial breeding population on the plateau where the wind turbines are sited, thus it is expected that distrubance due to construction will cause displacement
Bird	*Tetrax tetrax*	Little Bustard	Collision with wind turbines	High	Negligible	Insignificant	Observations of this species generated an interim CRM prediction of one wind turbine collision every 84 years for this species
Bird	*Tetrax tetrax*	Little Bustard	Collision with OHTL	High	Small	Minor	Low to moderate migratory observations during the baseline surveys (and eBird data from Chokpak pass) bring to conclusion that some impacts are possible, but are not expected to affect the population of this species
Bird	*Tetrax tetrax*	Little Bustard	Habitat loss and degradation	High	Small	Minor	Long-term displacement is possible when the Project is built and the landscape changes, but the impact is considered to be minor. The reason behind this conclusion is that there were no large migratory flocks of birds evident during surveys, and regarding the breeding population, suitable habitats are present around the Project area, so the displacement should not pose a threat to breeding success
Bird	*Vanellus vanellus*	Northern Lapwing	Collision with wind turbines	Medium	Negligible	Insignificant	In the Project region, this species occurs as a fairly common migrant. Research data show that non-breeding lapwings are sensitive to very large wind turbines (high avoidance) thus it is not expected that collision poses a threat to this species

Bird	*Vanellus vanellus*	Northern Lapwing	Collision with OHTL	Medium	Negligible	Insignificant	Most of observations of this species happend along the Jambyl OHTL segment, in the vicinity of Lakes Bilikol and Akkol, whose shoreline wetland habitats may have attracted concentrations of migrating Northern Lapwings. The impacts are likely to occur during spring and autumn migration periods, and the significance of these impacts is limited by the relatively low level of sensitivity of this abundant and widespread species
Bird	*Pandion haliaetus*	Osprey	Collision with wind turbines	Medium	Negligible	Insignificant	Risk at the Project site is likely low, because of this species' extreme rarity in the region, and because the wind farm consists entirely of upland habitats (there are no significant water bodies located within 1 km of any Project infrastructure, hence there is nothing to attract an Osprey to engage in the sustained foraging flights)
Bird	*Pandion haliaetus*	Osprey	OHTL electrocution	Medium	Negligible	Insignificant	There was only a single observation of this species collected during the baseline surveys, in autumn migration, 2025, along the Jambyl OHTL.
Bird	*Other migratory waterbird species*	Other migratory waterbird species	Collision with wind turbines	Low	Small	Insignificant	Most species in this category are restricted to, or highly associated with wetlands and waterbodies, thus limiting exposure of this group to risk from the upland and inland habitats of the Project area. Seven species though were recorded in the WPP area but with a very few observations (exception was Lesser Black-backed Gull, for which 483 observations were documented in the wind farm area during spring migration in 2025)

Bird	*Other migratory waterbird species*	Other migratory waterbird species	Collision with OHTL	Low	Small	Insignificant	With regard to collision risk associated with the overhead transmission line (OHTL), which represents the most relevant impact pathway for species in this category, potential risk is considered highest for the seven species for which at least 100 observations were recorded during the OHTL vantage-point surveys. However, even for these species the risk is assessed as insignificant, primarily due to the minimum separation distance of 3 km between the Project's OHTL segments and any large water bodies.
Bird	*Other upland bird species, including migratory populations*	Other upland bird species, including migratory populations	Displacement during construction	Low	Medium	Minor	Some of "other" breeding or seasonally resident species such as Long-legged Buzzard and Eurasian Kestrel could be impacted during construction, but this impact is considered to be minor
Bird	*Other upland bird species, including migratory populations*	Other upland bird species, including migratory populations	Collision with wind turbines	Low	Medium	Minor	While some collisions are likely to occur during the Project's operations phase for species described in the section "Other upland migratory bird species", such risks are not likely to reach levels that would jeopardize any species' population or conservation status, or raise significant conservation concerns
Bird	*Circus macrourus*	Pallid Harrier	Collision with wind turbines	Medium	Negligible	Insignificant	The interim CRM analysis for this species yielded a prediction of one turbine collision every 152 years
Bird	*Falco peregrinus*	Peregrine Falcon	Collision with wind turbines	Medium	Negligible	Insignificant	VP survey observations within the wind farm area generated an interim CRM prediction of one wind turbine collision every 306 years for this species

Bird	*Falco peregrinus*	Peregrine Falcon	OHTL electrocution	Medium	Negligible	Insignificant	Taking into account current OHTL design this impact is considered negligible
Bird	*Falco vespertinus*	Red-footed Falcon	Collision with wind turbines	Low	Negligible	Insignificant	Baseline surveys yielded only a single observation of this species; a presumed migrant seen during spring surveys along the Kentau OHTL segment
Bird	*Falco cherrug*	Saker Falcon	Displacement during construction	Medium	Negligible	Insignificant	During the survey period, no evidence of nesting was found, and surveys yielded total of 13 observations (10 observations are from autumn 2024). Additionally, there are no observations of Sakers at Chokpak Pass in the eBird database. Taking into account the usage of this area by Saker Falcon, it is not expected that construction could pose a threat to this species.
Bird	*Falco cherrug*	Saker Falcon	Collision with wind turbines	Medium	Negligible	Insignificant	VP survey observations within the wind farm area generated an interim CRM prediction of one wind turbine collision every 141 years for this species
Bird	*Circaetus gallicus*	Short-toed Snake-eagle	Displacement during construction	Medium	Small	Minor	Nesting was confirmed both at the WPP area and OHTL (one nest in WPP area in 2024, and one nest near Kentau OHTL in 2025), thus impacts during construction could generate impact to the breeding population
Bird	*Circaetus gallicus*	Short-toed Snake-eagle	Collision with wind turbines	Medium	Small	Minor	VP surveys conducted within the WPP area resulted in an interim CRM prediction of 0.36 wind turbine collisions per year for this species. This mostly reflects the activity of a single breeding pair, which represents 0.017% of a national population (6000 pairs)

Bird	*Aquila nipalensis*	Steppe Eagle	Collision with wind turbines	High	Large	Major	The highest levels of Steppe Eagle activity within the Project area were recorded during the autumn 2024 VP surveys, corresponding to the migration period and indicating a potentially elevated collision risk. Since then, the Project layout has been revised to reduce exposure to this risk, including avoidance of key movement areas. An updated CRM, reflecting the revised layout, is currently pending and will inform the final assessment of impact significance.
Bird	*Aquila nipalensis*	Steppe Eagle	Collision with OHTL	High	Medium	Moderate	During the OHTL VP survey individuals were recorded flying over the planed OHTL. As the powerlines pose a serious risk for the species the impact are considerd elevated
Bird	*Ciconia ciconia*	White Stork	Collision with wind turbines	Medium	Negligible	Insignificant	Considering that White Stork has low susceptibility to WF collisions, and that in the Project region this species is a very rare breeding species and migrant with low density and small numbers (as reflected by eBird reports and only one observation in the Project's baseline surveys) this impact is considered to be negligible
Bird	*Ciconia ciconia*	White Stork	Collision with OHTL	Medium	Small	Minor	This species is known to breed around Lake Bilikol, located roughly 3 km to the east of the Jambyl OHTL segment, thus some impacts on White Stork are possible, but as observations during two-year survery yielded only one observation of this species, the impact is considered to be very small

Bird	*Oxyura leucocephala*	White-headed Duck	Displacement during powerline construction	Medium	Small	Minor	As the species was found breeding in a small pond within 800 m of the Jambyl OHTL, it might be afftected by noise during construction of the powerline segment. Takin into account the population size and the affected portion (as observed during baseline surveys) the impact is considered to be minor.
Bird	*Oxyura leucocephala*	White-headed Duck	Collision with OHTL	Medium	Small	Minor	As this species was found within 800 m of Jambyl OHTL, collision impacts are possible, but low due to this species' limited flight activity, and likely confinement to the immediate vicinity of the lake during the breeding season
Bird	*Haliaeetus albicilla*	White-tailed Eagle	Collision with wind turbines	Medium	Small	Minor	VP survey observations within the wind farm area generated an interim CRM prediction of one wind turbine collision every 10 years. Impacts are possible during winter and migration season, but are limited due to the relatively low abundance of this species in the Project area
Bird	*Haliaeetus albicilla*	White-tailed Eagle	Collision with OHTL	Medium	Negligible	Insignificant	OHTL electrocution on high-voltage lines is a low risk for this species. Taking also into account current OHTL design, this impact is considered negligible, even though the species was observed along the OHTL segments
Bat	*Barbastella leucomelas*	Arabian barbastelle	Collision with wind turbines	Medium	Small	Minor	This species' activity during baseline surveys was low

Bat	*Nyctalus noctula*	Common noctule	Collision with wind turbines	Medium	Medium	Moderate	This species has a high collision risk and fatalities are well-documented in the research worldwide (often among the most frequent bat casualties at wind turbines). Common noctule flies at rotor-height thus is susceptible to collision impacts. It was recorded at rotor height during baseline surveys, with moderate activity in the WPP area compared to other detected species, which makes it susceptible to Project impacts. Habitat suitability has also been assessed as high for this species.
Bat	*Pipistrellus pipistrellus*	Common pipistrelle	Collision with wind turbines	Low	Medium	Minor	Pipistrellus species are among the most numerous bat casualties at wind farms due to open-air flight and high activity around turbines (Salguero, M. et al., 2023). Compared to other detected species, this species is highly active in the Project area and could be threatened by collision, due to flight in the turbine rotor area. Habitat suitability has also been assessed as high for this species.
Bat	*Pipistrellus pipistrellus*	Common pipistrelle	Displacement during construction	Low	Small	Insignificant	Displacement (habitat loss) is a possible impact as this species was found during roost search. Even though it was found in a cave outside WPP footprint, impacts on foraging activities could happen but are considered to be minor.

Bat	*Tadarida teniotis*	European free-tailed bat	Collision with wind turbines	Medium	Medium	Moderate	This species is moderately abundant at the site, and is likely to be exposed to collision impacts from the Project. Passive acoustic recordings collected at higher elevation detectors positioned on meteorological masts in the wind farm area confirmed that this species focuses a substantial portion of its flight activity within rotor swept altitudes.
Bat	*Myotis emarginatus*	Geoffroy's Bat	Collision with wind turbines	Low	Small	Insignificant	This species was moderately active in the Project area, and usually flies lower; thus its risk of collision is low, but still some fatalities are possible.
Bat	*Myotis emarginatus*	Geoffroy's Bat	Displacement during construction	Low	Small	Insignificant	Displacement (habitat loss) is a possible impact as this species was found during roost search. Even though it was found in a cave outside WPP footprint, impacts on foraging activities could happen but are considered to be minor.
Bat	*Rhinolophus ferrumequinum*	Greater Horseshoe Bat	Collision with wind turbines	Low	Small	Insignificant	This species generally flies lower, but some collision impacts are still possible.
Bat	*Rhinolophus ferrumequinum*	Greater Horseshoe Bat	Displacement during construction	Low	Small	Insignificant	Displacement (habitat loss) is a possible impact as this species was found during roost search. Even though it was found in a cave outside WPP footprint, impacts on foraging activities could happen but are considered to be insignificant.
Bat	*Myotis blythii*	Lesser Mouse-eared Bat	Collision with wind turbines	Low	Small	Insignificant	This species was highly active in the WPP area according to baseline surveys, but it is considered to have low susceptibility to collision due to its usually lower flight

Bat	*Myotis blythii*	Lesser Mouse-eared Bat	Displacement during construction	Low	Small	Insignificant	Displacement (habitat loss) is a possible impact as this species was found during roost search. Even though it was found in a cave outside WPP footprint, impacts on foraging activities could happen but are considered to be insignificant.
Bat	*Eptesicus ognevi*	Ognev's serotine	Collision with wind turbines	Medium	Medium	Moderate	This species is also characterised by open-air flight behaviour and overlap with rotor area. This species was moderately active in the WPP area according to baseline surveys and compared to other detected species. Habitat suitability has also been assessed as high for this species.
Bat	*Vespertilio murinus*	Parti-coloured bat	Collision with wind turbines	Low	Medium	Minor	This species is a long-range migratory and capable of flying at heights that overlap with rotor blades, which was also detected during baseline surveys. Compared to other detected species, this species was highly active in the WPP area, reflecting the habitat suitability for the species.
Bat	*Hypsugo savii*	Savi's pipistrelle	Collision with wind turbines	Low	Medium	Minor	This species was also recorded at the site, and could be impacted due to its flight in the rotor area. However, it was not one of the most abundant species recorded during baseline surveys
Bat	*Eptesicus serotinus*	Serotine bat	Collision with wind turbines	Medium	Medium	Moderate	This species is a moderately frequent casualty because of open-air flight behaviour and overlap with rotor area. This species was highly active in the WPP area according to baseline surveys and compared to other detected species. Habitat suitability has also been assessed as high for this species.

Bat	*Plecotus strelkovi*	Strelkov's long-eared bat	Collision with wind turbines	Low	Small	Insignificant	This species' activity during baseline surveys was low
Bat	*Otonycteris leucophaea*	Turkestani long-eared bat	Collision with wind turbines	Medium	Small	Minor	This species' activity during baseline surveys was low
Non-flying mammal	*Ovis ammon nigrimontana*	Karatau Argali	Vehicle fatalities during construction	High	Small	Minor	Some fatalities are possible because the species uses the WPP area, but this impact is considered to be minor
Non-flying mammal	*Ovis ammon nigrimontana*	Karatau Argali	Displacement during construction	High	Medium	Moderate	The survey yielded a total of 66 individual observations of Argali within the Project area. The majority of these observations occurred within the WPP area (only two along the Kentau OHTL in 2025). As observations have occurred in 7 different months of the year, from February through October, Argali may be present in the Project area year-round, and that reproduction may occur within the WPP area, thus the displacement impact during construction could pose a threat to this species, but considering that it is a restricted range species, this impact is expected to be moderate

Non-flying mammal	*Ovis ammon nigrimontana*	Karatau Argali	Habitat loss and degradation	High	Small	Minor	Once the Project is operating, the low level of human activity on the WPP might enable this species to make normal use of these areas. Project's northwestern OHTL segment (OHTL 2) passes across the Ecological Corridor so there is a possibility to impact the migratory movement of this species, but as it will be located along an existing roadway which also has pre-existing aerial powerlines along it, hence the additive displacement of the Project's OHTL segment in this area is likely to be marginal
Reptile	*Testudo horsfieldii*	Central Asian Tortoise	Vehicle fatalities during construction	Medium	Small	Minor	Some fatalities are possible, but not significant for species population due to its limited distribution in the Project area
Reptile	*Testudo horsfieldii*	Central Asian Tortoise	Displacement during construction	Medium	Small	Minor	As a terrestrial species that digs burrows in which it roosts, it could be impacted during construction. The Project's potential to impact this species is limited by its apparent absence from the WPP area, and limited distribution along the Project's OHTL routes
Aquatic species	*Triplophysa coniptera*	Coniptera Stone Loach	Habitat loss	High	Small	Minor	This species could occur in the Project area. The southern end of the southeastern OHTL segment does overlap the species' range, and crosses several small tributaries where this fish could occur. The Project has some potential to impact this species through sediment inputs to streams which could reduce habitat quality

Plants	*Iris orchioides*	Orchid Iris	Habitat loss	Medium	Small	Minor	Records of this species were at locations at least 3 km from Project infrastructure areas. The Project is considered to have minimal potential to impact this species
Plants	*Tulipa orthopoda*	Orthopoda Tulip	Habitat loss	High	Small	Minor	Because of this species' extremely limited geographic range, habitat loss within the Project area of influence could have significant implications for the global status of the species, but considering that the species was not recorded during baseline surveys the impacts are not considered to pose a threat to this species
Plants	*Spiraeanthus schrenkianus*	Schrenk's Spiraeanthus	Habitat loss	High	Small	Minor	This species is present across the Syrdarya Karatau mountain range and the Betpak-Tala desert. It was observed during baseline surveys, but considering the number of recorded localities, habitat loss is not considered to significantly impact this species within its known range.
Habitat		Cereal steppe	Habitat loss and degradation	Medium	Small	Minor	Dominant habitat across the Project area, characterised by plant communities with a high proportion of endemic and sub-endemic species. The project impacts include direct habitat loss, as well as degradation (soil stripping, compaction).

Habitat		Shrub land on Piedmont Slopes	Habitat loss and degradation	High	Small	Minor	This habitat type is associated with calcareous/stony substrates and is part of the landscape where nationally red-listed/endemic plants were recorded within the Project buffer (dry valleys/ridges/steppe grasslands context). Habitat loss is a recognised impact but considered to be minor within the Project footprint.
Habitat		Valleys of rivers, streams, ponds and springs (riparian valleys, ravines, gorges)	Habitat loss and degradation	High	Medium	Moderate	This important biodiversity “microrefugia”is highly sensitive to disturbance (bank damage, sedimentation, hydrological alteration).

10.7Mitigation, Management & Residual Impacts

Mitigation measures have been developed in accordance with the impact assessment framework applied in this ESIA. As described in the assessment methodology, impact significance is determined as a function of receptor sensitivity and impact magnitude. The scope and intensity of mitigation are therefore proportionate to the predicted level of impact significance.

Mitigation measures are prescribed for receptors for which the assessment identified **moderate** or **higher** impact significance prior to mitigation. These measures are designed to reduce impact magnitude, address key risk pathways, and ensure that potential effects remain within acceptable limits.

For receptors assessed as minor or insignificant, no additional species-specific mitigation is proposed beyond standard good practice construction and operational controls, unless site-specific conditions require refinement during implementation.

It should be noted, however, that several mitigation measures developed for higher-risk receptors, such as habitat avoidance, construction timing restrictions, collision risk reduction measures and targeted monitoring, are expected to generate additional ecological benefits beyond the focal species. Consequently, these measures may contribute to reducing risks for other species and ecological receptors within the Project area, even where such impacts were initially assessed as of lower significance.

Mitigation is structured by impact pathway and project phase, and follows the mitigation hierarchy of avoidance, minimisation and restoration. This approach ensures consistency between the assessment conclusions and the proposed management responses, and provides a clear and proportionate link between predicted impacts and prescribed measures.

Adaptive Management Framework

Masdar has committed to implementing a precautionary and adaptive approach to Biodiversty management during the pre-construciton and operational phase of the Project. This approach will include continued monitoring and the implementation of additional mitigation measures if monitoring results indicate elevated risk.

Specifically:

- Post-Construction Fatality Monitoring (PCFM) will be implemented to quantify bird and bat mortality at operational turbines.
- Operational bat activity monitoring may be undertaken, including monitoring at rotor-swept height where feasible.
- Monitoring results will be reviewed periodically to evaluate whether operational mitigation measures remain adequate.

Fatality thresholds and adaptive mitigation

At the time of ESIA disclosure, species-specific fatality thresholds for bird and bat species of Moderate impact significance have not yet been defined. Establishing such thresholds requires further data collection, integration with operational monitoring data, and consideration of species ecology and regional population context.

Therefore:

- Quantitative fatality thresholds and associated adaptive management triggers will be developed following ESIA disclosure, prior to or during the early operational phase of the Project.
- These thresholds will be used to determine whether additional mitigation measures should be implemented.

This adaptive management framework will be developed as part of the BMP and BAP and will define at least:

- Monitoring frequency and methods
- Threshold values triggering management review
- Roles and responsibilities
- Reporting requirements to Lenders
- Review intervals and corrective action procedures

Adaptive management measures will be implemented where monitoring indicates elevated risk relative to baseline expectations.

Table 24 Mitigation measures (potential mitigation for bats is still under consideration, as inconsistencies in the assessment were identified)

Mitigation Measure ID	Impact Pathway	Receptor Group	Mitigation Measure	Project Phase	Objective	Responsible Party	Monitoring Indicator	Adaptive Trigger
M1	Habitat loss and disturbance	All habitats	Micro-siting to avoid sensitive features including riparian habitats, springs, ponds, ravines and other high-value ecological features	Construction	Avoid high sensitivity habitat loss	Project Company / EPC	Footprint compliance audits	Non-compliance identified
M2	Habitat disturbance	Birds	Pre-construction nest surveys and spatial and temporal exclusion buffers; construction timing restrictions to avoid breeding season where active nests or breeding territories are present	Construction	Avoid breeding disturbance	Qualified ecologist / Contractor	Number of active nests within footprint	Active nest within works area
M3	Temporary land take	All habitats	Progressive reinstatement and rehabilitation including habitat restoration where feasible	Construction	Restore disturbed land	EPC Contractor	Area reinstated vs disturbed	Delayed or failed restoration
M4	Turbine collision	Bats	Pre-construction acoustic monitoring at height and on the ground to enable threshold development	Pre-construction / Operation	Understand risks	Project Company	Pre-construction survey report	Fatality threshold defined
M5	Turbine collision	Birds	Observer or Automated Shutdown on Demand (ASD) for priority species	Operation	Detect and reduce collision risk	Operator	Observed fatalities per monitoring period	Exceedance of species-specific threshold

			including large soaring birds and bustards					
M6	OHTL collision	Large birds	Installation of bird flight diverters and collision monitoring combined with adaptive management thresholds	Operation	Increase line visibility	Operator / EPC	Diverter installation verification	Collision evidence on marked spans
M7	OHTL collision	Large birds	Staggered pole alignment where parallel to existing transmission lines to enhance corridor visibility	Construction / Operation	Increase detectability and reduce collision risk	Project Company / EPC	Engineering layout verification and as-built survey	Post-construction monitoring indicates elevated collision risk
M8	Vehicle–fauna collisions	Terrestrial fauna	Speed limits, driver training on biodiversity sensitivity, use of designated access routes, restrictions on off-road driving, and temporary exclusion fencing where required	Construction	Minimise vehicle-related fauna mortality	EPC Contractor / Site Manager	Speed compliance checks; wildlife incident log	More than 3 incidents recorded within a monitoring period
M9	Habitat loss and disturbance	Great Bustard	Landscape-scale monitoring programme using BACI approach to track habitat use, displacement and breeding activity. Monitoring outcomes inform adaptive management and conservation measures addressing key pressures such as poaching and	Pre-construction / Construction / Operation	Monitor and reduce pressures on the species	Project Company	Biodiversity Action Plan for Great Bustard	Non-compliance identified

			habitat degradation.					
M10	Scavenger attraction / collision risk	Raptors and scavengers	Carcass management protocol including rapid removal of livestock and wildlife carcasses within the Project area	Construction / Operation	Reduce scavenger attraction and collision risk	Operator / EPC	Carcass removal records	Repeated carcass presence recorded
M11	Residual biodiversity impacts	Priority species	Implementation of a biodiversity offset programme addressing residual impacts on Critical Habitat trigger species	Operation	Achieve no net loss / net gain	Project Company	Offset implementation progress	Offset performance below target
M12	All operational impacts	All key receptors	BMEP and BAP implementation and annual review	Operation	Enable adaptive management	Project Company	Annual monitoring report	Threshold exceedance requiring mitigation refinement
M13	Habitat loss	Priority species	Pre-construction biodiversity surveys will be undertaken within the final Project footprint to enable detailed quantification and qualification of residual impacts.	Pre-construction / Operation	Assess residual impacts	Project Company	Pre-construction survey report	Impact assessment of the targeted receptors updated with mitigation measures refined, where necessary

Table 25 Residual impact assessment

Taxonomic Group	Receptor name	English name	Impact Pathway	Impact significance	Mitigation IDs	Residual Impact	Rational
Bird	*Ciconia nigra*	Black Stork	Collision with OHTL	Moderate	M6, M7	Minor	Installation of bird flight diverters is expected to reduce collision risk by approximately 50%, based on empirical evidence from comparable transmission line studies. Diverters increase conductor visibility and improve obstacle detection, thereby reducing collision probability. In sections with staggered pole alignment, enhanced corridor visibility further supports early avoidance behaviour. Combined, these measures are expected to substantially lower collision risk and reduce residual impact significance.
Bird	*Hieraaetus pennatus*	Booted Eagle	Collision with wind turbines	Moderate	M5, M10	Minor	Observer-based and automated shutdown-on-demand (SoD) systems are considered good international industry practice for mitigating collision risk of large soaring birds at operational wind farms. Experience from operational projects indicates that, when properly designed, adequately resourced and consistently implemented, such systems can substantially reduce collision risk, in some cases by up to approximately 80% under high-exposure conditions. When effectively applied and paird with habitat managment, significant reduction in residual collision risk are expected.

Bird	*Aegypius monachus*	Cinereous Vulture	Collision with wind turbines	Moderate	M5, M10	Minor	Observer-based and automated shutdown-on-demand (SoD) systems are considered good international industry practice for mitigating collision risk of large soaring birds at operational wind farms. Experience from operational projects indicates that, when properly designed, adequately resourced and consistently implemented, such systems can substantially reduce collision risk, in some cases by up to approximately 80% under high-exposure conditions. When effectively applied and paird with habitat managment, significant reduction in residual collision risk are expected.
Bird	*Neophron percnopterus*	Egyptian Vulture	Displacement during powerline construction	Moderate	M2	Minor	By avoiding construction activities during the confirmed breeding season in areas where active breeding is recorded, the risk of disturbance will be minimised.
Bird	*Gyps fulvus*	Eurasian Griffon	Collision with wind turbines	Moderate	M5, M10	Minor	Observer-based and automated shutdown-on-demand (SoD) systems are considered good international industry practice for mitigating collision risk of large soaring birds at operational wind farms. Experience from operational projects indicates that, when properly designed, adequately resourced and consistently implemented, such systems can substantially reduce collision risk, in some cases by up to approximately 80% under high-exposure conditions. When effectively applied and paird with habitat managment, significant

							reduction in residual collision risk are expected.
Bird	*Aquila chrysaetos*	Golden Eagle	Collision with wind turbines	Moderate	M5, M10	Minor	Observer-based and automated shutdown-on-demand (SoD) systems are considered good international industry practice for mitigating collision risk of large soaring birds at operational wind farms. Experience from operational projects indicates that, when properly designed, adequately resourced and consistently implemented, such systems can substantially reduce collision risk, in some cases by up to approximately 80% under high-exposure conditions. When effectively applied and paird with habitat managment, significant reduction in residual collision risk are expected.
Bird	*Otis tarda*	Great Bustard	Displacement during construction	Moderate	M2, M3, M11	Minor	By avoiding construction activities during the confirmed breeding season in areas where active breeding is recorded, the risk of disturbance will be minimised.
Bird	*Otis tarda*	Great Bustard	Collision with wind turbines	Moderate	M5, M11	Moderate	Shutdown-on-demand (SoD) systems are recognised as effective mitigation for diurnal soaring birds; however, current night-time detection capability remains limited. Consequently, their effectiveness for nocturnal species is

							constrained, and complementary measures may be necessary where night-time collision risk is identified. Potential options will be documented in the BMP
Bird	*Otis tarda*	Great Bustard	Collision with OHTL	Moderate	M6, M7, M11	Minor	Installation of bird flight diverters is expected to reduce collision risk by approximately 50%, based on empirical evidence from comparable transmission line studies. Diverters increase conductor visibility and improve obstacle detection, thereby reducing collision probability. In sections with staggered pole alignment, enhanced corridor visibility further supports early avoidance behaviour. Combined, these measures are expected to substantially lower collision risk and reduce residual impact significance.
Bird	*Otis tarda*	Great Bustard	Habitat loss and degradation	Moderate	M1, M3, M9, M11	Moderate	Implement BACI-based monitoring to assess habitat use, territory persistence and Project-related effects within and around the wind farm. As a CH-trigger species, a BAP with additional conservation actions addressing poaching and habitat management are required to strengthen regional population viability.
Bird	*Tetrax tetrax*	Little Bustard	Displacement during construction	Moderate	M2, M3	Minor	By avoiding construction activities during the confirmed breeding season in areas where active breeding is recorded, the risk of disturbance will be minimised.

Bird	*Aquila nipalensis*	Steppe Eagle	Collision with wind turbines	Major	M5, M10	Minor	Observer-based and automated shutdown-on-demand (SoD) systems are considered good international industry practice for mitigating collision risk of large soaring birds at operational wind farms. Experience from operational projects indicates that, when properly designed, adequately resourced and consistently implemented, such systems can substantially reduce collision risk, in some cases by up to approximately 80% under high-exposure conditions. When effectively applied and paird with habitat managment, significant reduction in residual collision risk are expected.
Bird	*Aquila nipalensis*	Steppe Eagle	Collision with OHTL	Moderate	M6, M7	Minor	Installation of bird flight diverters is expected to reduce collision risk by approximately 50%, based on empirical evidence from comparable transmission line studies. Diverters increase conductor visibility and improve obstacle detection, thereby reducing collision probability. In sections with staggered pole alignment, enhanced corridor visibility further supports early avoidance behaviour. Combined, these measures are expected to substantially lower collision risk and reduce residual impact significance.

Bat	*Nyctalus noctula*	Common noctule	Collision with wind turbines	Moderate	M4	Moderate	An enhanced bat monitoring programme will be implemented to address data gaps and establish site-specific fatality thresholds to support adaptive management under the BMP. While impacts are currently assessed as precautionary and unlikely to exceed moderate significance, monitoring results will be used to confirm impact levels; if defined thresholds are exceeded, additional mitigation measures, including partial or full turbine curtailment, will be triggered. Potential specific mitigation measures will be documented in the BMP
Bat	*Tadarida teniotis*	European free-tailed bat	Collision with wind turbines	Moderate	M4	Moderate	An enhanced bat monitoring programme will be implemented to address data gaps and establish site-specific fatality thresholds to support adaptive management under the BMP. While impacts are currently assessed as precautionary and unlikely to exceed moderate significance, monitoring results will be used to confirm impact levels; if defined thresholds are exceeded, additional mitigation measures, including partial or full turbine curtailment, will be triggered. Potential specific mitigation measures will be documented in the BMP
Bat	*Eptesicus ognevi*	Ognev's serotine	Collision with wind turbines	Moderate	M4	Moderate	An enhanced bat monitoring programme will be implemented to address data gaps and establish site-specific fatality thresholds to support adaptive management under the BMP. While impacts are currently assessed as precautionary and unlikely to exceed moderate significance,

							monitoring results will be used to confirm impact levels; if defined thresholds are exceeded, additional mitigation measures, including partial or full turbine curtailment, will be triggered. Potential specific mitigation measures will be documented in the BMP
Bat	*Eptesicus serotinus*	Serotine bat	Collision with wind turbines	Moderate	M4	Moderate	An enhanced bat monitoring programme will be implemented to address data gaps and establish site-specific fatality thresholds to support adaptive management under the BMP. While impacts are currently assessed as precautionary and unlikely to exceed moderate significance, monitoring results will be used to confirm impact levels; if defined thresholds are exceeded, additional mitigation measures, including partial or full turbine curtailment, will be triggered. Potential specific mitigation measures will be documented in the BMP
Non-flying mammal	*Ovis ammon nigrimontana*	Karatau Argali	Displacement during construction	Moderate	M2, M3, M11	Minor	By avoiding construction activities during the confirmed breeding season in areas where active breeding is recorded, the risk of disturbance will be minimised.
Habitat		Valleys of rivers, streams, ponds and springs (riparian valleys, ravines, gorges)	Habitat loss and degradation	Moderate	M1, M3, M13	Minor	Avoidance of riparian valleys, streams, springs, ponds, ravines and gorges during layout design, combined with road engineering solutions that minimise habitat fragmentation and degradation, is expected to substantially reduce the magnitude of this impact. Protecting these habitat types is disproportionately beneficial for other taxa,

							particularly bats, which rely on riparian corridors and ponds as key foraging and commuting habitats.

11 Noise and Vibration

11.1 Introduction and Overview of Assessment Methodology

This section presents the approach adopted for assessing the potential noise and vibration impacts associated with the construction and operation of the Project. The assessment considers the construction and operation phases and evaluates the extent to which project activities may influence the acoustic environment and sensitive receptors within the Project's Area of Influence (AoI).

Noise and vibration are key considerations for large-scale wind power projects. During construction there will be heavy machinery, earthworks, transport movements and foundation works which can generate elevated noise levels. During operation, wind turbines may generate audible aerodynamic noise and, to a lesser extent, low-frequency characteristics.

Note that operational noise from 220 kV OHTLs is negligible and limited to occasional corona effects under wet conditions and is highly localised to the immediate vicinity of the conductors. At the distances separating the proposed OHTL alignments from identified sensitive receptors (see Section 10.3.2 below) and as required by national legislation of at least 25 m from the outside conductor to the nearest dwelling, any operational noise would be below the threshold of human audibility and well below applicable WBG/WHO guideline values. As identified in the Scoping Report, operational OHTL noise does not represent a credible impact pathway and is therefore scoped out of further detailed assessment.

Vibration impacts are typically negligible for wind power projects due to the substantial separation distances between turbines and receptors, the assessment also considers the potential for short-term construction-related vibration, including localised vibration generated by blasting for WTG foundations and by heavy plant and equipment. These activities are expected to be temporary and controlled, but are nonetheless evaluated to ensure compliance with national safety requirements and international good practice.

The purpose of this assessment is to identify, quantify and evaluate potential noise and vibration impacts, and to ensure that the Project complies with national regulatory requirements, international lender standards (including IFC Performance Standards), and GIIP as outlined in the WBG EHS Guidelines for Wind Energy and for Electric Transmission and Distribution.

An overview of the assessment methodology is provided below:

- **Baseline Definition**: Baseline noise conditions have been characterised through on-site monitoring surveys undertaken within and around the WPP and OHTL corridors. The surveys establish representative daytime and night-time residual noise levels at sensitive receptors, considering the sparse population, open steppe landscape, and the low ambient noise typical of remote rural environments. Baseline monitoring locations and methods follow the approach outlined during ESIA scoping and in line with lender expectations.
- **Definition of the Area of Influence**: The AoI for noise encompasses areas within which construction or operational activities could cause perceptible noise increases at receptors. The WPP AoI is influenced primarily by turbine noise propagation, while the OHTL AoI reflects corridor-specific noise characteristics, particularly during construction.
- **Identification of Sensitive Receptors**: Sensitive receptors include permanent and seasonal dwellings, community facilities, public-access locations, and any other areas where prolonged human presence may be affected by increased noise. Receptor sensitivity and relevance are determined with reference to receptor type, occupancy/use, and distance from Project infrastructure. Receptors were identified using satellite imagery, site reconnaissance, and community engagement records from the Scoping Report.

- **Prediction of Potential Impacts**: Construction-phase impacts are assessed considering typical source power levels for machinery and plant, combined with distance attenuation and site-specific conditions. Operational impacts are assessed using indicative manufacturer sound power levels for the candidate turbine models and the results from noise modelling.
- **Evaluation of Significance**: Predicted noise levels are compared against applicable standards, including Kazakh National Environmental Standards (NES) and the World Bank/IFC/WHO guidelines. The ESIA significance matrix combines receptor sensitivity (as defined in the Assessment Methodology chapter) and the magnitude of predicted change to determine overall impact significance.
- **Mitigation and Management**: Where impact assessment indicates that significant impacts may arise , mitigation measures are identified following the mitigation hierarchy. These may include equipment controls, scheduling restrictions, optimised turbine selection or layout adjustments, management of transport routes, etc,.
- **Assessment of Residual Impacts**: Residual impacts are evaluated after the application of feasible mitigation to determine whether the Project meets regulatory and lender requirements.

11.2Applicable Requirements & Standards

11.2.1 National Regulations

The NES for noise establishes maximum permissible levels of noise for different types of areas, including residential, industrial, natural reserves and recreational areas. These noise levels do not regulate noise sources, but prescribe the maximum available noise load for different area types. The standards also establish requirements for measuring and monitoring noise levels and for implementing noise mitigation measures.

Kazakh national law includes two legislative acts that regulate noise levels:

- Order of the Minister of Agriculture of the Republic of Kazakhstan (dated October 7, 2015 No. 18-02/899) on approval of norms for noise and other acoustic impacts of artificial origin;
- Order of the Minister of Health of the Republic of Kazakhstan (dated February 16, 2022 No. KR DSM-15) on approval of the hygienic standards for physical factors that affect a person, registered with the Ministry of Justice of the Republic of Kazakhstan on February 17, 2022 No. 26831.

The Order No. 18-02/899 regulates artificial noise levels in natural reserves. Table 10-1 represents acceptable values of noise sound for the territories.

Table 10-1: Acceptable values of sound pressure levels in octave frequency bands, equivalent and maximum levels of penetrating noise sound in the territory of state natural reserves.

Time of Day	**Sound Pressure Levels, dB, in Octave Bands with Centre Frequencies, Hz**									**Sound Levels and Equivalent Sound Levels LAeq (in dB(A))**	**Maximum Sound Levels Lmax, dB(A)**
	31,5	**63**	**125**	**250**	**500**	**1000**	**2000**	**4000**	**8000**		
Round the clock	76	59	48	40	34	30	27	25	23	35	50

Order (No. KR DSM-15) also encompasses a broad range of requirements related to environmental safety and comfort for the population and workers. It includes standards not only for noise but also for illumination,

temperature, humidity, vibrations, and other similar parameters for indoor spaces. This order operates within the framework of Maximum Permissible Concentrations (MPC). The NES presents noise pollution standards for various types of development and land use, as well as for workspaces based on types of occupational activities. Table 10-2 below presents the relevant national noise level requirements.

Table 10-2: Acceptable noise levels according to national standards

he	Receptor	One-hour LA_{eq} (dB(A))		LA_{max} (dB(A))	
		Daytime 07.00 - 23.00	Night-time 23.00 - 07.00	Daytime 07.00 - 23.00	Night-time 23.00 - 07.00
NES	Residential premises	40	30	55	45
	Residential areas	55	45	70	60
	Working zone	80			
	Nature reserves	35		55	

11.2.1.1 National norms and standards for transmission lines

Sanitary protection zones are areas separating special purpose zones, such as industrial facilities and OHTLs from nearby residential areas, buildings and structures to minimize any potential impacts on them.

There are two key laws that relate to sanitary protection zones:

- Rules for establishing Protection Zone of Electric Grid Facilities and Special Conditions for the Use of Land Plots Located within the Boundaries of Electric Grid Facilities and special conditions for the use of land plots located within the boundaries of such zones issued by Ministry of Energy (Order № 330 dated September 28, 2017). The Rules are focused on protection of equipment of OHTLs;
- Sanitary and epidemiological requirements for Sanitary Protection Zones of Facilities that are Objects of Influence on Habitat and Human Health stipulated by the Order № 26447 of the Minister of Health (dated January 11,2022) – it is focused on protecting the public from the harmful effects of facilities that may have a harmful impact on human health.

Article 33 of the Kazakh Sanitary Rules "Sanitary and epidemiological requirements for Sanitary Protection Zones", requires that a sanitary protection zone shall be established along the route of the high-voltage line, beyond which the electric field strength does not exceed one (1) kilovolt per meter (kV/m).

For newly designed OHTLs, a sanitary protection zone from the outermost wires of the overhead power line shall be the following distances to the nearest residential, industrial and non-production buildings and structures are as follows:

- 25 m - for overhead power lines with voltage of up to 220 kilovolts (kV);
- 30 m - for overhead power lines with voltage of up to 500 kV;
- 40 m - for overhead power lines with voltage of up to 750 kV;
- 55 m - for overhead power lines with voltage of up to 1,150 kV.

Article 34 of the Sanitary Rules "Sanitary and epidemiological requirements for Sanitary Protection Zones": states that residential and public buildings and structures shall not be located within the boundaries of the

sanitary protection zones for OHTLs.

When overhead and cable lines are routed within rural and urban areas, local executive bodies shall not allow the development within the protection zones. The land plots that are within the sanitary protection zones for OHTLs will not be acquired or expropriated from the existing landowner and the landowner can continue to use the land for agricultural purposes.

Agricultural field works, such as ploughing, harvesting, hay removal, estuary irrigation, in the protection zones of OHTLs can continue to be carried out by the land users with prior written notification to the relevant akimat.

OHTLs cannot be routed over the properties of stadiums, educational and children's institutions, and cannot pass above buildings and structures.

11.2.2 Lender Requirements and International Standards

The Project will apply international good practice for noise assessment, including the World Bank Group (WBG) Environmental, Health and Safety (EHS) General Guidelines (2007), the WBG EHS Guidelines for Wind Energy (2015), the World Health Organization (WHO) Guidelines for Community Noise (1999) and the WHO Environmental Noise Guidelines for the European Region (2018). Together, these documents establish health-based exposure limits and performance expectations for both construction and operational activities.

The WBG EHS Guidelines require that noise levels at sensitive receptors do not exceed the WHO guideline values presented in

, or result in a maximum increase of more than 3 dB(A) above existing baseline levels at the nearest off-site receptor, whichever results in the more stringent limit. The IFC/WBG guidance does not prescribe fixed numerical limits for construction noise but requires the application of good international industry practice (GIIP), scheduling of noisy activities, and appropriate community engagement to avoid excessive disturbance.

Table 10-3: WBG/WHO Noise Level Guidelines

Receptor	**One-hour LA_{eq} (dB(A))**	
	Daytime **07.00-22.00**	**Night-time** **22.00 – 07.00**
Residential; institutional; educational	55	45
Industrial; commercial	70	70

The 45 dB(A) LAeq night-time limit and the +3 dB(A) above-background criterion set out in the WBG EHS Guidelines apply specifically to residential receptors and are intended to protect sleep and residential amenity. These standards are not designed for non-residential or intermittently occupied areas, such as grazing shelters, temporary camps or open land within the WPP area.

The WHO Environmental Noise Guidelines for the European Region (2018) advises reducing long-term exposure to wind turbine noise to below 45 dB Lden to minimise annoyance. As Lden is a 24-hour metric incorporating evening and night penalties, it is not directly comparable to the LAeq values used in the WBG EHS Guidelines. For this Project, the primary operational noise criterion remains the WBG/WHO night-time external limit of 45 dB(A) LAeq, which provides a more appropriate and internationally recognised benchmark for wind farm ESIA assessments.

The WBG/WHO levels are almost identical to Kazakh noise standards, however, for residential areas, WBG international practice designates nighttime starting an hour earlier, making this standard more stringent, and therefore it is most appropriate for the project.

WHO Guidelines for Community Noise also provide relevant international good practice for protecting residential amenity. Table 4.1 of the WHO Guidelines sets an external noise guideline value of 45 dB(A) LAeq for outdoor areas adjacent to bedrooms at night, established to prevent sleep disturbance where windows may be open. Although not a regulatory requirement in Kazakhstan, the Project adopts this WHO value as a design objective for the nearest permanent dwellings, including Ushbas village, in line with the Client's expectations and consistent with international health-based guidance.

The WHO Guidelines for Community Noise (1999) do not provide a specific numerical noise limit for outdoor natural environments, recreational areas or wilderness settings, recognising that such environments vary widely and that no universal threshold is supported by evidence. The only WHO values for outdoor spaces relate to residential outdoor living areas, where daytime guideline levels of 50–55 dB LAeq are recommended to prevent serious or moderate annoyance. These values, however, are intended for urban or suburban residential contexts and are not applicable to remote non-residential receptors such as grazing areas, temporary shelters, or cultural sites within the Project area. For these locations, the assessment instead relies on receptor use, sensitivity, occupancy patterns, local baseline noise conditions and the conservative modelling assumptions described in Section 10.4.2. This approach aligns with WHO principles and international good practice for assessing noise impacts in sparsely populated natural environments.

While the WBG EHS Guidelines specify guideline noise levels of 55 dB(A) during daytime and 45 dB(A) at night for residential receptors, these values are intended primarily for steady-state operational noise and long-term exposure. For construction activities, which are temporary and highly variable, the WBG EHS Guidelines do not prescribe fixed numerical limits. Accordingly, the 55/45 dB(A) values are used in this ESIA as contextual reference levels to inform the assessment of potential nuisance at sensitive receptors, rather than as strict compliance thresholds for construction-phase activities.

WBG EHS Guidelines define a noise receptor as: "*A point of reception or receptor may be defined as any point on the premises occupied by persons where extraneous noise and/or vibration are received. Examples of receptor locations may include: permanent or seasonal residences; hotels/motels; schools and daycares; hospitals and nursing homes; places of worship; and parks and campgrounds*.

In addition to the WBG/WHO absolute limits, the Project also references international wind farm noise practice, specifically the ETSU-R-97 guidance (The Assessment and Rating of Noise from Wind Farms, UK Department of Trade and Industry, 1996). While not a mandatory standard in Kazakhstan, ETSU-R-97 is widely regarded by lenders and practitioners as a robust and internationally accepted framework for assessing wind turbine noise in rural environments.

Under ETSU-R-97, turbine noise limits are derived from measurements of existing background sound levels (LA90), with typical criteria including:

- Daytime: Background noise +5 dB(A), subject to a minimum absolute limit of 35–40 dB LA90,10min
- Night-time: Background noise +5 dB(A), with a fixed lower limit of 43 dB LA90,10min
- High-amenity or exceptionally quiet locations: A more conservative background +3 dB(A) may be applied, typically with a minimum limit of 35 dB LA90,10min

These ETSU-based criteria were developed specifically for fixed, permanent residential receptors and are not intended to apply to non-residential or intermittently occupied receptors such as grazing shelters, temporary camps or areas of open land within the WPP. They are not used as regulatory limits for the Project but serve as an additional reference point, particularly for assessing the perceptibility of wind turbine noise relative to

very quiet rural baseline conditions.

Accordingly, the Project's operational noise assessment will evaluate predicted noise levels against:

- Absolute WBG/WHO guideline values (Table 12); and
- Relative change above background noise levels, with reference to ETSU-R-97 margins (+3 to +5 dB(A)), to ensure a robust, lender-compliant, and internationally aligned assessment.

11.3Baseline Conditions and Receptors

11.3.1 Area of Influence

The Area of Influence (AoI) for noise and vibration encompasses all locations where construction or operational activities associated with the Project may result in audible noise or perceptible vibration at sensitive receptors. The AoI varies depending on the source type, duration, and intensity, and is therefore defined separately for:

- general construction noise,
- construction-related vibration including blasting for WTG foundations, and
- operational noise from wind turbine generators (WTGs).

Operational noise from OHTLs has been scoped out, in accordance with the Scoping Report.

11.3.1.1 AoI for Construction Noise

Construction noise primarily arises from earthworks, foundation excavation, concrete batching, cranes, HGV movements, and other mobile plant. These are temporary but can generate elevated noise levels locally.

Based on international guidance (WBG EHS General Guidelines; UK BS 5228) and typical source sound power levels for wind farm construction, construction noise may be audible within 1–1.5 km of active work areas under favourable propagation conditions. Beyond this distance, noise typically attenuates to below daytime residual levels characteristic of the Project area.

Given the very low baseline noise environment and unobstructed steppe landscape a conservation approach has been adopted with a construction noise AoI of 1.5 km around each active work location assumed for the purposes of this noise assessment.

11.3.1.2 AoI for Blasting-Induced Vibration

Blasting will be used for the installation of some WTG foundations. Blast-induced vibration attenuates rapidly with distance but may be perceptible at greater ranges than standard construction vibration. Assessment requires a conservative AoI to ensure all potential receptors are screened.

International practice indicates that for controlled rock blasting:

- human perception of vibration typically occurs around 0.5–1.0 mm/s, usually at 500–800 m,
- cosmetic building damage thresholds begin above 12–15 mm/s, typically at <200 m,
- environmental annoyance thresholds are reached before any damage thresholds.

Given the open terrain, absence of multi-storey structures, and the controlled nature of the blasting, a vibration AoI of 1 km is adopted for blasting activities.

At this distance, ground vibration is expected to be far below levels associated with structural damage and generally below levels perceptible to humans; however, this AoI ensures that all sensitive receptors potentially affected by perceptible vibration are captured for assessment.

Air overpressure (blast noise) can be heard at longer distances, but peak levels decrease significantly beyond

a few hundred metres; at distances >1 km, levels are generally within ambient fluctuations.

11.3.1.3 AoI for Construction Vibration (Non-Blasting)

Vibration from mobile plant, compaction, or piling is typically restricted to very short ranges. Numerous international studies demonstrate:

- perceptible vibration rarely extends beyond 50–100 m from heavy tracked plant
- risk of cosmetic building damage is generally limited to <20–30 m.

Therefore a 100 m AoI is adopted for general construction vibration. No receptors are located within this distance for the majority of WTG locations, but the buffer is retained for completeness.

11.3.1.4 AoI for Operational WTG Noise

Operational noise from WTGs is a key consideration during the operational phase. Theoretical detectability of large modern WTGs under downwind conditions can extend a few kilometres from a turbine. However, the range at which operational noise may influence receptor amenity is typically less.

Based on international GIIP, including the IFC/WBG EHS Guidelines for Wind Energy and established industry noise-modelling practice, the operational noise AoI has been defined using the distance at which turbine noise reduces to approximately 35 dB(A) LAeq, the commonly applied screening level for potential audibility. For the candidate WTG models, this corresponds to a conservative AoI of up to 4 km from each turbine."

This AoI ensures that all potentially affected receptors, including those identified in the Scoping Report and from satellite imagery, are included in predictive noise modelling and assessment against IFC and national limits.

Table 10-4: Summary of AoI

Source	AoI Distance	Rationale
General construction noise	1.5 km	Audible range under typical conditions
Blasting vibration	1 km	Captures perceptible vibration and air overpressure
Construction vibration (non-blasting)	100 m	Conservative limit based on plant vibration attenuation
Operational WTG noise	4 km	Ensures all potentially affected receptors included

11.3.2 Sensitive Receptors

Sensitive receptors for the assessment of noise and vibration include locations where people live, work, or may otherwise experience nuisance, annoyance, or disturbance as a result of increased noise levels or construction-related vibration. Sensitive receptors have been identified in accordance with the IFC EHS Guidelines definition of a receptor. In accordance with this definition, sensitive receptors include permanent and seasonal dwellings, public-access locations and other premises where people may be present for extended durations. The applicability of noise guideline values is determined with reference to receptor function, sensitivity and typical occupancy, recognising that the most stringent night-time noise limits are intended primarily to protect locations where sleep disturbance may occur.

The identification of receptors draws on multiple data sources, including satellite imagery, observations from site visits and surveys, and stakeholder engagement undertaken to date.

Receptor sensitivity for the purposes of the noise and vibration assessment has been defined in accordance with the criteria set out in Chapter 4 (Assessment Methodology), taking account of receptor type, occupancy/use and duration of exposure.

The Project is located in a sparsely populated part of the Jambyl Region, characterised by extensive open steppe, grazing land, and isolated settlements. The nearest receptors are typically small rural villages, dispersed farmsteads, occasional individual dwellings associated with agricultural activity, as well as seasonal grazing activity and the presence of herders working within the WPP area. The closest permanent settlements in the wider area include Ushbas village and other small clusters of dwellings. Across much of the WPP plateau, settlement density is extremely low, with large areas showing no built infrastructure or resident population, although livestock grazing is common and forms an important land use within the Project area.

Receptors were screened using the following criteria, consistent with international ESIA practice:

- Permanent residential dwellings: villages, hamlets, individual houses, and farmsteads where people reside year-round.
- Seasonal or intermittent temporary shelters/wagons used periodically by herders.
- Community facilities: schools, clinics, mosques or other buildings where people congregate, where present.
- Any other structures where human presence is expected for extended periods, and where exposure to construction noise or operational WTG noise could affect comfort.

All potential receptors within the Noise AoI, defined separately for construction noise, blasting vibration and operational turbine noise, were mapped from high-resolution satellite imagery and cross-checked against field observations and records from local authorities. During the site visits undertaken as part of the ESIA surveys, no permanent residential sensitive receptors were identified within the immediate vicinity of individual WTG locations or within the WPP area.

Outside the plateau, several small rural settlements are present within the broader landscape. The nearest settlements are listed below, along with approximate distances measured from nearest WTG locations:

- Ushbas – approximately 2.1 km west of the nearest WTG;
- ‘Summer Camp’ and its associated buildings - over 4.5 km east
- Turkestan – approximately 8 km north-west;
- Zhanaaryk – approximately 9 km north-east;
- Aktogay – approximately 10 km east;
- Karaoy – approximately 15 km south-east.

A permanent shelter/structure used on a seasonal basis by herders was identified within the WPP area. Aside from this structure and a limited number of dispersed seasonal movable grazing shelters/wagons, most receptors are located at a significant distance from the proposed WTG locations due to the large plateau expanses and the low density of settlement across the WPP area and surroundings.

In addition to residential and seasonal receptors, Kamar Aulie and the Ushbas cemetery have been identified as sensitive receptors for the purposes of the operational noise assessment, in recognition of their cultural, religious and communal significance and their periodic use by members of the local community. While neither location is permanently occupied, Kamar Aulie and the adjacent rest area may be used intermittently for religious and cultural activities and may involve short-term overnight presence, whereas the Ushbas cemetery is used for visitation and commemorative purposes only. Both sites are located beyond the defined construction-phase noise Area of Influence (1.5 km from construction activities) and are therefore not

considered sensitive receptors for construction-phase noise and vibration impacts. Accordingly, these receptors have been assessed proportionately in line with the IFC EHS Guidelines and good international practice, with consideration focused on potential operational noise effects only.

Although not considered as residential dwellings and therefore subject to the same noise standards as permanent residence, fixed and movable seasonal structures within the WPP area have also been included in the assessment, to ensure that potential exposure, nuisance and sleep-disturbance risks are transparently identified and assessed, and that the findings can be used to inform proportionate mitigation measures, stakeholder engagement, and, where relevant, livelihood restoration or compensation mechanisms in accordance with GIIP.

The receptor environment along the OHTL corridors differs from the WPP plateau. Settlements and isolated dwellings occur with slightly higher frequency along linear transport routes. However, noise impacts from OHTL operations have been scoped out, and only construction-phase receptors along the OHTL routes are relevant for this assessment.

Given the typically large separation distances between WTGs and the nearest settlements (often several kilometres), receptor sensitivity is influenced more by the quiet baseline sound environment than by receptor density. Rural dwellings in remote steppe locations are generally considered as medium sensitivity receptors under the Project's impact assessment methodology: receptors that may experience discomfort or disturbance from external physical changes, but do not represent highly vulnerable or legally protected environments.

The final list of sensitive receptors subject to assessment include:

Table 10-5: WPP Sensitive Receptors (4 km AoI)

Receptor	**Distance to nearest WTG**
Residential Dwelling (Permanent)	
Ushbas village	2.1 km
Summer camp	4 km
Cultural heritage asset: Kamar Aulie and Ushbas cemetery	1.9 km
Permanent Seasonal Shelter - within WPP Area	1.0 km
Non-Residential, Intermittent: Movable Grazing Shelters/Wagons	Varies from 400 m to over 1 km.

Table 10-6: OHTL Sensitive Receptors 1.5 km construction AoI)

Receptor	**Distance to OHTL**
Residential Dwelling (Permanent)	
Auliekol	250 m
Akhtogay,	60 m
Zhanaaryk	200 m
Zhanatas	850 m
Oyik	350 m
Shoktas villages	600 m
southern outskirts of Sholakkorgan settlement	550 m
Residential cluster near Ushtobe dam	100 m

Receptor	Distance to OHTL
Summer camp and Sanatorium 'Koktal'	1450 and 700 m
Agricultural farms - nearest	Varies from 10 m to over 1 km (at least 25m to any dwellings as per national requirements)
Permanent Seasonal Shelter (Within OHTL AoI) – nearest	Varies from 150 – 250 m to over 1 km
Non-Residential - Movable Grazing Shelters/Wagons (nearest)	Varies from 50 m to over 1 km

The locations of the above identified sensitive receptors within and around the WPP site, as well as along the OHTL routes are provided in Figure 10-1 and Figure 10-2 below.

No schools, healthcare facilities, or other uniquely high-sensitivity buildings have been identified within any of the AoIs at this stage.

This categorisation ensures that all locations where people live, gather, or may reasonably be affected by changes in the acoustic environment are included in predictive modelling and impact evaluation.

Figure 10-1: Noise AoI receptors for WPP area

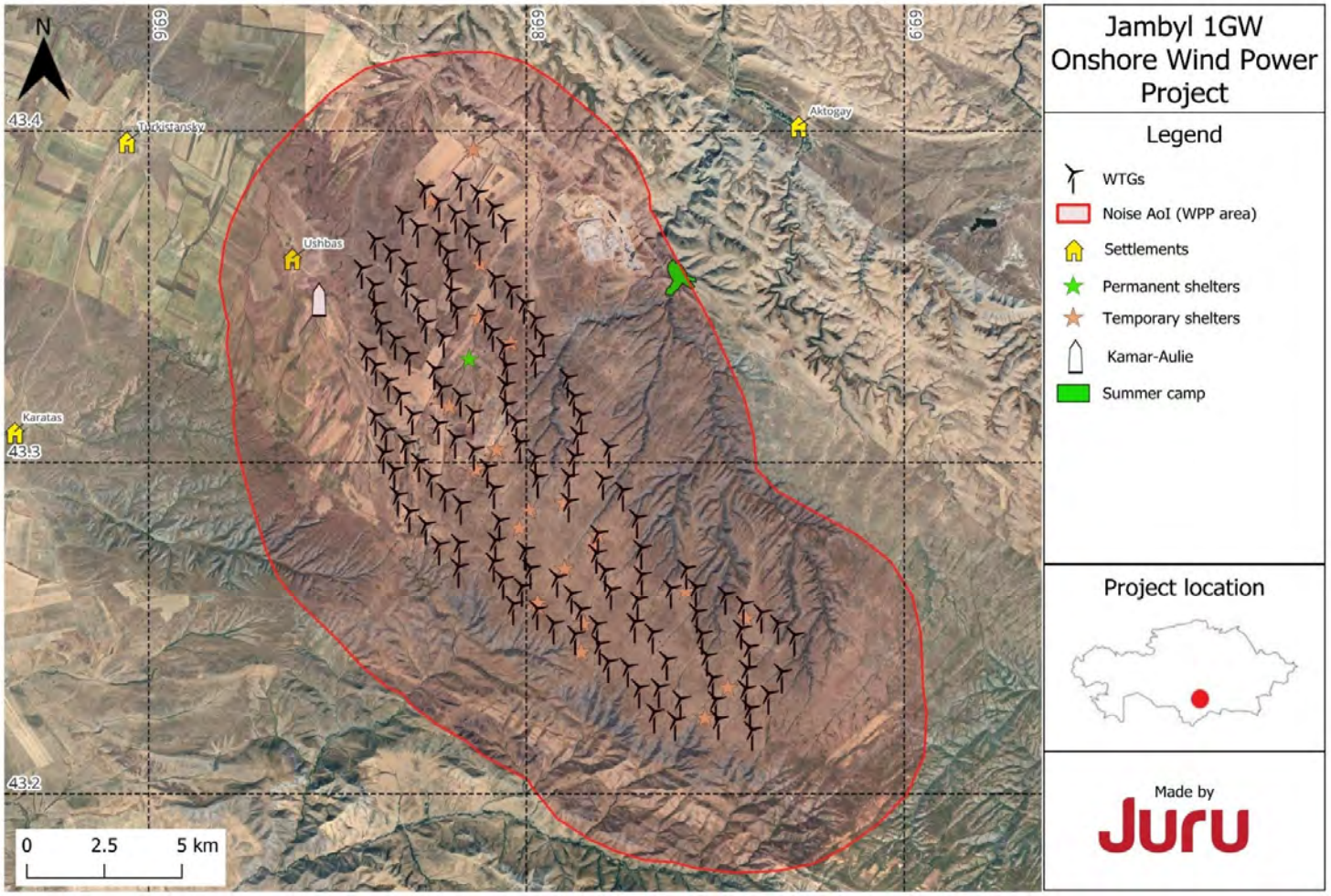


Figure 10-2: Noise AoI receptors for OHTL

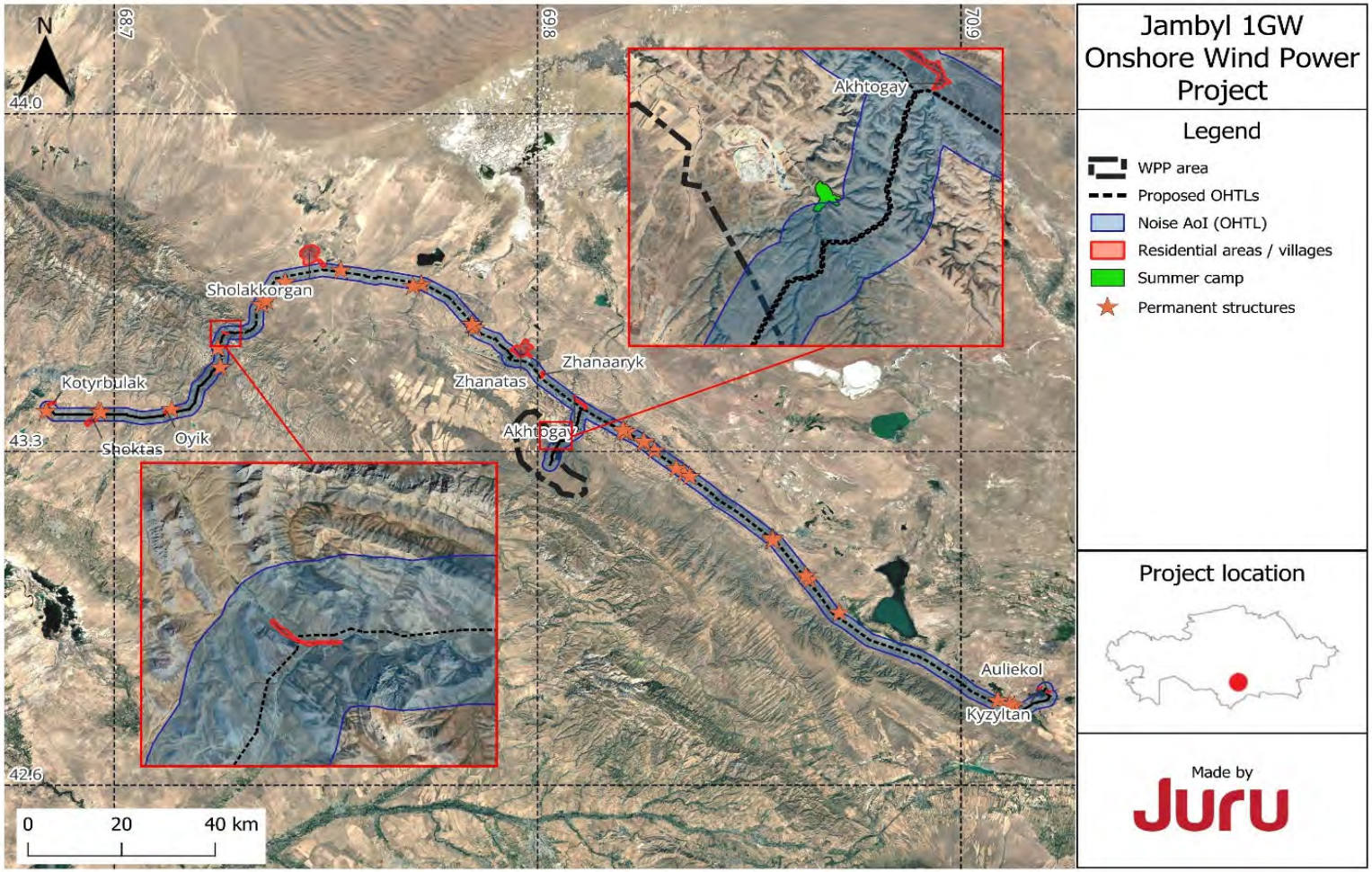


Figure 10-3: Ushbas



Figure 10-4: Ushbas – indication of dwelling



Figure 10-5: Kamar Aulie Shrine #1



Figure 10-6: Kamar Aulie Shrine #2



Figure 10-7: Rest Area nr Ushbas Cemetery #1 - Wide valley shot with stream



Figure 10-8: Rest Area nr Ushbas Cemetery #2 - Resting area under trees



Figure 10-9: Fixed Structure within WPP Area #1



Figure 10-10: Fixed Structure within WPP Area #1



Figure 10-11: Typical mobile herder wagons #1



Figure 10-12: Typical mobile herder wagons #2



Figure 10-13: Summer camp territory



Figure 10-14: Farmer house



Figure 10-15: Sanatorium 'Koktal'



Figure 10-16: Typical farm



11.3.3 Baseline Noise Survey

To support the impact assessment process within the project area, noise measurements were carried out at 12 locations between 22nd to 30th September 2024 and between 6th to 30th September 2025. The study included 5 points within the WPP area, 2 points within the wider 4 km WPP AoI (the nearest receptors), and 5 points at various distances from the WPP area near the closest settlements.

10 points lie within the defined Noise AoI for the WPP and/or OHTL, and 1 point located each to the north and south of the project area along roads in the villages, to establish noise baselines near roads.

Two different noise baseline survey approaches were used:

- 14-day monitoring at 2 locations to establish noise baselines levels for a prolonged period to be used for operational noise assessment, taking into consideration baseline noise levels at different wind speeds; one located at the closest residential receptor in Ushbas and the other close to the only fixed structure within the WPP area.
- 24-hour noise monitoring at 11 locations to establish baselines related to overall noise load within the WPP area.

The noise measurements were conducted using an unattended Class 1 (Type 1) noise meter compliant with IEC 61672-1 with WS-15 wind shield. The device was installed near the selected noise-sensitive receptors (NSRs) at a height of 1.7 m. Measurements were recorded in 10-minute intervals. A-weighted continuous values were recorded for the equivalent noise level (LAeq), along with LAmax, LAmin, LA10, and LA90. Noise measurements were not conducted during rains.

To evaluate the correlation between noise loads and wind speeds, both on-site met mast (with a top measurement height of 120 m, for 14-day monitoring) and ground anemometer (1.7 m above ground level; for 24-hour monitoring) wind speeds were recorded during the measurement campaign. A 14-day monitoring campaign was conducted to support modelling of WTG noise impacts at different wind speeds, while the 24-hour monitoring provided an assessment of overall diurnal noise level patterns for the evaluation of general baseline conditions and for consideration of data relevant to non-continuous project-related noise, such as during the construction phase. Thus, the 14-day monitoring was conducted in proximity to fixed structures within the WPP AoI to represent the operational phase, while the 24-hour monitoring was undertaken near temporary structures within the operational AoI of the WPP and near

permanent structures located outside the WPP AoI that had the potential to be affected by increased traffic or construction activities associated with the WPP area or the OHTLs. More detailed information is available within the Ambient Noise monitoring report (ESIA Volume III: Technical appendices).

The monitoring location and equipment setup were selected in accordance with ETSU-R-97 and relevant good practice, as well as ISO 1996-2:2017. The monitoring location was chosen to represent the worst-case scenario: where possible, positions were selected on the exposed side of noise barriers, at a distance of at least 1.5 m from such obstacles. The microphone height was selected with an allowance for open-field conditions, as referenced in ISO 1996-2:2017.

A description of the monitoring points is provided in Table 10-7 below and the locations are shown in Figure 10-17.

Table 10-7: Noise monitoring locations data

Location No.	Description	Coordinates		Photo
		Northing	Easting	
NA 1	24 Hour Farm at KN-1 highway	43.3941	69.99153	
NA 2	24 Hour Southern part of Akhtogay village	43.43825	69.89349	

Location No.	Description	Coordinates		Photo
		Northing	Easting	
NA 3/ NL-2	24 Hour & 14 day Permanent structure within WPP area	43.37662	69.76365	
NA 4	24 Hour Area used for shelter overnight stay (WPP area)	43.29888	69.80789	
NA-5	24 Hour Farm in the vicinity of Karaoy village	43.2929	70.03073	

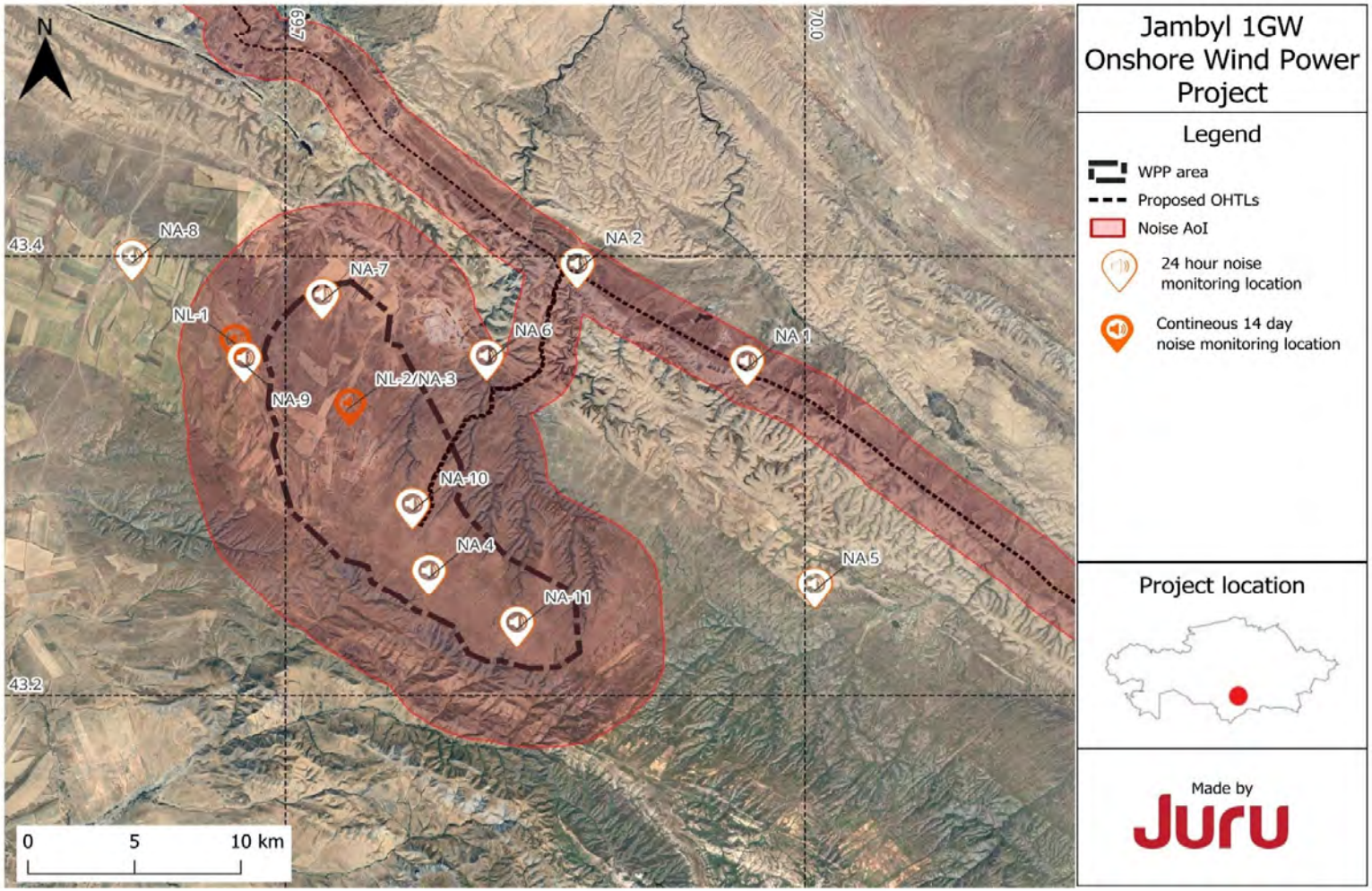
Location No.	Description	Coordinates		Photo
		Northing	Easting	
NA-6	24 Hour Southwestern part of Summer camp	43.39657	69.84116	
NA-7	24 Hour Area used for shelter overnight stay (WPP area)	43.42425	69.74628	

Location No.	Description	Coordinates		Photo
		Northing	Easting	
NA-8	24 Hour Southern part of Turkestanskiy village	43.44176	69.63642	
NA-9	24 Hour Kamar-Aulie Shrine	43.3956	69.7012	

Location No.	Description	Coordinates		Photo
		Northing	Easting	
NA-10	24 Hour Area used for shelter overnight stay (WPP area)	43.32922	69.79831	
NA-11	24 Hour Area used for shelter overnight stay (WPP area)	43.27506	69.85866	

Location No.	Description	Coordinates		Photo
		Northing	Easting	
NL-1	14 day Southern part of Ushbas village	43.40535	69.69563	

Figure 10-17: Ambient noise monitoring locations



Based on the results of the 24-hour monitoring, 9 out of 11 locations were below the WHO and national legislative requirements for average equivalent noise levels (LAeq) during both nighttime and daytime periods for residential areas, namely 45 and 55 dB(A) respectively.

Elevated levels of LAeq above these guidance values were recorded at point NA-4 during the night and at NA-10 during the day. For both points, the main cause was prolonged periods of wind speeds above 8 m/s (at 1.7 m height), which resulted in increased noise from the rustling of dry steppe vegetation.

Overall, the study showed that the project area is relatively homogeneous in terms of noise levels, with the most significant contributor being dry vegetation movement in the wind, which produces a characteristic rustling sound. As wind speed increases, this rustling becomes the dominant noise source - average LAeq levels rose substantially with higher wind speeds. As a result, average noise levels (across all monitored points) exceeded the nighttime regulatory guidance of 45 dB(A) when wind speeds were above 9 m/s, reaching more than 49 dB(A). For reference, at 8 m/s, the average LAeq was below 42 dB(A); at 6 m/s, below 33 dB(A), and at 4 m/s below 26 dB(A).

Anthropogenic noise sources were sporadic and included background household noise near settlements, noise from livestock activities, and noise from generators and vehicle engines.

The results of the 24-h noise survey are presented in Table 10-8 below.

Table 10-8: 24-h ambient noise monitoring results

Location No.	Monitoring period (D – 7 AM – 10 PM; N – 10PM - & AM)	LAeq average, dB(A)	LAmax average, dB(A)	LA10 average, dB(A)	LA90 average, dB(A)	Wind speed average, m/s (1.7 m height)
		Daytime standard – 55 dB(A) Nighttime standard – 45 dB(A) (WHO/national)				
NA-1	D	37.4	51.8	40.3	30.6	4.6
	N	27.8	42.6	29.7	22.4	2.8
NA 2	D	39.5	57.4	41.0	33.6	0.7
	N	37.0	52.8	39.2	34.0	0.8
NA 3	D	23.1	41.9	24.8	16.9	2.7
	N	21.2	34.6	23.4	17.2	2.4
NA 4	D	51.9	62.9	55.3	44.9	8.3
	N	51.3	60.8	54.6	44.4	8.2
NA-5	D	27.9	43.1	29.5	20.1	3.1
	N	22.0	37.7	23.4	18.5	1.2
NA-6	D	32.1	45.0	34.9	26.5	1.7
	N	25.4	39.6	28.0	17.6	0.5
NA-7	D	39.4	52.5	42.1	31.4	5.7
	N	28.9	41.5	31.1	23.0	3.6
NA-8	D	47.2	61.7	50.8	38.3	3.1
	N	34.2	52.0	37.9	22.4	3.0
NA-9	D	43.1	53.5	45.3	39.7	3.1
	N	40.1	45.1	40.7	39.1	1.4

Location No.	Monitoring period (D – 7 AM – 10 PM; N – 10PM - & AM)	LAeq average, dB(A)	LAmax average, dB(A)	LA10 average, dB(A)	LA90 average, dB(A)	Wind speed average, m/s (1.7 m height)
		Daytime standard – 55 dB(A) Nighttime standard – 45 dB(A) (WHO/national)				
NA-10	D	57.6	70.3	61.6	44.7	8.7
	N	42.0	56.3	45.8	33.0	4.7
NA-11	D	51.3	69.6	54.0	38.8	8.8
	N	26.7	38.7	28.4	22.0	1.9

The 24-hr noise monitoring survey showed that despite the uniformity of noise sources, the noise load at different locations varied significantly and depended more on wind speed during the monitoring period than on surrounding noise sources. However, it is important to note that location did play a role: the noisiest points were those situated within exposed areas in the project area on flat, open terrain (NA-4, NA-10, NA-11), while wind speeds were lower in depressions (NA-1 – NA-3, NA-5 – NA-7).

Average LA90 values ranged from 17.7 to 57.4 dB(A), depending on wind speed. Higher noise levels were identified in Ushbas, with minimum average LAeq values of around 29–30 dB(A) and maximum values of 56–57 dB(A). At the location near the permanent structure within the WPP area, average noise levels ranged between 17 and 43 dB(A). The difference between the points is associated with noise from vegetation as near Ushbas village has more diverse and widespread vegetation cover, including large trees (which produces rustling in the wind).

The results of the 14-day noise monitoring are presented in Table 10-9 below. The average wind speed data are provided at the hub height (145 m) for the WTGs. It is important to note that wind speeds at this height are significantly higher than those at the ground surface (due to the absence of surface friction).

Table 10-9: 14-day ambient noise monitoring results

Hub height wind speed, m/s	NL-1 LA90, dB(A)	NL-2 LA90, dB(A)
0 – 1	30.10	20.20
1 – 2	26.80	17.70
2 – 3	24.90	18.10
3 – 4	24.50	18.10
4 – 5	27.10	18.85
5 – 6	28.25	19.20
6 – 7	28.50	20.15
7 – 8	33.26	20.10
8 – 9	34.19	25.45

9 – 10	36.35	29.45
10 – 11	36.68	29.55
11 – 12	39.80	31.10
12 – 13	40.55	31.00
13 – 14	41.50	35.90
14 – 15	40.80	39.00
15 – 16	42.90	42.12
16 – 17	44.40	-
17 – 18	48.10	-
18 – 19	48.55	-
19 – 20	49.17	-
20 – 21	48.60	-
21 – 22	55.65	-
22 – 23	57.37	-

11.4Potential Impacts

11.4.1 Construction Phase

Construction of the WPP, supporting infrastructure and the two 220 kV OHTLs will generate temporary noise and, to a lesser extent, vibration within the Project's AoI, leading to increase overall noise levels. Construction noise will be intermittent, localised and confined to daytime hours. Given the open steppe landscape and the large separation distances between work areas and permanent residential receptors, impacts are expected to be low in magnitude. The receptors most likely to be exposed are herders, grazers and land users within the WPP area.

The assessment considers the baseline noise conditions described in Section 1.3, which show that the Project area is characterised by very quiet rural sound levels, with limited anthropogenic noise. No sensitive receptors are located close to any WTG foundation locations, access track upgrades or internal construction zones.

Construction-phase noise and vibration impacts have been grouped into the following activities according to their main noise-generation characteristics; these same categories also form the basis for the construction-phase mitigation and management measures:

- Earthworks, site preparation and access-road upgrades – including topsoil stripping, grading, cut-and-fill activities and track widening.

- WTG foundation excavation and civil works – including excavation, concrete batching, pouring, and reinforcement placement.
- Controlled blasting for WTG foundations – applied only at locations where bedrock must be fragmented to reach design depth.
- Tower erection, crane operations and turbine assembly – including lifting of towers, nacelles and blades, and associated mechanical operations.
- Construction traffic and transport of components – including HGV deliveries along regional roads, site access routes and internal WPP tracks.
- OHTL construction activities – including tower foundation works, tower erection, conductor stringing and tensioning.

Each activity type is assessed separately for its potential to generate noise and vibration at sensitive receptors, and the significance of impacts is evaluated in accordance with the ESIA methodology.

11.4.1.1 Earthworks, Site Preparation and Access Road Upgrades

This phase includes the preparatory works required to establish construction access and prepare turbine locations for foundation excavation. Activities will typically involve:

- Topsoil stripping and stockpiling
- Minor cut-and-fill operations
- Levelling and grading of turbine hardstands
- Widening, upgrading and compacting of internal access tracks
- Construction of temporary work pads, laydown areas and turning circles
- Delivery and movement of earthmoving plant across the site.

These works will be undertaken using excavators, bulldozers, graders, rollers, scrapers, water trucks, and dump trucks. Activities will be mobile, dispersed across the WPP area, and undertaken only during daytime working hours.

Earthworks equipment generates typical noise levels of 75–85 dB(A) at 10 m, based on BS 5228 reference data. Noise is intermittent and dominated by engine revving, movement of tracked machinery, blade engagement during grading, and reversing alarms. Given the open terrain and lack of reflective surfaces, noise will decay rapidly with distance.

Vibration from tracked plant, compactors and rollers generally becomes imperceptible beyond 50–100 m,

All permanent residential receptors lie several kilometres from any earthworks locations and are far outside the range at which noise or vibration could be perceptible. The receptors most likely to experience noise or vibration from these works are herders, grazing livestock and the permanent seasonal shelter within the WPP plateau. Even for these receptors:

- Noise exposure will be brief and localised, depending on proximity of work area
- Vibration will generally be negligible, except for short periods if heavy compaction occurs nearby
- Activities are restricted to daylight hours (typically 07:00 – 19:00), reducing nuisance potential
- No significant unplanned events are anticipated, other than general construction-vehicle movements on internal tracks.

Activity/Impact/Aspect

Noise and vibration from earthworks, grading, topsoil stripping, access-road upgrades and internal track construction.					
Type	**Duration**	**Extent**	**Scale of Impact**	**Frequency**	**Likelihood (unplanned events)**
Direct	Short term	On-site/local	Distinguishable (but localised)	Intermittent	Possible (localised short-term disturbance)

Receptor	**Sensitivity**	**Magnitude**	**Significance of Impact**
Permanent residential receptors (e.g., Ushbas, dispersed dwellings)	High	Negligible	Insignificant
Herders, livestock and grazing activity	Medium	Small	Minor

Construction noise and vibration from earthworks, grading and access-road upgrades will be temporary, intermittent and localised, with impacts limited to occasional short-term exposure for transient grazing receptors. No impacts are expected at any residential community. Overall, this activity results in a Minor impact for herders and grazers, and an Insignificant impact for permanent settlements.

11.4.1.2 WTG, BESS and Substation Foundation Works, Cable Trenching and Internal Access Track Construction

This activity includes the civil works required for the construction of WTG foundations, BESS hardstands, the on-site substation area, and associated electrical infrastructure. The works also covers trenching for underground cabling and the formation of permanent internal access tracks. Activities will typically involve:

- Excavation to required depths for WTG, BESS and substation foundations
- Removal of hard or compacted material where present
- Grading and levelling of foundation pads and equipment platforms
- Placement and tying of steel reinforcement
- Installation of formwork and shuttering
- Concrete batching, delivery and pouring (note any concrete batching plant will be located in a dedicated area within the WPP area)
- Trenching and backfilling for electrical and fibre-optic cable routes
- Construction of permanent internal access tracks, including compaction and culvert installation
- Movement of plant, materials and workers between work locations.

These works will be undertaken using excavators, breakers (if required), mobile cranes, concrete trucks, compactors, rollers, trenchers, small generators and support plant. Activities will be undertaken only during daytime working hours and will occur at discrete locations dispersed across the WPP area.

Excavators, trenchers and concrete trucks typically generate 75–90 dB(A) at 10 m (BS 5228). Noise is intermittent and dominated by engine load changes, material excavation, bucket impacts, trench cutting and concrete pouring operations. Given the open steppe terrain and absence of reflective surfaces, noise decays rapidly with distance.

Vibration from tracked excavation plant, trenching equipment and rollers is generally imperceptible beyond 50–100 m, with levels remaining well below thresholds associated with structural damage or

human disturbance.

Permanent residential receptors lie a few kilometres from all WTG, BESS, substation and cable trench locations and are far outside the range at which noise or vibration would be perceptible. The receptors most likely to experience noise or vibration from these works are herders, grazing livestock and other land users within the WPP area. Even for these receptors:

- Noise exposure will be brief and localised, depending on proximity of work areas
- Vibration will be negligible except for short periods if heavy compaction or trenching occurs nearby
- All activities are restricted to daylight hours (typically 07:00-19:00)
- Disturbance will be intermittent and short-term and easily avoided once work locations are known.

Activity/Impact/Aspect					
Noise and vibration from excavation, civil works for WTG, BESS and substation foundations; cable trenching and backfilling; and construction of permanent internal access tracks.					
Type	**Duration**	**Extent**	**Scale of Impact**	**Frequency**	**Likelihood (unplanned events)**
Direct	Short term	On-site/local	Distinguishable (but localised)	Intermittent	Possible (localised short-term disturbance)

Receptor	**Sensitivity**	**Magnitude**	**Significance of Impact**
Permanent residential receptors (e.g., Ushbas, dispersed dwellings)	High	Negligible	Insignificant
Herders, livestock and grazing activity	Medium	Small	Minor

Construction noise and vibration from foundation works, cable trenching and internal access-track construction will be temporary, intermittent and localised, with impacts limited to occasional short-term exposure for grazing receptors within the WPP plateau. No impacts are expected at any residential community due to the very large separation distances. Overall, this activity results in a Minor impact for herders and grazers, and an Insignificant impact for permanent settlements.

11.4.1.3 Blasting Activities for WTG Foundation Excavation

Controlled blasting is anticipated at selected turbine locations where bedrock must be fragmented to achieve the design excavation depth for WTG foundations. Blasting will be infrequent, occurring only at specific turbines where geotechnical conditions require it. Blasting activities will typically involve:

- Pre-blast inspections and establishment of exclusion zones
- Drilling of blast holes and placement of explosive charges
- Installation of stemming materials and initiation systems
- Clearing of personnel and livestock from the defined safety radius
- Controlled detonation of charges
- Post-blast inspection and removal of fragmented rock
- Occasional mechanical breaking of oversized fragments, if required
- Movement of blasting equipment, specialist personnel and monitoring instruments.

All blasting will be undertaken by a licensed blasting contractor under an approved method statement and a permit-to-work system. Blasting will be restricted to daytime hours only and will be subject to pre-

blast notifications and communication with land users within the WPP. Blasting produces two main environmental effects:

- A short-duration airborne noise pulse, typically lasting a fraction of a second; and
- Ground vibration, which attenuates rapidly with distance.

Airblast noise typically consists of a sharp, impulsive sound lasting less than a second. Although the peak sound level at the detonation point is high, it decays extremely rapidly with distance in open environments. Airblast noise is typically:

- clearly audible within 200–300 m
- audible as a reduced “dull thump” at 300–500 m
- faint and often masked by wind at 500–1,000 m
- indistinguishable from natural ambient noise beyond approximately 1–1.5 km.

Ground vibration attenuates even more rapidly. Experience from similar wind-farm projects indicates that perceptible vibration generally does not extend beyond 200 m, and levels associated with cosmetic building damage rarely occur beyond 50–100 m, depending on geology, charge size and blast design. Given that all permanent settlements and dispersed dwellings are located several kilometres from all WTG foundation sites, no residential receptors are within the range at which blast-induced noise or vibration could be perceptible. These ranges align with the Project’s minimum exclusion radii of 200–300 m, within which no personnel or livestock are permitted during blasting.

Given that all permanent residential receptors (e.g., Ushbas and dispersed agricultural dwellings) are located several kilometres from the nearest WTG foundation, they are far outside any distance at which blast-related noise or vibration would be perceptible.

The receptors most likely to experience any blasting-related effects are herders, grazing livestock and other land users within the WPP plateau, particularly those passing near active blast locations. For these receptors:

- Noise exposure will be momentary, occurring only at the instant of detonation
- Vibration will be negligible except in the unlikely event they approach the 200–300 m exclusion zone
- Exclusion zones and pre-blast communication will prevent close proximity during blasting
- Any disturbance will be temporary and short-lived.

A review of the cultural heritage baseline presented in Section 9 (Archaeology and Cultural Heritage) confirms that the majority of identified archaeological and cultural heritage features are located several hundred metres to several kilometres from all WTG locations and are therefore well outside any potential vibration impact range. The two closest assets to any WTGs —Kurgan A-01 and Kurgan A-03, located approximately 252 m and 317 m respectively from the nearest turbine foundation—represent the only sites within distances where blast-induced vibration could theoretically be perceptible. However, controlled micro-blasting for WTG foundations generates very low peak particle velocities that dissipate rapidly with distance, and vibration levels at these ranges are expected to remain far below thresholds associated with structural damage or disturbance to archaeological features. All other cultural heritage assets identified in Section 9 lie at significantly greater distances and would not be affected by construction or blasting activities. Accordingly, no adverse vibration impacts on cultural heritage

receptors are anticipated.

Activity/Impact/Aspect					
Noise and vibration from controlled blasting associated with WTG foundation excavation and post-blast rock removal.					
Type	**Duration**	**Extent**	**Scale of Impact**	**Frequency**	**Likelihood (unplanned events)**
Direct	Short term	On-site/local	Distinguishable (but localised and very brief)	Intermittent	Possible (localised short-term localised disturbance)

Receptor	**Sensitivity**	**Magnitude**	**Significance of Impact**
Permanent residential receptors (e.g., Ushbas, dispersed dwellings)	High	Negligible	Insignificant
Herders, livestock and grazing activity	Medium	Small	Minor
Cultural Heritage/Kurgans (A01 & A03)	High	Negligible	Insignificant

Blasting activities will generate brief, localised, daytime-only noise and vibration. Due to the large distances to all residential communities, no impacts are expected at permanent dwellings. Occasional short-term impacts may occur for herders or livestock in the WPP area but will be effectively managed through exclusion zones and coordinated pre-blast notifications. Overall, this activity results in a Minor impact for herders and grazers and an Insignificant impact for permanent settlements.

11.4.1.4 Tower Erection, Turbine Assembly, and Installation of BESS and Substation Equipment

This activity includes the installation of major electrical and mechanical components across the WPP area, encompassing:

- WTG tower erection, nacelle installation and blade assembly
- Installation of BESS containers, inverters, transformers and switchgear
- Installation of substation equipment, including transformers, control buildings, switchgear, gantries and busbars
- Placement of prefabricated electrical kiosks and auxiliary plant
- Mechanical and electrical fitting works, including bolting, torqueing, cabling and terminations
- Use of large mobile cranes, telehandlers, service vehicles and commissioning tools
- Movement of personnel, components and smaller plant between WTG locations, the BESS platform and the substation site

These works will be carried out using heavy-lift cranes, mobile cranes, telehandlers, trucks, generators and hydraulic tooling systems. Activities occur at discrete hardstand areas (WTG pads, BESS platform and substation site) and progress sequentially across the WPP. All installation works will be undertaken during daytime hours only.

Large cranes, telehandlers and generators typically generate 70–80 dB(A) at 10 m (BS 5228). Noise arises from engine operation, hydraulic movements, slewing, equipment positioning and intermittent reversing alarms. Given the open terrain and absence of reflecting surfaces, noise will decay rapidly with distance.

Vibration associated with equipment installation activities is generally negligible, as cranes and handling

equipment operate on stable, compacted hardstands. Any low-level vibration from support vehicles or generators becomes imperceptible beyond approximately 20–30 m, and is far below thresholds associated with structural impacts or human disturbance.

Permanent residential receptors, including Ushbas and dispersed agricultural dwellings, are located several kilometres from the nearest turbine, BESS or substation locations. These distances are far beyond the range at which any noise or vibration from installation works could be perceptible. The receptors most likely to experience any disturbance are herders, grazing livestock and other land users within the WPP, particularly when moving near an active installation site. For these receptors:

- Noise exposure will be brief and localised around the immediate work areas
- Vibration effects will be negligible
- Activities are restricted to daytime hours, reducing nuisance potential
- Disturbance will be intermittent and short-term as work areas shift across the site.

Activity/Impact/Aspect					
Noise and vibration from tower erection, turbine assembly, and installation of BESS and substation electrical equipment.					
Type	**Duration**	**Extent**	**Scale of Impact**	**Frequency**	**Likelihood (unplanned events)**
Direct	Short term	On-site/local	Distinguishable (but localised)	Intermittent	Possible (localised short-term disturbance)

Receptor	**Sensitivity**	**Magnitude**	**Significance of Impact**
Permanent residential receptors (e.g., Ushbas, dispersed dwellings)	High	Negligible	Insignificant
Herders, livestock and grazing activity	Medium	Small	Minor

Noise and vibration from turbine erection, BESS equipment installation and substation works will be temporary, intermittent and highly localised, limited to individual work areas as these move across the WPP area. Impacts will be confined to occasional short-term exposure for grazing receptors within the WPP plateau. No impacts are anticipated at any permanent residential community due to the large separation distances. Overall, this activity results in a Minor impact for herders and grazers and an Insignificant impact for permanent settlements.

11.4.1.5 Construction Traffic and Transport of Components

This activity covers the transport of construction materials, equipment and personnel along existing public roads, upgraded access tracks and internal WPP roads. Typical movements will include:

- Delivery of WTG tower sections, nacelles, hubs and blades
- Transport of BESS units, transformers, inverters and other electrical equipment
- Delivery of substation components (switchgear, busbars, gantries, transformers)
- Delivery of aggregates, concrete, reinforcement steel and construction consumables
- Movement of heavy goods vehicles (HGVs), flatbed trailers and specialised blade transporters
- Light vehicle movements for daily workforce transportation
- Refuelling, maintenance and logistics movements between construction zones.

Transport will occur primarily during daytime hours and will follow designated delivery routes agreed with local authorities. Internal movements will follow upgraded access tracks and existing pathways within the WPP area.

HGVs and heavy transport vehicles typically generate 70–80 dB(A) at close range (BS 5228). Noise arises from engine operation, air-brake release, gear changes, trailer movement and reversing alarms. As vehicles move past a receptor, exposure is brief and transient, with noise decaying rapidly as distance increases. Internal construction tracks are located within the WPP area, where baseline noise levels are very low and receptors are sparse.

Vibration from vehicle movements is generally low and becomes imperceptible beyond 10–20 m from the track for light vehicles and 20–30 m for HGVs. Vibration levels remain well below thresholds associated with building damage or significant human disturbance. No permanent dwellings lie within these distances along the internal roads.

Along public roads used for component delivery, some buildings may be located close to the carriageway. In these locations, noise from passing HGVs will be audible; however, exposures will be brief and transient as vehicles pass, and levels will remain within accepted guideline limits for public-road traffic. No vibration impacts are expected, as vehicle-induced vibration becomes imperceptible at distances of approximately 20–30 m from the road.

The receptors most likely to experience transport-related noise, and to lesser degree vibration, are herders, grazing livestock and other land users within the WPP, particularly in areas where access tracks intersect grazing routes. For these receptors:

- Noise exposure will be brief, occurring only as vehicles pass
- Vibration will be minimal and short-lived
- All movements are daytime-only, reducing nuisance potential
- Interactions are low in frequency due to sparse settlement patterns.

Permanent residential receptors, including Ushbas and dispersed agricultural dwellings, are located at distances where vehicle noise from internal construction roads will not be perceptible. Occasional brief noise increases may occur when HGVs pass near settlements on public roads, but exposures will remain compliant with guideline levels and will not result in disturbance.

Activity/Impact/Aspect					
Noise and vibration from HGV movements, oversize transport deliveries and construction-related vehicle					
Type	**Duration**	**Extent**	**Scale of Impact**	**Frequency**	**Likelihood (unplanned events)**
Direct	Short term	Local (WPP) and along designated public road transport corridors	Distinguishable (but localised)	Intermittent	Possible (localised short-term disturbance)

Receptor	**Sensitivity**	**Magnitude**	**Significance of Impact**
Permanent residential receptors (e.g., Ushbas and dwellings located along public road delivery routes)	High	Small	Moderate
Herders, livestock and grazing activity	Medium	Small	Minor

Noise and vibration from construction-related traffic will be temporary, intermittent and transient, occurring only as vehicles pass along internal WPP tracks or designated public delivery routes. Within the WPP area, grazing receptors may experience occasional short-term noise as construction vehicles move between work locations, although vibration effects will be minimal and short-lived. Along public roads, some permanent residential receptors may lie close to the carriageway and will experience brief periods of audible noise as HGVs pass; however, exposures will be momentary, limited to daytime hours, and within accepted guideline levels for public-road traffic. No discernible vibration impacts are expected for roadside residences. Overall, this activity results in a Minor impact for residential receptors along public delivery routes and for herders and grazers within the WPP, and an Insignificant–to–Minor impact for all other receptors.

11.4.1.6 OHTL Construction Activities

Construction of the two OHTLs includes a series of linear, mobile work fronts extending along the full length of both OHTL corridors. Activities typically include:

- Establishment of temporary access tracks and tower work pads
- Excavation of tower foundations (predominantly mechanical excavation)
- Casting of reinforced concrete foundations and setting anchor bolts
- Assembly and erection of steel lattice towers using cranes
- Stringing of conductors and ground wires using tensioners, pullers and winches
- Guarding operations at road crossings and public-access points
- Restoration of work pads and reinstatement of disturbed land.

At this stage, blasting is not anticipated for OHTL tower foundations. Should detailed design identify any localised requirement for blasting along the OHTL corridors, such works would follow the same technical and management principles outlined for WTG foundation blasting and would be subject to the same controls and communication measures.

OHTL construction relies mainly on excavators, concrete trucks, mobile cranes, light vehicles, specialised stringing machinery, and occasional flatbed deliveries of tower components. Noise generated by these activities typically falls within 70–80 dB(A) at 10 m (BS 5228), dominated by engine noise, hydraulic movement, lifting operations, mechanical winching during conductor stringing, and intermittent reversing alarms. Because works are linear and progressive, noise exposure at any given point along the corridor is generally short-lived.

Vibration from tower-foundation excavation and crane operations is very low, becoming imperceptible beyond 20–30 m from the activity. Concrete pouring and tower erection do not generate meaningful vibration. No vibration impacts are expected at permanent dwellings.

OHTL corridors traverse sparsely populated steppe landscapes, grazed pastures and scattered agricultural dwellings. For most of their length, tower locations are many hundreds of metres to several kilometres from permanent settlements. The receptors most likely to experience temporary increases in noise are therefore:

- Herders, farmers, grazing livestock and other land users encountered along the corridor
- Occasional agricultural dwellings situated near tower locations or access tracks
- Road users when conductor stringing crosses public highways.

Even for these receptors:

- Noise exposure is brief and intermittent, tied to the advancing work front
- Vibration effects are negligible
- Works are confined to daytime hours only
- Activities are temporary and revert to baseline conditions once the work front moves on.

No significant unplanned noise or vibration events are expected, other than occasional increases associated with machinery movement, concrete deliveries, or tensioning equipment.

Activity/Impact/Aspect					
Noise and vibration from OHTL tower-foundation works, crane operations, conductor stringing, and movement of machinery along the OHTL corridor.					
Type	**Duration**	**Extent**	**Scale of Impact**	**Frequency**	**Likelihood (unplanned events)**
Direct	Short term	Local (tower sites and linear transport/working corridor)	Distinguishable (but localised and transient)	Intermittent	Possible (localised short-term disturbance)

Receptor	**Sensitivity**	**Magnitude**	**Significance of Impact**
Permanent residential receptors (e.g., villages, roadside dwellings located near public sections of the corridor)	High	Small	Moderate
Herders, farmers, livestock and grazing activity along the OHTL corridor	Medium	Small	Minor

Noise and vibration from OHTL construction will be temporary, mobile and short-duration, reflecting the linear, advancing nature of tower erection and conductor stringing. Grazing and agricultural receptors along the route may experience occasional short-term noise when machinery or vehicles pass nearby; however, levels will remain within acceptable limits and are limited to daytime hours. No vibration impacts are expected at any permanent settlement. Overall, this activity results in a Minor impact for all receptor groups.

Site reinstatement, demobilisation and commissioning activities are expected to generate lower noise levels than the construction activities assessed above, rely on similar equipment, and occur for short durations. As such, they do not introduce any additional noise or vibration impacts beyond those already assessed for the construction phase.

11.4.2 Operation Phase

11.4.2.1 Operational Noise Modelling Methodology

Operational noise emissions from the Project will be dominated by the aerodynamic sound generated by the WTGs. Following the methodology established in the previous sections, the assessment focuses on predicting noise levels at identified sensitive receptors located within the AoI to ensure compliance with both absolute limits (WBG/WHO guidelines of 55 dB(A) day/45 dB(A) night) and relative criteria (maximum increase of +3 dB(A) above baseline) for fixed residential receptors.

The predictive noise modelling was executed using the industry-standard software WindPRO v4.1, based

on the internationally recognised ISO 9613-2:2024 standard, which defines an engineering method for the calculation of sound propagation outdoors. This model calculates the A-weighted equivalent continuous sound pressure level (L_{Aeq}) at a receptor position for a given set of input parameters.

11.4.2.2 Model Inputs and Parameters

The following key inputs, consistent with Good International Industry Practice (GIIP), were used to establish a robust and conservative assessment:

WTG Source Data: The model uses manufacturer-supplied sound power level data for the candidate turbine model, the Envision EN206/11.0 with a 145 m hub height. The model was run using the worst-case (full operational power) sound power curve, which results in a maximum overall sound power level of 114.6 dB(A). All sound power level data were provided with third-octave bands data ranging from 20 Hz to 10 kHz, with a summary L_{WA} used for the overall A-weighted calculation. This ensures the assessment conservatively evaluates the maximum possible noise emission from the selected WTG model.

The Project is designed for a total installed capacity of approximately 1.1 GW. For this ESIA, the noise model conservatively assumes that turbines are installed at all 140 identified WTG locations, regardless of the turbine model selected. This represents a deliberately precautionary approach. For example, if the 11 MW Envision model were selected, only around 100 WTGs would be required to achieve the target capacity, while the smaller 8 MW turbine option would require more units but would be inherently quieter. The base-case modelling layout therefore overestimates cumulative noise emissions and provides significant scope for noise reduction during final layout optimisation.

The Envision 11 MW turbine represents the noisiest of the candidate models under consideration and therefore provides the most conservative basis for assessment. For comparison, the overall maximum sound power levels for the other candidate WTG models are summarised in Table 10-10.

Table 10-10: WTG Model Options Considered[236]

Model	Goldwind GW204-10.5MW	Envision EN206-11.0MW	SANY SI-19580
Capacity/rated power (MW)	10.5	11.0	8
Hub Height (m)	148	145	120
Rotor Diameter (m)	204	210	195
Max Sound Power Level dB(A)	113.0	114.6	112.0

Topography and Ground Conditions: The model incorporates digital terrain data for the WPP site. The Digital Terrain Model (DTM) data was sourced through the NASA-DEM dataset. The use of terrain elevation data allows for the inclusion of ground effects, reflections, and topographic screening effects. The following ground/terrain assumptions were used within the modelling:

- Ground absorption coefficient/Ground Factor (G): 0.5 applied across the open steppe landscape. This value represents mixed ground typical of rural areas and provides a realistic, yet still conservative, approach to attenuation over the WPP terrain.

[236] The technical solution is not final and is pending final design and technology selection.

- Topographic screening reduction: The calculation applied a maximum topographic screening reduction of 2.0 dB as receptors shielded by prominent terrain features. This factor accounts for the measurable attenuation achieved when the line of sight between the WTG hub and the receptor is significantly broken by high ground.
- Valley effect penalty: To conservatively address the potential for sound channelling or reflections within local depressions, a precautionary valley effect penalty of 1.5 dB was applied to the predicted noise levels for relevant receptors located within or adjacent to these features. This penalty compensates for the potential reduction in atmospheric absorption and the focusing of sound energy that can occur in confined valleys.

Meteorological Parameters (Propagation): In line with the conservative approach required by lenders, the model simulates downwind propagation, which results in the least amount of atmospheric attenuation and thus the highest predicted noise levels. The parameters adopted within the WindPRO ISO 9613-2 implementation were:

- Wind Direction: Modelling was run with all turbines assumed to be operating simultaneously, and the sound propagation calculated from each turbine towards each receptor, conservatively assuming downwind conditions for all source-receptor paths.
- Atmospheric Absorption: A moderate air temperature of 10ºC and relative humidity of 70% were used for calculating atmospheric absorption, ensuring that this attenuation factor is not overstated.

Receptor Locations and Height: Receptor coordinates and elevations (immission height) were derived from the mapping exercise described in previous sections. For the permanent dwellings at Ushbas Village the receptor immission height was set at 4.0 m above ground level. This height represents a worst-case scenario, such as a window on an upper floor, which minimises the potential for ground-level screening. For the fixed seasonal shelter (R13), an immission height of 1.5 m was used as this was observed to be only a single story building.

The specific receptor locations identified for detailed noise modelling are summarised in Table 10-11 below.

Table 10-11: Summary of noise receptors analysed

Receptor	Easting (m) WGS84 UTM North Z42	Northing (m) WGS84 UTM North Z42	Immission height (m)	Description
NL-2	561,751	4,802,892	1.5	Fixed building – grazing season shelter
NA-9	556,908	4,804,833	1.5	Kamar-Aulie Shrine
NL-1	556,352	4,806,061	4.0	Ushbas village
NA-6	568,119	4,805,198	1.5	Summer camp

11.4.2.3 Assessment Scenarios

The operational phase noise assessment was conducted across three distinct scenarios to ensure compliance with both the absolute criteria of the WBG/WHO and the relative criteria mandated by both WBG/WHO and the ETSU-R-97 framework. A summary of these is presented below.

Scenario 1: Maximum Predicted Noise (Absolute Limit Check) This scenario calculates the maximum cumulative noise level L_{Aeq} predicted at each receptor based on the simultaneous operation of all WTGs

at their highest sound power level, irrespective of wind speed. The resulting values are the primary indicator of potential impact and are compared directly against the WBG/WHO absolute limits of 55 dB(A) (daytime) and 45 dB(A) (nighttime). This analysis ensures the project does not exceed acceptable noise exposure thresholds. The results for this scenario are detailed in Table 10-12 in the results section below.

Scenario 2: Relative Impact Check (L_{Aeq}) (WBG Requirement) This analysis addresses the WBG requirement that the Project should not cause an increase of more than +3 dB(A) above the existing baseline noise level (L_{Aeq}) at the receptors. The predicted turbine noise levels are logarithmically added to the measured L_{Aeq} baseline levels to confirm the following:

$$L_{Aeq,\ Project} + L_{Aeq,\ Baseline} \leq L_{Aeq,\ Baseline} + 3\ \text{dB(A)}$$

This check is an important consideration in the quiet steppe environment where baseline noise levels are low and a perceptible increase could trigger an adverse impact. The results for the WBG relative check are detailed in Table 10-13 in the results section below.

For the purpose of this analysis, the baseline noise levels for NL-1 has been selected considering a wind speed of 10 m/s at hub height as this reflects the scenario where the WTGs will be operating at their maximum sound power level.

Scenario 3: Relative Impact Check (L_{A90}) (ETSU-R-97 Requirement) To ensure comprehensive regulatory compliance, a third analysis was undertaken using the ETSU-R-97 methodology, which compares project noise against the background noise metric L_{A90}. This check compares the predicted wind turbine noise levels (converted to L_{A90} equivalent) to a limit derived from 5 dB(A) above the prevailing L_{A90} background noise level, or the fixed lower limits (35-40 dB(A) Day, 43 dB(A) Night), whichever is the greater.

This analysis is specifically conducted against wind speed bins to assess the correlation between increasing wind and increasing turbine noise, as required by the standard. The resulting compliance assessment against the ETSU-R-97 criteria is detailed in Table 10-14 and in the results section below in addition to graphical representation presented in Figure 10-18 and in the section below.

11.4.2.4 Operational Noise Modelling Results

This section presents the results of the noise modelling scenarios outlined in the previous section. All predicted levels are compared against the relevant WBG and ETSU-R-97 criteria to determine compliance and residual impact significance.

Table 10-12 compares the maximum predicted cumulative wind turbine noise level L_{Aeq} with the WBG/WHO absolute noise limits (55 dB(A) Day/45 dB(A) Night). Figure 10-19 graphically presents the predicted noise levels generated within the AoI from the operation of the WTGs at maximum load.

Table 10-12: Scenario 1 results - Maximum Predicted Noise (WBG Absolute Limit Check)

Receptor	Max. predicted WTG noise L_{Aeq}	Absolute limit (daytime, dB(A))	Compliance (daytime)	Absolute limit (night time, dB(A))	Compliance (night time)
NL-2	49.7	55	Yes	45	No
NA-9	43.2	55	Yes	45	Yes
NL-1	41.0	55	Yes	45	Yes
NA-6	33.9	55	Yes	45	Yes

Table 10-13 below assesses the WBG relative impact criterion: the increase in noise from the project must not exceed +3 dB(A) above the baseline L_{Aeq}.

The criterion is met if $L_{Aeq, Project} + L_{Aeq, Baseline} \leq L_{Aeq, Baseline} + 3$ dB(A).

Table 10-13: Scenario 2 results - Relative Noise Compliance (L_{Aeq} WBG) for fixed residential receptors

Receptor	Baseline ambient noise dB(A) (L_{Aeq})	Predicted WTG noise dB(A) (L_{Aeq})	Calculated total dB(A) (WTGs + Baseline ambient) (L_{Aeq})	Predicted L_{Aeq} increase dB(A) (Total – Baseline)	Relative limit dB(A)	Compliance
NL-1 – Night	39.0	41.0	43.1	4.1	< 3.0	No
NA-6 – Day[237]	32.1	33.9	36.1	4.0	< 3.0	No
NL-2 – Night	28.8	49.7	49.7	20.9	< 3.0	N/A

Note that receptor NL-2) has been included in Table 10-13 for comparative purposes only. The WBG relative noise criterion of +3 dB(A) above baseline is intended to apply to permanent residential receptors and is therefore not considered a compliance requirement for NL-2, which is a non-residential structure. Notwithstanding this, absolute predicted noise levels at NL-2 have been assessed against the WHO night-time external guideline value of 45 dB(A) LAeq, as discussed in Section 10.4.2.6, to inform the evaluation of potential sleep disturbance risk during periods of occasional overnight use.

Table 10-14 provide the compliance assessment against the ETSU-R-97 methodology, which requires the noise level to be the greater of a fixed minimum limit or 5 dB(A) above the prevailing L_{A90} background noise level, assessed per wind speed bin. Due to the low ambient noise levels at the Project, a fixed minimum level has not been considered. Receptors NA-9 and NA-6 are not considered in this analysis as no 14-day wind speed dependent measurements were taken at these locations.

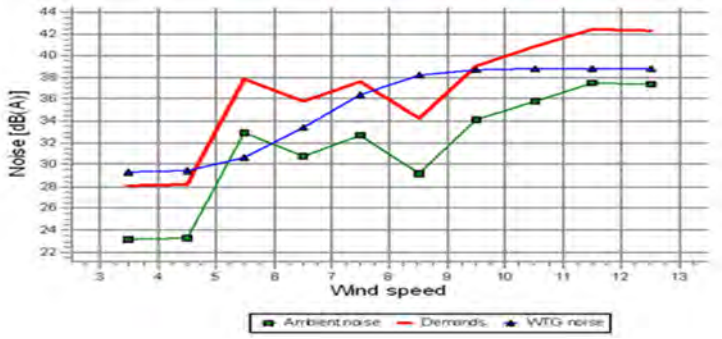
*Table 10-14: Scenario 3 results - Relative Noise Compliance (L_{A90} ETSU-R-97) – **NL-1 Receptor***

Wind speed (m/s)	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5
Ambient +5 dB(A) (dB(A))	28.1	28.3	37.9	35.8	37.6	38.3[238]	39.1	40.9	42.5	42.4
Predicted WTG noise (dB(A))	29.3	29.5	30.6	33.4	36.4	38.2	38.8	38.8	38.8	38.8
Exceedance (dB(A))	1.2	1.2	-7.3	-2.4	-1.2	-0.1	-0.4	-2.1	-3.7	-3.6

Figure 10-18: Relative noise (ETSU-R-97)

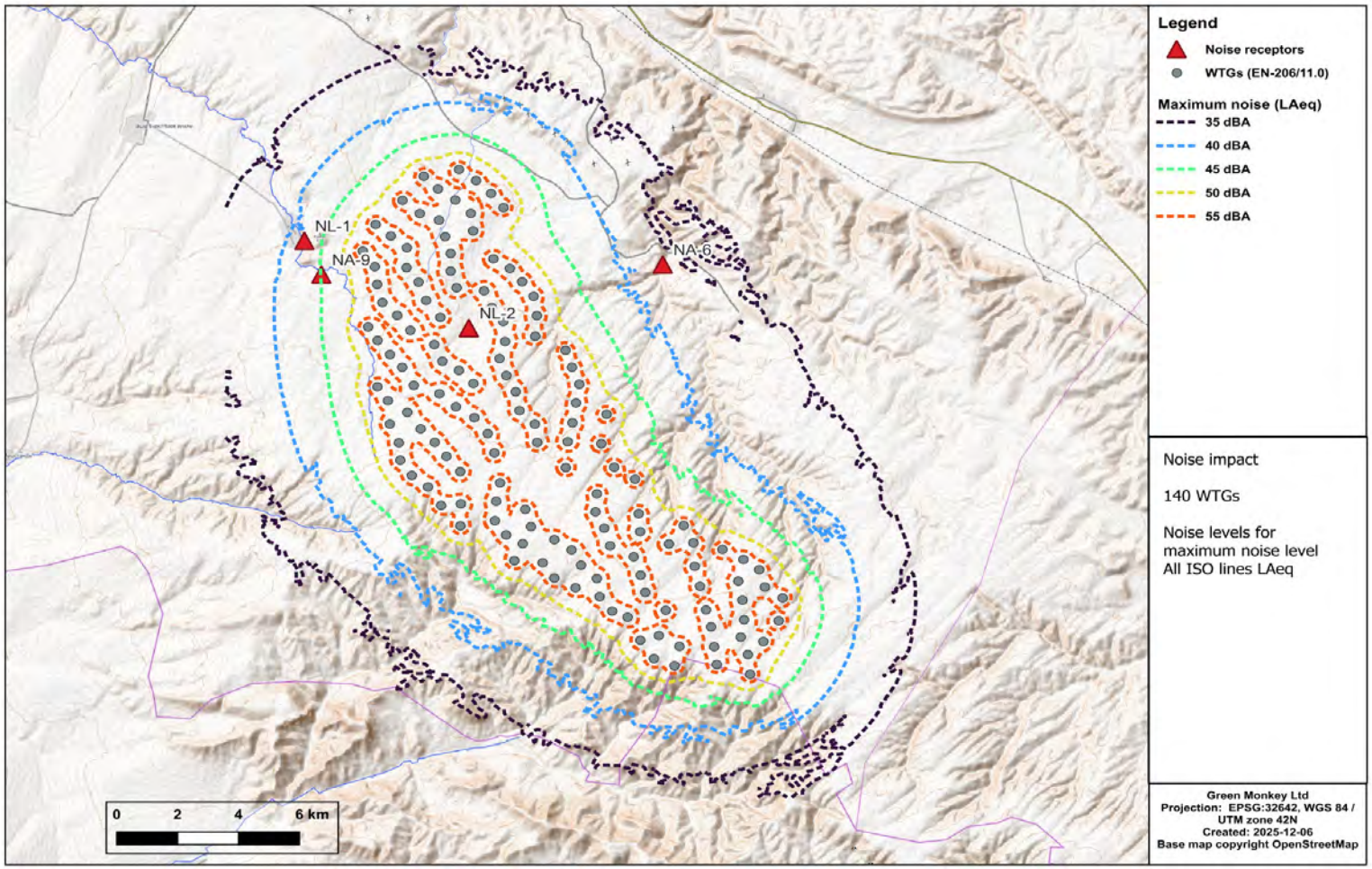
[237] Daytime noise levels have been selected for NA-6 due to the very low wind speeds (0.5 m/s average) during the night-time baseline monitoring period, likely to introduce an overly conservative representation of baseline noise levels.
[238] Note that at 8.5m/s the data showed a drop in baseline noise levels to 34.2 dB(A); this is considered an anomaly in the measurement data and a more representative noise level of 38.3 dB(A) has been taken based on extrapolation of results shown in the graph in Figure 10-18.

NL-1 Receptor



The night-time ambient noise data generally show the expected increase in sound levels with rising wind speed. However, the plot for NL-1 indicates an apparent dip in measured ambient noise at around 8–9 m/s, before increasing again at higher wind speeds. This reduction is not considered to be a real reflection of environmental acoustic conditions; rather, it is treated as a data artefact arising from natural variability within the measurement dataset. The overall trend clearly indicates that wind-induced noise dominates the acoustic environment at operational wind speeds, and the temporary dip at 8–9 m/s does not affect the interpretation of baseline conditions or the conservative nature of the operational noise assessment.

Figure 10-19: Project Predicted Noise Levels (LAeq)



11.4.2.5 Additional Sensitivity Modelling Results

In addition to the conservative operational noise assessment presented above, supplementary sensitivity modelling has been undertaken to explore the potential for further noise reduction through mitigation-through-design measures. These sensitivity scenarios are intended to demonstrate how operational noise impacts may be reduced through realistic variations in final project design. Without altering the conclusions of the base-case assessment, two sensitivity scenarios have been considered, reflecting the principal design levers available to the Project at the detailed design stage:

- **Scenario 1**: Optimisation of the WTG layout through targeted removal of turbines closest to Ushbas village and Kamar-Aulie, assessed using the Envision EN206-11.0 MW turbine model, recognising that if this turbine option is selected only 100 WTGs would be required to achieve the Project's target capacity and therefore 40 WTG locations would be removed; and
- **Scenario 2**: Selection of an alternative smaller 8MW turbine model which has a lower associated noise emission, assessed using the Sany SI-195-80; this represents the only option under which all 140 identified WTG locations would be required to achieve the Project's target installed capacity.

Both scenarios have been modelled using the same conservative assumptions applied to the base-case assessment, including downwind propagation, maximum sound power output, all WTGs operating simultaneously and limited terrain screening, in order to allow direct comparison with the Envision worst-case scenario. The results are therefore not presented as revised impact predictions, but as illustrative sensitivity cases demonstrating the extent to which operational noise levels may be reduced through final layout refinement and turbine selection. The two sensitivity scenarios are presented below.

Scenario 1

Under this scenario the noise model run was undertaken in which 18 WTGs located closest proximity to Ushbas village and Kamar-Aulie were removed from the layout in order to assess the resulting change in operational noise levels at nearby sensitive receptors. The spatial distribution of predicted operational noise levels for this scenario is illustrated in Figure 10-20.

Under this layout-optimised configuration, predicted operational noise levels at the closest representative residential receptor, NL-1 (Ushbas), are reduced to approximately 34.9 dB(A) LAeq, which is well below all relevant IFC/WBG and WHO guideline values. This sensitivity scenario demonstrates that targeted layout refinement can result in a substantial reduction in operational noise levels at key receptors when compared to the conservative base-case assessment.

Scenario 2

Under this scenario, a noise model run was undertaken for the Sany SI-195-80 (8 MW) WTG model to assess the potential reduction in operational noise levels associated with selection of a lower-noise turbine option, based on the manufacturer sound power data. As described above, this represents the only turbine option under which all 140 identified WTG locations would be required to achieve the Project's target installed capacity.

The spatial distribution of predicted operational noise levels for this scenario is illustrated in Figure 10-21, which presents the modelled noise contour plots for the Sany layout.

Table 10-15 compares the maximum predicted cumulative wind turbine noise level L_{Aeq} with the

WBG/WHO absolute noise limits (55 dB(A) Day/45 dB(A) Night).

Table 10-15: Scenario 2 - Maximum Predicted Noise (WBG Absolute Limit Check)

Receptor	Max. predicted WTG noise L_{Aeq}	Absolute limit (daytime, dB(A))	Compliance (daytime)	Absolute limit (night time, dB(A))	Compliance (night time)
NL-2	47.1	55	Yes	45	No
NA-9	40.4	55	Yes	45	Yes
NL-1	37.9	55	Yes	45	Yes
NA-6	31.2	55	Yes	45	Yes

Under this scenario, predicted operational noise levels at the closest permanent residential receptor, NL-1 (Ushbas), are reduced to approximately 37.9 dB(A) LAeq, remaining comfortably below all relevant IFC/WBG and WHO guideline values. At non-residential receptors within the WPP area, including the grazing-season shelter (NL-2), absolute predicted noise levels are lower than those associated with the conservative Envision case, representing a reduction in impact magnitude, although exceedance of the 45 dB(A) night-time guideline may still occur during periods of overnight use.

Compliance with the WBG relative impact criterion is also achieved at NL-1, as demonstrated in Table 10-16, with the predicted increase above baseline remaining below +3 dB(A).

Table 10-16: Scenario 2 - Relative Noise Compliance (L_{Aeq} WBG)

Receptor	Baseline ambient noise dB(A) (L_{Aeq})	Predicted WTG noise dB(A) (L_{Aeq})	Calculated total dB(A) (WTGs + Baseline ambient) (L_{Aeq})	Predicted L_{Aeq} increase dB(A) (Total – Baseline)	Relative limit dB(A)	Compliance
NL-1 – Night	39.0	37.9	41.5	2.5	< 3.0	Yes
NA-6 – Day[239]	32.1	31.2	33.1	2.6	< 3.0	Yes
NL-2 – Night	28.8	47.1	47.1	18.3	< 3.0	N/A

The results of this sensitivity scenario demonstrate that turbine model selection provides an effective additional mitigation-through-design measure, capable of materially reducing operational noise levels across the Project area when compared to the conservative base-case assessment. Final operational noise impacts will be confirmed through detailed noise modelling undertaken once the selected WTG model and final layout are approved.

[239] Daytime noise levels have been selected for NA-6 due to the very low wind speeds (0.5 m/s average) during the night-time baseline monitoring period, likely to introduce an overly conservative representation of baseline noise levels.

Figure 10-20: Scenario 2 - Layout optimisation (18 WTGs removed) – NL-1 noise levels below 35 dB(A) LAeq

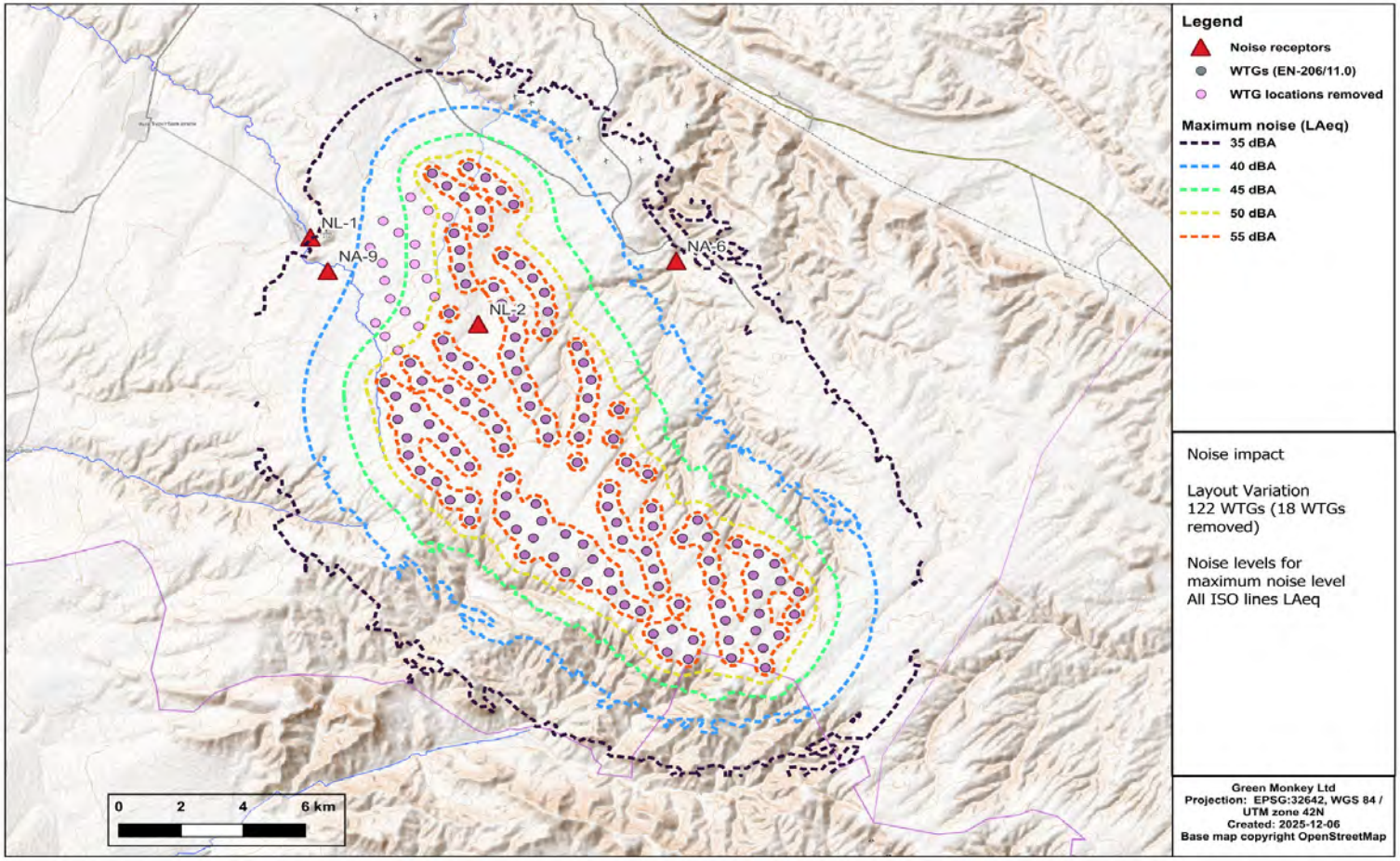
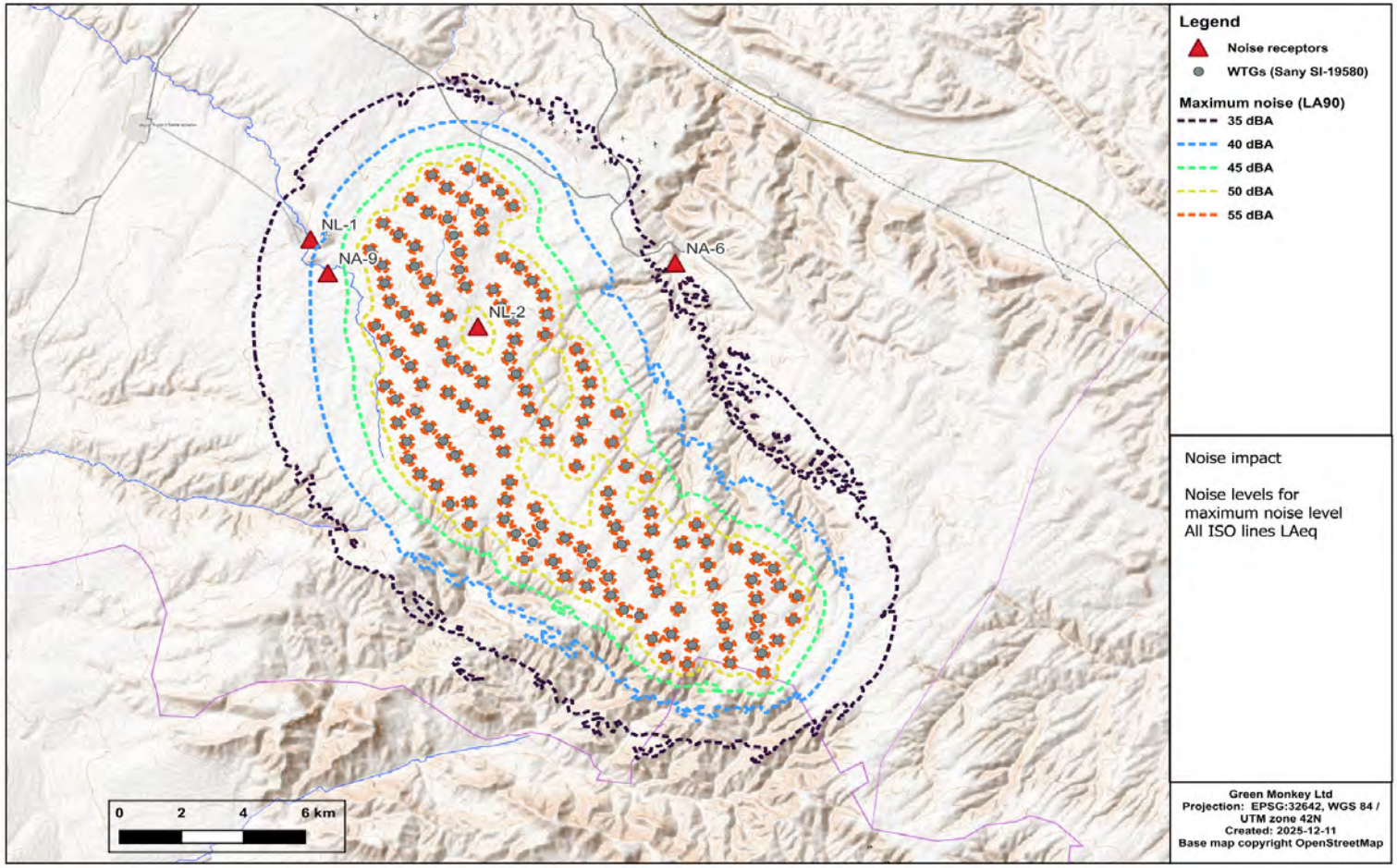


Figure 10-21: Scenario 2 layout based on 140 x Sany 8MW WTGs



11.4.2.6 Impact Assessment

This section provides an assessment of the predicted operational noise impacts on specific identified sensitive receptors based on the detailed modelling results for the Project. Predicted noise levels at each receptor have been evaluated against applicable WBG/WHO guideline values. For each receptor, the predicted turbine noise levels are considered in the context of local baseline noise conditions, receptor use and occupancy patterns, and the conservative assumptions embedded within the noise model. These assumptions ensure that predicted noise levels represent a highly conservative worst-case scenario, and include:

- all-turbines-operating,
- downwind propagation to every receptor, and
- precautionary valley penalties.

Furthermore, it should be noted that the modelling runs were based on the noisiest WTG option, namely the 11MW Envision EN206, and for it to be located at all of the 140 WTG locations. In reality, in the event that this turbine model is selected then the project will only install 100 WTGs and therefore 40 WTGs will be removed from the model. The Project will only require all 140 WTG in the event that an 8 MW WTG model is selected, which as discussed in Section 10.4.2.2 are inherently quieter that an 11 MW turbine. Therefore the model results present a very conservative approach. Supplementary sensitivity modelling exploring alternative layout and turbine selection options is presented in Section 10.4.2.5.

The discussion focuses not only on the modelled numerical exceedances but also on their practical significance under real-world conditions, taking account of receptor sensitivity, actual exposure likelihood, and environmental context.

The following receptors are considered in this analysis:

- Ushbas Closest Representative Dwelling – NL-1
- Kamar Aulie Sacred Site (Shrine and Rest Area) - NA9
- Grazing-Season Shelter (Fixed Building) – NL-2
- Movable Grazing Shelters/Wagons
- Summer camp – NA-6.

Operational noise from the Project's BESS and on-site substation has been considered as part of the operational noise screening. These facilities will comprise fixed electrical equipment (e.g. transformers, inverters and cooling systems) designed and operated in accordance with international standards, with noise emissions typically limited to low-frequency hum and cooling fan noise. The BESS and substation will be located within the WPP area at substantial distances from permanent residential receptors (over 10 km), and at least 600m from the nearest identified moveable grazer wagon, and operational noise levels are expected to attenuate rapidly with distance. Compared to wind turbine noise, which represents the dominant operational noise source for the Project, noise contributions from the BESS and substation are minor and would not be perceptible at off-site sensitive receptors. Accordingly, operational noise from the BESS and substation does not represent a distinct or material impact pathway and is not expected to result in adverse noise effects beyond those assessed for wind turbine operation.

Ushbas Closest Representative Dwelling – NL-1

Ushbas is the nearest permanent residential settlement to the WPP, located at least 2.1 km from the

closest WTG. The receptor selected for assessment (NL-1) represents the closest dwelling within the village and therefore provides a conservative basis for evaluating potential community noise effects.

Under worst-case operating conditions, the modelled noise level from the Project at NL-1 is predicted to be 41.0 dB(A) LAeq, which is below the WHO night-time guideline value of 45 dB LAeq. The predicted level is well below the WBG EHS daytime limit of 55 dB LAeq. Compliance with both absolute guideline values is therefore achieved.

Background noise monitoring demonstrates that Ushbas experiences very low ambient levels during calm conditions, occasionally falling below 20 dB(A). However, these minima are not representative of periods when turbines will be in operation. During moderate to high wind speeds—the conditions under which turbines generate power—local ambient noise levels rise accordingly due to wind-induced sound across the surrounding landscape and from vegetation. The background noise levels when the WTG is running at full power i.e. at 10m/s is around 37 dB(A) LA_{90} or 39 dB(A) LAeq, and with the predicted WTG noise 41.0 dB(A) (LAeq) gives a calculated total dB(A) (WTGs + Baseline ambient) (LAeq) of 43.1 dB(A) LAeq which is +4.1 dB(A) above background, and therefore marginally exceeds the +3 dB(A) above background limit of the WBG EHS Guidelines. However, considering the conservative modelling assumptions described above, the predicted noise levels at NL-1 are likely to overstate real-world exposure. In practice:

- The modelled scenario assumes all 140 WTG locations are occupied by 11 MW turbines, which is unrealistic and therefore overestimates cumulative noise levels.
- Only a proportion of turbines will be downwind of the village at any given time.
- Background noise will naturally increase during windy conditions, reducing perceptibility.
- Outdoor exposure is intermittent and of limited duration.

It should be noted that the NL-1 monitoring position was located in open terrain outside the village, while the nearest dwellings are partially sheltered by nearby tree belts. As vegetation movement is a significant source of wind-related noise, it is possible that baseline levels at the dwellings may, at times, differ from those measured at NL-1. The NL-1 data therefore provides a precautionary basis for assessment, and while broadly representative of local acoustic conditions, some natural variability in comparison to conditions experienced at individual houses is expected.

Taking these factors into account, operational noise at NL-1 is not expected to result in significant disturbance, adverse community response, or adverse health impacts. Based on the assessment of the conservative base-case scenario, the overall impact at the closest representative dwelling in Ushbas is assessed as Minor to Moderate. However, this is based on an unrealistic scenario where the WPP area has 140 x 11 MW WTGs operating simultaneously. In practice, the final Project design is expected to involve either a reduced number of higher-capacity turbines and/or selection of alternative turbine models, providing opportunities to further reduce overall noise contribution from the Project at this sensitive receptor through layout refinement and turbine selection (see Section 10.4.2.5).

It is recommended that noise modelling is undertaken based on the final approved WTG layout and model selection to confirm that all relevant noise standards are met at sensitive receptors. As part of this process, the Project may also consider undertaking additional baseline noise monitoring at locations closer to residential properties (subject to landowner permission) to further confirm representativeness and support validation of the final modelling results, in order to supplement the existing noise dataset to ensure continued alignment with good practice during final design.

Kamar Aulie Sacred Site (Shrine and Rest Area) - NA9

Kamar Aulie is a culturally significant pilgrimage location used intermittently by visitors for short periods of rest, reflection, and spiritual activity. The receptor (NA9) represents the most exposed point within the shrine area and is assessed as a non-residential, intermittently occupied receptor with inherently lower sensitivity to operational noise than permanent dwellings.

Operational noise levels at NA9 under worst-case conditions are predicted to be 43.2 dB(A), below the WHO 45 dB(A) LAeq night-time standard; although it should be noted that WBG/WHO residential criteria does not apply directly to a site of this nature but provides an indication of the potential levels above which annoyance may occur.

Baseline conditions around Kamar Aulie are typical of the open steppe landscape, with very quiet conditions during calm periods but with natural wind noise becoming more dominant during the meteorological conditions in which turbines operate.

For the noise impact assessment, daytime noise levels were selected for NA-9 due to the very low wind speeds (1.7 m/s average) experienced during the night-time baseline monitoring period. Such low wind speed will result in very low background noise levels from vegetation and are therefore likely to introduce an overly conservative representation of baseline noise levels.

The measured background noise level at Kamar Aulie is approximately 43.1 dB(A) LAeq, while the predicted turbine noise level is 43.2 dB(A) LAeq, giving a combined value of around 46.1 dB(A) LAeq. This represents a small, perceptible increase above existing ambient conditions; however, the +3 dB(A) above-background criterion applies only to permanent residential receptors and is not relevant for a non-residential, intermittently used site such as Kamar Aulie. Given its limited occupancy and cultural-heritage use rather than residential use, the predicted noise levels are not expected to result in material disturbance or adverse effects on the receptor's functional use.

Taking account of the conservative modelling assumptions described above, the predicted noise levels likely overestimate the actual experience at the site. In practical terms:

- Turbine audibility will be infrequent and limited to specific wind directions
- Background wind noise around the terrain features of the shrine will often mask turbine sound
- Visitor stay durations are short and do not involve prolonged exposure
- The cultural functions of the site do not require sustained quiet akin to a residential setting.

As discussed above, a further model run was undertaken where 18 WTGs were removed that are located in the WPP area close to Ushbas and NA-9. The results of the predicted noise level from the Project based on this scenario are shown in Figure 10-20 with noise levels at NL-1 predicted to be 36.5 dB(A) LAeq, well below all relevant IFC/WHO standards.

Given these factors, operational turbine noise is not expected to adversely affect visitor experience or interfere with cultural or spiritual use of the site; the impact is assessed as minor.

Grazing-Shelter (Fixed Building) – NL-2

The grazing-season shelter (NL-2) is a small fixed structure used intermittently during seasonal grazing activities. It is not continuously occupied, and periods of overnight use are irregular. As such, the receptor is considered lower sensitivity than a permanent dwelling, though higher than completely transient receptors such as movable grazing wagons.

The modelled turbine noise level at NL-2 is predicted to be 49.7 dB(A) LAeq which is above the WBG/WHO guideline night-time value of 45 dB(A). Although this guideline formally applies to permanent residential buildings, it offers a useful benchmark for evaluating potential sleep disturbance should the shelter occasionally be used overnight.

Baseline noise measurements within the WPP plateau indicate very low ambient noise levels during calm weather, and also in windier conditions, due to the open terrain and lack of trees. Even at 10 m/s hub height, background noise levels are low at around 30 dB(A), meaning that turbine noise will represent a clearly perceptible contribution at this location. Although background noise comparisons are informative, they are not used as a compliance benchmark for this non-residential, intermittently occupied receptor. The assessment therefore focuses on absolute predicted noise levels and the potential for nuisance or sleep disturbance when overnight use occurs.".

Specific consultation will be required with the owner of the building to ensure they are fully informed of the potential elevated noise levels that they may experience at this building. Acoustic insulation may offer a reduction in internal noise levels to degree that would allow for undisturbed sleep and this option should be discussed with the relevant PAP, as well as the option for relocation assistance as it is a fixed structure.

However, it should be noted that the conservative modelling assumptions described above, mean that the predicted values likely overstate actual exposure. In real conditions:

- Turbines not upwind of the shelter at a given moment will contribute reduced noise compared to that modelled in the analysis undertaken;
- Wind masking effects, including turbulence around the shelter structure, can reduce audibility;
- Occupancy is intermittent and rarely associated with long, uninterrupted quiet periods;
- Outdoor noise exposure is limited and mobile, as herders do not remain fixed at the shelter for extended durations.

Overall, the predicted noise levels at NL-2 are expected to cause nuisance and potentially lead to sleep disturbance. The impact at this receptor is therefore assessed as Moderate.

Movable Grazing Shelters/Wagons – NA4, 10 & 11

These structures are temporary, repositioned as grazing patterns shift, and are used largely for short periods of rest, storage, weather protection and sleep. They are considered to be lower sensitivity receptors, however they are used throughout the grazing season for night-time occupancy but are not classified as residential dwellings.

Although not specifically modelled for, the worst-case modelled turbine noise levels at these locations are predicted to be similar to those experienced by the fixed grazing-season shelter (NL-2) at around 50 dB(A) LAeq which is above the WBG/WHO guideline night-time value of 45 dB(A). Although this guideline formally applies to permanent residential buildings, it offers a useful benchmark for evaluating potential sleep disturbance should the shelter be used overnight.

Similarly the baseline noise measurements within the WPP area where these movable shelters are located have a very low ambient noise levels at around 30 dB(A) even during windier conditions when WTGs are operating and turbine noise will therefore constitute a noticeable contribution to the acoustic environment during periods of use.

Although this suggests a perceptible change in noise levels under worst-case modelled conditions, it

should be noted that the actual exposure at these receptors is likely to be considerably lower than the model outputs, primarily because of their intermittent use and transient nature. In practice:

- Only turbines located upwind or crosswind of a given shelter at a specific moment will meaningfully contribute to sound levels
- Wind masking—including turbulence around the wagon and livestock noise—typically reduces audibility of turbine sound
- Herders move these shelters frequently, meaning they are not tied to a fixed location of maximum exposure
- Herders spend substantial amounts of time outside and moving across the landscape, rather than remaining at or inside the shelters.

Based on the Envision 11 MW turbine sound power levels, the predicted distance to the 55 dB(A) WBG/WHO daytime noise guideline is approximately 300–350 m. This contour lies within the WBG EHS Guideline for Wind Energy's recommended safety setback distance of 1.5 times turbine height, which for this turbine is around 375 m. Although the safety setback is not a noise criterion, the fact that the 55 dB(A) noise contour falls inside this boundary indicates that daytime noise levels outside the safety zone will be below the residential daytime guideline, and therefore daytime nuisance for land users within the WPP area is expected to be low.

Given these factors, the likelihood of sustained exposure to the conservative worst-case predicted noise levels is low. While turbine noise may be audible at times and exceed background noise levels, the impact is expected to be limited, intermittent, and not materially disruptive to herding activities or temporary rest. However, these levels of noise can lead to some sleep disturbance.

Specific consultation will be required with the users of these movable shelters to ensure they are fully informed of the potential elevated noise levels that they may experience. Acoustic insulation may offer a reduction in internal noise levels to degree that would allow for undisturbed sleep and this option should be discussed with the relevant PAP.

Overall, noise impacts at these receptors are also assessed as Moderate.

Summer camp – NA-6

The Summer Camp (NA-6) is located just within the 4 km AoI defined for the operational noise assessment. The facility consists of several recreational buildings historically used for seasonal leisure and company activities. The camp is not currently in active use and has no permanent residents. When occupied, use is typically daytime-focused, intermittent, and seasonal in nature. Accordingly, the receptor is considered low sensitivity within the noise impact assessment methodology.

The predicted worst-case turbine noise level at NA-6 is approximately 33.9 dB(A) LAeq, reflecting the significant separation distance from the nearest WTG. This level is significantly below the WHO night-time external guideline value of 45 dB(A) for residential outdoor areas and is fully compliant with WBG EHS absolute noise limits.

For the noise impact assessment, daytime noise levels were selected for NA-6 due to the very low wind speeds (0.5 m/s average) experienced during the night-time baseline monitoring period. Such low wind speed will result in very low background noise levels from vegetation and are therefore likely to introduce an overly conservative representation of baseline noise levels. Even if temporary overnight use were to occur in future, the predicted sound level remains well within a range that is unlikely to

cause sleep disturbance or annoyance.

The measured background noise level of 32.1 dB(A) LAeq with a predicted WTG noise level of 33.9 dB(A) (LAeq) gives a calculated total dB(A) (WTGs + Baseline ambient) (LAeq) of 36.1 dB(A) LAeq which is +4.0 dB(A) above background, and therefore marginally exceeds the <+3 dB(A) above background limit of the WBG EHS Guidelines.

Although baseline noise conditions in the vicinity of the camp are very low during calm periods, at moderate to higher wind speeds, which are required for turbines to operate and therefore generate noise, natural wind-generated noise across the steppe and vegetation movement would mask turbine sound to a considerable degree, further reducing perceptibility.

Considering the conservative modelling assumptions described above, including downwind propagation from all WTGs and maximum turbine sound power levels compared to baseline noise levels collected during low wind speed conditions, the predicted level of 33.9 dB(A) represents a highly precautionary scenario. In real-world conditions, actual turbine audibility at this location is expected to be minimal, and significant disturbance is highly unlikely.

Given its distance from the WPP, non-residential and intermittent use, and the low predicted noise levels, operational noise impacts at NA-6 are assessed as Insignificant.

Summary of Operational Noise Impacts

The assessment indicates that operational noise impacts at the nearest permanent residential settlement, Ushbas, are limited, with predicted levels remaining below relevant WBG/WHO absolute guidelines and only marginally above background +3dB(A) criterion under the most conservative modelling scenario. At Kamar Aulie, a culturally significant but non-residential site, predicted turbine noise levels are also below the 45 dB(A) guideline and impacts are assessed as Minor. Receptors within the WPP area associated with grazing activities, including the fixed shelter and movable grazing wagons, are located closer to the turbines and therefore will experience higher noise levels which may reach around 50 dB(A) LAeq, exceeding the WHO night-time external guideline of 45 dB(A) and therefore presenting a potential risk of sleep disturbance where occasional overnight use occurs. No perceptible impact is predicted at the summer camp. The table below summarises the sensitivity, magnitude and significance of impacts for all assessed receptors.

Activity/Impact/Aspect					
WTG operational noise Impact					
Type	**Duration**	**Extent**	**Scale of Impact**	**Frequency**	**Likelihood (unplanned events)**
Direct	Long-term	Local	Distinguishable	Intermittent	N/A

Receptor	**Sensitivity**	**Magnitude**	**Significance of Impact**
Ushbas – Closest Representative Dwelling (NL-1)	High	Small	Moderate
Kamar Aulie Sacred Site (Shrine and Rest Area) - culturally significant but non-residential, intermittent use (NA9)	Hight	Small	Moderate
Grazing-Season Shelter (Fixed Building) - non-residential, intermittent seasonal use (NL-2)	Medium	Medium	Moderate
Movable Grazing Shelters/Wagons - non-residential, movable structures used intermittently and easily re-oriented by occupants	Medium	Medium	Moderate

Summer Camp	Medium	Small	Minor

11.5Mitigation, Management & Residual Impacts

11.5.1 Construction Phase

The table below presents a summary of the mitigation and management measures required to minimise noise and vibration impacts associated with construction activities. It is structured around the key activity groups assessed in the preceding sections and identifies the pre-mitigation significance, the specific measures to be implemented, and the expected residual significance once mitigation is applied. The measures reflect good international industry practice, comply with the WBG EHS Guidelines, and are appropriate to the rural and sparsely populated context of the Project. These commitments will be incorporated into the Contractor's Construction Environmental and Social Management Plan (CESMP) and relevant method statements to ensure consistent implementation throughout the construction period.

Activity/Aspect	Pre- mitigation	Mitigation and Management Measures	Residual Significance
General Construction Noise & Vibration (Earthworks, site preparation, WTG/BESS/Substation foundations, cable trenching, internal access tracks, tower erection, turbine assembly, equipment installation, reinstatement/demobilisation) General construction noise and vibration from mobile plant, excavation equipment, cranes, generators, trenching equipment and installation tools.	Minor	• Restrict all works to daytime hours. • Maintain construction plant and machinery in good working order, with functioning silencers. • Avoid unnecessary idling and throttle use near receptor areas. • Use broadband reversing alarms where practicable. • Notify herders and farmers of daily work locations and activities. • Implement access control or temporary fencing where construction zones intersect grazing areas. • Reinstate disturbed areas promptly following completion of works. • Maintain communication channels with local communities through the grievance mechanism. • Prepare and implement a Noise Management Plan as part of the CESMP, consolidating all noise mitigation, monitoring, complaint response and corrective action measures, and ensuring clear roles, responsibilities and reporting procedures are defined. • Restrict routine construction activities generating elevated noise levels to defined daytime working hours (typically 07:00–19:00), with no planned night-time works close to sensitive receptors unless otherwise agreed with relevant authorities and affected stakeholders, and subject to appropriate additional controls.	Insignificant - Minor
Blasting Activities (WTG foundations only; not	Minor	• Undertake blasting only under an approved blasting procedure and permit-to-work system. • Implement minimum exclusion zones of 200–300 m for all personnel and livestock.	Minor

Activity/Aspect	Pre- mitigation	Mitigation and Management Measures	Residual Significance
anticipated for OHTL foundations) Short-duration airblast noise and ground vibration from controlled blasting and post-blast rock handling.		• Ensure that the final WTG micrositing confirms that no archaeological or cultural heritage assets, including burial mounds, are located within at least 200 m of any WTG foundation requiring blasting. • Provide pre-blast notification to herders and farmers within or near the WPP. • Deploy observers to maintain exclusion-zone clearance. • Use audible pre-blast and all-clear signals. • Use conservative charge sizes and stemming appropriate to site geology. • Conduct blasting during daylight hours only (typically 07:00-19:00). • Monitor vibration where required. • EPC Contractor to develop Blasting Management Plan/Procedure for approval by the Client.	
Construction Traffic & Transport of Components (HGVs, oversize loads, worker transport, logistics movements) Noise and minor vibration from construction traffic along public roads, access tracks and internal WPP routes.	Minor	• Restrict deliveries and heavy vehicle movements to daytime hours. • Define and enforce approved delivery routes. • Implement speed limits, avoid convoys through communities and ensure safe driving practices. • Maintain vehicles with functional exhaust silencers. • Provide notice to communities for exceptional or oversize deliveries. • Install signage at crossing points where haul routes intersect grazing or farmland. • Ensure drivers are briefed on local conditions and interactions with livestock. • Implement traffic management and marshals at road crossings where conductor stringing intersects public roads.	Minor
OHTL Construction Activities (Tower foundations, tower erection, conductor stringing) Noise and vibration from tower excavation, crane use, stringing equipment, and machinery movement along the OHTL corridor.	Minor	• Restrict tower erection and stringing works to daytime hours. • Position winches, pullers and generators as far from dwellings as practicable. • Notify landowners and land users when the work front is approaching their area. • Maintain plant and equipment in good condition to minimise noise. • Install temporary access control and signage at active tower sites. • Reinstate disturbed ground surfaces once construction is complete.	Minor

Implementation of the above measures will ensure that construction-phase noise and vibration are effectively managed and remain within acceptable levels for all surrounding receptors. With these controls in place, residual impacts are expected to be low, temporary and confined to the immediate vicinity of active work areas, and no significant adverse effects are anticipated during the construction period.

11.5.2 Operation Phase

The primary performance standard for operational noise is the WBG/WHO night-time outdoor guideline of 45 dB(A) LAeq, applicable to permanent residential receptors. The operational noise mitigation strategy is therefore centred on ensuring compliance at all non-consenting dwellings, particularly Ushbas, through a combination of layout optimisation, turbine selection and verification modelling. The principal mitigation measures are summarised below.

WTG Layout Optimisation and Setbacks

The Project is designed for a total installed capacity of approximately 1.1 GW. However, the base case WTG layout modelled for this assessment includes a total of 140 x Envision 11 MW WTGs. Therefore, as mentioned previously, the model results are very much based on an over conservative scenario. In reality, either smaller WTGs will be used, which are inherently quieter, or if the larger WTGs are selected then there would be fewer WTGs. With the currently modelled assumption of 11 MW WTGs, the total required number of turbines would be reduced by 40 leaving 100 WTGs to achieve the target capacity; this provides significant room for noise optimisation and reduction of noise levels at key receptor locations. The final layout selection should therefore prioritize design options that maximize separation distances/setbacks between the WTGs and key sensitive receptors.

The modelling confirms that adjustments to the WTG layout are the principal means of mitigation for the closest permanent receptor, Ushbas (NL-1). As discussed previously, sensitivity modelling has been undertaken to assess the impact on noise levels, including the targeted removal of 18 WTGs from the current layout that are in close proximity to NL-1; this demonstrated a significant reduction in noise exposure (maximum noise levels below 35 dB(A) L_{Aeq}) at the NL-1 receptor location, as shown in Figure 10-20. A further scenario where smaller quitter turbine models are selected was also modelled, and this showed significant reduction in predicted noise levels at key sensitive receptors, with full compliance with WBG/WHO noise standards predicted at the key sensitive receptor of NL-1. This demonstrates that reduction in noise levels at this main sensitive receptor can be achieved to ensure full compliance with all relevant standards through careful layout adjustments, setbacks, and turbine selection.

Layout optimisation could also consider potential reductions in turbine numbers in areas where movable grazing shelters are frequently positioned. However, the overall optimization of the final WTG layout will need to balance noise compliance with other environmental and social factors, as well as technical considerations.

Landowner Waivers for Noise Limits

The Project will adhere to the 45 dBA limit as the regulatory compliance threshold for all permanent residential receptors. In line with normal industry practice, consenting landowners who have a receptor dwelling within the modelled 45 dBA contour may be allowed to waive the Project's internal noise limits, provided a formal agreement is reached with the Project Proponent. Notwithstanding any waivers, noise levels should not exceed 45 dBA at night for any non-consenting, non-project-associated receptor.

Final Noise Modelling

A final detailed noise propagation model will be run using the specific technical data for the final approved selected WTG model and Project layout, in order to demonstrate compliance with the 45 dBA limit prior to the construction phase, as well as confirm final predicted noise impact, and inform any further optimisation that may be required prior to construction. As part of this process, the Project may also consider undertaking supplementary baseline noise measurements at locations closer to residential

properties, to further verify representativeness of existing data and support validation of the final noise model.

Grazing Receptors (Permanent Shelter and Movable Wagons)

As discussed in Section 10.4.2.6 operational noise within the WPP area may affect seasonal grazing receptors, including the fixed shelter (NL-2) and movable wagons used for overnight stays, with predicted night-time noise levels within the WPP area occasionally exceeding WHO external guideline value of 45 dB(A) LAeq, which is intended to limit sleep disturbance based on achieving an internal sleep environment of approximately 30 dB(A) within bedrooms. However, these receptors differ fundamentally from permanent residential dwellings in terms of occupancy pattern and structural characteristics.

The fixed shelter has been avoided in the Project layout and is not expected to require demolition. However, due to its location within the WPP area, its continued use for overnight accommodation without undisturbed sleep due to noise may potentially not be feasible following full WTG operation. The extent and significance of this potential impact will be verified through confirmatory noise modelling based on the final WTG model and layout, followed by operational noise monitoring during early operation. These confirmation steps will inform the determination of proportionate and feasible mitigation or compensation measures for this receptor, to be agreed and implemented in consultation with the structure owner.

Potential mitigation may consist of provision of noise insulation for the structure, while compensation may consist of covering the full replacement cost of materials to rebuild a comparable structure, subject to final valuation. Alternatively, the structure owner is also eligible for wagon-related livelihood restoration measures under the LRP process. Accordingly, operational noise impacts at this location may be addressed either through technical acoustic mitigation or through compensation and livelihood restoration, depending on the confirmed level of impact and the outcomes of consultations with the affected PAP.. Implementation of these measures will be monitored under the LRP.

For PAPs using movable wagons for seasonal overnight stays, there remains uncertainty regarding the actual effect of turbine noise on sleep. Internal noise levels within wagons, particularly under windy conditions, are currently unknown and may already be elevated due to wind-induced noise on the structure. In addition, final WTG layout and turbine model selection remain to be confirmed, and individual sensitivity to noise is likely to vary. Therefore, an adaptive management approach will be implemented during operations, as set out in the LRP; this approach will include:

- Confirmation modelling based on the final approved WTG layout and turbine model;
- A defined operational noise monitoring period (e.g. one grazing season) within selected wagons;
- Targeted consultation with affected PAPs, including discussion of their current overnight sleeping conditions, particularly during windy conditions;
- Agreement and implementation of proportionate mitigation or compensation measures tailored to individual circumstances.

Potential measures may include relocation of wagons within plots, provision of improved or replacement wagons, including feasible acoustic insulation measures, or alternative livelihood-based compensation measures agreed with PAPs. Alternative solutions (for example, enclosed sheds for secure overnight housing of animals, enabling PAPs to sleep at alternative locations) may also be considered where preferred by PAPs.

Avoidance through layout optimisation will be pursued where feasible in line with the mitigation

hierarchy; however, such measures cannot guarantee achievement of a specific internal noise level within each wagon. The LRP includes a dedicated budget to implement monitoring and agreed mitigation or compensation measures during operations. Residual impacts will therefore be managed through structured monitoring, consultation and adaptive response rather than through predictive modelling and mitigation alone.

The following table summarises the mitigation and management measures proposed for each identified receptor. Measures focus on WTG layout refinements, receptor-level awareness, monitoring during the early operational phase, and simple physical or behavioural interventions where these are appropriate. These actions should be integrated into the Operational ESMMP and the Project's engagement processes to ensure continued responsiveness to community needs

Sensitive Receptor	Pre- mitigation	Mitigation and Management Measures	Residual Significance
General Measures (Applicable to All Receptors)	*	• Implement final layout optimisation to maximise setbacks from sensitive receptors. • Select quieter WTG variants where there is an option. • Undertake final noise modelling with the selected WTG type and the final layout to confirm compliance with WBG/WHO limits prior to construction, and consider undertaking supplementary baseline noise measurements at locations closer to residential properties to further support validation of the final noise model and confirm representativeness of baseline conditions. • Undertake post-commissioning noise performance testing to validate modelling assumptions. • Establish an operational noise monitoring programme during early operation. • Maintain a complaint response and engagement mechanism; record, investigate and respond to noise grievances, including follow-up monitoring. • Investigate and correct any exceedances through operational adjustments (e.g. sound modes), turbine control or other feasible mitigation. • Ensure O&M teams receive training on noise awareness and operational limits. • Prepare and implement a Noise Management Plan as part of the OESMS, consolidating all noise mitigation, monitoring, complaint response and corrective action measures, and ensuring clear roles, responsibilities and reporting procedures are defined. In the event that detailed operational noise modelling or post-commissioning monitoring indicates a risk of non-compliance with applicable noise standards at permanent sensitive receptors, including Ushbas village, Kamar Aulie or the Ushbas cemetery, additional operational noise controls will be implemented as required. These measures may include: • Targeted derating or operational curtailment of individual WTGs during specific wind speed and wind direction conditions where elevated noise levels are predicted to occur at sensitive receptors; • Specification of low-noise turbine configurations, including the use of serrated (saw-tooth) trailing edges on turbine blades, where required to reduce aerodynamic noise emissions; and • Refinement of turbine operational modes through manufacturer-provided noise-reduction settings, applied selectively to turbines influencing the identified receptors. These measures would be implemented in coordination with the turbine supplier and informed	-

Sensitive Receptor	Pre- mitigation	Mitigation and Management Measures	Residual Significance
		by final noise modelling and operational monitoring results, ensuring that operational noise impacts remain within applicable standards while minimising effects on energy yield. • Implement agreed mitigation or compensation measures through the LRP framework, supported by a dedicated budget for monitoring and adaptive response during operations.	
Closest Residential Area (Ushbas – NL-1)	Minor - Moderate	• Avoid placement of WTGs in the closest positions to Ushbas. • Where possible, further layout optimisation to prioritise targeted turbine removal/relocation near Ushbas to reduce cumulative exposure. • Confirm compliance with the 45 dB(A) night-time guideline via final noise modelling.	Insignificant - Minor
Kamar Aulie Sacred Site (Shrine and Rest Area – NA9)	Minor	• No receptor-specific mitigation required given low predicted levels and intermittent use. • Maintain general operational monitoring and grievance mechanism.	Insignificant - Minor
Grazing-Season Shelter (Fixed Building – NL-2)	Moderate	• Inform NL-2 structure owner of expected operational noise conditions during pre-operation and ongoing engagement. Engage directly regarding predicted noise levels. • Undertake confirmation noise modelling based on the final approved WTG layout and turbine model prior to operation. • Conduct consultation with affected PAP regarding current overnight sleeping conditions, including experience during windy periods. • Undertake an operational noise monitoring programme (e.g. one grazing season) at the receptor as part of an adaptive management approach. • Develop and implement specific operational noise impacts mitigation and compensation at NL-2 either through feasible technical acoustic mitigation or through full replacement compensation and livelihood restoration measures as defined in the LRP, depending on the confirmed level of impact and the outcomes of consultations with the affected PAP. In case of provision of compensation for rebuilding a comparable structure or provision of wagon-related livelihood restoration support, the structure will not continue to function as an operational overnight receptor within the WPP area. Accordingly, no further technical noise mitigation measures would be required. Implementation of compensation and restoration measures will be monitored under the LRP. • Maintain ongoing communication and accessible noise-related grievance mechanism with commitment to verification and corrective actions.	Insignificant-minor (following mitigation or full replacement compensation under LRP)

Sensitive Receptor	Pre- mitigation	Mitigation and Management Measures	Residual Significance
Movable Grazing Shelters/Wagons	Moderate	• Undertake confirmation noise modelling based on the final approved WTG layout and turbine model prior to operation. • Conduct targeted consultation with affected PAPs regarding current overnight sleeping conditions, including experience during windy periods. • Undertake operational noise monitoring programme (e.g. one grazing season) within selected wagons as part of an adaptive management approach. • Develop and implement household-specific compensation action plans in consultation with PAPs where monitoring confirms material disturbance. • Inform herders of expected noise levels and typical propagation patterns, including the 375 m WBG safety "setback" distance. • Provide simple acoustic improvements for movable wagons used for occasional overnight stays (e.g. sealing gaps, lightweight insulation, or replacement wagons if appropriate). • Provide operational awareness training for site staff and herders regarding noise variability, wind masking and shelter positioning. • Maintain communication and accessible noise grievance channels.	Minor - Moderate
Summer Camp (NA-6)	Insignificant	• No receptor-specific mitigation required given low predicted levels and non-residential, intermittent use. • General operational monitoring to be maintained.	Insignificant

With implementation of the above mitigation and management measures, particularly final layout optimisation, verification modelling using the selected WTG model, and targeted engagement with seasonal land users, residual operational noise impacts are expected to remain Minor to Moderate for grazers who stay overnight within the WPP area, reflecting their closer proximity to turbines and the potential for noise levels to approach or exceed 45 dB(A). For permanent residential receptors, including Ushbas, residual noise impacts are anticipated to remain Minor to Insignificant, subject to confirmation through final noise modelling undertaken once the turbine model and optimised layout have been confirmed.

12 Shadow Flicker

12.1Introduction and Overview of Assessment Methodology

This section presents the approach adopted for the assessment of potential shadow-flicker impacts associated with the operation of the Project; this impact is only relevant to the operation of WTGs. Shadow flicker is the periodic variation in light intensity experienced when the rotating blades of a WTG pass between the sun and an observer, casting moving shadows across dwellings or other sensitive locations. It occurs only under specific condition, as follows:

- when the sun is shining,
- the WTG is operational, and
- the observer is within a sector where the WTG rotor is positioned between the sun and the receptor.

The purpose of the shadow-flicker assessment is to identify and evaluate the likelihood, duration, and significance of potential shadow-flicker effects on nearby sensitive receptors, and to recommend mitigation or management measures where necessary to ensure compliance with Good International Industry Practice (GIIP), national requirements, and lender standards.

Shadow flicker is relevant only during the operational phase of the Project, as no construction-related activities can generate this effect.

12.1.1 Overview of Methodology

The assessment covers all WTGs proposed within the Jambyl WPP layout and identifies residential or other sensitive receptors within the potential shadow-flicker zone of influence. The modelling is undertaken using WindPRO software, applying the Shadow Module to simulate the theoretical extent and duration of shadow flicker based on project-specific WTG geometry and site conditions. The worst-case WTG model selected for analysis is the Envision EN206-11.0 MW, with a hub height of 145 m and a rotor diameter of 210 m; this represents the maximum swept-area configuration expected within the Project and therefore provides a conservative prediction of potential effects.

Table 11-1: WTG specifications considered for shadow flicker modelling

Category	Data
Manufacturer and model	Envision EN206-11.0MW
Capacity/rated power (MW)	11.0
Hub Height (m)	145
Rotor Diameter (m)	210

The assessment follows the general methodology outlined in the Project's Scoping Report and comparable GIIP studies:

- **Model Setup**: Input parameters include WTG coordinates, hub height, rotor diameter, topography, and the geographic position of the site (latitude and longitude).
- **Identification of Receptors**: Receptors are mapped within a preliminary radius of 2.5 km from the nearest WTG, consistent with international guidance. Residential buildings, schools, healthcare facilities, and other locations where occupants could be affected are digitised from high-

resolution satellite imagery and verified against local land-use data and community consultation records.

- **Model Execution**: The WindPRO Shadow module calculates the annual duration of potential shadow flicker at each receptor under:
  - "Worst-case" conditions (sun shining, WTG operational, no cloud cover, windows facing WTGs, rotor always perpendicular to the sun, no vegetation screening); and
  - "Real-case" conditions, adjusting for local meteorology and average sunshine hours.
- **Evaluation of Significance**: Modelled shadow duration (hours per year and minutes per day) is compared against international benchmarks, typically: 30 hours per year and 30 minutes per day (IFC EHS Guidelines and European best practice). Receptors predicted to exceed these thresholds are classed as experiencing potentially significant effects.
- **Mitigation and Management**: Where exceedances are predicted, site-specific mitigation is proposed, including micro-siting of WTGs, or use of screening vegetation or window treatments at affected dwellings. All measures will be incorporated into the Project's Environmental and Social Management Plan (ESMP) and operational Environmental and Social Monitoring Programme.
- **Residual Assessment**: Following the application of feasible mitigation, residual impacts will be re-evaluated and their significance classified according to the ESIA's standard impact-significance matrix (combining receptor sensitivity and magnitude of effect).

Exceedance of the IFC shadow flicker thresholds under worst-case modelling is used in this assessment as a screening criterion to identify receptors requiring further evaluation. In line with the ESIA methodology presented in Chapter 4, final impact significance is determined through consideration of both impact magnitude and receptor sensitivity, rather than threshold exceedance alone.

12.2Applicable Requirements & Standards

12.2.1 National Regulations

Kazakhstan's Environmental Code (2021, as amended 2023) provides the overarching framework for environmental protection and impact assessment. The Code establishes the requirement to identify, evaluate and mitigate environmental and social impacts arising from development projects. Shadow flicker is not addressed explicitly under national legislation; however, its assessment is covered implicitly within the Environmental Impact Assessment (EIA) process through the requirement to evaluate impacts on human health, well-being, and living conditions, including nuisance effects associated with light and visual disturbance.

Key provisions relevant to the assessment include:

- Articles 278–288 of the Environmental Code: require that the EIA consider the influence of projects on the population and landscape, and evaluate aesthetic and comfort impacts.
- Sanitary-Epidemiological Rules of the Ministry of Health (2021): establish general requirements for the protection of residential areas from physical and visual disturbance factors associated with industrial facilities.
- Construction Norms SN 2.04-03-2011 (Planning and Development of Settlements): require that wind-energy projects maintain appropriate sanitary-protection distances from residential areas to prevent adverse effects such as noise, shadow flicker or light reflection.

No national quantitative limit values are defined for shadow flicker exposure in Kazakhstan; therefore, international benchmarks recognised under GIIP are adopted to ensure the Project meets both domestic

and lender expectations.

12.3Lender Requirements

Within IFC Performance Standards (2012) the following are considered relevant:

- PS 1 – Assessment and Management of Environmental and Social Risks and Impacts: requires identification and evaluation of all project-related environmental and social risks, including those affecting the amenity and comfort of nearby communities.
- PS 3 – Resource Efficiency and Pollution Prevention: obliges proponents to avoid or minimise any adverse impacts from project emissions and physical effects such as light or shadow flicker.

The IFC Environmental, Health and Safety (EHS) Guidelines for Wind Energy (2015) specify that shadow-flicker impacts under normal operating conditions should be limited to:

- 30 hours per year and
- 30 minutes per day at any dwelling or other sensitive receptor.

The above standards are the primary evaluation criterion relevant for the Project, as there are no specific limits defined under national legislation or within other relevant international Lender standards.

12.4Area of Influence and Receptors

This section provides an overview of the environmental and land-use context relevant to the assessment of shadow flicker, including the defined area of influence and the identification of sensitive receptors within and surrounding the WPP site. It summarises key features of the existing setting that influence the potential for shadow-flicker occurrence, such as settlement distribution, topography, and land cover.

12.4.1 Area of Influence

The Area of Influence (AoI) for the shadow-flicker assessment represents the geographical area within which moving WTG blades could cause perceptible variations in sunlight at residential or other sensitive receptors. Based on international practice and the spatial extent of potential flicker effects, it is generally accepted that at distances greater than 10 times rotor diameters from a WTG the potential for shadow flicker is very low[240], which in this case with an assumed WTG rotor diameter of 210 m, the impact could theoretically extend up to 2.10 km; therefore the AoI would generally be defined as a 2.1 km radius from each proposed WTG location. This extent reflects the maximum distance at which shadow flicker may remain theoretically detectable under clear-sky conditions for large-scale modern WTGs. Nevertheless, this analysis has been undertaken and presentation of shadow maps has been provided based on a 2.5 km radius from each WTG which results in a conservative over-estimation of shadow flicker impact.

Within this area, the assessment considers:

- All dwellings or occupied buildings, including permanent and seasonal residences;
- Community facilities such as schools, clinics, and places of worship; and
- Other structures or land uses where prolonged human presence could lead to nuisance or discomfort from shadow flicker (e.g. smallholdings, workplaces, or field shelters).

12.4.2 Sensitive Receptors

The WPP site is located on a plateau within the low Karatau mountain foothills of Jambyl Region,

[240] An update of the UK Shadow Flicker Evidence Base as reported for DECC by Parsons Brinckerhoff https://www.gov.uk/government/publications/update-of-uk-shadow-flicker-evidence-base

characterised by gently undulating terrain and isolated escarpments and semi-arid grazing land with sparse population density. Elevations vary between approximately 550 and 800 metres above sea level. The generally open steppe landscape across the plateau contains few obstacles such as trees or artificial structures capable of blocking direct sunlight or WTG blade shadows.

Sensitive receptors were identified using a combination of:

- GoogleEarth satellite imagery and topographic maps;
- Information gathered through community consultations and stakeholder engagement; and
- Observations from the 2024 and 2025 site visit and surveys.

Outside the plateau, several small rural settlements are present within the broader landscape. The nearest settlements are listed below, along with approximate distances measured from nearest WTG locations:

- Ushbas – approximately 2.1 km west of the nearest WTG;;
- 'Summer Camp' and its associated buildings - over 5 km east
- Turkestan – approximately 8 km north-west;
- Aktogay – approximately 10 km east.

Of these, only Ushbas lies close to the 2.5 km shadow-flicker AoI, defined above, and therefore it was included in the receptor screening. Ushbas village includes several homes and farm buildings located near small tree belts, gardens, and irrigated household plots. Many dwellings are partly screened by mature trees planted around properties, which provide partial shading from low-angle sunlight (see Figure 11-1 and Figure 11-2). Shadow-flicker modelling included two representative locations:

- N-1_Ushbas – the dwelling closest to the WPP; however, direct line-of-sight to turbines is partially screened by the local ridge.
- Alt_Ushbas – an alternate location within the village selected to avoid the topographic screening present at N-1_Ushbas and represent the highest potential exposure within the residential area.

The representative receptor locations within Ushbas village (N-1_Ushbas and Alt_Ushbas) were specifically selected to represent worst-case potential shadow flicker exposure, including the closest residential location and a location selected to avoid topographic screening effects.

No schools, health posts, or community centres were recorded within 2.5 km of the proposed WTGs.

A key non-residential but culturally sensitive receptor lies to the west of the site: Kamar Aulie, a sacred location situated adjacent to the Ushbas cemetery. The site has cultural, spiritual, and traditional significance for local communities and is visited periodically for prayer, healing, and rest (see Section 9 for more details). There are two elements to this receptor:

- Brick shrine structure – a small, walled, roofless structure used for short-duration ritual visits. Although the high perimeter walls restrict low-angle lateral sunlight and reduce direct exposure to turbine-related shadows, the open roof functions as a broad overhead aperture. As a result, any blade shadow passing across the roofline would manifest only as a diffuse, short-lived change in ambient light rather than a focused flicker event. Given the brief nature of visits and the diffuse lighting conditions inside the enclosure, the potential for shadow flicker to cause noticeable disturbance within the shrine is considered very low (see Figure 11-3 and Figure 11-4).
- Sacred spring and shaded rest/overnight area – located several metres below surrounding ground level within a sheltered stream valley. Visitors may rest, picnic, or spend short overnight stays under mature tree cover. The combination of (i) valley topography, (ii) steep rock formations, and

(iii) vegetation provides natural shielding from direct low-angle sunlight, significantly limiting the potential for shadow-flicker effects to be experienced in this location (see Figure 11-5 and Figure 11-6).

Although the site does not contain permanent residential dwellings, its cultural importance and intermittent presence of visitors necessitate its inclusion in the shadow-flicker assessment as sensitive receptor R7.

The shrine structure does not contain windows and is accessed via a single doorway. Based on site observations, the doorway is not oriented directly towards the WPP, although the assessment does not assume that the doorway is closed during use. The associated rest and overnight area comprises an outdoor location adjacent to a stream, with no enclosed or permanent structures present.

As discussed in Section 6, no permanent residential dwellings exist within the WPP project boundary. There is however one fixed seasonal building (R-13) is used periodically as a grazing-season shelter and lies approximately 1 km from the nearest WTG (see Figure 11-7 and Figure 11-8). R-13 is a permanent structure used seasonally in connection with grazing activities, including occasional overnight stays. It does not house permanent residents and is therefore classified as a non-residential receptor in line with the definitions set out in Chapter 4 and consistent with the treatment of seasonal herder shelters in the Social and Noise chapters.

Several movable grazing wagons were observed across the WPP area, used seasonally by herders during the grazing period (see Figure 11-9 and Figure 11-10). These lightweight structures typically contain a single small window and can be easily repositioned or re-oriented. Occupancy is temporary and intermittent, and the wagons are often located in lower-lying or naturally sheltered terrain. As their position and orientation can be adjusted by users, and because they do not contain permanent residents, these units are not considered primary sensitive receptors for shadow-flicker modelling. Any potential exposure can be readily avoided through simple user reorientation, if required.

The 4 receptor locations identified for detailed modelling are summarised in Table 11-2 below.

Table 11-2: Summary of shadow receptors analysed

Receptor	Easting (m) WGS84 UTM North Z42	Northing (m) WGS84 UTM North Z42	Distance to nearest WTG (m)	Description
R13	561,749	4,802,863	1,024	Fixed building – grazing season shelter
R7	556,908	4,804,833	1,608	Area for rest and overnight stay
N-1_Ushbas	556,352	4,806,061	1,953	Closest receptor in Ushbas village to the WTGs
Alt_Ushbas	556,189	4,806,012	2,105	Higher shadow impact location in Ushbas village avoiding topographic screening

The identified sensitive receptors within and around the WPP site are mapped in the figures presented with the WindPRO modelling results below in Section 11.5.1.

While vegetation and trees are described to characterise existing site conditions, the shadow flicker

assessment adopts a conservative worst-case approach and does not rely on vegetation screening, recognising that such features may change over the operational lifetime of the Project.

Figure 11-1: N-1_ Ushbas



Figure 11-2: Alt_ Ushbas – indication of dwelling



Figure 11-3: R-7 - Kamar Aulie Shrine #1



Figure 11-4: R-7 - Kamar Aulie Shrine #2



Figure 11-5: R-7 Rest Area #1 - Wide valley shot with stream



Figure 11-6: R-7 Rest Area #2 - Resting area under trees



Figure 11-7: R-13 receptor – north facing façade of building showing two windows



Figure 11-8: R-13 receptor – south facing façade of building showing no windows



Figure 11-9: Typical mobile herder wagons #1



Figure 11-10: Typical mobile herder wagons #2



12.5Potential Impacts

12.5.1 Shadow Flicker Model Results

The project is required to comply with WBG guidance thresholds for shadow flicker, which specify that exposure at sensitive receptors should not exceed 30 mins/day and 30 hr/yr based on an 'astronomic worst case' calculation; there are no national standards specifically relating to shadow flicker.

Meteorological data for the Jambyl region indicate:

- Average annual sunshine duration of approximately 2,800–3,000 hours[241], with the majority of clear-sky days occurring between April and September;
- Prevailing winds predominantly from the west and north-west; and
- Generally low cloud cover during summer months, increasing during winter when solar angles are low.

These conditions suggest that shadow-flicker effects, if experienced, would occur primarily during early morning or late afternoon in the spring and autumn months when the sun is low and angle aligns with

[241] Sunshine duration values are based on regional climatological data; no site-specific sunshine probability records were identified for the WPP area.

WTG blades relative to receptor positions.

Shadow flicker can only occur when all of the following conditions are met:

- The sun is shining (after dawn and before sunset);
- The WTG is located directly between the sun and the affected receptor; and
- The wind speed is sufficient to move the WTG blades and the WTG is operational.

Given the turbine dimensions considered for this assessment (hub height 145 m, rotor diameter 210 m), the maximum theoretical shadow reach can extend up to 2.1 km under low-angle sunlight. However, actual potential for nuisance is moderated by:

- the sparse distribution of receptors within this range,
- terrain screening from ridgelines and local depressions,
- vegetation shielding in parts of Ushbas and the Kamar Aulie valley, and
- non-residential and intermittent use patterns for receptors within WPP area.

A detailed worst-case shadow-flicker assessment was undertaken using EMD WindPRO Version 4.0, the industry-standard modelling software. The model applied intentionally conservative assumptions, including:

- continuous turbine operation;
- clear, unobstructed sunlight;
- no terrain or vegetation screening; and
- receptors assumed to have unrestricted exposure to all orientations.

Consistent with worst-case assessment principles, vegetation screening is not relied upon in the modelling or compliance assessment.

Worst-case raster maps showing predicted annual hours and maximum daily minutes of potential shadow flicker within 2.5 km of the WTGs are shown in Figure 11-11 and Figure 11-12. Isolines are also included which highlight the applicable IFC shadow flicker thresholds of 30 mins/day and 30 hr/yr. In addition, results have been calculated at the identified receptors and are included in Table 11-3 below.

Table 11-3: Worst case shadow flicker results

Receptor Name	Maximum shadow hours per year (h/yr)	Maximum shadow hours per day (h/day)	Below IFC h/yr shadow flicker threshold?	Below IFC h/day shadow flicker threshold?
R-7	47:23	0:28	No	Yes
R-13	208:48	1:27	No	No
N-1_Ushbas	8:55	0:18	Yes	Yes
Alt_Ushbas	24:44	0:23	Yes	Yes

Shadow-flicker modelling predicts that extensive parts of the WPP area, including areas used by grazers for occasional overnight stays, would experience annual exposure above IFC benchmark levels under a conservative, worst-case scenario.

Based on the outcome of these initial calculations, the fixed structure located within the WPP area (R-13), in addition to the area for rest and overnight stay (R-7), are predicted to be impacted by shadow flicker at levels that exceed IFC standards. Grazers that continue to use the moveable structures within the WPP

area may also be impacted by shadow flicker; however this is dependent on their location and as these are movable assets impacts can be avoided by relocating or reorientating these moveable assets.

In line with the IFC EHS Guidelines for Wind Energy, the assessment is based primarily on a conservative worst-case (geometric maximum) scenario, which assumes that turbines operate continuously whenever the sun is above the horizon, skies are clear, and there is an unobstructed line of sight between turbine and receptor. Predicted shadow-flicker durations under this worst-case scenario are compared directly with the international benchmark criteria of 30 hours per year and 30 minutes per day.

To account for the fact that not all residences will have windows facing towards all WTGs, the orientation and estimated size of windows has been considered for receptor R-13, which based on photos taken during a site visit show that windows are only present on one façade of the building, which faces approximately north (see Figure 11-7 and Figure 11-8). There are two windows located on the northern façade, and the building width is approximately 7.4m wide. It is not clear whether the two windows are for separate rooms or a single room within the building, therefore the whole façade has been modelled as a single window as summarised in Table 11-4 below which will result in a marginally conservative estimation of the shadow flicker impact.

Table 11-4: Details of R13-a – directional receptor for northern façade of building

Receptor name	Window width	Window height	Orientation	Inclination
R-13-a	7.5 m	1 m	~2 deg	Vertical

The results of the shadow flicker impact assessment on this updated receptor are provided in Table 11-5 below.

Table 11-5: Results of shadow flicker impact assessment for R13-a

Receptor Name	Maximum shadow hours per year (h/yr)	Maximum shadow hours per day (h/day)	Below IFC h/yr threshold?	Below IFC h/day threshold?
R-13-a	111:03	1:10	No	No

Whilst the worst case shadow flicker impact is reduced with more detailed modelling, the levels still exceed IFC thresholds.

In addition to the more accurate modelling of the windows at the receptor, it is possible to undertake a more probabilistic analysis of the likelihood of clear skies. Typically local sunshine probability data would be utilised to generate a “realistic case” scenario. However, no reliable, long-term sunshine probability dataset was available for the Project area, and the nearest station with such records lies several hundred kilometres away and is not climatically representative of the site. For this reason, a full realistic-case model was not undertaken. This does not affect the assessment, as IFC compliance must be based on the conservative worst-case scenario, and any realistic adjustment would only reduce predicted exposure.

Overall, it should also be noted that the results of worst-case scenario modelling can be considered to be conservative as:

- The WTGs will not always be rotating;
- The sun will not always be shining sufficiently (i.e. cloud cover may be present) between sunrise and sunset;
- The WTG rotors will not always be directed perpendicularly to the residences;

- Not all residences will have windows facing onto the wind farm; and
- Some dwellings may be screened by vegetation.

Figure 11-11: Shadow Flicker Minutes per Day Model Results – Worst Case Scenario

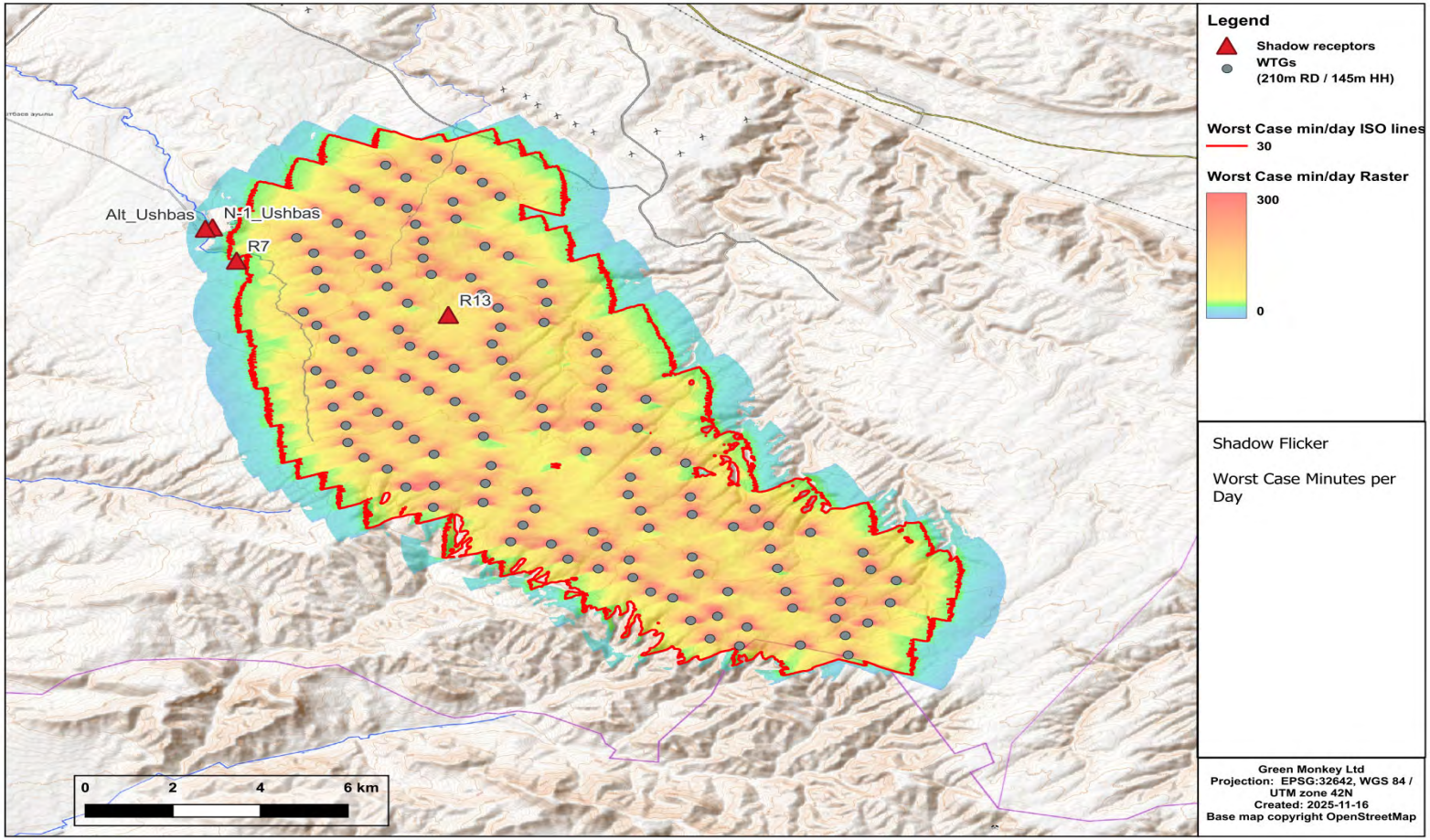
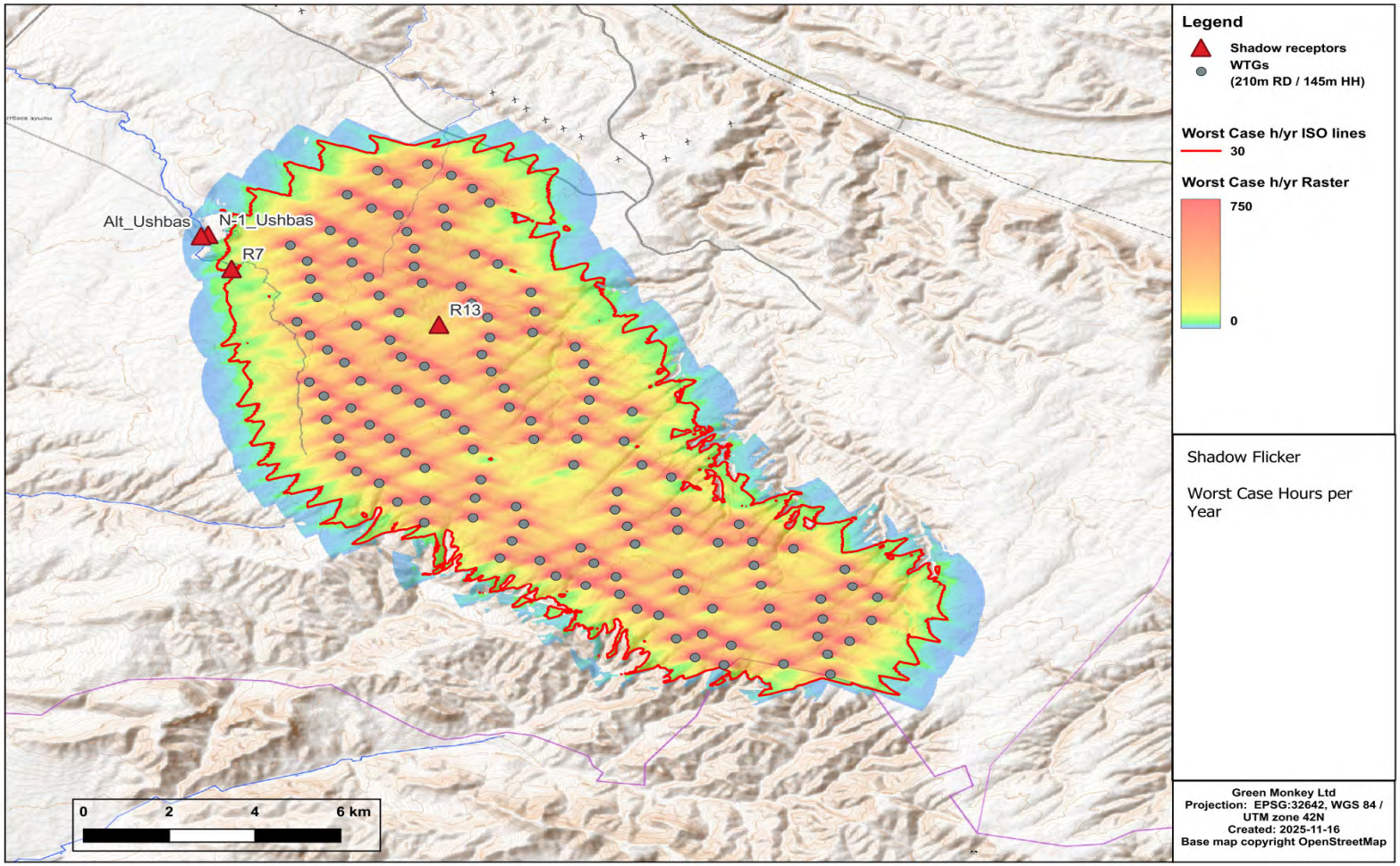


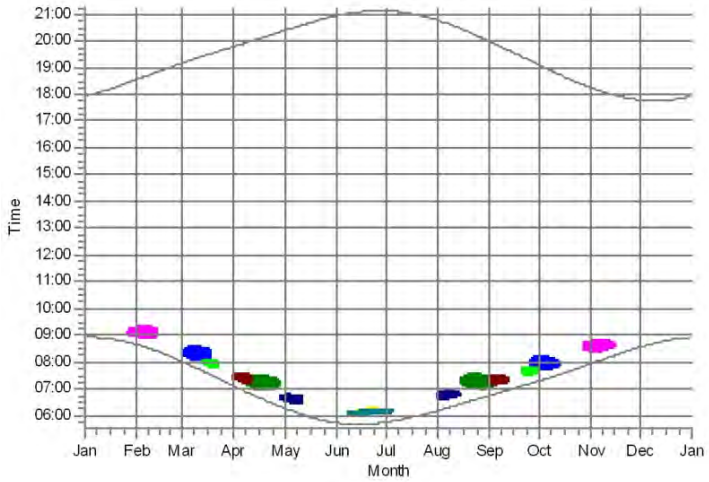
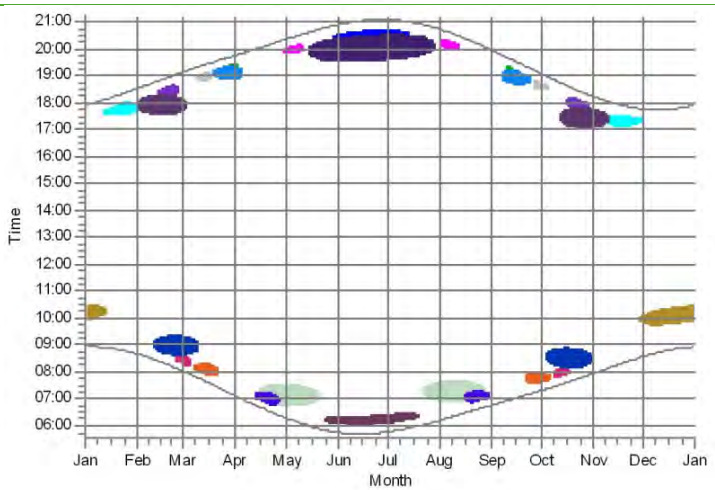
Figure 11-12: Shadow Flicker Hours per Year Model Results – Worst Case Scenario



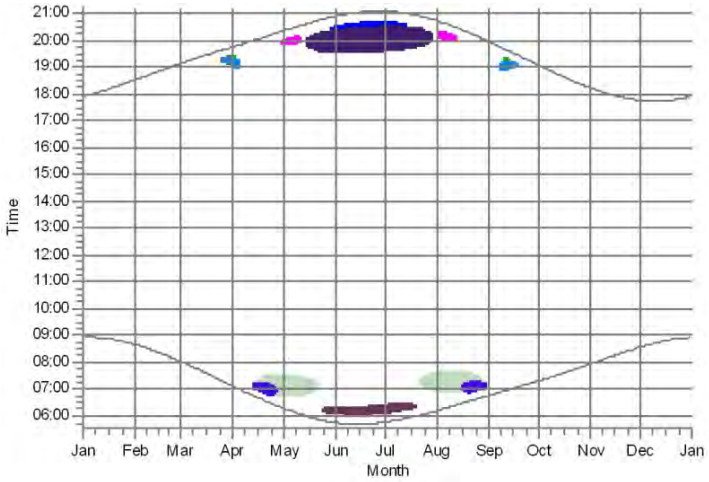
12.5.2 Graphical calendars

This section provides a graphical summary of the time of day and time of year that shadow flicker could potentially occur at the identified receptor locations. The colours on the calendars represent shadow flicker impact from different WTGs within the wind farm.

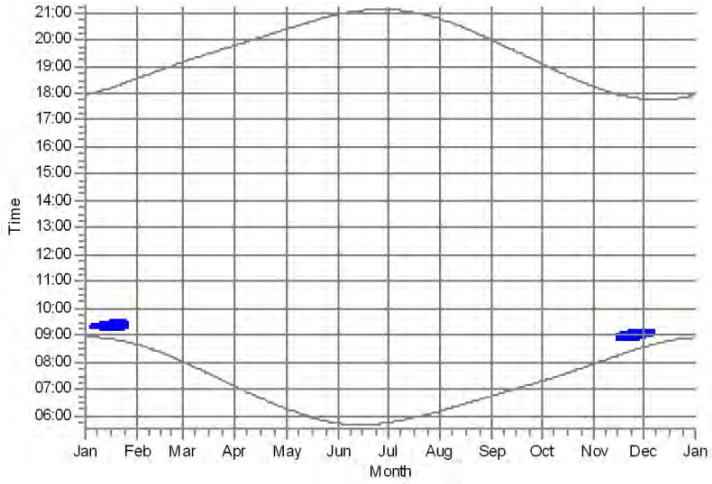
Figure 11-13: Graphical Summary of Shadow Flicker at Identified Receptors

Receptor and commentary	Graphical calendar
R7 **Impacted for typically less than one hour after sunrise from February through to December**	
R13 Impacted in the morning for up to 90 minutes after sunrise all year round in addition to in the evening for up to 100 minutes before sunset all year round	

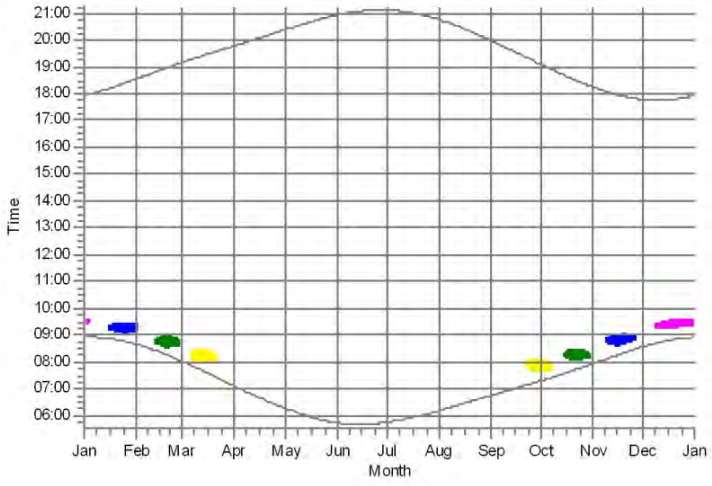
R13-a
As receptor R13 but with no shadow flicker exposure during the winter



N-1_Ushbas
Impacted for less than 60 minutes after sunrise in the winter



Alt_Ushbas
Impacted for less than 60 minutes after sunrise from late autumn through to early spring



12.5.3 Impact Assessment

This section evaluates the potential significance of predicted shadow–flicker effects at each identified receptor, based on the worst-case modelling results and the sensitivity and site specific nature of each identified receptor. Worst-case modelling represents the maximum theoretical exposure, assuming continuous sunshine, uninterrupted turbine operation, and no topographic or vegetation screening.

Realistic exposure will be notably lower due to cloud cover, vegetation screening and typical occupancy patterns. Receptor sensitivity and impact magnitude are defined and applied in accordance with the significance criteria set out in Chapter 4 (Assessment Methodology).

Receptor	Model Results	Discussion of Impact
R13 – Grazing-Season Shelter (Fixed Building)	208:48 h/year- exceeds IFC annual threshold 1:27 h/day- exceeds IFC daily threshold	R-13 is a simple, non-residential structure used periodically during the grazing season. Although the annual worst-case value exceeds the IFC benchmark, this is considered highly conservative because the structure is only briefly and intermittently occupied, has limited window openings, and is partially screened by local terrain. Note taking into consideration window locations modelling results show a reduction in shadow flicker impact to 111.03 h/yr and 1:10 h/day; however, this is still above IFC threshold. The sensitivity classification of R-13 is consistent with the characterisation of seasonal grazing shelters presented in the Social baseline and Noise assessment chapters. While worst-case modelling predicts exceedance of IFC thresholds at R-13, the receptor's low sensitivity and intermittent seasonal use mean that the resulting impact significance remains Minor Realistic exposure would occur only during short sunrise/sunset periods and would be substantially lower than the modelled geometric maximum.
R7 – Kamar Aulie Sacred Site (Shrine and Rest Area)	47:23 h/year - exceeds IFC annual threshold 0:28 h/day - below IFC daily threshold Should base it on R-13a results	R7 represents the Kamar Aulie sacred site, comprising (i) a walled, roofless shrine and (ii) a shaded valley with a sacred spring and defined resting/overnight areas. The worst-case model assigns high theoretical exposure because the receptor point is placed at an unobstructed location. However: • the shrine interior is shielded by high brick walls, preventing direct light entry; • the stream valley is located several metres below the surrounding terrain and is surrounded by dense tree cover; • there should be no direct line of sight to WTG blades from the areas where visitors gather; • visitor presence is intermittent and typically short-duration. Although vegetation and topography currently provide substantial screening at Kamar Aulie, impact significance has been assessed conservatively without assuming the long-term persistence of such features. Although Kamar Aulie is a culturally sensitive site, its sensitivity to shadow flicker as a nuisance effect is moderated by the absence of enclosed residential spaces and the short-duration, outdoor nature of use. Consequently, real-world exposure is expected to be minimal or zero, despite modelled exceedances. Importantly, shadow flicker does not affect the physical integrity or cultural value of the site.
N-1_Ushbas – Representative Dwelling (Topographically Screened)	8:55 h/year - below IFC threshold 0:18 h/day - below IFC threshold	N-1 is the closest dwelling to the WPP; however, field observations and WindPRO modelling confirm that a low ridge between the village and the WPP partially obstructs the sun–WTG–receptor geometry, reducing actual exposure. Trees surrounding household plots also provide periodic shading. The receptor therefore

		comfortably meets IFC annual and daily criteria.
Alt_Ushbas – Location Representing Maximum Potential Exposure	24:44 h/year - below IFC threshold 0:23 h/day - below IFC threshold	Alt_Ushbas was selected to represent the highest possible theoretical exposure within Ushbas village, avoiding the topographic screening present at N-1. Even under worst-case conditions, the annual and daily values remain below IFC standards. Considering typical dwelling orientation, vegetation shading and realistic sunshine hours, actual exposure will be significantly lower.
Movable Grazing Shelters/Wagons	Likely to exceed both IFC annual and daily thresholds, depending on location.	Although not fixed residential receptors, herders may occasionally spend time inside the wagons during early morning or evening periods when shadow flicker may theoretically occur. Unlike fixed dwellings, wagon occupants can experience flicker through the single window if the wagon is positioned with a direct line of sight to a turbine during low-angle sunlight. However, the ability to easily rotate the wagon, combined with surrounding micro-topography that often provides natural shielding, limits the likelihood and duration of any disturbance. Under realistic operating conditions—considering intermittent occupancy, shading from local terrain, and the ability to reorient the window away from turbines—exposure is expected to remain low.

Activity/Impact/Aspect					
WTG Shadow Flicker					
Type	**Duration**	**Extent**	**Scale of Impact**	**Frequency**	**Likelihood (unplanned events)**
Direct	Long-term	Local	Distinguishable	Intermiitent	N/A

Receptor	**Sensitivity**	**Magnitude**	**Significance of Impact**
R13 – Grazing-Season Shelter (Fixed Building) - non-residential, intermittent seasonal use	Low	Large	Moderate
R7 – Kamar Aulie Sacred Site (Shrine and Rest Area) - culturally significant but non-residential, intermittent use, real-world exposure is expected to be minimal	High	Small	Moderate
N-1_Ushbas – Representative Dwelling (Topographically Screened)	High	Small	Moderate
Alt_Ushbas – Location Representing Maximum Potential Exposure	High	Negligible/Small	Insignificant - Minor outside shadow flicker AoI and heavily screened
Movable Grazing Shelters/Wagons - non-residential, movable structure used intermittently and easily re-oriented by occupants	Low	Medium	Minor

The worst-case modelling showed exceedances at R-13 and R-7; however, these reflect conservative geometric assumptions rather than realistic experience as:

- Neither receptor contains permanent residents.
- Both are used intermittently.
- For R7, the sacred site's key use areas are effectively shielded from potential flicker.

All Ushbas village receptors remain below both daily and annual IFC thresholds.

Taking into account receptor sensitivity, occupancy patterns, verified topographic and vegetation screening, and the short periods during which flicker can occur, all predicted shadow-flicker impacts are assessed as Minor pre-mitigation and Negligible–Minor residual (see section below).

No turbine shutdown or design modifications are considered necessary based on the modelled results and field conditions.

12.6Mitigation, Management & Residual Impacts

The following table summarises the mitigation and management measures proposed for each identified receptor. Although worst-case modelling outputs are intentionally conservative, the Project has adopted a proportionate approach to mitigation based on receptor sensitivity, actual likely exposure considering local terrain and vegetation, and the intermittent nature of use at non-residential sites. Measures focus on receptor-level awareness, monitoring during the early operational phase, and simple physical or behavioural interventions where these are appropriate. These actions should be integrated into the Operational ESMP and the Project's engagement processes to ensure continued responsiveness to community needs.

Sensitive Receptor	Pre- mitigation	Mitigation and Management Measures	Residual Significance
General	-	• Include shadow flicker in the CLO communication programme, providing simple fact sheets explaining when flicker can occur and how it is managed. • Add shadow flicker as a monitored parameter in the Operational ESMP, with a mechanism to log and respond to any community concerns. • An Operational Shadow Flicker Management Plan will be implemented as part of the OESMP. This will include procedures for logging and investigating shadow flicker complaints through the grievance mechanism, undertaking site verification during likely shadow flicker periods, and implementing proportionate corrective actions where required.	-
R13 – Grazing-Season Shelter (Fixed Building)	Minor	• inform the shelter's users of predicted shadow-flicker patterns, particularly early morning and late afternoon periods. • Any concerns raised by seasonal users of this shelter in relation to shadow flicker to be managed through the Project's LRP and grievance mechanism, and CLO to maintain regular seasonal contact with the shelter's users to enable reporting of any nuisance. • Provide basic internal window coverings (e.g. curtains, cloth blinds, or reflective foil film) for use if minor disturbance occurs. • Offer to install a simple external shading element (e.g. timber/fabric awning) if requested by the owner to reduce low-angle sunlight. Note while IFC guidance identifies turbine shutdown algorithms as a potential mitigation for permanent residential receptors, their use is not considered proportionate for R-13 due to its non-residential, seasonal and intermittent occupancy. Alternative receptor-level measures and grievance-based management are therefore considered appropriate.	Negligible - Minor
R7 – Kamar Aulie Sacred Site (Shrine and Rest Area)	Minor- Negligible	• No structural mitigation required given the natural screening from vegetation and terrain.	Negligible

Sensitive Receptor	Pre- mitigation	Mitigation and Management Measures	Residual Significance
		• Conduct a site visit during the operational phase at times when shadow flicker is most likely to occur (spring/autumn sunrise/sunset) to observe and confirm that flicker does not affect areas used by visitors. If any flicker is observed at pilgrimage use areas, assess the need for proportionate receptor-level measures (e.g. cloth awning, additional shading vegetation). Such effects are considered unlikely. • CLO to maintain seasonal engagement with Ushbas residents and site users to allow reporting of any concerns.	
N-1_Ushbas – Representative Dwelling & Alt_Ushbas – Location Representing Maximum Potential Exposure	Negligible- Minor	• Monitor the light environment at the two representative dwellings during the first operational season through short, targeted visits during likely flicker periods (sunrise/sunset in spring and autumn). • CLO to maintain regular engagement with Ushbas residents to record and respond to any concerns. • No further mitigation should required, as exposure remains below IFC thresholds and existing vegetation around dwellings provides natural shading.	Negligible
Movable Grazing Shelters/Wagons	Minor	• Undertake awareness-raising with herders on how shadow flicker occurs and advise that wagons can be rotated so that the window does not face the turbines during sunrise/sunset. • Provide simple internal window coverings (e.g. curtains/blinds) to reduce any potential disturbance. • Any concerns raised by seasonal users of grazing shelters in relation to shadow flicker to be managed through the Project's LRP and grievance mechanism, and the CLO to maintain regular seasonal contact with the grazers using wagons in the WPP area, and log any reported concerns.	Negligible- Minor

Overall, with the implementation of the proposed mitigation and monitoring measures, residual shadow-flicker impacts across all receptors are assessed as negligible, and no significant adverse effects are expected during the operational phase of the Project.

13 Landscape and Visual

13.1 Introduction and Overview of Assessment Methodology

This section presents the assessment of potential landscape and visual impacts associated with the construction and operation of the Project, with a particular focus regarding potential impacts associated with the introduction of new WTGs in the WPP area. The purpose of the assessment is to determine how the Project may influence the character of the surrounding landscape and the views experienced by people living in, travelling through, or using the wider area. The assessment distinguishes between landscape effects - changes to the physical landscape resource and its character - and visual effects, which relate to changes in the composition and amenity of views.

Construction-phase effects are expected to be temporary and largely associated with the establishment of access tracks, turbine foundations, crane activity, and the presence of construction compounds. Operational-phase effects are typically long-term in nature and relate to the visibility, scale, and arrangement of the WTGs within the wider steppe and foothill landscape.

To support the assessment of operational impacts, a suite of visual modelling tools was applied using WindPRO software. The modelling includes preparation of a Zone of Visual Influence (ZVI), vertical subtended angle analysis, and photomontage visualisations, based on the representative worst-case turbine model (Envision EN206-11.0 MW). Modelling was undertaken using a conservative “bare-ground” scenario that excludes screening from vegetation and buildings, thereby representing a worst-case visibility envelope. Field photography was carried out at representative viewpoints identified through scoping, site reconnaissance, and community consultation.

An overview of the assessment methodology is provided below:

- **Baseline Definition**: Baseline landscape and visual conditions were characterised through desktop review, high-resolution satellite imagery and field photography, identifying landscape character, settlement distribution, and the visual qualities of the surrounding steppe environment.
- **Area of Influence**: A 20 km radius from the nearest WTG was adopted as the assessment extent, consistent with GIIP for large-scale wind farms.
- **Receptor Identification**: Sensitive receptors include residential dwellings, rural communities, road users, recreational users, and landscape character areas. Receptors were identified using satellite imagery, consultations, and field observations.
- **Modelling of Operational Visibility**: WindPRO ZVI mapping, vertical subtended angle analysis, and photomontages were used to predict theoretical visibility and illustrate the likely appearance of turbines from selected viewpoints.
- **Evaluation of Significance**: Impacts are assessed by combining receptor sensitivity with magnitude of change in accordance with the ESIA methodology (Section 4), GLVIA3 principles and international lender guidance.
- **Mitigation and Residual Effects**: Where significant effects are predicted, mitigation measures - such as micrositing, layout refinement, and reduction of visual clutter - are identified and residual impacts are reassessed.

13.2 Applicable Requirements & Standards

13.2.1 National Regulations

Although Kazakhstan does not prescribe quantitative thresholds or detailed methodologies for landscape

and visual impact assessment, several national instruments provide the legal context within which visual impacts must be assessed:

- **Environmental Code of the Republic of Kazakhstan** (2021, as amended 2023): Establishes general principles for environmental protection and requires identification, evaluation and mitigation of all significant environmental and social impacts during the national Environmental Impact Assessment (EIA) procedure. While the Code does not explicitly regulate visual effects, changes to the landscape, surroundings, or community environment fall within the scope of impacts to be considered.
- **Rules for Environmental Impact Assessment**: The EIA procedure requires project developers to assess all types of environmental and social impacts, including those affecting landscape integrity, visual amenity, and the overall perception of the environment by local communities. Public consultation, a mandatory element of the national EIA, provides the mechanism through which concerns about visual intrusion or landscape change may be raised and addressed.

In practice, national requirements are addressed through the EIA process and public consultation, as communities may express concerns about visual intrusion, landscape change, and amenity effects.

Because Kazakhstan's national system does not provide technical guidance specific to LVIA, the assessment relies predominantly on international lender standards and accepted global practice.

13.2.2 Lender Requirements

The main internationally recognized standards applied to the assessment of landscape and visual impacts are:

- **IFC Performance Standards** (2012):
  - PS 1 – Assessment and Management of Environmental and Social Risks and Impacts: Requires identification and evaluation of all environmental and social risks, including those that may affect community amenity, sense of place, or landscape character.
  - PS 3 – Resource Efficiency and Pollution Prevention: Requires avoidance or reduction of nuisance impacts on nearby receptors, including visual disturbance where it affects community well-being.
- **World Bank Group Environmental, Health and Safety (EHS) Guidelines for Wind Energy** (2015): Require assessment of landscape and visual impacts and preparation of visual simulations (e.g., photomontages) from representative viewpoints. The Guidelines highlight the need to assess turbine prominence, visibility, and cumulative effects.
- **Guidelines for Landscape and Visual Impact Assessment (GLVIA)**, Third Edition (2013): Internationally recognised best practice for assessing landscape and visual effects. GLVIA provides clear principles for defining landscape character, evaluating receptor sensitivity, determining magnitude of change, and applying a structured significance evaluation.

In addition to lender standards, the LVIA applies GIIP for visual assessment of wind-energy projects, including:

- Use of wind-farm visibility modelling tools (e.g., WindPRO)
- Preparation of ZVI (Zone of Visual Influence) mapping
- Vertical subtended angle analysis to evaluate turbine prominence
- Photomontages from representative viewpoints
- Assessment of landscape character areas and visual receptors
- Application of an impact significance matrix combining sensitivity and magnitude.

13.3Baseline Conditions and Receptors

13.3.1 Area of Influence

The Area of Influence (AoI) defines the geographical extent within which the Project may cause perceptible changes to landscape character or visual amenity. Because the nature and scale of visual effects differ between construction and operation, separate AoIs are defined for each phase, with both informed by findings from the Scoping Report and refined ESIA modelling.

13.3.1.1 Construction Phase AoI

Construction-phase landscape and visual impacts are temporary and associated with low- to medium-height activities such as turbine foundation works, crane operations, internal access-track construction, laydown areas and construction traffic. Given the raised plateau setting of the WPP, these activities are visually contained by the plateau edge and surrounding lower-lying terrain, which significantly limits outward visibility.

Accordingly, for the WPP a construction-phase AoI of approximately 3 km from active construction areas has been adopted. Beyond this distance, construction elements are expected to be screened by landform or too small in scale to be visually discernible.

For the OHTLs, construction activities are linear and low-profile, and their visibility is highly localised. Therefore, a construction-phase AoI of 500 m to 1 km on either side of the OHTL alignment is considered appropriate.

13.3.1.2 Operation Phase AoI

During the Scoping stage, an initial radius of 35 km around the WPP was applied to identify potentially sensitive receptors. This broad screening confirmed the absence of protected landscapes, major touristic viewpoints, or highly sensitive cultural heritage locations within the wider region. The Scoping Report also concluded that, based on GIIP for large-scale wind farms, visual impacts beyond approximately 20 km are generally not considered significant, as turbine prominence diminishes rapidly at greater distances.

For the ESIA, the operational AoI has been refined using updated visibility modelling undertaken in WindPRO. General Zone of Visual Influence (ZVI) modelling was completed using a 22.5 km radius, which captures all settlements identified during Scoping and subsequent field surveys, and represents the maximum distance within which turbines of the representative model (Envision EN206-11.0 MW) may remain theoretically visible under clear atmospheric conditions. The ZVI results are presented in Figure 12-1.

For the OHTL components, operational visibility is substantially more limited than for WTGs due to the lower height and slender profile of transmission towers. There is no single established international standard for defining visibility extents for overhead lines; however, guidance such as the Best Management Practices for Reducing Visual Impacts of Renewable Energy Facilities on BLM-Administered Lands (2013) notes that the visual influence of OHTLs typically falls within a 0.3–3.2 km range, depending on tower type, scale and surrounding terrain. Given that the Project's 220 kV structures fall within the lower end of this range and considering the relatively open terrain, an operational AoI of 1.5 km on either side of the alignment has been adopted for this ESIA. The defined extent is illustrated in Figure 12-2.

Together, these AoIs ensure that the operational assessment captures all locations where the WPP and OHTLs may be visually perceptible, while remaining proportionate to the expected significance of effects

and consistent with GIIP for large-scale wind-energy developments.

Figure 12-1: ZVI for the WPP area (22.5 km buffer)

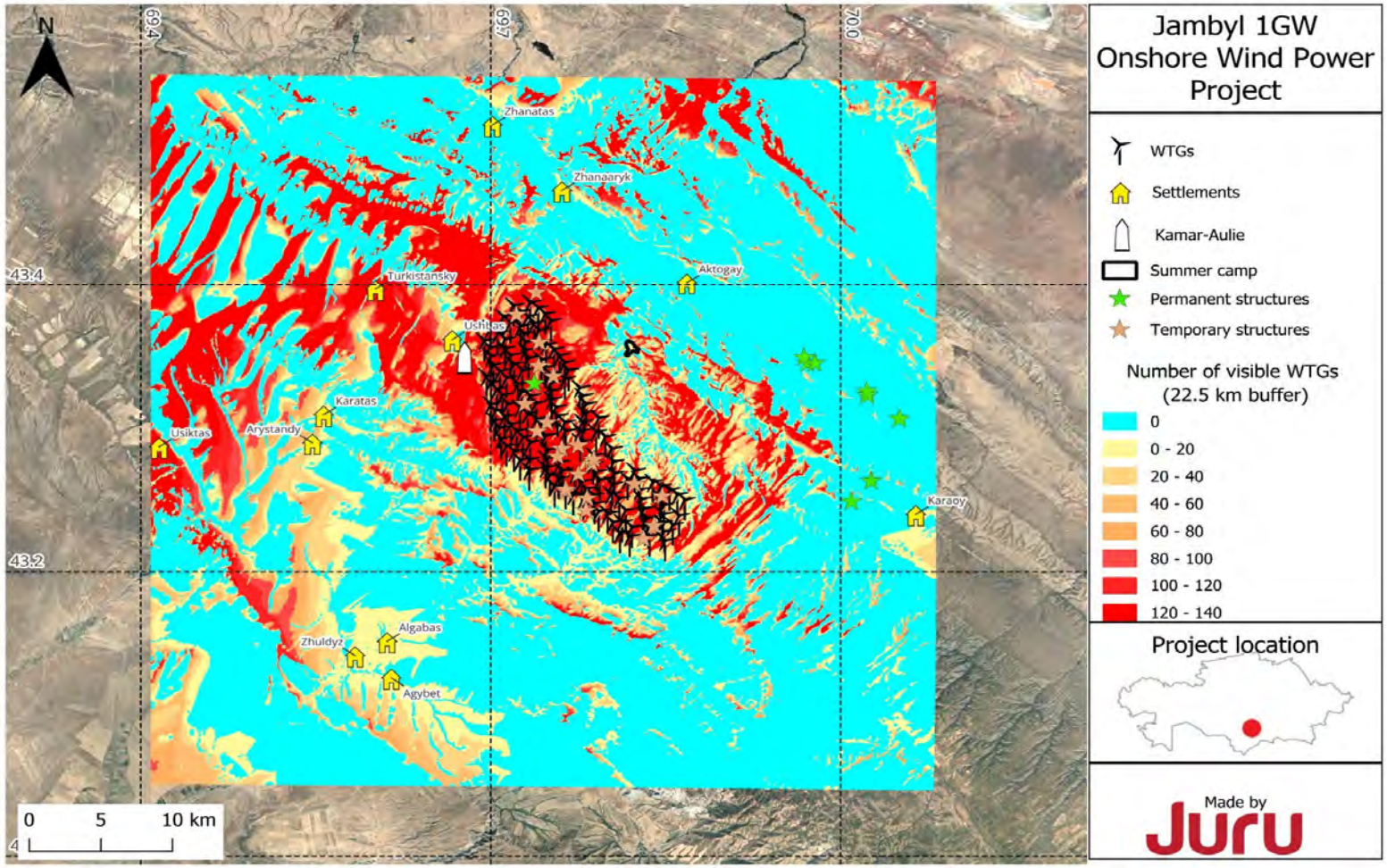
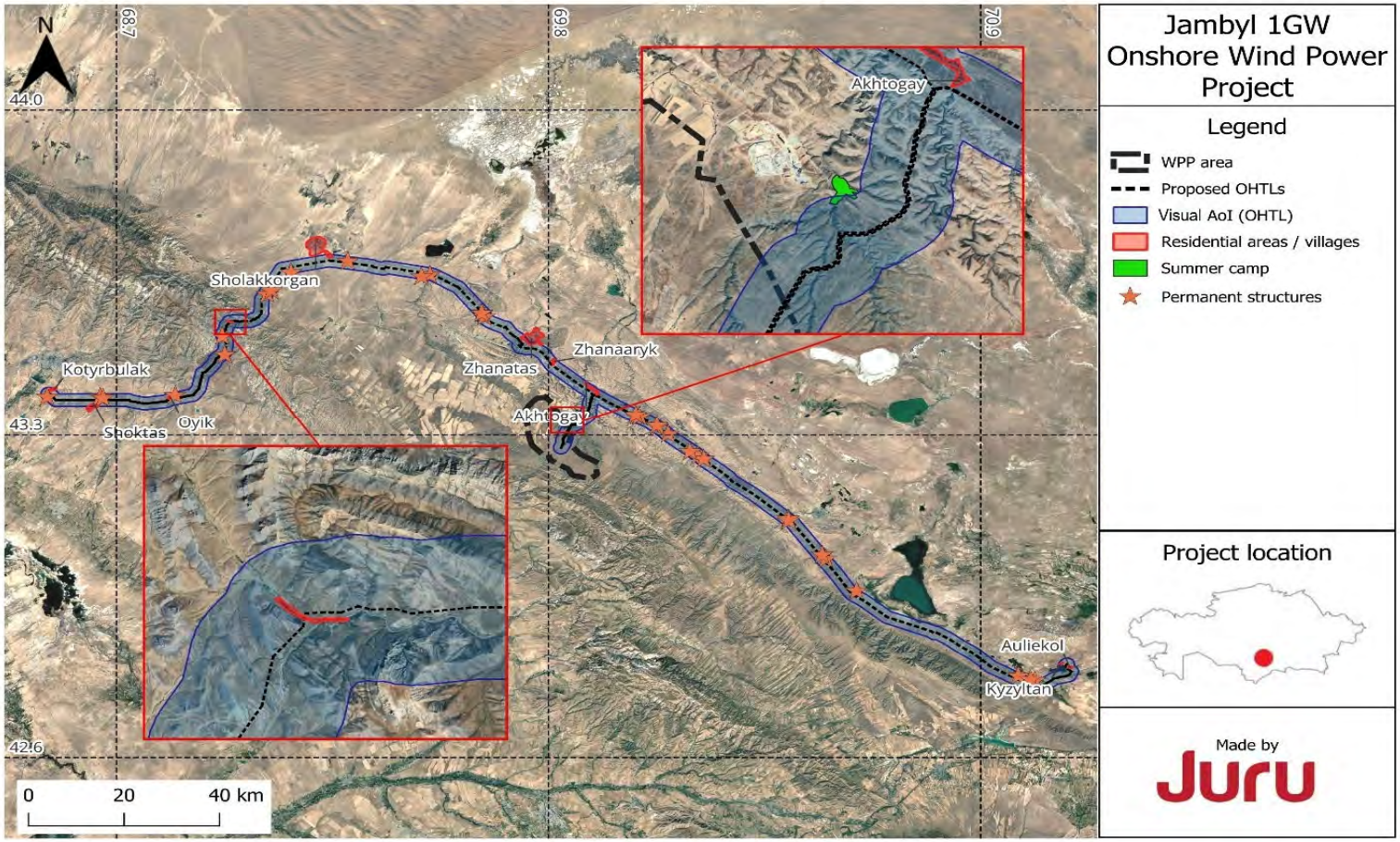


Figure 12-2: OHTL visual AoI



13.3.2 Sensitive Receptors

Sensitive receptors are locations or groups of people who may experience changes to landscape character or visual amenity as a result of the Project. Receptors were identified by determining which settlements, structures, land-use areas, activity zones, and transport routes fall within the defined construction and operational AoIs for the WPP and OHTL components. Identification was based on desk-based mapping, high-resolution satellite imagery, field observations and the visibility modelling undertaken for the ESIA.

Receptors are grouped by type in the tables below to provide a clear and consistent baseline for the subsequent landscape and visual impact assessment.

Table 12-1: Sensitive Receptors within the WPP AoI

Receptor Type	Receptor/Location	Approx. Distance to Nearest WTG	Notes
Residential Settlements (near–mid range)	Ushbas	~2 km	Within operational AoI; open views towards plateau.
	Turkestanskiy	~7–10 km	Within operational AoI; visible across open terrain.
Seasonal/Temporary Structures	Temporary herder shelters/wagons	<2–5 km	Located within or near WPP footprint; intermittent presence.
Grazing/General Landscape Users	Seasonal grazing areas (plateau and edges)	Within WPP area	Widespread outdoor use; potential for close and mid-range views.
Cultural/ Community/ Recreational	Kamar-Aulie (spiritual site including shrine and cemetery)	~2 km	Elevated culturally significant viewpoint.
	Summer camp facilities	~5–8 km	Regular seasonal use; open surrounding landscape.
Road Users	KN-1 highway (segments within AoI)	8–10 km	Transient receptor with intermittent open views.
	Local rural tracks and access roads	Variable	Intermittent visibility depending on elevation and orientation.
Residential Settlements – Wider AoI (ZVI extent)	Zhanatas	~14–22 km	Within ZVI; distant theoretical visibility only.
	Akhtogay	~10–15 km	Within wider AoI; long-range views possible.
	Zhanaaryk	~9–15 km	Within wider AoI; variable visibility depending on terrain.
	Karaoy	~14–18 km	Within ZVI; low prominence expected.
	Karatas	~12–18 km	Within ZVI extent.
	Arystandy	~12–20 km	Within ZVI; distant receptor.
	Algabas	~15–20 km	Within ZVI; long-range views only.

Table 12-2: Sensitive Receptors within the OHTL AoI

Receptor Type	Receptor/Location	Approx. Distance to Nearest WTG	Notes
Residential Areas (within 1.5 km operational corridor)	Auliekol	~0.2–1.5 km	Residential receptors within operational corridor.
	Kyzyltan	~0.7 – 1.5 km	
	Akhtogay	~0.1–2 km	Views influenced by local topography and alignment.
	Zhanaaryk	~0.2–2 km	Located along corridor; potential for intermittent visibility.
	Zhanatas	~1–2 km	Edge of settlement within wider OHTL AoI.

	Oyik	~0.4–1.5 km	Within operational corridor.
	Shoktas	~0.5–1.5 km	Within operational corridor.
	Southern outskirts of Sholakkorgan	~0.7–2 km	Residential edge within AoI.
	Residential cluster near Ushtobe Dam	~0.1 km	Localised group of dwellings within visibility zone.
Agricultural/ Pastoral Users	Agricultural farms/ farmsteads	<0.5–1 km	Frequent outdoor use; near-field visibility of towers.
	Seasonal grazing areas	<1 km	Open grassland; potential for clear-sightlines.
	Temporary grazing shelters/wagons	<0.5–1 km	Intermittent presence; near-field receptors.
Community/ Recreational Facilities	Sanatorium "Koktal"	~1–3 km	Recreational/community receptor with occasional open views.
	Summer camp (near OHTL sections)	~1–3 km	Seasonal-use location within visibility zone.
Road Users	Local roads, rural tracks, and access routes	Passing within 0.5–1.5 km	Transient receptors with intermittent visibility of transmission structures.

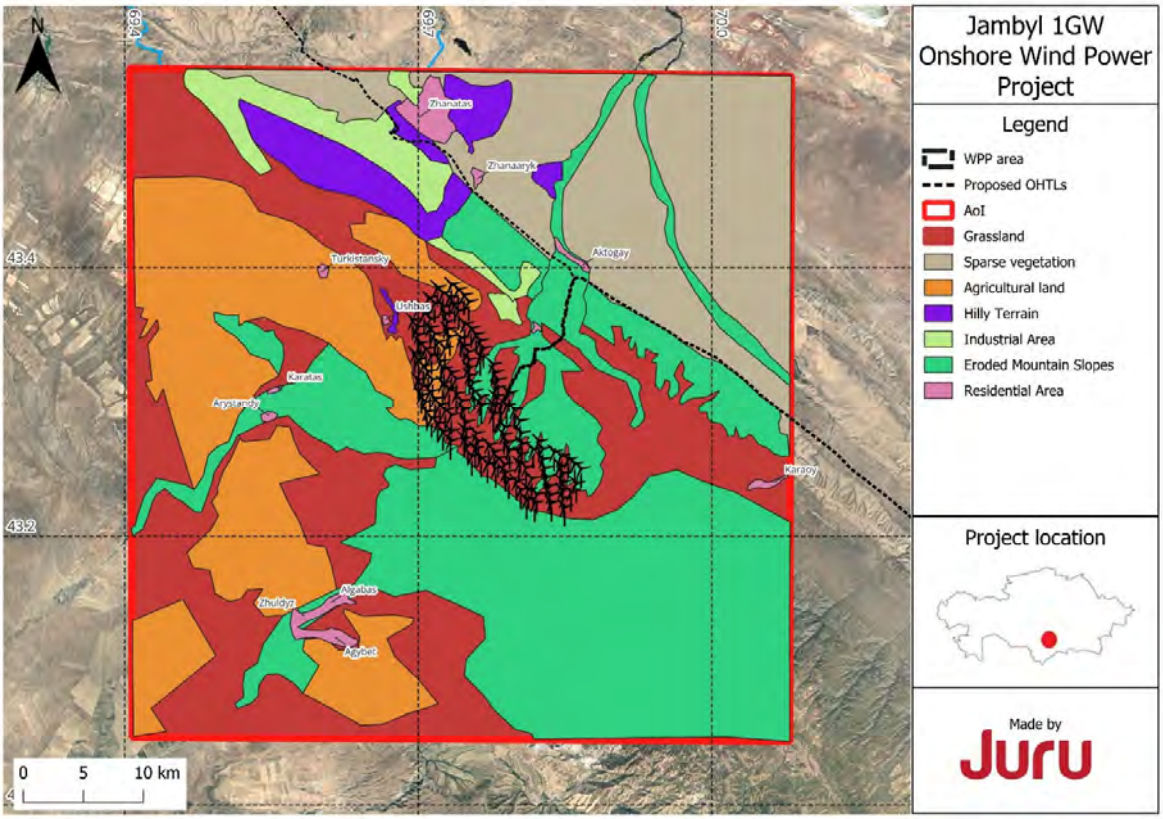
13.3.3 Landscape Character

Landscape character within the WPP AoI has been defined based on a combination of desktop review, high-resolution satellite imagery and field observations. The classification reflects the distinct combinations of landform, land cover, vegetation, drainage features and human activity that shape the appearance and experience of the landscape. A total of seven Landscape Areas (LAs) were identified within the AoI, as follows:

- LA 1 – Grassland
- LA 2 – Sparse Vegetation
- LA 3 – Agricultural Land
- LA 4 – Hilly Terrain
- LA 5 – Industrial Area
- LA 6 – Eroded Mountain Slopes
- LA 7 – Residential Areas.

These represent the primary landscape character types present in the WPP surroundings; the distribution of the identified character areas are shown in Figure 12-3, and are discussed in more detail below.

Figure 12-3: Landscape areas for the WPP visual AoI



13.3.3.1 LA 1 - Grassland

This Landscape Area covers much of the elevated plateau of the Small Karatau and forms the dominant landscape type within the WPP footprint. The area is characterised by extensive open grasslands with gentle, broad undulations and isolated shallow erosion features. Vegetation is primarily composed of low herbaceous cover typical of semi-arid steppe grassland, with seasonal variation in colour and texture.

Land use within this LA is mainly associated with traditional grazing, with herders and livestock frequently moving across the plateau during appropriate seasons. Evidence of human activity is limited to informal grazing tracks, small temporary shelters and occasional livestock-related structures. Built development is minimal, and long uninterrupted views across the plateau reinforce the area's open and largely natural character.

The combination of elevation, simple landform and sparse vegetation creates a landscape with wide horizons and a strong sense of exposure. This contributes to an overall impression of an expansive, uncluttered environment with little vertical structure. Most of the proposed WTGs are located within this Landscape Area, reflecting the suitability of its landform and open terrain for turbine installation (See associated photograph in Figure 12-4).

Figure 12-4: Example of LA 1 (WPP area)



13.3.3.2 LA 2 – Sparse vegetation

This Landscape Area comprises flat to gently undulating semi-arid steppe where vegetation cover is noticeably reduced and occurs in patchy, discontinuous patterns. Grass cover is denser in the foothills of the Small Karatau and gradually decreases towards the east, where the landscape transitions to more sparsely vegetated steppe with localised signs of desertification. Similar to the grassland areas, this landscape is dissected by a network of shallow river channels, which form subtle linear features across the terrain.

Human influence is more evident in this LA than in LA 1. The area includes a number of existing visual modifications, such as overhead transmission lines, the KN-1 road, minor dirt tracks, and scattered isolated houses or small enclosures. These elements introduce a degree of built form into an otherwise open natural setting.

Overall, LA 2 presents the appearance of an ordinary, visually simple landscape without prominent or distinctive features. The combination of sparse vegetation, muted colour tones, and limited landform variation contributes to a landscape of modest scenic interest and relatively uniform visual character (see associated photograph in Figure 12-5).

Figure 12-5: Example of LA 2 (view of the existing OHTL along the KN-1 highway)



13.3.3.3 LA 3 – Agricultural land

This Landscape Area comprises flat or gently sloping terrain that has been modified for agricultural use, forming a distinct contrast with the surrounding natural and semi-natural steppe. The land is divided into rectilinear cropped fields, with linear boundaries and access tracks creating a more regular and geometric landscape pattern than neighbouring grassland or sparsely vegetated areas.

Vegetation in this LA is predominantly seasonal crops or managed grasses, resulting in simplified vegetation structure and reduced species diversity compared to natural steppe grasslands. Colour and texture vary significantly throughout the year depending on cultivation cycles, contributing to a more dynamic but less natural visual character.

Human influence is noticeably higher in this LA, with agricultural machinery, field edges, small storage structures, and occasional irrigation features present in places. Despite this, settlement density remains low and most farming activity is dispersed.

Overall, LA 3 has the visual qualities of a modified and utilitarian agricultural landscape, characterised by orderly patterns and limited scenic interest. It forms part of the wider land-use mosaic within the WPP AoI but lacks distinctive natural features (see associated photograph in Figure 12-6).

Figure 12-6: Example of LA 3 (vicinity of the WPP area)



13.3.3.4 LA 4 – Hilly terrain

This Landscape Area comprises a series of scattered hills, ridges and elevated landforms occurring both along the margins of the WPP plateau and across the lower plains surrounding it. These features introduce noticeable topographical variation into an otherwise open landscape and create areas of local visual enclosure where slopes rise abruptly from the surrounding terrain.

The hills are typically characterised by rocky or sparsely vegetated slopes, with patches of low grasses and shrubs that thin out towards the upper elevations. Vegetation cover is generally limited, and the exposed rock and soil surfaces contribute to a rugged, natural appearance. The landform also influences local drainage patterns, with shallow gullies, small ravines and erosion channels forming between slope features.

Human influence in this LA is very limited. Apart from occasional informal tracks created by grazing activity, there is little built development or infrastructure. As a result, the area retains a largely natural and undeveloped character, with a strong sense of isolation.

Visually, LA 4 provides important natural containment in the wider landscape. The hills screen views in some directions and open up elevated viewpoints in others, creating changes in perspective and occasionally offering long-range views toward the WPP plateau or surrounding plains. These landforms therefore play a significant role in shaping the visual structure and viewing experience of the area (see associated photograph in Figure 12-7).

Figure 12-7: Example of LA 4



13.3.3.5 LA 5 – Industrial area

This Landscape Area includes the extractive, industrial and energy-infrastructure zones located to the northeast and north of the WPP, associated with EuroChem and Kazphosphate operations, as well as the Zhanatas Wind Farm and Shokpar Wind Farm situated to the east and southeast. These elements create a clearly anthropogenic landscape dominated by engineered landforms and industrial structures.

Key features include quarry pits, exposed rock faces, stockpiles, internal haul roads, and processing and maintenance facilities, together with the turbine arrays and access tracks of the existing wind farms. The urban and industrial edge of Zhanatas city forms part of this wider modified landscape unit, reinforcing its developed and utilitarian character.

Vegetation is sparse due to ground disturbance, and natural landform patterns are largely replaced by engineered slopes and artificial surfaces. Overall, LA 5 represents a heavily altered, low scenic quality landscape, clearly distinct from the natural and semi-natural steppe areas elsewhere within the WPP AoI (see associated photograph in Figure 12-8).

Figure 12-8: Example of LA 5



13.3.3.6 LA 6 – Eroded Mountain Slopes

This Landscape Area comprises the deep erosion depressions, ravines and dissected slopes formed by water flows originating from the uplands of the Small Karatau. Although the WPP itself is located on the elevated flat plateau, it is surrounded by numerous deeply incised erosion features, some extending for several kilometres and forming narrow, linear cross-sections along the mountain range.

These eroded slopes and channels vary in scale - from small gullies to larger systems stretching tens of kilometres - and exhibit steep, irregular landforms dominated by exposed rock, loose soils and sparse vegetation. Ground cover is limited to grasses and shrubs that occupy sheltered pockets, with the steeper slopes largely bare.

Accessibility across this LA is generally low due to the rugged terrain, and anthropogenic use is minimal. The only signs of human presence include occasional informal grazing tracks. Importantly, a migration corridor of the Karatau Argali passes through this landscape east of the WPP area, reflecting its ecological and natural value.

Visually, the combination of steep natural landforms, exposed geological surfaces and the absence of development creates the impression of scenically valuable and predominantly natural spaces. These eroded slopes form a striking contrast to the flatter plateau landscapes, offering strong topographical containment and contributing significantly to the visual identity of the wider setting (see associated photograph in Figure 12-9).

Figure 12-9: Example of LA 6 (to the east of the WPP area)



13.3.3.7 LA 7 – Residential areas

This Landscape Area comprises the small rural settlements, isolated buildings and associated enclosed plots located within the wider WPP AoI. These include clusters of single-storey dwellings, agricultural outbuildings, fenced yards and small orchards or garden areas typically found around settlements such as Ushbas, Turkestanskiy and other villages in the region.

The built form is generally low and dispersed, with structures constructed in simple geometric shapes using locally available materials. Settlement edges transition quickly into open steppe or agricultural land, resulting in a loose settlement pattern with large areas of undeveloped land between residential clusters. Vegetation within this LA is limited to planted trees, small garden plots and localised shading vegetation around individual properties.

Human activity is more concentrated here than in surrounding LAs and includes daily domestic routines, small-scale agriculture, livestock maintenance and roadside movement. However, the overall landscape retains a rural character, with modest levels of development and minimal vertical structures. Beyond the settlement cores, the landscape opens out rapidly to the surrounding natural and semi-natural steppe.

Visually, this LA is defined by a mix of built and semi-natural elements, where buildings, tracks and fenced plots introduce small-scale human features into an otherwise expansive environment. The scale and height of built form are limited, meaning settlements remain visually contained and do not dominate the wider landscape (see associated photograph in Figure 12-10).

Figure 12-10: Example of LA 7 (Turkestanskiy village)



13.3.3.8 OHTL landscapes

The combined OHTL route extends for more than 300 km, crossing a diverse range of landscapes within the wider region.

A section of the Jambyl OHTL runs along the boundary between LA 2 – Sparse Vegetation and LA 6 – Eroded Mountain Slopes. Here, the line is typically located within sparsely vegetated steppe, but when viewed from the eastern slopes of the Small Karatau, it is also seen against the backdrop of deep erosion depressions. This part of the corridor already contains existing infrastructure, including an OHTL and the KN-1 road, which run broadly parallel to the planned alignment.

The Kentau OHTL is routed mainly through LA 2, with varying degrees of desertification, from the eastern areas north of Zhanatas to the western slopes of the Greater Karatau. Shorter sections also pass near LA 3 – Agricultural Land in the western portion of the route. In the vicinity of Zhanatas city, the line enters LA 5 – Industrial Area, near the Kazphosphate waste dumps and associated industrial features.

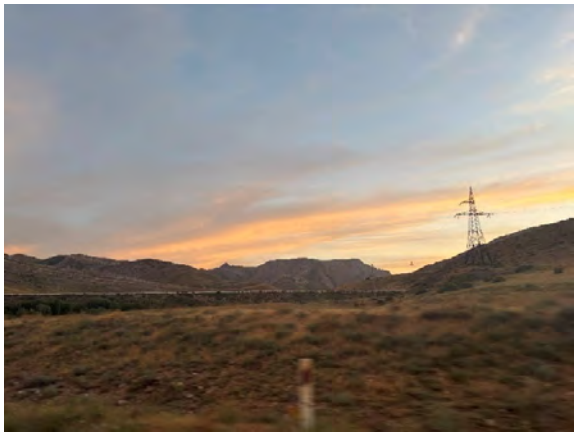
A significant part of the Kentau route (over 20 km) crosses LA 6 – Eroded Mountain Slopes, where steep, rugged landform and limited accessibility create a predominantly natural and visually distinctive landscape.

Eight residential areas fall within the visual AoI of the OHTL, but the alignment passes close to only four: Aulie-Kol, Akhtogay, Zhanaaryk, and the residential cluster near the Ushtobe Dam. The remaining settlements lie further away, where visibility is more limited by distance and landform. Landscape variety along the OHTLs RoW is presented in Figure 12-11 and Figure 12-12.

Figure 12-11: LA 2 and LA 6 landscapes along Jambyl OHTL




Figure 12-12: LA 2 and LA 6 landscapes along Kentau OHTL

13.3.4 Visual Amenity

The entire WPP area lies within two LAs – Grassland (LA 1) and Agricultural Land (LA 3), and along the boundary with Eroded Mountain Slopes (LA 2) or Hilly Terrain (LA 4).

At most randomly selected points within the Project area, the viewer's field of vision includes flat open spaces sparsely intersected by tracks, with hills visible on the horizon (Figure 12-13).

Figure 12-13: Common views within the WPP area





The area contains numerous temporary structures evenly scattered across the territory, including wagons and stables; however, these are only visible when located in close proximity (Figure 12-14). In the northern part of the WPP area, existing WTGs of the Shokpar WPP are visible (Figure 12-15).

Figure 12-14: Views within the WPP area with temporary structures



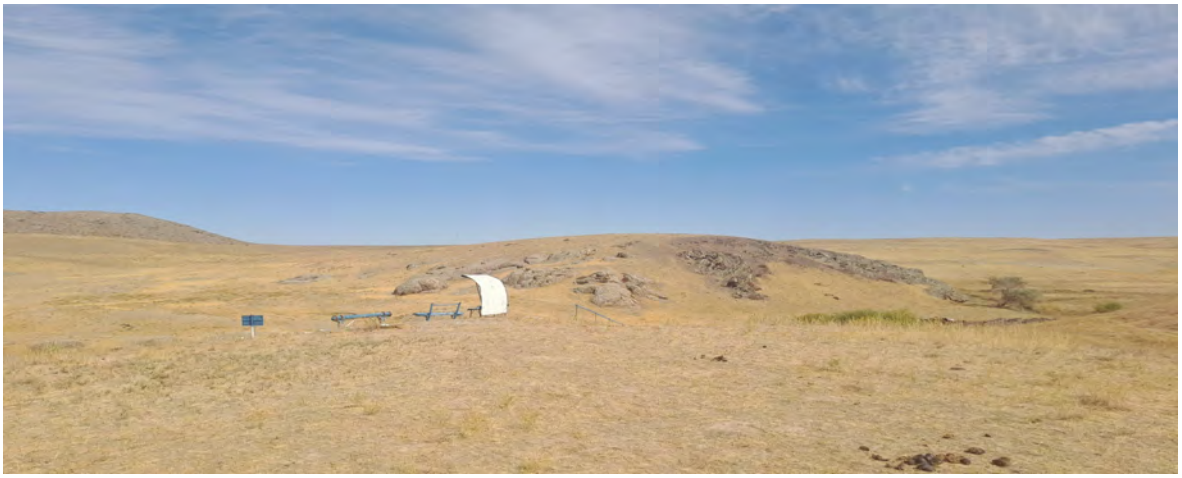


Figure 12-15: Views of the neighbouring Zhanatas/Shokpar Wind Farm



Overall, visibility of the surrounding areas from the WPP area is limited by the surrounding hills, and the terrain outside the WPP area lies at a lower elevation. Consequently, the nearest residential areas remain outside the line of sight. The only receptor with mutually high visibility (both from the receptor and from the WPP) is Kamar-Aulie and the adjacent recreation area (Figure 12-16).

Figure 12-16: Recreation area near Kamar-Aulie



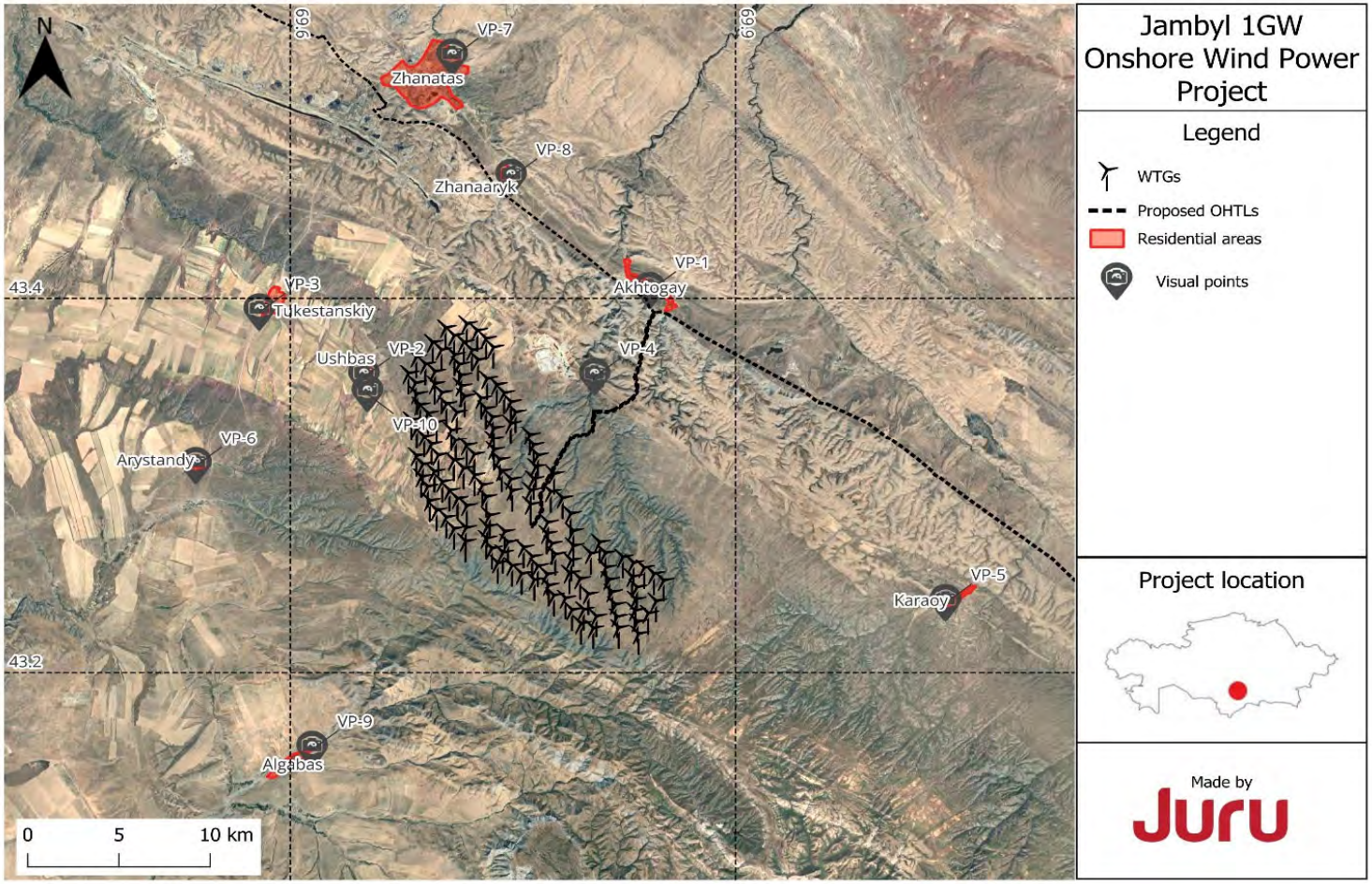
From the residential areas, there is also no direct visibility toward the WPP area (except for the aforementioned Kamar-Aulie).

13.3.5 Viewpoints

A total of 10 viewpoints were identified during the scoping phase in the areas surrounding the WPP to represent locations from which changes to visual amenity are most likely to be experienced. The viewpoints were selected to include both the main residential areas around the project site and locations of cultural importance, and were positioned in all relevant directions to ensure coverage of settlements and other key receptors situated within the 22.5 km AoI.

The locations of the selected VPs are shown in Figure 12-17.

Figure 12-17: Visual point locations



13.3.5.1 VP 1 – Akhtogay village

This VP is located west of the houses of Akhtogay village, on the KN-1 road, approximately 10 km northeast of the WPP area. Looking toward the WPP area (bearing 225°), the camera's field of view includes the existing OHTL and the eastern slopes of the Small Karatau (see Figure 12-18).

Figure 12-18: Visual point 1 photograph



13.3.5.2 VP 2 – Ushas village

This VP is located on the southern edge of Ushbas village, approximately 2 km from the nearest proposed WTG. The field of view from this point shows a dirt road extending from Ushbas village toward the WPP area passing through a series of low hills. These hills screen the WPP area from the village, such that turbines become visible only when approaching or reaching the hilltops. The viewpoint faces east–southeast, with a viewing direction of approximately 100° (see Figure 12-19).

Figure 12-19: Visual point 2 photograph



13.3.5.3 VP 3 – Turkestanskiy village

This VP is located 9 km from the nearest WTG, on the southern edge of Turkestanskiy village. The VP's field of view includes a rural road, a telecom tower, and the line of hills that separates the plains around the village from the WPP area. The viewpoint faces southeast, with a viewing direction of

approximately 135° (see Figure 12-20).

Figure 12-20: Visual point 3 photograph



13.3.5.4 VP 4 – Summer camp

This VP is located in the eastern part of the summer camp, positioned on the highest ground within the camp, where potential visibility of the WTGs is greatest (the rest of the camp lies in lower-lying areas with more limited views). Unlike the natural surroundings, the summer camp contains planted trees, which provides localised screening of adjacent areas.

The field of view from this point includes camp buildings, tree planting, and nearby landscape features. The viewpoint is located approximately 5 km from the nearest proposed WTGs and faces west, with a viewing direction of approximately 260° (see Figure 12-21).

Figure 12-21: Visual point 4 photograph



13.3.5.5 VP 5 – Karaoy village

This VP is located on the main street in the central part of Karaoy village, approximately 16 km from the nearest WTGs. The village is separated from the WPP area by a series of hills.

The field of view includes the main street, low-voltage distribution lines, and, at the time of photography, local road earthworks. The viewpoint faces west-northwest, with a viewing direction of approximately 280° (see Figure 12-22).

Figure 12-22: Visual point 5 photograph



13.3.5.6 VP 6 – Arystandy village

This VP is located to the north of the village's main street, where all houses are positioned along the southern side. The nearest proposed WTGs are located approximately 12 km from this VP. The field of view includes residential properties and associated vegetation roughly 150 m from the viewpoint. The direction toward the WPP is east, with a viewing direction of approximately 90° (see Figure 12-23).

Figure 12-23: Visual point 6 photograph



13.3.5.7 VP 7 – Zhanatas city

This VP is located on the northeastern edge of Zhanatas city. This part of the city lies on elevated ground, providing wide, open views toward the WPP area. Vegetation in this part of the city is sparse, and the urban form consists mainly of low-rise residential buildings and streets. The nearest proposed WTG is approximately 16 km from this VP.

The field of view includes the surrounding urban landscape, with houses, streets and other built features visible in the foreground, and the hills of the Small Karatau forming the distant backdrop. From this location, the wind farm lies in a position where its narrow side is oriented toward the viewpoint. The viewing direction is approximately 170°, facing south-southeast (see Figure 12-24).

Figure 12-24: Visual point 7 photograph



13.3.5.8 VP 8 – Zhanaaryk village

This viewpoint is located on the northern edge of Zhanaaryk village, where views extend toward nearby industrial landscapes, including the Shokpak WPP and KazPhosphate quarries, making this the viewpoint closest to such features. From this location, the nearest turbines of the existing wind farm are visible. In contrast, the planned WPP is screened by intervening hills, and the nearest proposed WTG is approximately 9 km from the viewpoint. The layout of the planned wind farm is oriented such that its narrower configuration faces toward this viewpoint.

The field of view includes village-edge vegetation and the outlines of surrounding hills in the direction of the WPP area. The viewing direction is approximately 190°, facing south (see Figure 12-25). To the right of the field of view shown in Figure 12-25 is the Zhanatas/Shokpar WPP, whose nearest WTGs lie between 2.5 to 4 km away and can be clearly seen from this point; the view of the existing WTGs, at a viewing direction of approximately 230°, is provided in Figure 12-26.

Figure 12-25: Visual point 8 photograph



Figure 12-26: View of the Zhanatas/Shokpar WPP from Visual Point 8.



13.3.5.9 VP 9 – Algabas village

This VP is located on the northeastern edge of the village. In this area, the only visual barrier between the village and the WPP area is the intervening hilly terrain. The nearest proposed WTGs are approximately 14 km from this VP. The field of view includes the surrounding hills and a dirt road leading toward the higher ground. The viewpoint faces east, with a viewing direction of approximately 90° (see Figure 12-27).

Figure 12-27: Visual point 9 photograph



13.3.5.10 VP 10 – Kamar-Aulie

This VP is located on elevated ground near the cemetery of Ushbas village, close to a recreational area used by local residents, which includes benches and seating areas both on the elevation and at lower levels. The culturally significant site of Kamar-Aulie lies in the eastern part of the cemetery. The entire WPP area is visible from this VP, and the nearest proposed WTG situated approximately 2 km away. The field of view includes open vistas toward the project area as well as elements of the cemetery, such as the perimeter fencing. The viewpoint faces east, with a viewing direction of approximately 90° (see Figure 12-28).

Figure 12-28: Visual point 10 photograph



13.4Potential Impacts

13.4.1 Construction Phase

Construction activities for the WPP and OHTL will generate a range of temporary visual changes associated with civil works, machinery use, material storage, turbine erection and tower installation. These activities are transient, occur at defined work fronts, and shift progressively across the project area. As such, construction-related visual effects are limited in duration and extent compared with operational impacts.

The construction-phase AoI is considerably smaller than the operational AoI. For the WPP, construction visibility is largely restricted to areas within approximately 1–2 km of active work zones, reflecting the elevated plateau setting and the screening provided by surrounding hills. For the OHTLs, visibility is even more localised, typically within 500 m to 1 km of the alignment, due to the low height of construction equipment relative to the broader landscape and the linear, mobile nature of the works. Beyond these distances, construction elements are unlikely to be noticeable.

Only receptors located within or close to this construction AoI are expected to experience temporary changes in visual amenity. These include:

- Ushbas and Turkestanskiy villages, where intermittent views of machinery or construction traffic may occur, though screened in places by intervening hills;
- the summer camp, due to its proximity to the WPP plateau;
- herders, grazing shelters and seasonal users located within or near the WPP area;
- road users on segments of the KN-1 highway and local tracks passing near active work zones; and
- residential clusters near the OHTL, particularly Auliekol, Akhtogay, Zhanaaryk and the small settlement near Ushtobe Dam.

Other settlements within the wider AoI identified for the operational assessment are unlikely to experience construction-phase visual effects due to distance, lower elevation or lack of direct visibility toward construction areas.

Construction works will introduce temporary visual changes associated with plant, machinery, materials, and short-term ground disturbance. These effects occur at defined work fronts and move progressively across the WPP and OHTL corridors. As a result, visibility of construction activities varies over time and is generally limited to receptors located closest to active works.

For the WPP, temporary visual changes may arise from earthworks, foundation excavation, crane operations, turbine component delivery, and on-site traffic movements. These elements introduce localised contrast within the open plateau landscape, but their visibility is moderated by the

surrounding hills, which screen most distant receptors. Construction compounds and laydown areas may create short-term focal points of activity, though these are removed or reinstated once each phase is completed.

For the OHTLs, visual effects are typically brief and low in intensity due to the linear and mobile nature of construction. Tower installation, stringing operations, and movements of specialist vehicles may be visible at close range but are short-lived at any one location. Vegetation and local landform provide additional screening in many areas.

Across both components, construction activities generally remain low to moderate in height, meaning they do not form prominent skyline features except during isolated crane operations. Most temporary stockpiles and equipment have minimal visual mass and are viewed against expansive open terrain.

Given the temporary, intermittent and reversible nature of these activities - and the rapid progression of work fronts - construction-phase visual effects are expected to be minor for most receptors, with short-term moderate effects possible where activities occur very close to residential or grazing receptors.

Activity/Impact/Aspect					
Temporary visual changes caused by construction activities associated with both the WPP and the OHTLs, including earthworks, grading, access-road upgrades, foundation works, crane operations, laydown areas, machinery movement, turbine component delivery and erection, as well as OHTL tower installation and stringing works.					
Type	**Duration**	**Extent**	**Scale of Impact**	**Frequency**	**Likelihood (unplanned events)**
Direct	Short term	On-site/local	Distinguishable (but localised)	Intermittent/ mobile work fronts	Possible (localised short-term disturbance)

Receptor	**Sensitivity**	**Magnitude**	**Significance of Impact**
Permanent residential receptors (e.g., Ushbas, Turkestanskiy)	Medium	Negligible	Insignificant
Summer camp	Medium	Low	Minor
Herders, livestock and grazing activity within or near the WPP area	Medium	Low	Minor
Road users (KN-1 highway and local tracks)	Low	Negligible	Insignificant
Residential clusters close to OHTL construction (Auliekol, Akhtogay, Zhanaaryk, Ushtobe Dam cluster)	Medium	Low	Minor
Kamar-Aulie (cultural viewpoint)	Medium	Low	Minor

Overall, construction-phase visual impacts are expected to be limited in extent, short in duration and largely reversible, with effects experienced only by receptors located close to active work areas. Temporary machinery, vehicle movements and short-term construction compounds may be noticeable at times, but these elements are localised and move progressively across the site, reducing the duration of exposure for any individual receptor. As a consequence, construction-phase visual impacts are assessed as Insignificant to Minor for all receptors, with no long-term or permanent changes to visual amenity anticipated.

13.4.2 Operation Phase

During operation, the WPP will introduce large-scale vertical structures into an otherwise open and predominantly horizontal landscape, resulting in visual changes that differ in scale and permanence from the temporary effects experienced during construction. The operational phase assessment therefore focuses on the long-term visibility of the WTGs and, where relevant, the associated OHTL infrastructure, as these elements will remain present throughout the lifetime of the Project.

The visibility of the WTGs is primarily influenced by their height, location on the elevated plateau, and the openness of the surrounding terrain. The operational AoI has been defined based on the results of the ZVI modelling, which demonstrates that theoretical visibility extends across much of the surrounding plain up to approximately 22.5 km. However, as concluded in the Scoping Report, operational visual impacts are generally unlikely to be significant beyond 20 km, given distance-induced reduction in apparent scale and turbine prominence.

Operational visual impacts may occur for settlements, cultural and recreational sites, road users, grazing receptors, and seasonal users located within the AoI. The most relevant receptors include Ushbas, Turkestanskiy, the summer camp, Kamar-Aulie, and a number of smaller settlements where partial long-range visibility of turbines may occur.

The evaluation of operational visual impacts is based on:

- the ZVI and subtended-angle modelling,
- the representative viewpoints described in Section 1.3.5,
- the photomontages prepared for key locations, and
- the sensitivity of receptors identified in the baseline assessment.

The following subsections outline the operational visual modelling methodology, present the Zone of Theoretical Visibility (ZTV) results, and provide the landscape and visual assessment, including a viewpoint-based evaluation supported by photomontages to illustrate turbine visibility, prominence and overall landscape integration.

13.4.2.1 Operational Visual Modelling Methodology

The assessment covers all WTGs proposed within the Jambyl WPP layout and identifies receptors that may experience changes in landscape character or visual amenity. The modelling has been undertaken using WindPRO software, applying the Zone of Visual Influence (ZVI) and Photomontage Modules to determine both the theoretical extent of visibility and their likely appearance at representative viewpoints.

A worst-case WTG model has been selected for all modelling to ensure conservative predictions. The selected model is the Envision EN206-11.0 MW (hub height 145 m; rotor diameter 210 m), representing the maximum turbine dimensions expected for the Project.

Table 12-3: WTG specifications considered for ZVI modelling and Photomontage

Category	Data
Manufacturer and model	Envision EN206-11.0MW
Capacity/rated power (MW)	11.0
Hub Height (m)	145
Rotor Diameter (m)	210

To ensure a precautionary and transparent assessment, the LVIA has used the largest candidate turbine model currently under consideration. Other turbine models being evaluated for the Project have

smaller hub heights and rotor diameters, resulting in lower visual prominence and reduced skyline penetration. Using the Envision 11 MW turbine therefore provides a worst-case visual scenario for all modelling outputs, including ZVI, vertical-subtended-angle calculations and photomontages.

Table 12-4: Candidate WTG Models Considered – Geometric Comparison (Visual Relevance)

Model	**Goldwind GW204-10.5MW**	**Envision EN206-11.0MW**	**SANY SI-19580**
Capacity/rated power (MW)	10.5	11.0	8
Hub Height (m)	148	145	120
Rotor Diameter (m)	204	210	195
Relevance to LVIA	Slightly smaller rotor than Envision; reduced sweep area → lower visual prominence.	Largest dimensions → **worst-case visibility**; used for all LVIA modelling.	Shorter hub height and rotor diameter → significantly reduced turbine visibility.

This comparison confirms that the assessment is based on a conservative assumption, and that the final turbine selection may result in reduced visual effects relative to the modelled worst-case scenario.

The evaluation of landscape and visual effects follows GLVIA3 principles, including explicit consideration of receptor sensitivity, magnitude of change (form, scale, skyline effects and visual composition), and the application of professional judgement to determine overall significance.

The assessment follows the general methodology outlined in the Project's Scoping Report and comparable GIIP studies:

- **Model Setup**: Input parameters include WTG coordinates, hub height, rotor diameter, topography, and the geographic position of the site (latitude and longitude).
- **Identification of Receptors**: Receptors and type of landscape are identified and mapped within a preliminary radius of 20 km from the nearest WTG, consistent with international guidance. Residential buildings, schools, healthcare facilities, and other locations where occupants could be affected are digitised from high-resolution satellite imagery and verified against local land-use data and community consultation records.
- **Identification of visual points (VPs)** near key receptors and conducting photo series at these points (with geolocation, viewing direction, and camera height recorded).
- **Model Execution**: For all the calculations, the "bare ground" scenario was applied, meaning the Project's visibility is assessed in a landscape with no screening elements, such as buildings, landform features, or vegetation. The ZTV also does not account for weather or atmospheric effects. As a result, it represents a "worst-case" situation in which the wind farm could theoretically be visible, assuming there are no intervening obstacles and weather conditions are fully favourable.
    - The WindPRO ZVI module calculates from which areas surrounding the project n-turbines will be visible, creating a ZVI map. On this map, for grid cells of 25x25 meters, the selected visibility parameter is displayed.

- "Standard ZVI" – calculates how many WTGs (including any part – foundation, tower, hub, blades and their tips) can theoretically be seen within a given radius from the selected point (set as the central point of the area with WTGs);
- "Vertical subtended angle" – used for an assessment closer to the actual visibility of WTGs, i.e. instead of general visibility, only the vertical angle occupied by the visible WTGs in the viewer's field of vision is considered (for example, a wind farm may be physically visible but occupy less than 1° of the field of view, thus remaining unnoticeable); and,

o The WindPRO Photomontage module – allows overlaying a virtual 3D model of the selected WTG type, taking into account the location of the planned WTGs on the terrain, as well as the location, height, and viewing angle (focal length) of the photograph. Thus, this module makes it possible to generate a realistic view from a specific VP onto the project area.

- **Evaluation of Significance**: The obtained modelling results, taking into account the importance of certain landscapes, allow predicting the significance of the impact on these areas.
- **Mitigation and Management**: Where significant impacts are predicted, site-specific mitigation is proposed, including micro-siting of WTGs, or use of screening vegetation or window treatments at affected areas. All measures will be incorporated into the Project's Environmental and Social Management Plan (ESMP) and operational Environmental and Social Monitoring Programme.
- **Residual Assessment**: Following the application of feasible mitigation, residual impacts will be re-evaluated and their significance classified according to the ESIA's standard impact-significance matrix (combining receptor sensitivity and magnitude of effect).

13.4.2.2 Zone of Theoretical Visibility

The Zone of Theoretical Visibility (ZTV) represents the area within which the project may theoretically be visible under ideal weather and unobstructed conditions. ZTV modelling was undertaken in WindPRO using the ZVI (Zone of Visual Influence) module. All modelling applied a bare-ground scenario, meaning only terrain elevation was considered; buildings, vegetation and other screening elements were not included. The ZTV therefore represents a worst-case envelope of potential visibility and does not account for weather, atmospheric conditions or micro-topographic variation.

Initial modelling for the Scoping Report was undertaken using a 35 km radius around the WPP. This was later refined to a 22.5 km radius for the ESIA, covering all key settlements (including Zhanatas) and reflecting updates to the WTG layout, which primarily involved shifting turbines toward the centre of the plateau. A correctional ZVI run was carried out using the revised layout.

The results of the general ZVI modelling are presented in Figure 12-1 (Section 1.3.1) and cover the entire 22.5 km calculation zone for elevated areas (mostly in the north-western direction from the WPP area); the legend in Figure 12-1 indicates, by colour, the number of WTGs visible from each point. A limitation of this modelling approach is that it shows only general visibility without assessing the apparent size of the WTGs in the field of view. Therefore, even within areas identified as ZVI, actual visibility is often minimal.

To address this limitation, a second modelling approach using the Vertical Subtended Angle was undertaken (Figure 12-29). This method considers both terrain elevation and the vertical angle occupied by visible turbine components in the viewer's field of view. As a general guide:

- 0–1° → turbines are theoretically visible but difficult to distinguish;

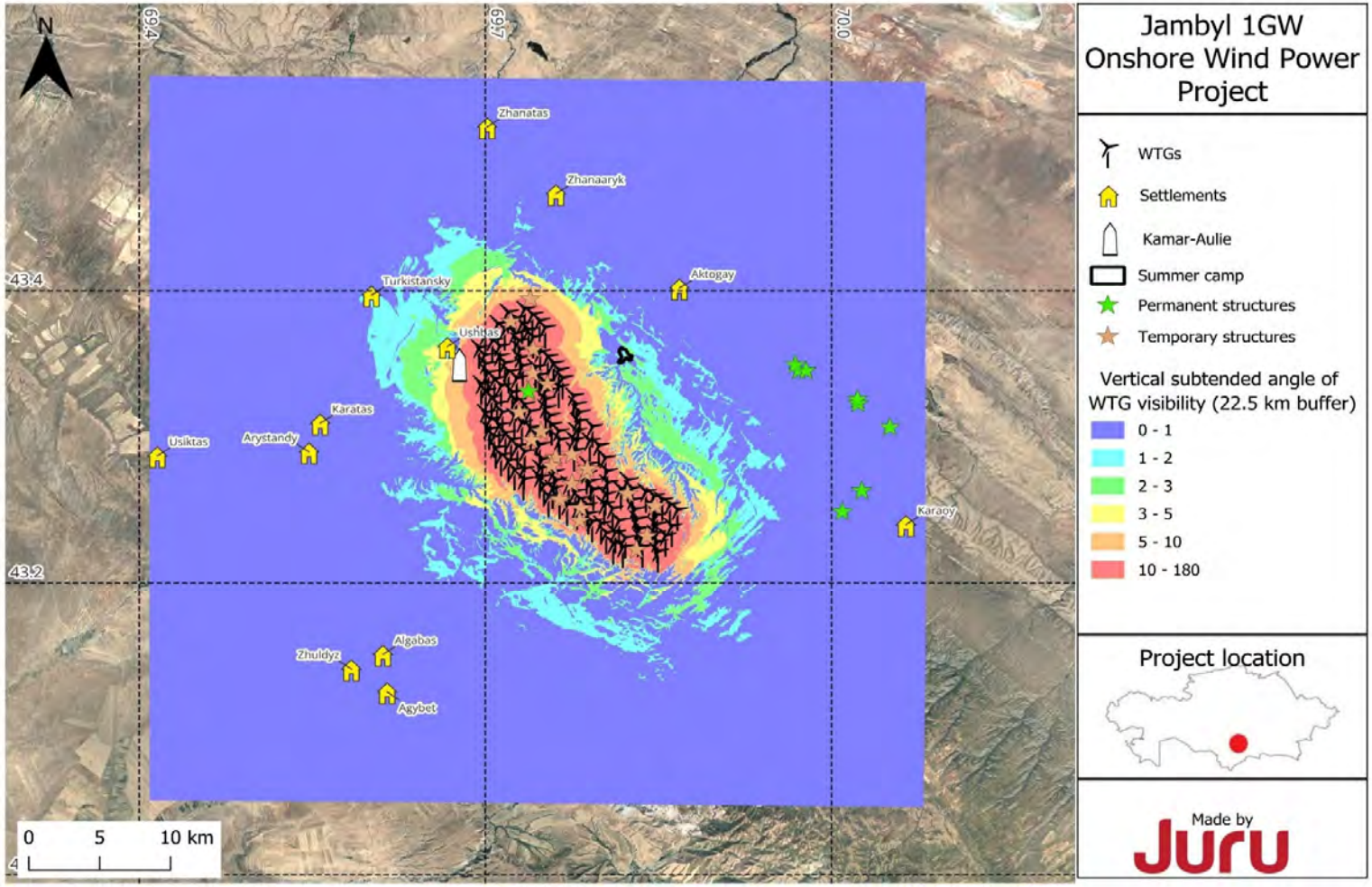
- 1–2° → turbines appear small and visually unobtrusive;
- 5–10° → turbines appear large and attract noticeable attention;
- >10° → turbines become visually dominant in the landscape.

The results of the vertical subtended-angle modelling (Figure 12-29) indicate that only receptors located within approximately 10 km of the WPP fall within zones where turbines would occupy more than 1–2° of the vertical field of view and may therefore be noticeably visible. These areas include elevated ground near the WPP plateau and locations such as Ushbas, Turkestanskiy, the summer camp, and Kamar-Aulie. Beyond this distance, most settlements fall within the 0–1° band, where turbines may be technically visible but would appear extremely small and often merge with the horizon under normal viewing conditions. This reflects the pronounced influence of topography and distance on perceived turbine prominence and provides a more realistic indication of actual viewer experience than the general ZVI alone.

Thus, the general ZTV can be defined as 22.5 km, while the Vertical Subtended Angle ZTV is 10 km.

Photomontage testing confirmed that in areas where subtended angles fall below 1°, such as at selected viewpoints in Zhanatas, turbine visibility is minimal and often merges with the horizon.

Figure 12-29: Vertical subtended angle ZVI (22.5 km buffer)



13.4.2.3 Landscape and Visual Assessment and Photomontages

To complement the ZVI and vertical subtended-angle modelling, photomontages were prepared for the 10 representative viewpoints described in Section 12.3.5. The photomontages illustrate how the proposed WTGs would appear within actual views experienced by receptors under clear conditions. In locations where the subtended-angle modelling indicated 0–1° vertical visibility, photomontages confirmed that turbine components—when visible at all—would appear extremely small and often merge with the horizon. Findings for each viewpoint are summarised below.

VP 1 - Akhtogay Village

Photomontage results showed that the WPP area will not be visible from VP 1, as the point is located in a low-lying area and the foothills of the Small Karatau act as a natural visual barrier. Therefore, no visual effects from the planned development are expected from the Akhtogay village side. A photomontage output of VP 1 in the Visualisation of Hidden Objects mode is shown in Figure 12-30.

Figure 12-30: Visual point 1 photomontage (Visualisation of Hidden Objects mode)



VP 2 - Ushbas Village

From VP 2, WTG visibility is limited by the intervening hills between Ushbas and the WPP plateau. Visibility is primarily confined to the depression between hills, where one full rotor and blade tips from several additional WTGs are perceptible. The photomontage shows that visibility is localised and intermittent, consistent with the modelling outputs (see Figure 12-31).

Figure 12-31: Visual point 2 photomontage



VP 3 - Turkestanskiy Village

VP 3 provides a wide long range view of the WPP area on the horizon. Approximately 50 rotors are theoretically visible across the horizon. At this distance, turbines appear small but detectable, with the nearest WTGs presenting slightly greater perceptibility (see

Figure 12-32). These results are consistent with the subtended-angle modelling, which places this viewpoint within the 1–2° range.

Figure 12-32: Visual point 3 photograph



VP 4 - Summer Camp

Although VP 4 was selected at an elevated point of the summer camp - where maximum visibility of WTGs was expected - extensive tree planting significantly obscures the view. Only one rotor and the blades of two additional WTGs are visible (see Figure 12-33). The “Visualisation of Hidden Objects” mode confirms that numerous turbines lie behind tree cover (see Figure 12-34).

Figure 12-33: Visual point 4 photomontage



Figure 12-34: Visual point 4 photomontage (Visualisation of Hidden Objects mode)



VP 5 - Karaoy Village

From VP 5, the WPP area lies behind intervening hills, placing the nearest WTGs below the horizon. As a result, no turbines are visible in the photomontage, and the viewpoint experiences no direct views of the development. The Visualisation of Hidden Objects mode indicating WTGs beyond the horizon is shown in Figure 12-35.

Figure 12-35: Visual point 5 photomontage



VP 6 - Arystandy Village

The photomontage for VP 6 shows 12 WTGs perceptible above the horizon line; however, the majority of each turbine is screened by the natural hills, and only blade tips are visible (see Figure 12-36). The Hidden Objects visualisation confirms that turbine towers and hubs remain entirely below the local skyline (see Figure 12-37).

Figure 12-36: Visual point 6 photomontage



Figure 12-37: Visual point 6 photomontage (Visualisation of Hidden Objects mode)



VP 7 - Zhanatas City

VP 7, located on elevated terrain, has long-distance views toward the WPP. The photomontage demonstrates that WTGs appear extremely small and are difficult to distinguish from the horizon, even though the modelling indicates theoretical visibility. This reflects the very low subtended angle (<1°) at this distance. The Visualisation of Hidden Objects mode provide contrast with WTGs along the horizon and is shown in Figure 12-38.

Figure 12-38: Visual point 7 photomontage (Visualisation of Hidden Objects mode)



VP 8 – Zhanaaryk village

From VP 8, the WPP remains entirely behind the hills separating the village from the plateau. No turbines are visible in the photomontage. The Hidden Objects mode confirms that all WTGs lie fully below the horizon (see Figure 12-39).

Figure 12-39: Visual point 8 photomontage (Visualisation of Hidden Objects mode



VP 9 – Algabas village

Similar to VP 6, only the blades of two planned WTGs will be visible above the hills from VP 9, while all other WTGs will remain behind the horizon. The photomontage is presented in Figure 12-40, and the Visualisation of Hidden Objects mode indicating WTGs behind the horizon is shown in Figure 12-41.

Figure 12-40: Visual point 9 photomontage



Figure 12-41: Visual point 9 photomontage (Visualisation of Hidden Objects mode)



VP 10 – Kamar-Aulie

VP 10 offers extensive views toward the WTGs. This is the only selected point from which full-height WTGs - from base to tip - can be seen, with six such WTGs visible. An additional eight WTGs are visible with more than half of the tower height, and several dozen more with visible rotors (see Figure 12-42).

Figure 12-42: Visual point 10 photomontage



13.4.2.4 OHTL Operational Visual Impacts

During operation, visual effects from the OHTLs are expected to be limited and localised, owing to the comparatively low height of transmission towers and the slender, linear form of the structures. Visibility is generally confined to receptors within approximately 1–1.5 km of the alignment, with intervening landform providing screening in many areas. Beyond this distance, towers typically lack visual prominence and do not form noticeable skyline features.

Both OHTL routes closely follow the alignment of existing transmission infrastructure, significantly reducing the degree of new visual change introduced into the landscape. Around the Jambyl Substation near Auliekol, several OHTLs already converge, forming an area of concentrated electrical infrastructure. The addition of the Project's OHTLs in this context therefore represents a modest incremental change within an already developed corridor, rather than the introduction of a new visual element into an otherwise undeveloped setting.

Receptors closest to the alignment - such as Auliekol, Akhtogay, Zhanaaryk, and the residential cluster near Ushtobe Dam, may experience Minor operational visual effects due to the proximity of towers. However, these effects are restricted to limited portions of the view and remain substantially less prominent than those associated with WTGs. For the majority of settlements within the wider AoI, the OHTLs are either entirely screened by terrain or visible only as negligible elements lacking visual dominance.

Accordingly, operational-phase visual impacts associated with the OHTLs are assessed as Insignificant to Minor.

13.4.2.5 Overall Operational Visual Impact Summary (WPP and OHTLs)

During operation, the WPP introduces tall, highly visible vertical structures into an otherwise open and generally low-relief landscape. The degree of visual change varies substantially with distance, topography, and receptor elevation. The ZTV (22.5 km) identifies where turbines may be theoretically visible; however, the vertical subtended-angle modelling indicates that notable turbine prominence occurs only within approximately 10 km of the WPP, with actual perceptibility often much lower where intervening hills screen views.

The photomontage assessment confirms that:

- No turbines are visible from several villages due to topographic screening (e.g., VP 1 Akhtogay, VP 5 Karaoy, VP 8 Zhanaaryk).
- Only partial turbine components (e.g., blade tips) are visible from mid-range receptors behind intervening hills (e.g., VP 6 Arystandy, VP 9 Algabas).
- At mid-range distances (approximately 5–10 km), turbines remain visible but have a low level of visual prominence. Subtended-angle values of approximately 1–2° indicate that turbines are perceptible but not dominant in the view (e.g., VP 3 Turkestanskiy).
- Turbines are visible but appear small from long-range elevated locations (>10 km), where subtended angles fall below 1°, causing turbines to merge with the horizon (e.g., VP 7 Zhanatas).
- Kamar-Aulie is the only receptor with clear, full-height visibility of multiple WTGs and is therefore the location of greatest visual prominence.
- Ushbas village experiences limited, localised visibility through gaps between hills but otherwise benefits from substantial natural screening.

Based on the combined ZVI, subtended-angle, and photomontage analysis, operational visual impacts from the WPP range from Insignificant to Moderate, with the highest effects occurring at Kamar-Aulie and localised areas of Ushbas.

Operational visual impacts from the OHTLs are limited and highly localised due to the relatively low height and slender form of transmission towers. Visibility is generally restricted to receptors within 1–1.5 km of the alignment, with terrain providing extensive screening. Both OHTLs closely follow existing transmission corridors, and near Auliekol and the Jambyl Substation, they enter an area already containing multiple lines. As a result, the Project introduces only minor incremental visual change, and operational OHTL impacts are assessed as Insignificant to Minor for all receptors.

Activity/Impact/Aspect					
Long-term visual change associated with the presence of operational WTGs and OHTL structures, including visibility of turbine towers, hubs and rotating blades, and visibility of OHTL towers along sections of the alignment.					
Type	**Duration**	**Extent**	**Scale of Impact**	**Frequency**	**Likelihood (unplanned events)**
Direct	Long term	Local to regional (within 10 km)	Perceptible where visible; negligible where screened	Continuous (day and dusk visibility)	Very unlikely

Receptor	**Sensitivity**	**Magnitude**	**Significance of Impact**
Ushbas & Turkestanskiy villages (near-range, partially screened)	Medium	Low	**Minor** Localised visibility through gaps in hills; limited prominence; extensive landform screening.
Kamar-Aulie, including shrine and cemetery (cultural viewpoint)	High	Medium	**Major** Only receptor with full-height visibility of multiple WTGs; turbines form a notable landscape element.
Mid-range screened settlements (Akhtogay, Karaoy, Zhanaaryk, Algabas)	Medium	Negligible–Low	**Insignificant–Minor** Turbines fully or mostly behind hills; occasional blade-tip visibility only
Long-range receptors (>10 km; e.g., Zhanatas)	Medium	Negligible	**Insignificant** Subtended angle <1°; turbines appear extremely small and merge with horizon.
Summer camp	Medium	Low	**Minor** Tree planting screens most turbines; one–two partially visible rotors remain.
Herders and seasonal users within WPP plateau	Medium	Low–Medium	**Minor–Moderate** Close-range exposure from within plateau; turbines more prominent at short distances.
Road users (KN-1 highway and local tracks)	Low	Negligible–Low	**Insignificant–Minor** Views are transient; frequent screening by terrain.
Residential clusters near OHTLs (Auliekol, Akhtogay, Zhanaaryk, Ushtobe Dam)	Medium	Low	**Minor** OHTLs locally visible but slender; most built within existing transmission corridors.

13.5Mitigation, Management & Residual Impacts

13.5.1 Construction Phase

Construction-phase visual impacts are temporary, localised and largely reversible, arising from the presence of machinery, construction compounds, material laydown areas, turbine erection equipment and OHTL installation works. These effects occur at specific work fronts and shift progressively across the WPP and OHTL corridors, meaning no single receptor experiences prolonged exposure. The following table sets out the key mitigation and management measures to reduce visual disturbance during construction, together with the expected residual impacts after implementation of these measures.

Activity/Aspect	Pre-mitigation	Mitigation and Management Measures	Residual Significance
Temporary visual disturbance from earthworks, grading, topsoil stripping, WTG pad preparation, and internal track/access-road construction (WPP & OHTL) Localised visibility of machinery, exposed earth and soil stockpiles; short-term visual disruption for nearby receptors.	**Minor**	• Limit site clearance, levelling and grading strictly to required footprints (WTG pads, access roads). • Use existing disturbed ground where feasible for construction activities. • Keep stockpiles low, neat and sited to avoid unnecessary skyline intrusion. • Progressive reinstatement of disturbed areas.	**Minor** Reduced through restricted footprints and orderly site management.
Construction compounds, laydown areas, temporary offices, storage containers Temporary introduction of visually cluttered elements in open landscape.	**Minor**	• Cluster temporary facilities (site office, laydown, workforce facilities) to minimise landscape spread. • Site compounds away from sensitive receptors where practicable and use natural landform for screening. • Maintain tidy, orderly storage areas and implement strict housekeeping (avoid scattered materials/litter). • Remove temporary facilities immediately after use.	**Minor** – Localised and reversible visual effects.
Crane operations and turbine erection (WPP) – Brief skyline intrusion during major lifting activities.	**Minor**	• Minimise duration of crane deployment. • Lower cranes and tall equipment when not in use so they do not protrude unnecessarily. • Notify nearby communities prior to major lifts.	**Minor** Very short duration; fully reversible.
Construction traffic along access roads and internal tracks (WPP & OHTL) Transient visibility of vehicles and dust	**Insignificant–Minor**	• Use designated and pre-approved access routes. • Enforce strict speed limits and avoid off-track driving. • Implement dust suppression to minimise temporary haze.	**Insignificant–Minor** Brief,

Activity/Aspect	Pre-mitigation	Mitigation and Management Measures	Residual Significance
plumes.		• Avoid convoy movements unless required for safety.	intermittent visibility only.
Night-time construction (if required) Potential visibility of lighting from nearby receptors, introduction of visible light-glow in dark rural environment.	**Minor**	• Avoid night works unless strictly necessary and permitted. • Use directional, shielded, downward-facing lighting (<30° from vertical; no receptor-facing lights). • Minimise intensity and number of lights.	**Insignificant** Well-controlled lighting prevents notable impacts.
OHTL tower construction, stringing works, and movement of installation equipment Localised visibility of tower erection activities and workfronts.	**Minor**	• Adopt sequential construction to minimise duration of exposure at any one location. • Remove temporary work areas and reinstate ground immediately following stringing. • Store materials neatly; avoid extended presence of unused equipment.	**Minor** Localised and short-term.

Implementation of these measures ensures that construction-phase visual impacts remain localised, temporary and fully reversible, with no significant adverse effects expected for any receptor. The residual impacts remain Insignificant to Minor, consistent with the magnitude and temporary nature of construction activities.

13.5.2 Operation Phase

During operation, most visual impacts arise from the long-term presence of the WTGs, with additional but more limited contributions from the OHTL infrastructure and ancillary facilities. As operational-phase visibility cannot be eliminated, mitigation focuses on minimising contrast, maintaining a consistent appearance, and avoiding the introduction of unnecessary visual clutter within the landscape. The following section outlines the key mitigation and management measures, together with the corresponding pre- and post-mitigation impact significance.

The operational visual assessment has been undertaken using a worst-case layout of 140 WTGs, based on an assumed turbine capacity of 11 MW. This represents a conservative scenario, as only approximately 100 WTGs would be required to achieve the Project's target capacity using 11 MW turbines. The reduction in turbine numbers provides significant flexibility for layout refinement during detailed design, enabling the Project to reduce turbine visibility and overall visual prominence at key receptor locations.

WTG Layout Optimisation and Setbacks

As demonstrated in the ZVI, subtended-angle modelling and photomontage assessment, the key determinants of visual impact are proximity, viewer elevation, and skyline penetration. The receptors most affected under the preliminary layout are Kamar-Aulie, where full turbine height is visible, and Ushbas, where turbines and blade tips are visible through breaks in the intervening hills.

In line with the mitigation hierarchy, layout optimisation is the most effective and practical means of reducing operational visual impacts. By selectively removing or repositioning turbines on the western and north-western perimeter of the WPP, i.e. those most visible from Ushbas and Kamar-Aulie, the number of turbines appearing above the skyline or forming prominent visual elements can be substantially reduced. With a layout reduced from 140 to approximately 100 turbines, the final arrangement can be designed to:

- increase separation distances between turbines and key visual receptors;
- avoid turbine placement that causes skyline intrusion from sensitive viewpoints;
- reduce the number of visible turbines in open views from Kamar-Aulie;
- minimise visual stacking and overlapping of turbines in the landscape;
- maintain visual coherence through orderly spacing and consistent turbine rhythm.

Preliminary visibility testing indicates that targeted removal of perimeter turbines can significantly reduce turbine visibility from Ushbas and reduce vertical-angle prominence in views from Kamar-Aulie, the most culturally sensitive receptor.

As with the noise optimisation strategy, the final WTG layout will need to balance multiple considerations, including:

- wind resource and energy yield
- constructability and geotechnical constraints
- biodiversity, hydrology, and cultural heritage sensitivities

- setback and micro-siting requirements.

Nevertheless, visual impact reduction will form an explicit part of the micro-siting process, and turbines identified as significantly contributing to visual prominence will be reviewed for potential removal or relocation. The refined layout will undergo final visual verification, including updated ZVI modelling and

viewpoint assessment, prior to construction.

Sensitive Receptor	Pre- mitigation	Mitigation and Management Measures	Residual Significance
Long-term visibility of WTGs from near-range receptors (e.g., Kamar-Aulie, parts of Ushbas), including blades, towers and rotor movement	**Moderate** for Kamar-Aulie; **Minor** for Ushbas	• **Layout optimisation**: In the event that 11MW WTGs are selected and turbine numbers reduced from 140 to ~100, prioritise removal or relocation of turbines on the western and north-western perimeter of the WPP, i.e., those contributing most to visibility from Ushbas and Kamar-Aulie. Configure the final layout to minimise skyline intrusion and reduce the number of turbines visible in key views; maintain coherent turbine spacing during micro-siting. • **Design measures**: Apply non-reflective finish and maintain turbine surfaces in good condition to minimise contrast. • **Operational housekeeping**: Keep turbine bases clear of unnecessary equipment; avoid long-term storage of materials in open views.	**Moderate** at Kamar-Aulie (unavoidable due to proximity and open views); **Minor** for Ushbas.
Visibility of WTGs from mid- to long-range settlements (e.g., Turkestanskiy, Zhanatas, Karaoy, Algabas)	**Insignificant–Minor**	• Same turbine colour and finish requirements as above. • Maintain good housekeeping at the WPP to avoid ancillary clutter near turbine bases.	**Insignificant–Minor** No additional visibility reduction achievable.
Visibility of WTGs to herders and seasonal users within the WPP plateau	**Minor–Moderate**	• Maintain orderly appearance of WTG bases and avoid unnecessary storage at turbine locations. • Reinstate any temporary construction areas not required during operation. • Reinstate temporary tracks and disturbed areas not required during operation.	**Minor–Moderate** Turbine visibility inherent to WPP operation.
Night-time visibility of aviation lights (WTGs only) *if required by aviation authorities*	**Minor** at long range; **Minor–Moderate** at close range	• Use aviation lighting that meets minimum regulatory intensity only. • Use synchronised, low-intensity, medium-red lights where permitted. • Avoid white strobe lighting unless expressly mandated.	**Minor–Moderate** Residual effects remain limited and compliant with regulatory requirements.
Ancillary operational infrastructure (e.g., O&M building, substation, storage areas)	**Insignificant–Minor**	• Architectural treatments and colours consistent with the surrounding landscape (light, neutral tones). • Maintain good housekeeping and avoid external storage of equipment where not required. • Use existing vegetation or landform to provide incidental screening where feasible.	**Insignificant–Minor**

Sensitive Receptor	Pre- mitigation	Mitigation and Management Measures	Residual Significance
Visibility of the OHTLs, particularly near Auliekol, Akhtogay, Zhanaaryk and Ushtobe Dam	**Minor**	• Align OHTL maintenance activities with existing access routes to avoid creating new visible disturbance. • Maintain tower surfaces to avoid rusting or colour contrast increases. • Keep the OHTLs clear of unnecessary signage or ancillary structures.	**Minor** – OHTLs remain slender and visually recessive; largely follow existing corridors.

Following implementation of the proposed mitigation and management measures, most operational visual impacts remain limited and manageable, reflecting the strong influence of distance, topography, and natural screening across the wider landscape. For the majority of settlements and receptors, residual impacts remain Insignificant to Minor, as turbines appear either fully screened, partially screened, or visually recessive at long range. Residual Moderate effects persist at Kamar-Aulie, where proximity and elevated viewing positions result in unavoidable turbine visibility, and to a lesser extent at specific locations within the Ushbas area, although layout refinement is expected to reduce turbine prominence in these views. Herders and seasonal users within the WPP plateau will experience residual Minor–Moderate impacts due to their close proximity and frequent use of open elevated terrain, where turbines remain a prominent and permanent feature of the landscape. No receptors experience Major or unacceptable levels of visual impact, and the Project's operational visual footprint is considered consistent with a large-scale wind energy development in this type of landscape.

14 Hydrology and Hydrogeology

14.1 Introduction and Overview of Assessment Methodology

This section describes the approach adopted to assess the potential impacts of the Project on surface water and groundwater resources. The assessment covers all Project components, including the WPP area, BESS, the two 220 kV OHTLs, access roads, construction camps, laydown areas, and all ancillary infrastructure.

The purpose of the assessment is to:

- characterise existing hydrological and hydrogeological conditions within the Project Area of Influence (AoI);
- identify potential pathways through which construction and operation of the Project may affect surface watercourses, springs, perched aquifers, and groundwater quality and availability; and
- evaluate the significance of potential impacts and define mitigation and management measures in line with national legislation and Good International Industry Practice (GIIP).

The assessment has been undertaken in accordance with the Water Code of the Republic of Kazakhstan and relevant sanitary rules, supported by Lender requirements including IFC Performance Standard 3 (Resource Efficiency and Pollution Prevention), IFC Performance Standard 1 (Assessment and Management of Environmental and Social Risks and Impacts), and applicable sections of the WBG General and Sectoral EHS Guidelines.

The hydrology and hydrogeology assessment follows the overarching ESIA methodology presented in Section 4 and includes the following steps:

- **Legislation and Standards Review**: Review of all applicable national legislation governing water resources, water protection zones, groundwater abstraction, sanitary protection zones, and water quality requirements, including the Water Code, Environmental Code, and sanitary–epidemiological regulations. Relevant international requirements—including IFC PS1 and PS3, and WBG EHS Guidelines—were also reviewed to establish the regulatory and GIIP framework within which the assessment must be undertaken.
- **Baseline Characterisation**: Compilation and review of available data on regional drainage systems, perched aquifers, spring locations, seasonal flow behaviour, groundwater depth, recharge mechanisms, and water quality. Field observations and sampling undertaken during the 2024–2025 scoping and baseline campaigns were integrated with regional datasets and the findings of specialist studies, including the project hydrological analyses.
- **Definition of the Area of Influence** (AoI): Identification of zones where Project activities may alter surface-water flows, modify runoff patterns, disturb spring discharge areas, or influence groundwater quality and recharge. This includes upstream areas intersected by construction works as well as downstream watercourses where sediment transport or accidental releases could propagate.
- **Impact Identification and Prediction**: Assessment of potential changes arising during construction—such as increased sediment loads, altered drainage pathways, erosion, accidental spills, and localised groundwater disturbance from excavation—or during operation, including routine maintenance activities and wastewater handling at the O&M compound.
- **Evaluation of Significance**: Classification of impacts based on the magnitude of predicted change and the sensitivity of receptors (e.g. springs used by herders, small watercourses contributing to

pasture health, downstream users, water-dependent ecosystems). Significance levels follow the ESIA's standard impact-rating matrix.

- **Mitigation and Management Measures**: Identification of measures consistent with the mitigation hierarchy, including erosion-control practices, surface-water protection, spill-prevention procedures, controlled wastewater management, and stormwater drainage measures integrated into Project design. Where necessary, recommendations for monitoring during construction and operation are provided.
- **Residual Impact Assessment**: Evaluation of expected impacts after implementation of mitigation and confirmation of whether residual effects remain acceptable under national and international standards.

14.2Applicable Requirements & Standards

14.2.1 National Regulations

The water legislation of the Republic of Kazakhstan is based on the Constitution of the Republic of Kazakhstan, the Water Code, and other regulatory legal acts.

According to Article 6 of the Constitution of the Republic of Kazakhstan, land, subsoil, water, flora and fauna, and other natural resources are the property of the people. The state exercises the right of ownership on behalf of the people, and such resources must be managed in the interest of the public good.

14.2.1.1 Water resource protection

According to Article 10 of the Water Code, the protection of water bodies and the prevention of harmful impacts of economic and other activities on natural aquatic ecosystems are governed by:

- The Water Code № 481 dated on July 9, 2003 (last amendments in 2025).
- The Environmental Code № 400-VI dated on January 2 (last amendments in 2025)
- The legislation on sanitary and epidemiological well-being of the population

The protection of water resources is implemented through the establishment of water protection zones (WPZ) and water protection lines (WPL) for water bodies, sanitary protection zones for water wells and drinking water supply sources, the setting of water quality standards, a permit-based water use system, and state supervision.

Water resource management and oversight are carried out by **Basin Inspections** for the Regulation of Use and Protection of Water Resources under the Committee for Water Resources of the Ministry of Ecology, Geology, and Natural Resources.

The goals of water legislation in the Republic of Kazakhstan are:

- To achieve and maintain an environmentally safe and economically optimal level of water use and protection of water resources, water supply, and wastewater disposal;
- To preserve and improve living conditions for the population and the environment.

The tasks of water legislation in the Republic of Kazakhstan include:

- Conducting state policy in the field of water resources use and protection, water supply, and wastewater disposal;
- Regulation of water-related activities, including water supply and wastewater disposal;
- Providing a legal framework for supporting and developing sustainable water use and protection

of water resources, water supply, and wastewater disposal;
- Determining the basic principles and directions of water resources use and protection, water supply, and wastewater disposal;
- Management and regulation of activities related to the exploration, study, rational and integrated use, and protection of water resources, hydromeliorative systems, and water management infrastructure;
- Defining directions for the development of land reclamation; and
- Protecting the population and economic facilities from emergencies at water management structures and the consequences caused by them.

Water protection zones and lines

According to Article 116 of the Water Code, in order to maintain water bodies in a condition that meets sanitary, hygienic, and environmental requirements, to prevent pollution, littering, and depletion of surface waters, and to preserve flora and fauna, water protection zones and lines with special conditions for use shall be established, except for water bodies located within specially protected natural areas and the state forest fund.

According to the Order of the Minister of Water Resources and Irrigation dated June 9, 2025 No. 120-NK, **water protection zones** (WPZ) are established to safeguard water bodies and their ecosystems. The width of these zones typically ranges from **500 to 1000 meters**, depending on the environmental situation and geographical conditions of the river basin.

Within water protection zones, **water protection lines** (WPL) are also defined. Their width depends on the slope steepness and land value, and generally ranges from **35 to 100 meters**. Water protection zones, water protection lines, and the regime for their economic use shall be established by local executive authorities (Akimats) of regions, cities of republican significance, and the capital, based on approved design documentation.

According to Article 119 of the Water Code, land plots located within water protection lines of water bodies may be provided for temporary use, on the condition that established requirements for the regime of economic activities are strictly observed. Compliance with these requirements within water protection zones and buffer strips is subject to ongoing monitoring by state authorities. The placement of enterprises and other facilities, as well as the conditions for carrying out construction and other works on water bodies, within water protection zones and water protected lines, is allowed only after obtaining approval from the **Basin Inspection**.

Sanitary protection zones for water wells and drinking water supply sources

According to Article 117 of the Water Code, in order to ensure the protection of water bodies used for drinking water supply, medical, recreational, and other public health purposes, sanitary protection zones are established by the local executive authorities of regions, cities of republican significance, and the capital.

Order of the Minister of Health dated February 20, 2023 No. 26, registered with the Ministry of Justice on February 20, 2023 No. 31934 On approval of the Sanitary Rules Sanitary and epidemiological requirements for water sources, places of water intake for domestic and drinking purposes, domestic and drinking water supply and places of cultural and household water use and safety of water bodies

The legislative act also establishes requirements for the **sanitary protection zone** (SPZ). They are used for

water sources and water mains. There are three protection belts; the first, closest to the source, protects it from direct damage or pollution, and the other two belts are designed to protect against microbiological and chemical pollution.

For surface flowing water bodies, the first SPZ belt is 200 m upstream of water intake point or 100 m in both directions for non-flowing ones. The second and third SPZ belts are 3 and 5 km, respectively.

For underground sources, the first SPZ belt is 30 m for reservoir waters and 50 m for groundwater. The zone may be reduced if there is no possibility of contaminating the source.

For water mains, the width of the sanitary protection strip is:

- 6 m for pipes up to 200 mm in diameter;
- 8 m for diameters up to 400 mm;
- 10 m for diameters up to 1000 mm;
- 20 m for larger diameters.

The procedure for the establishment of sanitary protection zones and sanitary buffer strips is regulated by the state authority responsible for ensuring the sanitary and epidemiological well-being of the population.

In Kazakhstan, water quality standards that ensure the safety of public health and the environment are approved by the Ministry of Health. Order of the Minister of Health dated February 20, 2023 No. 26, registered with the Ministry of Justice on February 20, 2023 No. 31934 On approval of the Sanitary Rules "Sanitary and epidemiological requirements for water sources, places of water intake for domestic and drinking purposes, domestic and drinking water supply and places of cultural and household water use and safety of water bodies.

This legislation establishes sanitary requirements for waters and water bodies for domestic and cultural-domestic water supply, comprehensive pollution, wastewater, and their protection, including protective zones and buffer strips.

Sanitary requirements are established to ensure the quality and safety of water sources, including drinking and domestic water supply points, as well as areas used for recreational and household water use. These requirements help protect public health and the safety of water bodies**:**

The quality of surface and groundwater bodies used for public water supply must comply with hygiene standards (for watercourses 1 km upstream from the nearest water use point, and in non-flowing reservoirs and water reservoirs 1 km in both directions from the water use point).

Water bodies used for drinking purposes are recognized as 1st category water bodies, and those for recreation use as 2nd category. Maximum Permissible Concentration (MPCs) for toxic substances must be met for 1st and 2nd category water bodies.

Discharge of wastewater containing unregulated substances, infections, untreated and inadequately treated water, petroleum products, waste, pulp and snow, as well as wastewater that can be used in a closed water use system, is prohibited from entering into water bodies.

Order of the Minister of Health dated November 24, 2022 No. KR DSM-138 On the Approval of Hygienic Norms for Indicators of Safety of Domestic and Cultural-Domestic Water Use provides the National Environmental Standards (NES) for water quality establishing maximum permissible concentrations of pollutants in water bodies, including rivers, lakes, and groundwater. The standards also establish

requirements for water quality monitoring, reporting data to the government, and implementing measures to protect water quality. The NES has more than 2,000 reference values for different substances. Table 13-1 summarizes the most relevant indicators of the national water quality standard reference values.

Table 13-1: Domestic and cultural-domestic water use Quality Standards (Kazakhstan)

Parameter	Kazakhstan Standard
pH (Hydrogen Index)	6.0–9.0
Total Dissolved Solids (TDS)	1000 (1500) mg/l
Petroleum Products (Total)	0.1 mg/l
Anionic Surfactants (A-SAS)	0.5 mg/l
Phenol	0.001 mg/l
Aluminium (Al, total	0.5 mg/l
Iron (Fe, total)	0.3 (1.0) mg/l
Cadmium (Cd, total)	0.001 mg/l
Manganese (Mn, total)	0.1 (0.5) mg/l
Copper (Cu, total)	1.0 mg/l
Arsenic (As, total)	0.05 mg/l
Nickel (Ni, total)	0.1 mg/l
Nitrates (as NO3)	45 mg/l
Mercury (Hg, total)	0.0005 mg/l
Lead (Pb, total)	0.03 mg/l
Sulphates (SO4)	500 mg/l
Chlorides (Cl−)	350 mg/l
Chromium (Cr6+)	0.05 mg/l
Zinc (Zn, total)	1.0 mg/l

14.2.1.2 Water discharge standards

Article 222. Environmental requirements for wastewater discharge. The discharge of wastewater into natural surface and underground water bodies is permitted only if the relevant environmental permit has been obtained. Operators of facilities are required to comply with the environmental discharge standards specified in the environmental permit. These standards are developed on a case-by-case basis for each wastewater discharge location. In the case of discharging wastewater into municipal sewerage systems, the provisions of this Regulation shall apply. Additional conditions may be specified in the wastewater discharge agreement. Rules for the Acceptance of Wastewater into Municipal Sewerage Systems.

Order No. 546 of the Minister of National Economy, July 20, 2015. These Rules regulate the acceptance of industrial wastewater into municipal sewerage systems. Clause 10: Industrial wastewater discharged jointly with domestic wastewater must not:

- Disrupt system operations or damage infrastructure;
- Exceed 40°c in temperature;
- Contain flammable, acidic, toxic, or gas-forming substances;
- Include clogging materials, suspended solids (>500 mg/l), oils, resins, or tars;
- Exceed macs or contain substances without established macs;
- Include mineral, bacterial, or viral contamination;
- Interfere with biological treatment (e.g., cod > 1.5 × bod);
- Fall outside the pH range of 6.5–9.0;
- Emit strong odours or harmful airborne substances;
- Include hazardous residues from air purification or water treatment (e.g., activated carbon, ion-exchange resins);
- Include slaughterhouse waste, blood, hides, or faecal matter from animal farming.

14.2.1.3 Special Water Use (Article 45)

Special water use is carried out by individuals and legal entities based on a permit. It involves the use of surface and underground water resources directly from a water body, with or without withdrawal. This use supports public drinking and domestic needs, agriculture, industry, energy, aquaculture, and transport. It also includes the discharge of industrial, domestic, drainage, and other wastewater.

To obtain a permit for special water use for groundwater abstraction, a legal entity must confirm the following:

- Ownership or use rights for the water management facility;
- The passport and operating rules of the water management facility;
- Compliance of the water abstraction volume with the approved water use limit for the water use facility;
- Measurement instruments for recording the volume of water use, registered in the state registries;
- A sanitary and epidemiological conclusion confirming compliance with standards;
- Approval of specific water consumption and wastewater generation rates;
- A plan for reducing water losses and applying best available technologies;
- Approved reserves of groundwater deposits for mineral water/approved reserves of other types of groundwater deposits when abstraction exceeds 50 m^3;
- Equipment for measuring water levels in wells.

If abstraction exceeds 1,000 m^3 per day, the following must additionally be developed:

- A groundwater monitoring program;
- A groundwater abstraction design (agreed upon with the subsoil study authority).

At the time of preparing this ESIA, according to Article 46 of the Water Code, the competent authority responsible for issuing permits is the Basin Water Inspectorate.

The authority responsible for subsoil study at the time of preparing this document is JSC "National Geological Service."

14.3Lender Requirements

The IFC Performance Standard 3 (Resource Efficiency and Pollution Prevention) establishes the requirement to avoid, or where avoidance is not possible, to minimise adverse impacts on human health and the environment by reducing pollution from project activities, including water pollution. It also requires minimising water use, monitoring specific (per-unit) consumption, and taking cumulative impacts from water use into account.

To reduce the generation of contaminated water, a hierarchy is introduced whereby wastewater generation must first be avoided, then minimised, and only thereafter treated.

Reference values for water quality standards are established in the IFC General EHS Guidelines and the WHO Guidelines for Drinking-water Quality, as well as in the EU Directive 2020/2184, as presented in Table 13-2 below.

Table 13-2: Complete Drinking Water Quality Standards Comparison (EU – IFC/WHO)

Indicator	EU Directive 2020/2184	IFC/WHO Guideline
pH (Hydrogen Index)	6.5–9.5	6.5–8.5
Total Dissolved Solids (TDS)	No fixed value (Recommended ≤ 1500 mg/l)	1000 mg/l (WHO)
Petroleum Products (Total)	Not specifically regulated	0.01–0.3 mg/l (WHO)
Anionic Surfactants (A-SAS)	Not regulated	0.2 mg/l (WHO)
Phenol	Not regulated	0.001 mg/l (WHO)
Aluminium (Al, total	200 µg/l (0.2 mg/l)	0.2 mg/l
Iron (Fe, total)	200 µg/l (0.2 mg/l)	0.3 mg/l
Cadmium (Cd, total)	5 µg/l (0.005 mg/l)	0.003 mg/l
Manganese (Mn, total)	50 µg/l (0.05 mg/l)	0.4 mg/l
Copper (Cu, total)	2.0 mg/l	2.0 mg/l
Arsenic (As, total)	10 µg/l (0.01 mg/l)	0.01 mg/l
Nickel (Ni, total)	20 µg/l (0.02 mg/l)	0.07 mg/l
Nitrates (as NO3)	50 mg/l	50 mg/l
Mercury (Hg, total)	1.0 µg/l (0.001 mg/l)	0.006 mg/l
Lead (Pb, total)	10 µg/l (0.01 mg/l)	0.01 mg/l
Sulphates (SO4)	250 mg/l	500 mg/l
Chlorides (Cl−)	250 mg/l	250 mg/l
Chromium (Cr6+)	50 µg/l (0.05 mg/l)	0.05 mg/l
Zinc (Zn, total)	Not regulated	3.0 mg/l

For wastewater discharges, the Project will be required to comply with the IFC/WBG General EHS Guidelines (2007), which specify effluent standards for treated domestic and industrial wastewater. These limits constitute the applicable international discharge requirements for the Project.

Table 13-3: IFC/WBG General EHS Guidelines (2007) - Wastewater Discharge Standards

Indicator	IFC/WBG General EHS Guideline Value
pH	6 – 9
Biochemical Oxygen Demand (BOD_5)	30 mg/L
Chemical Oxygen Demand (COD)	125 mg/L
Total Suspended Solids (TSS)	50 mg/L
Oil & Grease	10 mg/L
Total Nitrogen	10 mg/L
Total Phosphorus	2 mg/L
Faecal Coliforms	400 CFU/100 mL
Temperature	≤ 3°C above ambient receiving water
Residual Chlorine (where chlorination is used)	0.2 mg/L
Colour	Should not be objectionable in receiving waters
Odour	No objectionable odour

14.4Baseline Conditions and Receptors

14.4.1 Area of Influence

The Area of Influence (AoI) for hydrology and hydrogeology covers all areas where Project-related activities could directly or indirectly affect the quality or behaviour of surface and groundwater.

During the construction phase, the AoI includes the following areas that may be directly intersected by, or lie within the catchment area of, surface waters or groundwater aquifers.

- WPP site and supporting infrastructure, including turbine foundations, internal access roads, laydown, and temporary storage areas;
- OHTLs and their rights-of-way, including tower foundation sites, construction corridors, temporary access routes, and any associated laydown or storage areas;
- Construction camps and worker accommodation areas, including kitchens, sanitary blocks, and greywater systems;
- Ancillary facilities such as maintenance yards, fuel and lubricant storage areas, and vehicle wash-down or servicing zones;
- Access roads and transport corridors used for the movement of construction materials.

The AoI also extends to downstream sections of surface-water catchments where construction activities may influence runoff patterns, erosion, sedimentation, or accidental pollutant transport, and where such

effects could reach lower-lying land uses or ecological receptors.

For the operation phase, the AoI is narrower and primarily limited to:

- The O&M compound, including offices, workshops, and small sanitary facilities for the operational workforce;
- Designated collection and disposal routes for domestic and maintenance-related wastewaters.

14.4.2 Surface Water

The project is located in an area with a well-developed erosion network, which includes both small watercourses and rivers.

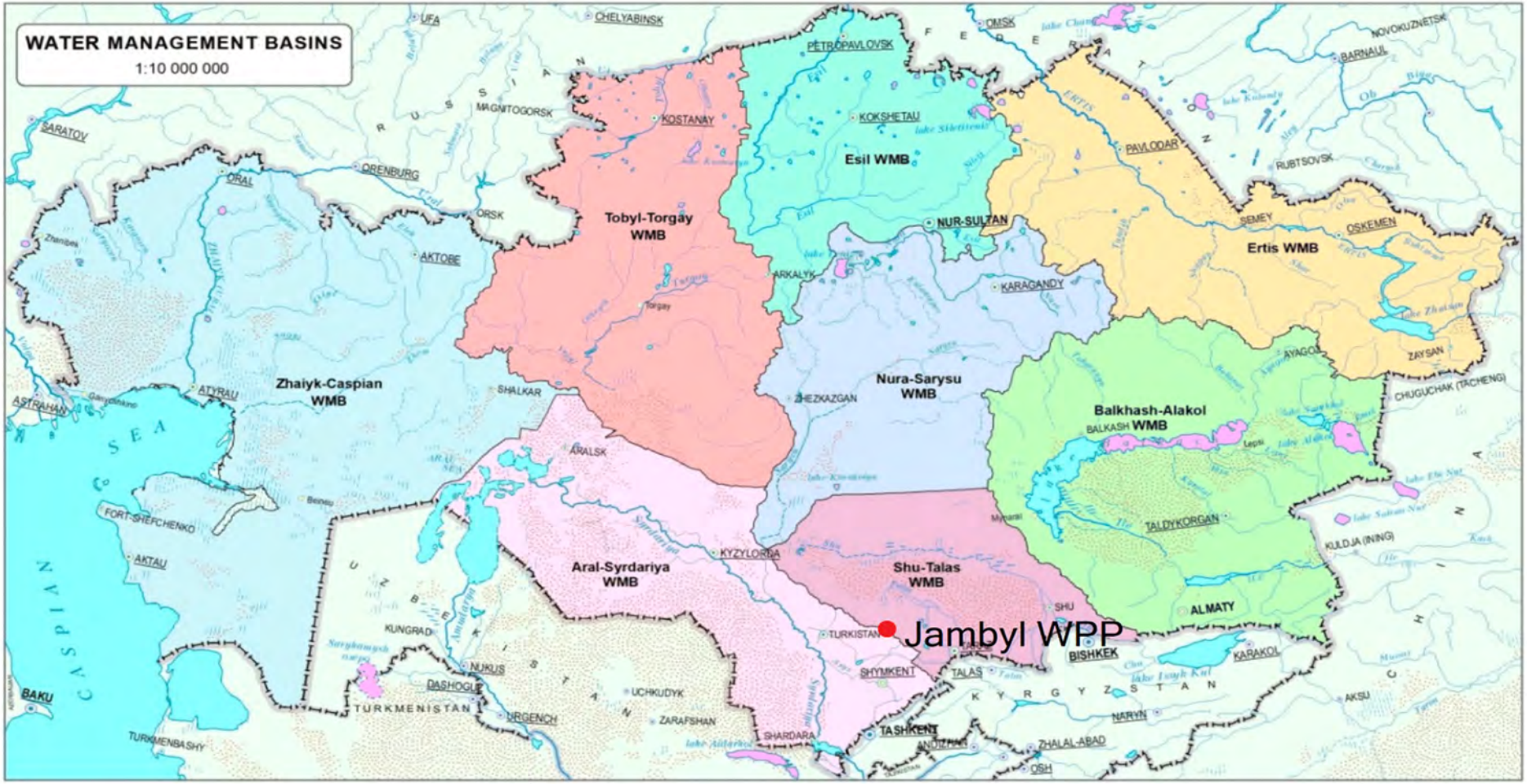
The northeastern part of the WPP area, situated on the eastern slopes of the Karatau range, belongs to the Shu and Talas river basins. The western and southwestern parts of the WPP area, including the western slopes of the Karatau range, fall within the Syr-Darya river basin[242]. The River basin map is presented in Figure 13-1 below.

The Syr-Darya is one of the most important rivers in Central Asia from a socio-political perspective. The river begins at the confluence of the Naryn and Kara-Darya rivers, which originate in the glaciers of Kyrgyzstan, providing the Syr-Darya with glacial-snowmelt; however, the confluence occurs in the territory of Uzbekistan, in the Fergana Valley. The river then crosses the territory of Tajikistan, then flows through Uzbekistan again, and finally passes through Kazakhstan to its mouth, where it flows into the northern part of the Aral Sea. The waters of the Syr-Darya are actively used for electricity generation and agriculture, supported by an extensive network of canals and reservoirs, including those in Kazakhstan[243]. The river's mouth is located approximately 770 km from the planned WPP site.

Within the Shu-Talas river basin, the Talas River is of most relevance to the project due to its proximity. The Talas River originates in the Kyrgyz Republic from the confluence of the Karakol and Uch-Koshoy rivers, which are fed by glaciers and snow. The river's waters are actively used for agriculture in both Kyrgyzstan and Kazakhstan[244]. The river disappears into the Akzhar lake within the Moyynkum sands, 85 km northeast of the WPP site.

[242] Tyumenev, S.D. Water Resources and Water Availability of the Territory of Kazakhstan: Textbook. Almaty: KazNTU, 2008. – 267 p.
[243] Sorg, A., Mosello, B., Shalpykova, G., Allan, A., Hill Clarvis, M., & Stoffel. Coping with changing water resources: the case of the Syr Darya river basin in Central Asia. Environmental Science and Policy, V. 43. M. 2014. 68-77. https://doi.org/10.1016/j.envsci.2013.11.003
[244] Mustafayev Zh.S., Kozykeyeva A.T., Ivanova N.I., Yeshmakhanov M.K., Tursynbayev N.A. Assessment of technogenic load on the catchment basin of the transboundary Talas River based on integral indicators of anthropogenic activity. Izvestiya (Bulletin) of the National Academy of Sciences of the Republic of Kazakhstan. V.2. N.38. 2017. pp. 48-56.

Figure 13-1: River basin map of Kazakhstan[245]



[245] Amirgaliev et al. Water Quality Problems Analysis and Assessment of the Ecological Security Level of the Transboundary Ural-Caspian Basin of the Republic of Kazakhstan. Applied Sciences. V.12. I.4. DOI: 10.3390/app12042059.

14.4.2.1 WPP area

According to the project hydrological report (IDOM, August 2025), 7 Major basins are identified within the WPP area. The map of the basins is presented in Figure 13-4 below.

The largest basin within the WPP area (MB-1) originates from springs, with an extensive erosion network, that converges to form a significant stream, identified as the Shabakty River. A large number of watercourses converge near the summer camp, where a small dam is located. Most of the Shabakty river watercourses within the project area remain dry throughout the year, except during the spring flood season.

The total length of Shabakty is 164 km, its watershed covers 1,290 km^2 and the river mouth at Akzhar lake. The river is mainly fed by rainfall, snowmelt, and groundwater. During summer, the riverbed often dries up[246]. Through consultations with local communities and PAPs it was identified that spring water within the WPP area is actively used as a drinking water source for livestock, for crop irrigation in some locations, and as a key water supply sustaining pastureland.

The river passes through the villages of Aktogay and Saudkent, with the phosphate mine quarries located within a 600m buffer from the river. Downstream from the project (about 25 km), there is also the Yntaly reservoir with a capacity of 30 million m³, which is used for flood regulation and water accumulation for agricultural needs[247][248].

In the northern part of the WPP area, there are two rivers - Ushbas and Burkrtti, which include major basins 4-6.

The Burkitti River has a length of 58 km and is a tributary of the Shabakty River. It is formed from surface runoff and aquifers[249], which are also used by shepherds within the WPP area. The riverbed passes through Zhanatas city and the villages of Zhanaaryk, Mayatas, and Zhayylma. In Mayatas and Zhayylma, the river water is used for irrigating fields, and during dry seasons the river water does not always reach its mouth.

The Ushbas River has a length of 71 km and a catchment basin area of 571 km². The water sources for the river are analogous to others in the WPP area in terms of both genesis and usage [250]. The river passes through Ushbas village and flows into Kyzylkol Lake, near which a canal begins from the river for irrigating lands in Kyzylkol village.

Major basins MB 6-7 belong to the Shayan River, which originates in the southwestern part of the WPP territory. The genesis of the river is analogous to that of other rivers in the project territory; its length is 168 km[251]. The river's waters pass through the villages of Algabas, Zhuldyz, Qazata, Tanatar, Shayan, Zhambyl, and Tasqudyq. In the area of Qazata village, there is a dam on the river forming the Kapchagay reservoir [252], after which another smaller dam is located immediately after Zhambyl village. Further downstream, the river enters the Arys-Turkestan Canal system (used for irrigation), which supplies agriculture in the Turkestan region.

To the east of the WPP area is the Arystandy River, whose water basin does not intersect with the

[246] IDOM hydrological report, 2025
[247] Consultations with KazVodKhoz
[248] https://www.inform.kz/ru/vodohranilisha-zhambilskoy-oblasti-gotovi-k-vegetativnomu-sezonu-5378f1
[249] IDOM hydrological report, 2025
[250] IDOM hydrological report, 2025
[251] IDOM hydrological report, 2025
[252] https://otyrar.kz/2016/05/putevoditel-po-yuko-ozero-kapshagaj/

WTG locations, with the closest WTG to Arystandy's tributary being 800 m away. Lower by the waterway, there is a dam and several settlements. The river joins the Arys-Turkestan channel system.

The major rivers in relation to WPP area are shown in Figure 13-5 below.

Existing springs and watercourses at the WPP area, which are tributaries of the main rivers described above, are used as water sources for grazing animals during the grazing season. Consultations identified that the area is used significantly less during the dry periods due to the lack of water and therefore reduced available grazing land. These springs are predominantly snow-fed, and after the snow melt period, they are rain-fed (which also support local aquifers). Watercourses/drainage channels within the WPP area are shown on Figure 13-6**.**

Figure 13-2 shows the all-year-round rivers of Shabakty and Ushbas, and Figure 13-3 presents an examples of dried temporary watercourse, part of the natural water drainage network, within the WPP area.

Consultations with the authorities confirmed that the rivers within the WPP area have established Water Protection Zones (WPZ) and Water Protection Lines (WPL), as defined by Resolution No. 318 of the Akimat of the Zhambyl Region dated 30.12.2024. The Ushbas, Shabakty, and Berkutti rivers have a WPL of 50 m (in the upper reaches of the rivers, within the WPP area) and a WPZ of 500 m. The WPLs identified within the WPP area were taken into consideration in the WTG layout, based on which two WTGs that were initially located within river WPLs were relocated.

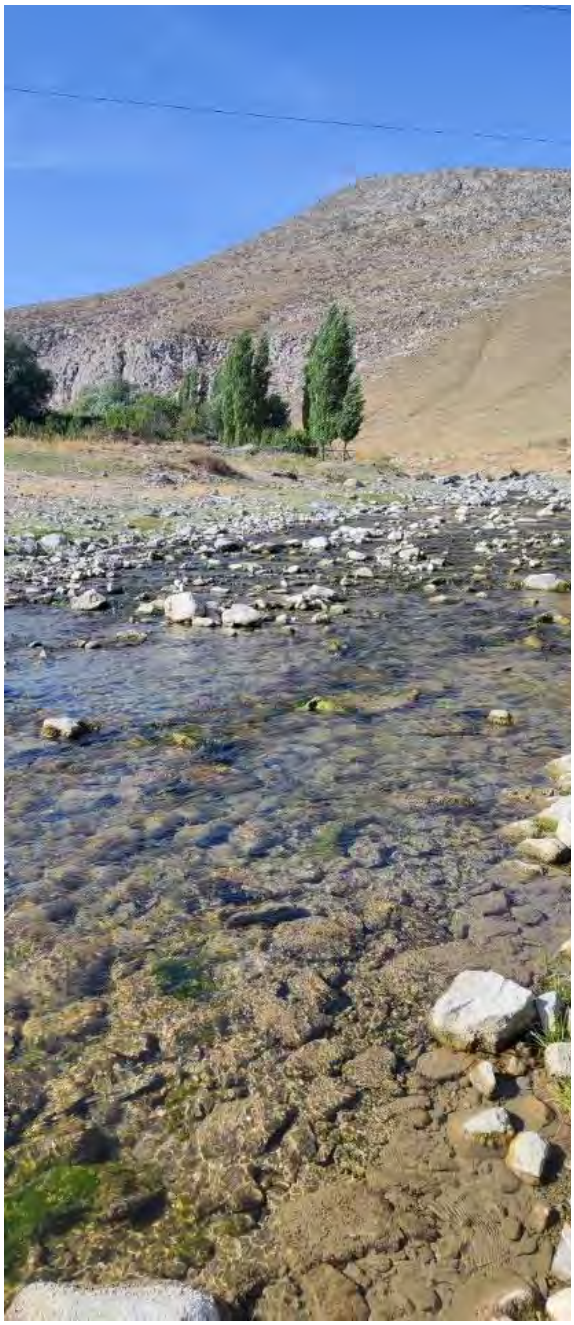
The Shayan and Arystandy rivers are located in the Turkestan Region. The WPL and WPZ for the Shayan River were established by Resolution No. 324 of the South Kazakhstan[253] Region dated 15.09.2010; however, this resolution has since been repealed. The project site is located at the headwaters of numerous small streams that form part of the Shayan River basin. As a result, during consultations with the water authorities, no potential overlaps with WPL or WPZ associated with the Shayan river were identified within the project boundaries.

The Arystandy River has established WPL (35 m) and WPZ (500 m), set by Resolution No. 200 of the Akimat of the South Kazakhstan Region dated 24.08.2017.

Water quality samples were collected for analysis from Ushbas, Berkutti, Shabakty, and the upper Shayan River tributaries, as well as from two representative springs within the WPP area. The sampling and results of the analysis are discussed within Section 13.4.4.

Figure 13-2: Permanent rivers within the WPP area

[253] Before 2018, the Turkestan region was known as the South Kazakhstan region



Shabakty river



Ushbas river

Figure 13-3: Dried watercourses within the WPP area





Figure 13-4: Jambyl WPP major basins (Modified based on project hydrological report, IDOM 2025)

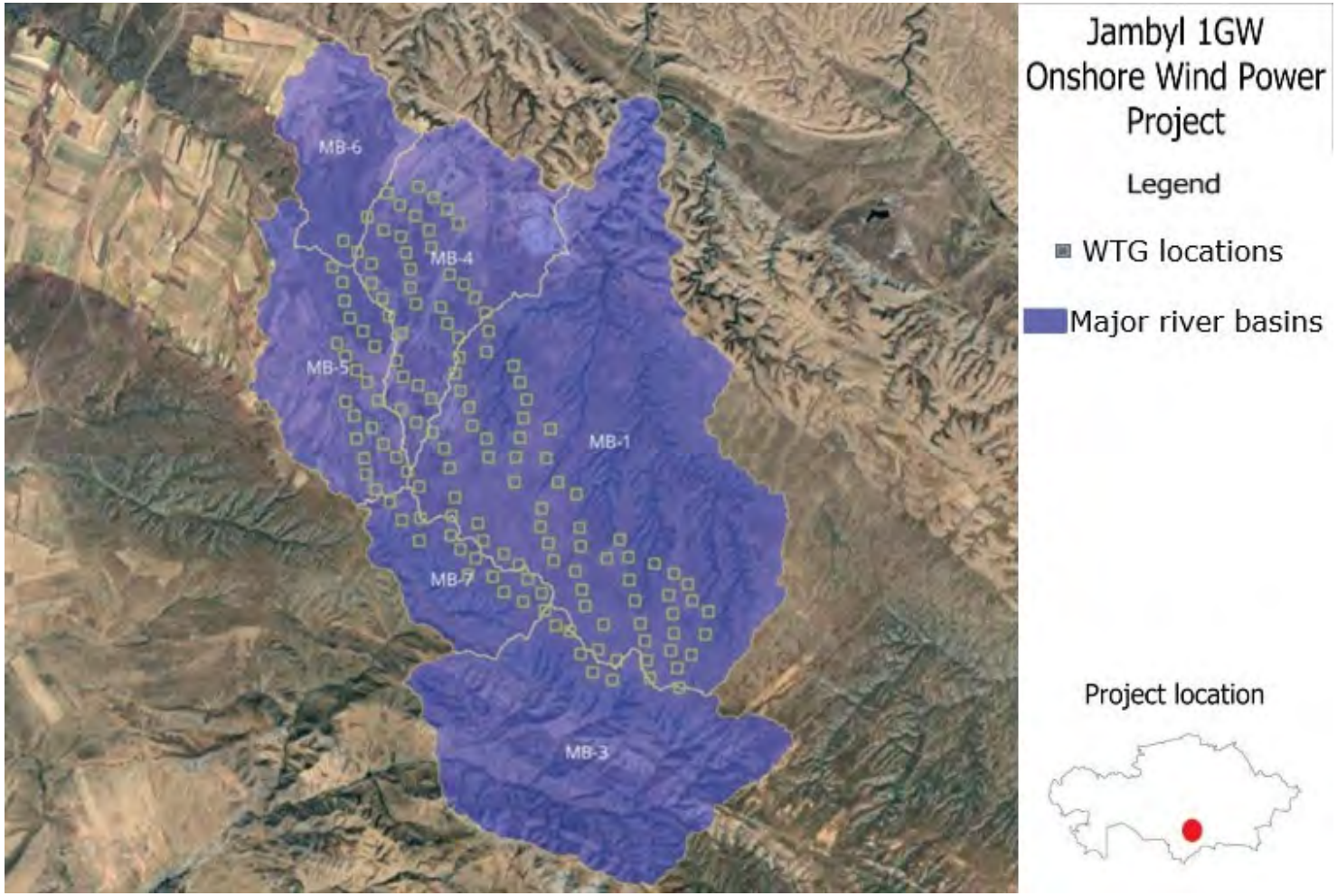


Figure 13-5: Rivers within the WPP area

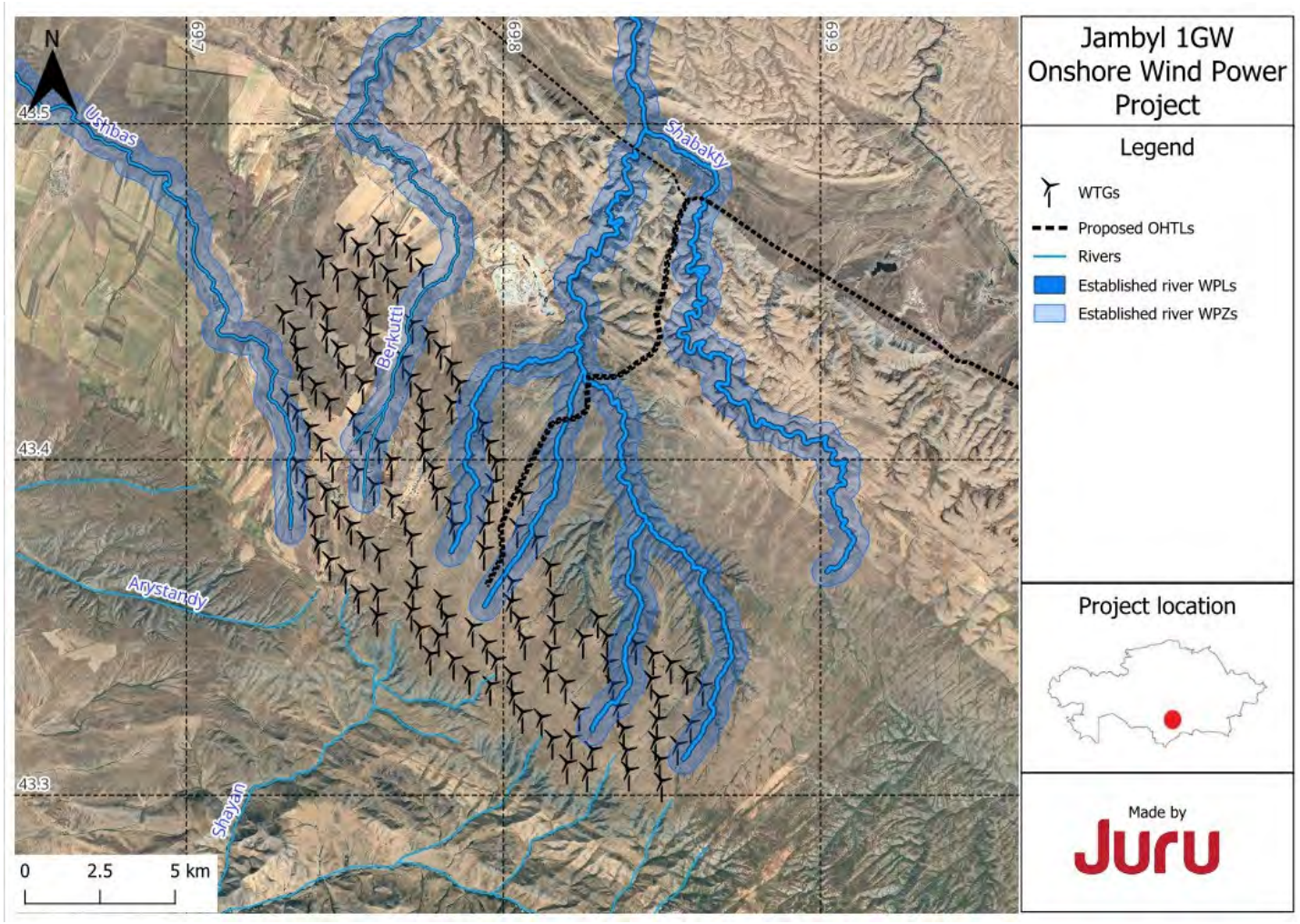
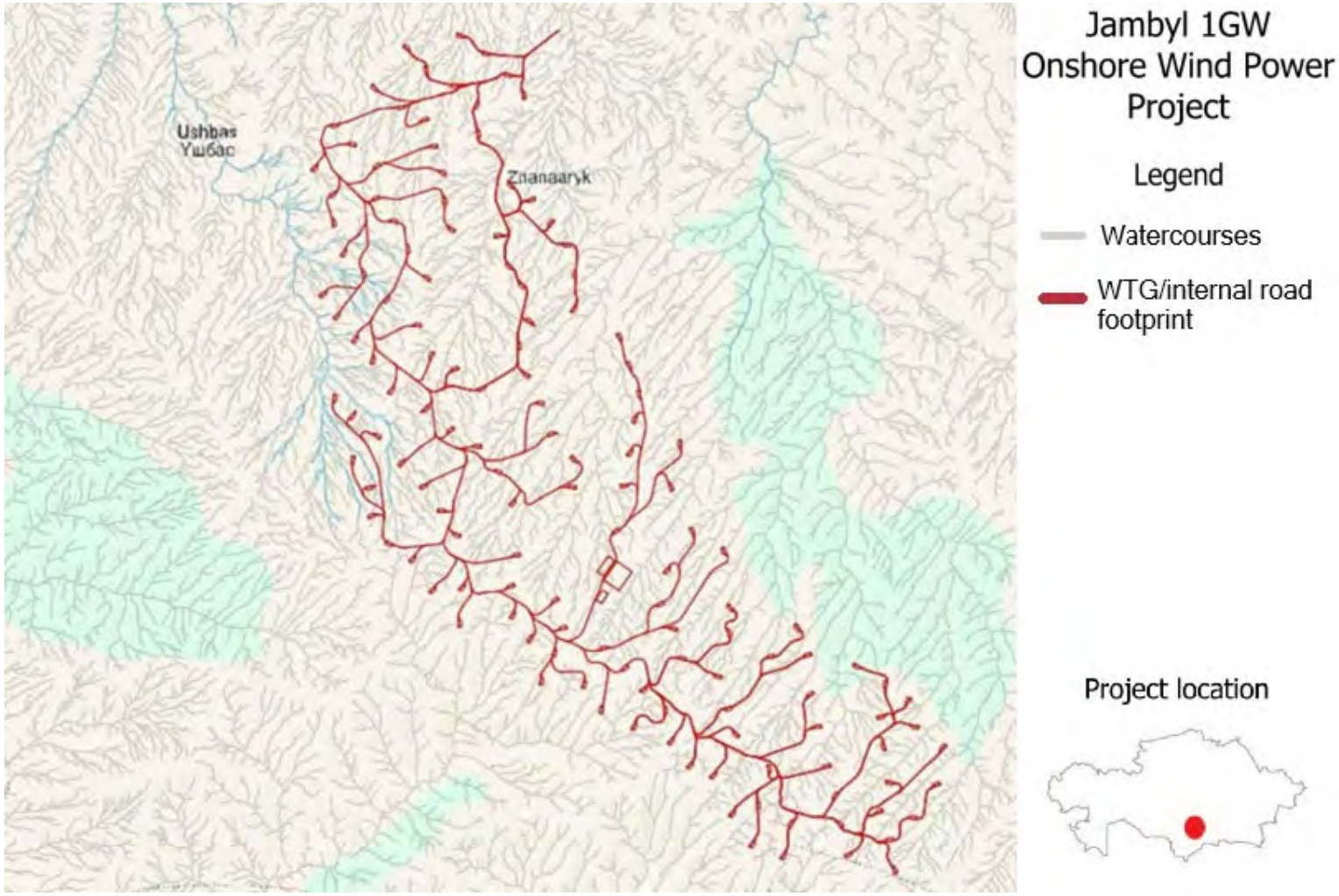


Figure 13-6: Watercourses within the WPP and surrounding area (Modified based on project hydrological report, IDOM 2025)



14.4.2.2 OHTL

The planned OHTLs intersect some rivers and many smaller permanent and temporary watercourses; these are described in more detail below.

Jambyl OHTL

The Jambyl OHTL crosses 3 permanent rivers and several dozen watercourses existing only during the spring period (see Figure 13-7). All the watercourses are related to the Shu-Talas river basin and are formed on the Karatau ridge fed by snowmelt, rainfall, and aquifer waters. The rivers include Shabakty (described above in the section 13.4.2.1), Kyrshabakty, Koktal, and Tamdy. The location of the most significant rivers and watercourses along the Jambyl OHTL are shown in Figure 13-7 below.

The Kyrshabakty River is a tributary of the Shabakty River with the confluence located approximately 41 km downstream from the intersection point with the planned OHTL. There are no settlements in this section, however, in the middle course there are several open-pit quarries bordering the riverbed.

Approximately 20 km downstream from the planned OHTL intersection, the Koktal River is divided by a canal near the settlements of Kyzylaut and Aktobe, where the river's water is used for irrigated agriculture. The water in the riverbed flows into Lake Ashchykol, and the canal water flows into Lake Akkol. Also, near the intersection of the river and the OHTL, there is the Koktal sanatorium and, 5 km downstream, a settlement.

The Tamdy River flows into the Assa River 30 km from the intersection point with the planned OHTL. In this section, the river passes through the town of Karatau and the village of Tamdy, where it is used for irrigated lands. Also, within the boundaries of Karatau, part of the river's water is diverted to the Zhartas reservoir (storage for seasonal irrigation) with a volume of 5.26 m^3[254].

The remaining permanent and seasonal watercourses along the Jambyl OHTL route flow into the rivers mentioned above, or into water bodies such as Lake Bilikol and Taskol (approximately 5 km from the OHTL) or Kyshy Akkol (0.8 km from the OHTL), which were formed in topographical depressions.

Among the watercourses crossed by the Jambyl OHTL, the Koktal and Tamdy rivers have established WPL and WPZ. The WPLs are 50–75 m and 35–50 m respectively, while the WPZ for both rivers is 500 m.

Among the perennial rivers crossed by the OHTL, the Kyrshbakty River does not have established WPL or WPZ.

Kentau OHTL

Kentau OHTL crosses 5 rivers existing all year round, and with many watercourses that stay dry for most of the year (see Figure 13-8). The number of such watercourses increases with proximity to mountainous areas. The rivers within the Shu-Talas river basin include Berkutti and Ushbas (described in the section 13.4.2.1), as well as Baba-Ata. The rivers belonging to the Aral-Syrdarya basin include Kokkia, Ibata, and Kursai. Like other rivers near the project area, these rivers are formed in mountainous terrain. The location of the most significant rivers and watercourses along the Kentau OHTL are shown in Figure 13-8 below.

The Baba-ata intersects the planned OHTL route in a desert area, where the river begins to disappear during hot periods. The river's mouth is in Lake Akzhar, approximately 30 km downstream; there are

[254] Consultations with KazVodKhoz

no visible signs of agricultural or settlement use in this section.

The Kokkia River intersects the planned OHTL on the territory of the Karatau ridge. The river is a tributary of the Ibata River. Downstream, after descending from the ridge to the plain, part of the river's water is diverted by a canal for irrigated agriculture.

The Ibata River flows into the Arys-Turkestan canal system around 25 km from the intersection with the OHTL. In this section, the river passes through the villages of Ibata and Zhana Ikan. At the OHTL intersection, the river's water is also directed through small channels for field irrigation.

The Kursai River, adjacent to the Ibata, dries up completely during the hot period of the year. There is no active agriculture on the river; however, upstream from the OHTL intersection, there are canals to divert the river's water into the same canal system as the Ibata River.

Also along the Kentau OHTL route, there are two important watercourses with no identified name:

1. On the eastern slopes of Karatau, there is a mountain stream, the water of which is collected by a Ushtobe dam. The OHTL route passes 100 m from the dam at its closest point. The dam territory is fenced.
2. Another significant watercourse intersects the OHTL 5 km from the Kentau Substation. It originates in the lower part of the Greater Karatau and passes through the villages of Shaga and Bershintobe, flowing into the Arys-Turkestan canal. The water from this watercourse is used for field irrigation in its middle course.

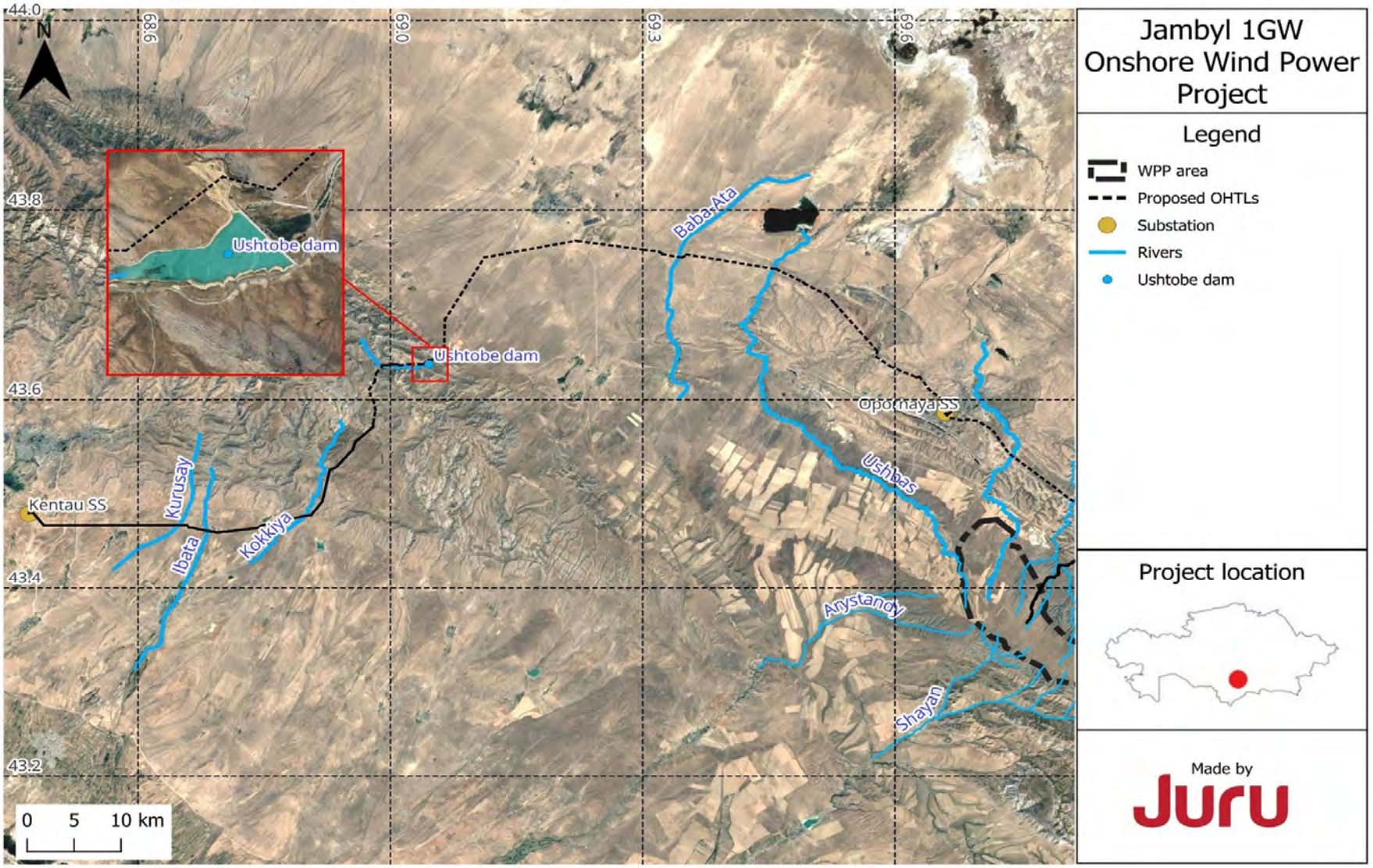
For the Kentau OHTL, WPL and WPZ have been established for the Baba-Ata, Kokkia, Ibata, and Kursai rivers. The Baba-Ata River has WPLs of 35–50 m, while the other rivers have WPLs of 35 m. The WPZ for all rivers is 500 m.

Water samples for quality analysis were collected from Koktal, Baba-Ata, Kokkiya, and Ibata rivers. The results of the analysis are discussed within Section 13.4.4.

Figure 13-7: Rivers and Watercourses intersecting Jambyl OHTL



Figure 13-8: Rivers and Watercourses intersecting Kentau OHTL



14.4.3 Ground water

The territory of the Jambyl region is hydrogeologically located within the large Shu-Sarysu system of artesian basins and has favourable hydrogeological conditions for the formation and accumulation of significant underground water resources[255]. Based on the data of the Institute of Hydrogeology and Geo-ecology, groundwater deposits have been explored in the region with confirmed reserves of 4.5 million m^3/day, including those with mineralization of up to 1 g/l (4.4 million m^3/d)[256].

The groundwater found in the Jambyl region predominantly consists of calcium-magnesium bicarbonate type, calcium type, and bicarbonate, typical of groundwater associated with alluvial and alluvial-proluvial sediments within the Talas-Assay interfluve area[257].

The project area encompasses a region featuring a complex primarily composed of fractured and karst carbonate rocks dating from the Cambrian to Middle Ordovician periods. Additionally, it includes a zone characterized by the junction of undivided Precambrian and Paleozoic rocks, with groundwater exhibiting a salinity ranging from 1 to 3 g/dm^3 (Figure 13-9).

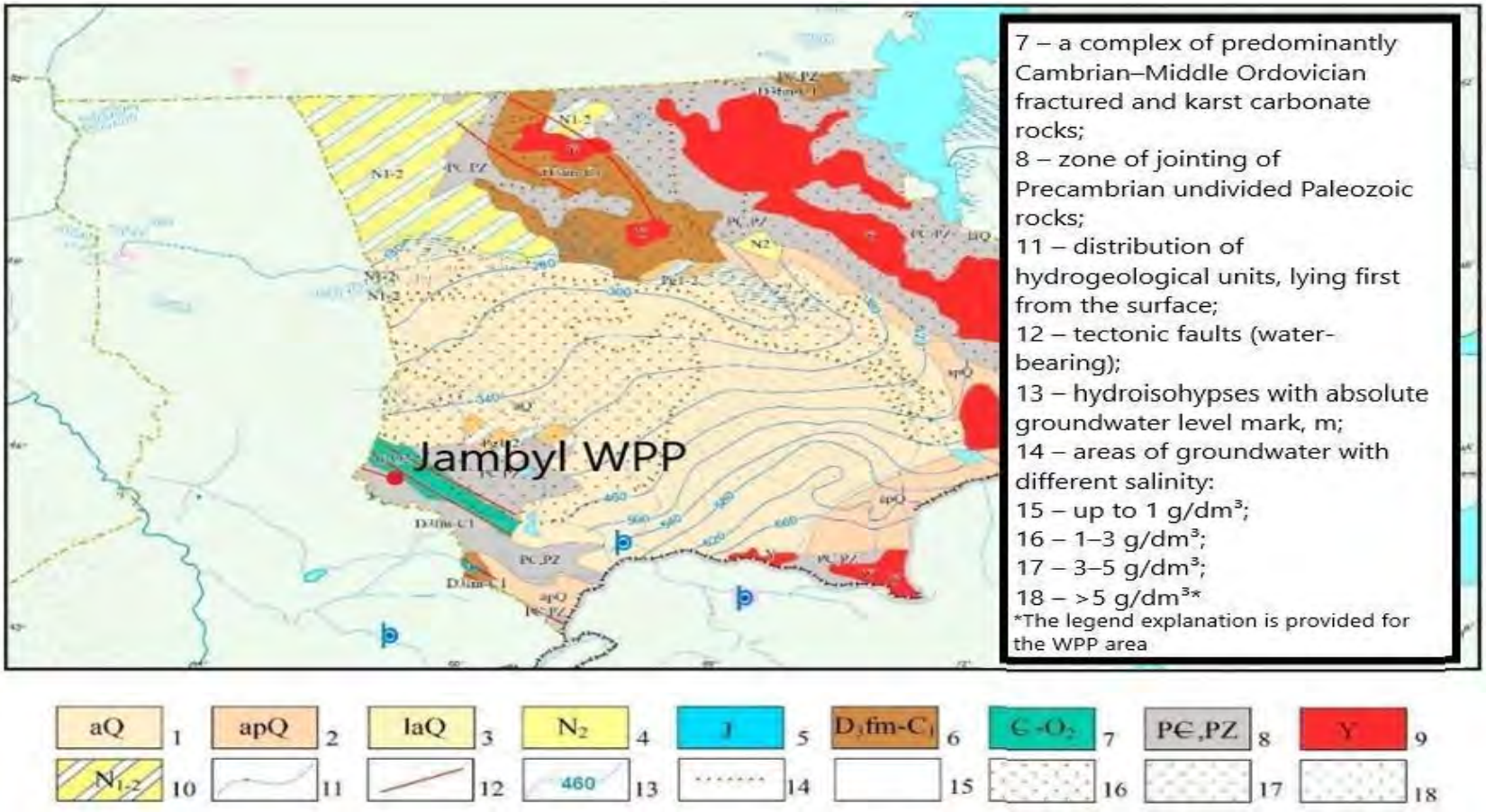
The negative impact of anthropogenic changes on groundwater has been observed in the Jambyl region, with a notable decline in groundwater levels; reductions ranging from 65-70 meters in Taraz city and 80-100 meters in Karatau town[258].

Based on the data obtained through the consultations during the scoping site visit and literature review, it is presumed that communities in the Project district have temporary problems with scarce water conditions in warm periods of the year. Wells, situated at residential homes, are one of the major water sources for households in the region.

The investigation of the public wells showed that the water had exceeded concentrations of various dissolved salts, so the main problem is mineralization. The rural population of the Jambyl region may use such water for drinking purposes and for daily needs[259].

[255] Beisenova, A., & Aldazhanova, G. (2022). Assessment of the State of Water Resources of Jambyl Region and Their Use in Agriculture. Вестник КазНПУ им. Абая, серия «Естественно-географические науки», No2(72), 98.
[256] Activity reports of Shu-Talas Basin Inspectorate on regulation of water resources use and protection for 2008-2017. - Taraz, 2008-2018
[257] Tleuova Z, Snow DD, Mukhamedzhanov M, Ermenbay A. Relation of Hydrogeology and Contaminant Sources to Drinking Water Quality in Southern Kazakhstan. Water. 2023; 15(24):4240. https://doi.org/10.3390/w15244240
[258] Osipov, S., Yerm enbai, A., Akylbekova, A., Livinsky, Yu., & Anarbekov, O. (2020). The Negative Impact of Anthropogenic Factors on the State of Groundwater of Kazakhstan. NEWS of the Academy of Sciences of the Republic of Kazakhstan. Series of Geology and Technical Sciences, 2(440), 132-140. https://doi.org/10.32014/2020.2518-170X.40
[259] D.K.Adenova et al., Assessment of the Condition and Quality of Hydrogeochemical Indicators of Artesian Groundwater in the Zhambyl Region. Geography and Water Resources, No. 4, 2024. https://doi.org/10.55764/2957-9856/2024-4-75-83.41

Figure 13-9: The hydrogeological map of the Jambyl region. Areal distribution of hydrogeological units, occurring first from the surface of the earth. Aquifers and complexes, aquifer fracture zones. (Description of the units is shown below the picture) [260]



[260] Adenova D, Tazhiyev S, Sagin J, Absametov M, Murtazin Y, Trushel L, Miroshnichenko O, Zaryab A. Groundwater Quality and Potential Health Risk in Jambyl Region, Kazakhstan.Water. 2023; 15(3):482. https://doi.org/10.3390/w15030482

As part of consultations with the National Geological Service, two existing groundwater drinking-water wells were identified 4.5 km from the WPP area. The strict protection zone for wells is a 50 m radius; the coordinates of the wells are provided in the Table 13-4 and their location shown in Figure 13-10 below.

Table 13-4: Coordinates of drinking groundwater wells

No	Well No	Northing	Easting
1	4097	43°27,258	69°51,842
2	4098	43°26,265	69°53,551

In the Turkestan region, in the territory near the Bolshoy Karatau, there is an aquifer complex of Upper Devonian-Lower Carboniferous deposits. The waters of the region are distinguished by the presence of nitrogen pollution, which is linked to the largest livestock population in Southern Kazakhstan[261].

Additional groundwater data were obtained as part of the geotechnical investigations for the WPP area and the Jambyl OHTL (Geotechnical Investigation Report for Zhambyl Wind Power Plant 500 MW, Juru, July 2025; and Geotechnical Investigation Report for Zhambyl Wind Power Plant 500 MW With 125 km of 220 KV OHTL, Juru, July 2025).

Within the wind farm area, groundwater was only encountered during drilling at two locations: one point in the northern part of the project area at a depth of 2.1 m, and one in the southern part at a depth of 5.6 m. A total of 36 boreholes were drilled within the WPP area. Analysis of water that was sampled from in the southern part of the project (at a depth of 5.6 m) showed a near-neutral pH, low organic content, and low salinity.

The investigations for the OHTL included 100 boreholes, with groundwater was encountered in only 7: one located 18 km southeast of the WPP area, and six in the Jambyl SS area. Groundwater depth ranges between 5 and 7 m, with only one point near the SS showing groundwater at a depth of 1 m.

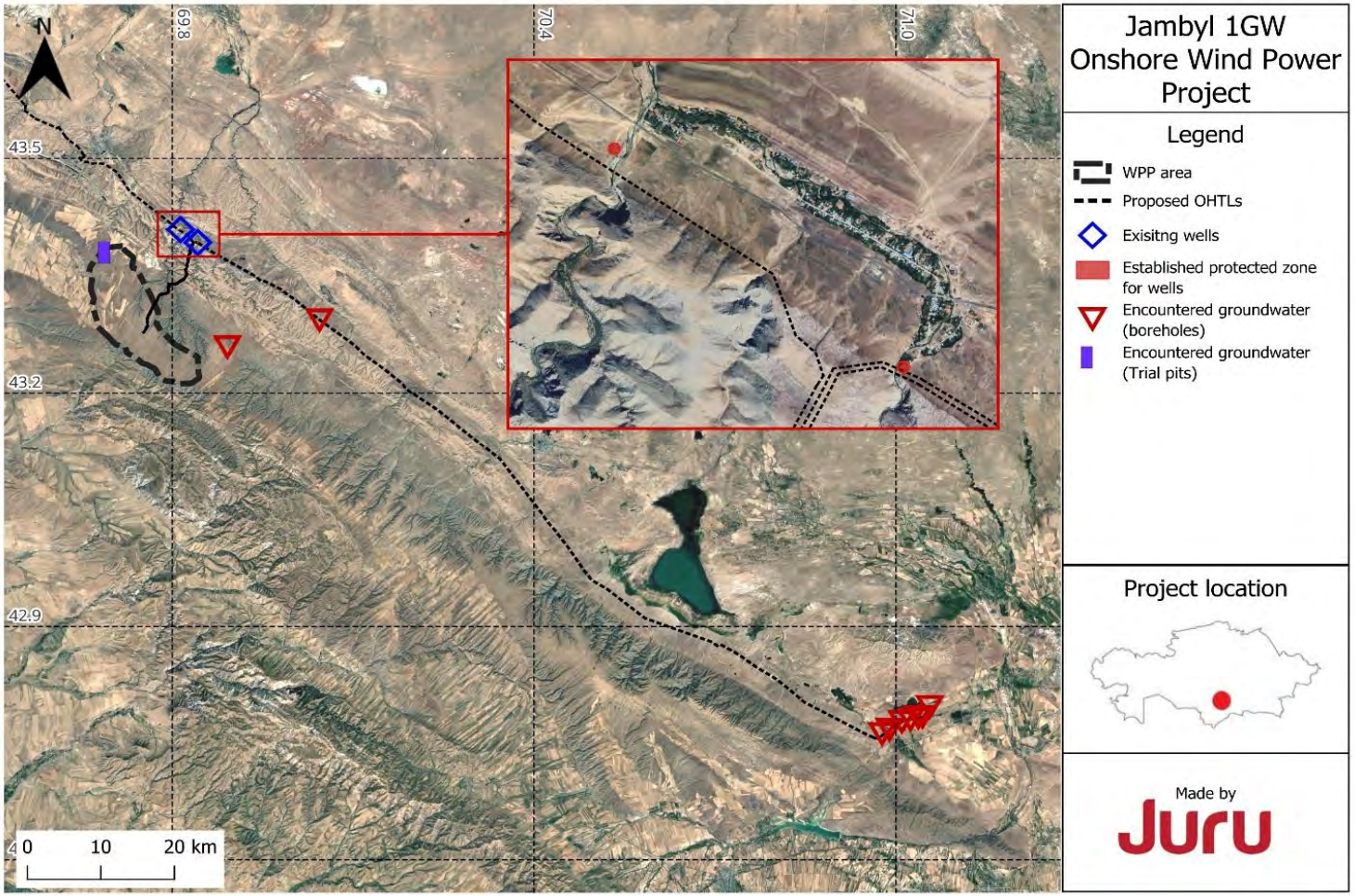
The water sampled along the OHTL, near the WPP area, has similar characteristics to the groundwater from the boreholes within the WPP area, whereas the water near the Jambyl SS showed high salinity.

Historical wells within the WPP area boundary were also mentioned during consultations with local residents; however, the relevant authorities do not have information on their locations.

The wells identified during consultations and the locations where groundwater was encountered during the geotechnical investigations are shown in Figure 13-10.

[261] Onlassynov Zh.A., Rakhimov T.A., Muratova M.M., Akynbayeva M.Zh. Assessment of groundwater quality in pasture areas of southern Kazakhstan. 3i: intellect, idea, innovation. No. 1, (2025). https://doi.org/10.52269/22266070_2025_1_174

Figure 13-10: Existing public wells and encountered groundwater during geotechnical studies



Ground water samples for quality analysis were collected from existing wells within summer camp, Abdykadyr village and stand-alone farmer house in the vicinity of Jambyl OHTL corridor, and at the residential area near Kentau SS. The results of the analysis are discussed within Section 13.4.4.

14.4.4 Water quality baseline survey results

Field studies were conducted within the project area to determine the quality of water resources. The studies were conducted in 2024 and 2025 and involved laboratories accredited under the national accreditation system for sampling and analysis. Full study reports are provided in Volume III of this ESIA. Locations of sample collection are shown in Figure 13-11 and Figure 13-12. The completed mapping of water sample collection is presented within the Water baseline quality reports (ESIA Volume III).

Within the WPP area, sampling was conducted in the Shabakty and Ushbas rivers (September 2024), and the Berkutti, Shayan rivers, and springs used by herders (August 2025).

Along the Jambyl OHTL route, sampling was conducted in September 2024, and along the Kentau OHTL in August 2025.

Figure 13-11: WPP area water sample collection

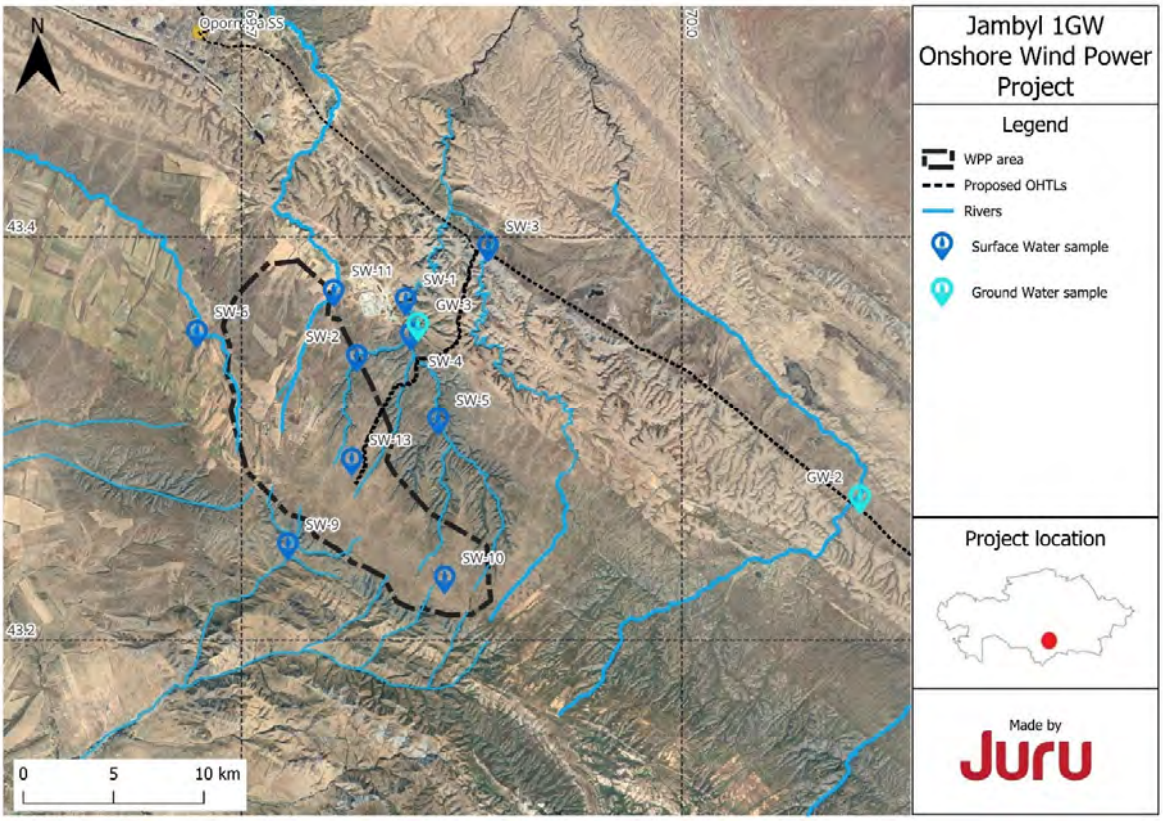
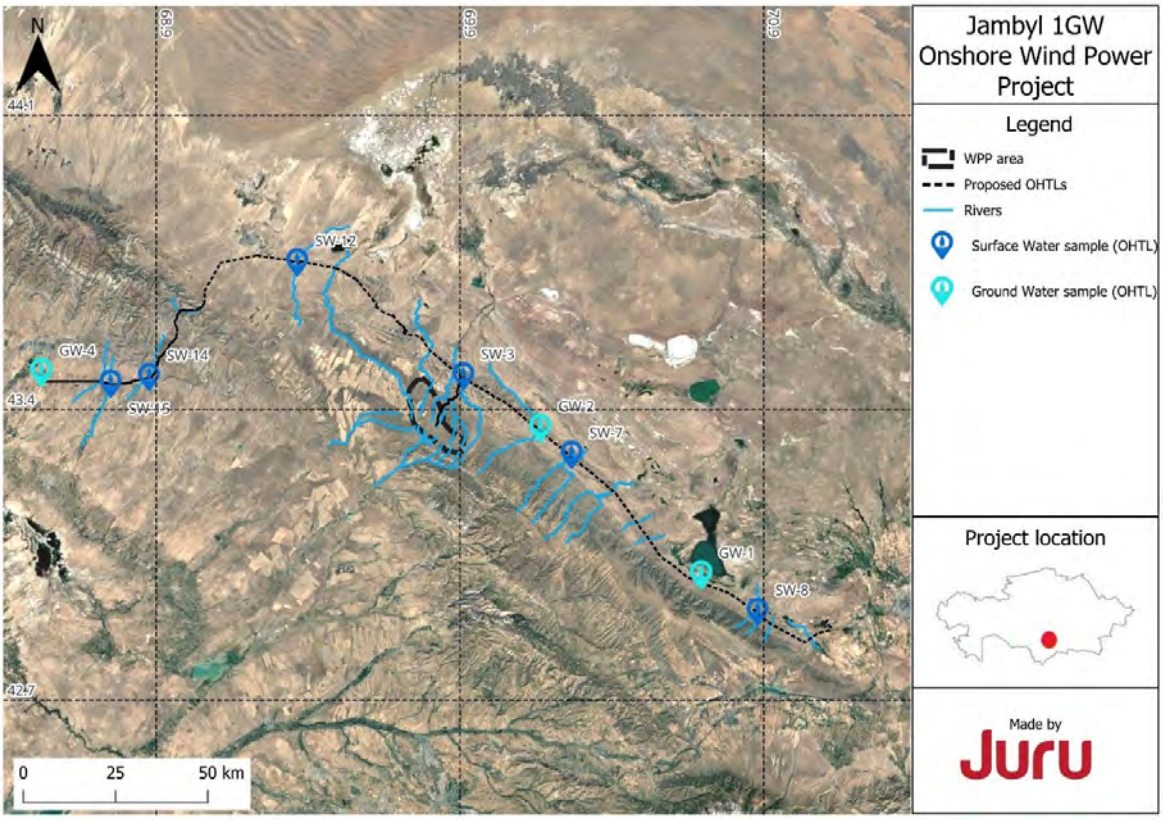


Figure 13-12: OHTL route water sample collection



14.4.4.1 WPP area rivers.

Within the WPP territory, the detailed sampling was conducted at various topographic points for the Shabakty River – on its main tributaries, in the dam's reservoir near the summer camp, and below the dam. Analysis of sampling results showed a pH value low for arid territories (5.8 – 6.5), elevated concentrations of arsenic (2-3 times above national standards which correlates to with an exceedance of 10-15 times against international target values). Additional studies in the dam showed exceedances of total organic carbon (TOC) (likely due to the water's overall high organic content), but no nitrogen compounds (NO2-, NO3-) or elevated oxygen demand was identified.

The Ushbas, Berkutti, and Shayan rivers show similar results, except more acidic water in the Ushbas River (pH 5.3), exceedances of zinc and arsenic in the Berkutti River – by 50% and 50 times the national standard, respectively, and exceedances of Ni in the Shayan River (14 times the local standards). The Berkutti and Shayan rivers also have high suspended-solids levels, possibly due to lower water levels in 2025.

The elevated results may reflect a combination of natural geochemical factors (such as arsenic-bearing bedrock or alluvial deposits) and land-use influences. Several observations point to a possible anthropogenic contribution: livestock spend prolonged periods at the main watering points, which also serve as recharge sources for nearby rivers; manure input at these locations can stimulate microbiological activity that produces organic acids, potentially altering local pH conditions and enhancing the mobilisation of naturally occurring arsenic from sediments. Elevated organic matter from livestock presence may also lead to increased Total Organic Carbon (TOC) in the water. In addition, small quantities of arsenic may enter the water through manure where it occurs as a trace component of livestock feed additives or veterinary treatments.

14.4.4.2 Surface watercourses used by herders

Watercourses that surface from perched aquifers within the WPP area and from surface run-off, create small water bodies (ponds) where herders stop with their livestock; the livestock can stand in the water for a long time. Water was sampled from two such watercourses in the central and southern parts of the WPP area.

The pollution was represented by elevated concentrations of nickel (exceeding national standards by 2 times and international standards by 8 times) and very high concentrations of arsenic, exceeding local standards by more than 40 times and international standards by 200 times. One of the samples also showed a 10-fold exceedance of cadmium content. The water also has a low pH and a very high suspended solids content.

These surface water bodies also play an important role in maintaining pasture health, as seasonal flow and shallow standing water contribute moisture that supports the growth and regeneration of grazing vegetation. Reliable access to such water sources helps sustain productive pastureland, which is critical for the livelihoods of local herders and the overall condition of the grazing ecosystem.

The small “lagoons” are frequently used by livestock, and while animals do not introduce arsenic directly, their repeated trampling and organic inputs can disturb sediments and increase nutrient loading, which may mobilise naturally occurring arsenic in local soils and alluvial deposits; this can then be transported onwards into nearby rivers.

14.4.4.3 Jambyl OHTL

Water samples were taken at two locations in the area of intersection with the planned power line – in the central section of the OHTL from the Koktal river (near the sanatorium of the same name) and a large watercourse in the initial section, which flows into Lake Bilikol (see Figure 13-12).

Analyses showed similar results for the two water bodies, analogous to the Shabakty or Ushbas rivers. The rivers had an acidic pH (5.1), oxygen deficiency, and exceedances of arsenic levels (by 4 or 20 times, respectively, compared with national or international standards).

Since both rivers originate on the central plain at the top of the Small Karatau ridge, the pollution's genesis may be analogous to that of other water bodies in the area.

14.4.4.4 Kentau OHTL

Kentau OHTL Sampling was conducted at three locations at the intersection of the OHTL route with the Baba-Ata, Kokkia, and Ibata rivers (see Figure 13-12).

The results for the three rivers show similar values: pH in the range of 6-6.5; oxygen deficiency; a 10-fold exceedance for Cd, 2-fold for Pb, and up to 3-fold for Zn. Arsenic concentrations were also high, exceeding national standards by 35-45 times and international standards by more than 200 times. For the samples, additional studies were conducted, which showed high biological oxygen demand. These results confirm the similarity of pollution problems in water bodies at different locations within the project territory.

14.4.4.5 Ground water quality

Groundwater was sampled at 4 locations – 1 in the central part of Jambyl OHTL (Abdykadyr village), 2 locations near the WPP area (near the KN-1 highway and on the territory of a summer camp), 1 location near the Kentau SS (Kotyrbulak village). All samples were taken from local wells.

The sample taken on Jambyl OHTL had a neutral pH and safe nitrate content, but an elevated content of

petroleum products[262] (40% above the standard) and exceedances of mercury by 40 times according to national standards (3 times according to international ones).

Near the WPP area, exceedances of petroleum products are also observed in the groundwater; for the point near the highway, also mercury (by 40 times) and arsenic (by 2 times).

In the Turkestan region, no exceedances of nitrates were found in the water, but there was a more acidic pH (6), a slight oxygen deficiency, as well as exceedances of zinc (by 3 times), arsenic (by 25% according to local and 6 times according to international standards), and lead by more than 2 times. Benz(a)pyrene in the water was below detectable limits.

14.4.5 Flood Risk

Despite the seasonal rise in water levels during spring snowmelt and increased precipitation, flood phenomena are only weakly expressed within the WPP area. This is because the larger rivers develop further downslope, outside the project footprint, while the WPP infrastructure is situated in the upper part of the Small Karatau range, where only small, highly dispersed watercourses are present.

The site is situated along elevated upper slopes, and therefore flood hazards relate primarily to localised surface-runoff concentration rather than riverine flooding. Flood risk further downstream is also reduced by the presence of numerous dams across the regional river network, which help regulate flows and attenuate peak discharges.

Dedicated hydrological assessments have been undertaken for the Project. According to the 2025 study prepared by IDOM (see Volume III: Technical Appendices), the overall flood risk within the WPP area is assessed as medium to low.

14.4.6 Precipitation

The project area is located in an arid climate zone, which results in low precipitation and a predominance of evaporation. However, due to its location on the elevated part of the Small Karatau range, the project area receives more precipitation than the surrounding plains, as clouds accumulate along the mountain slopes. This aspect is discussed and more are discussed in Section 19 (Climate).

Monthly average, maximum, and minimum precipitation values for the meteorological station closest to the WPP area, located in the town of Zhanatas, are shown below in Figure 13-13. Maximum and minimum precipitation for 24 hours for the period between 2000 and 2023 are shown in Table 13-5.

Figure 13-13: Average precipitation graph (Zhanatas station)

[262] The testing methodology for “petroleum hydrocarbons” in the Republic of Kazakhstan corresponds to the Hydrocarbon Oil Index (HOI). The HOI includes long-chain and branched aliphatic, alicyclic, aromatic, and alkyl-substituted aromatic hydrocarbons, which, in addition to anthropogenic petroleum products, also comprise substances of natural origin.

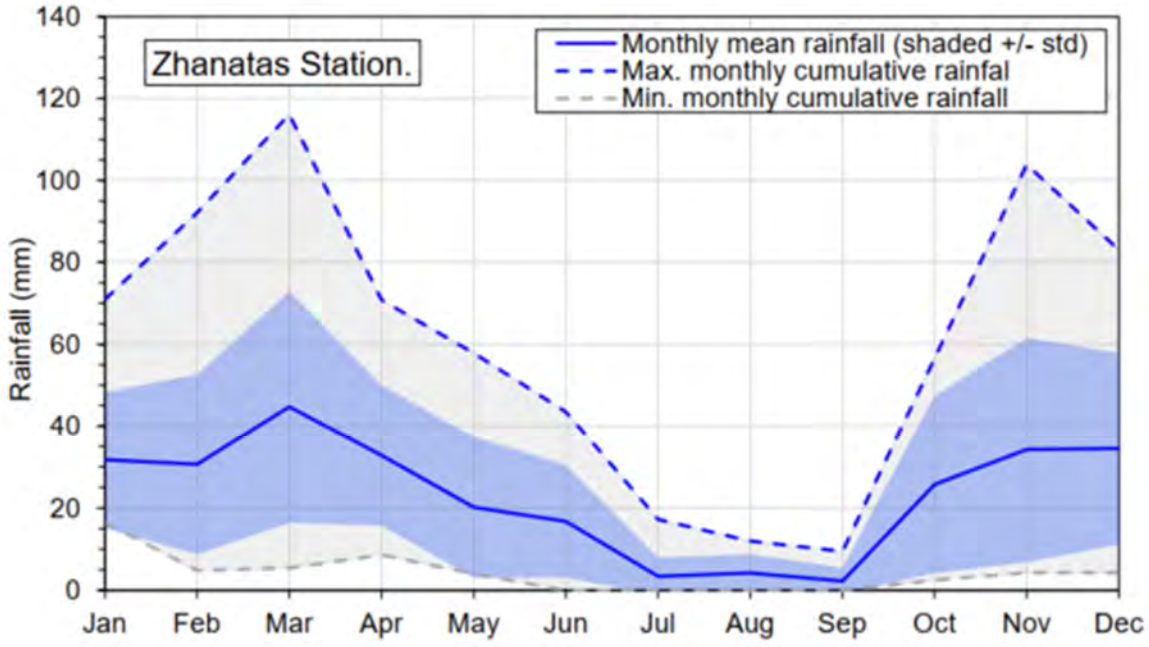


Table 13-5: 24-hr Precipitation extremums for the period 2000 – 2023 (Zhanatas weather station)

	Zhanatas	Kozhahmetov
Maximum (mm)	37.9	41.2
Mean (mm)	24.6	26.6
Minimum (mm)	13.0	17.8

14.4.7 Water Resources and Distribution

There are several potential sources of water in the project area for drinking and/or domestic use.

Water can be delivered to the project site by entering into a supply contract with a legal entity. This legal entity must hold a special water-use license (which may include the use of both surface and groundwater sources by the supplier).

The legislation of the Republic of Kazakhstan also allows legal entities to independently abstract water from existing sources (surface or groundwater); however, in this case the project would need to obtain a special water-use license. The criteria for obtaining this license are described in Section 13.2.1.3 of this chapter.

The Project has opted to source water from licensed suppliers and will be tankered to site based on demand requirements.

14.4.8 Sensitive Receptors

14.4.8.1 WPP area

Within the WPP area, several surface-water features and groundwater receptors may be directly or

indirectly affected by Project activities. Project components such as wind turbine foundations, internal roads, and underground cables directly intersect with the following water bodies and hydrological features:

- Shabakty River
- Ushbas River
- Berkutti River
- A network of smaller permanent and temporary watercourses, including natural drainage channels and erosion gullies that act as tributaries of the major rivers and to the Shayan River
- Springs used by herders for livestock watering and small-scale irrigation
- Groundwater aquifers underlying planned infrastructure locations

In addition to the water bodies themselves, the users of these water resources constitute sensitive receptors. These include local herders, livestock, and small-scale land users who rely on springs, shallow ponds, and seasonal channels for watering livestock, maintaining grazing pasture quality, and in some cases irrigating small crop plots.

Indirect impacts may also occur on watercourses and springs that do not physically intersect with constructions areas or project components but lie within adjacent catchment areas influenced by altered runoff patterns, sediment mobilisation, or accidental releases.

14.4.8.2 OHTL RoW

Along the two OHTL routes, tower foundations, construction corridors, temporary access routes, and associated works intersect the following surface-water bodies:

- Jambyl OHTL:
    - Kyrshabakty River
    - Koktal River
    - Tamdy River
    - Shabakty River
- Kentau OHTL
    - Berkutti River
    - Ushbas River
    - Baba-Ata River
    - Kokkia River
    - Ibata River
    - Kursai River
    - Ushtobe Dam.

In addition to the above-named rivers and reservoirs, both OHTLs also cross smaller permanent and temporary watercourses, including natural drainage channels and ephemeral flow paths.

Groundwater aquifers underlying or adjacent to tower locations and access routes also constitute sensitive hydrological receptors

Similarly to the WPP area, indirect impacts may occur on catchment areas adjacent to those directly intersected, particularly where construction activities could alter runoff patterns, mobilise sediments, or introduce contaminants that may propagate downstream.

14.5Potential Impacts

14.5.1 Construction Phase

Construction activities for the WPP, BESS area, the two 220 kV OHTLs, access roads, temporary construction camps, laydown areas, and associated ancillary facilities have the potential to affect surface water and groundwater systems within the Project AoI. The primary hydrological and hydrogeological risks during the construction phase relate to land disturbance, modification of natural drainage patterns, increased sediment mobilisation, accidental releases of hazardous materials, and the generation and management of construction-related wastewater.

Potential construction-phase impacts on hydrology and hydrogeology have been grouped into the following two overarching categories:

- Impacts on Natural Drainage Processes, and
- Impacts on Surface-Water and Groundwater Quality.

These represent the fundamental mechanisms through which construction activities may affect local hydrological conditions—either by altering how water moves across or through the landscape, or by affecting the quality of surface water and groundwater.

Both the WPP area and the OHTL corridors are considered under each impact theme, and where relevant, impacts are described separately for each component.

In addition, construction activities require significant volumes of water for concrete batching, dust suppression, compaction, domestic use in worker camps, and general site operations.

Water sourcing itself therefore represents an additional potential impact pathway, particularly if abstraction were to occur from local springs, shallow groundwater, or surface-water bodies already used by herders and livestock. At this stage, it is understood that the Project intends to prioritise tankered water delivery, and that any abstraction from groundwater wells would require permitting and approval during EPC mobilisation. The potential impacts of construction-phase water sourcing are therefore included in the assessment below.

14.5.1.1 Impacts on Natural Drainage Processes

General Construction-Phase Effects (WPP and OHTLs)

Construction activities—including excavation for turbine and tower foundations, trenching, grading, establishment of access roads, stockpile placement, and operation of heavy machinery—can modify natural drainage patterns. These activities may:

- change the direction, concentration, or velocity of surface runoff;
- create new localised flow paths or block existing ones;
- reduce infiltration due to soil compaction; and
- increase the likelihood of rilling or gullying, especially on sloping terrain.

The upper parts of the Small Karatau range, where the WPP is located, are characterised by a dispersed network of ephemeral watercourses, shallow depressions, perched springs, and small natural ponding areas used by herders and livestock. These features are sensitive to alterations in surface-water behaviour.

Specific Considerations for the WPP Area

The siting of WTGs, internal roads, and underground cables in the WPP area has the potential to affect these natural drainage features. If improperly located, infrastructure could intercept or divert runoff, cut through natural drainage channels, or reduce inflow to shallow ponds and spring-fed depressions. Such changes risk:

- reducing water availability for livestock at informal watering points;
- limiting natural moisture inputs that support pasture productivity; and
- altering spring discharge or shallow infiltration patterns.

Recognising this sensitivity, Masdar has already sought to avoid placing WTGs, platforms, and internal access roads within or directly adjacent to natural drainage channels, surface depressions, and livestock-used ponding areas. Where WTGs are proposed to be installed near water courses these were planned to be located along the upper edges of these watercourses; Masdar confirmed that the WTG layout was informed by the project drainage study to ensure that WTGs are located a safe distance away from identified drainage channels.

In addition, the project Drainage Sizing Report establishes that cross-drainage structures (culverts, box culverts and fords) must be installed wherever Project access roads intersect natural drainage lines, including ephemeral channels and minor tributaries, to maintain natural flow connectivity and preserve the local hydrological regime. These structures are designed and sized based on the hydrological modelling of upstream catchments and hydraulic criteria intended to prevent ponding, erosion and flow diversion. Their inclusion in the detailed design ensures that road construction does not obstruct or alter the natural drainage pathways within the WPP area.

This design approach is essential to minimise long-term disruption of hydrological functioning. Although this is primarily a design measure, it directly reduces construction-phase impacts by avoiding extensive earthworks in sensitive areas. It also has relevance for the operational phase, as the correct placement of permanent infrastructure prevents ongoing modification of natural drainage pathways.

Through consultations with herders, it was confirmed that perennial watercourses within the WPP area are used for household and livestock purposes. As part of the ESIA, an analysis of the proposed WTG layout was undertaken to assess their proximity to key springs and other water sources within the Project area. All water sources located near herder structures—such as wagons and small stables—were mapped.

The results of the mapping were then overlaid onto satellite imagery, using a mean-value composite based on the SAVI[263] index for the summer dry period of 2014–2024. Areas with vegetation preserved during the dry season (according to SAVI) and located near the herder structures were mapped using a 50-m buffer from the centreline of these features. Any WTG foundations falling within this buffer were flagged for potential micro-siting or relocation. The following 7 WTGs (according to their No.) were identified as lying within 50m of the identified water spring areas.

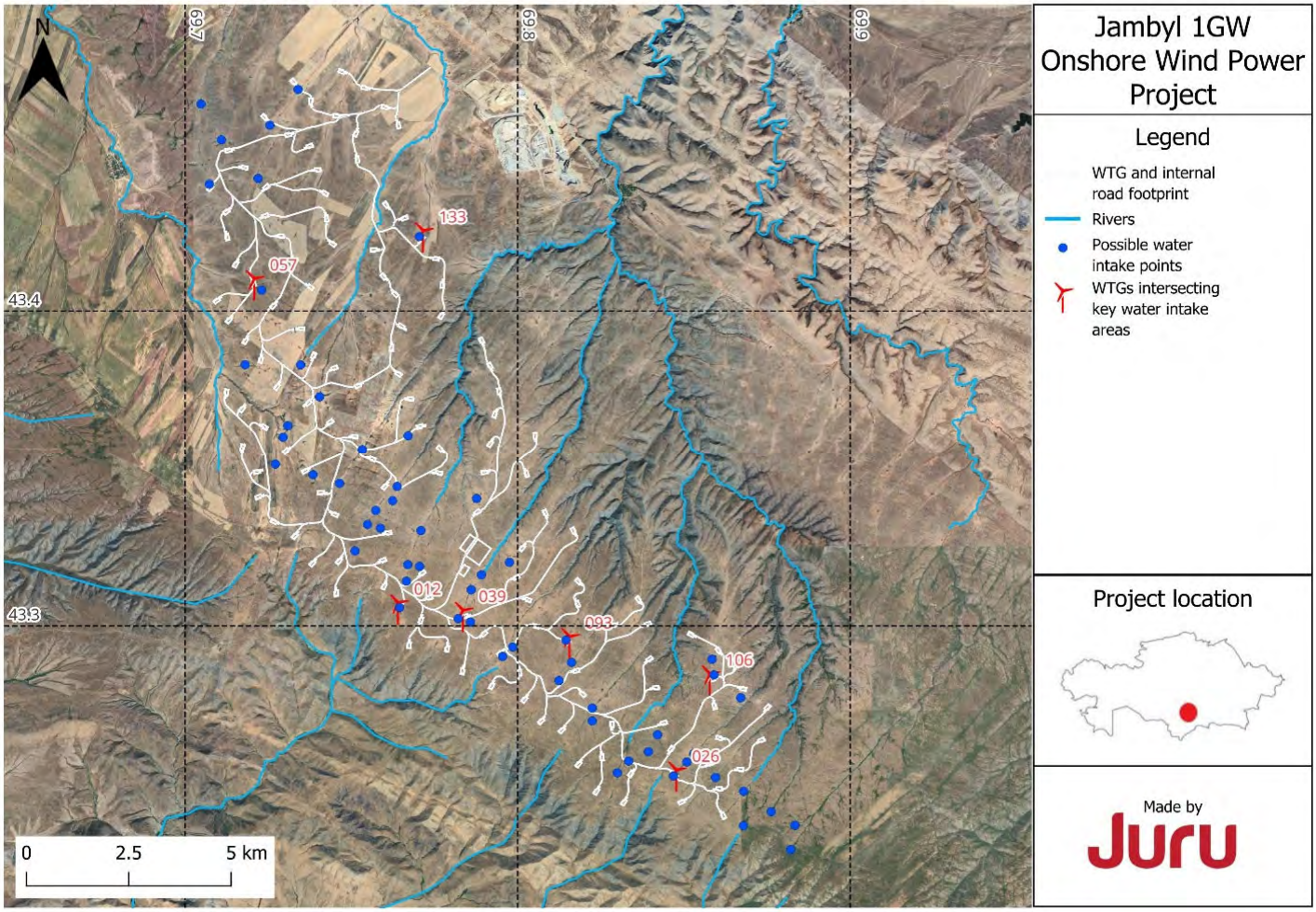
- 012
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[263] SAVI (Soil-Adjusted Vegetation Index) is a remote sensing indicator that enables assessment of vegetation density and health in arid or sparsely vegetated areas by accounting for the soil background's optical influence.

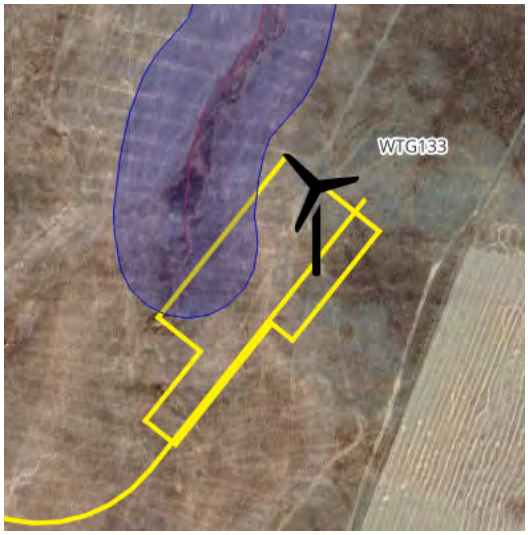
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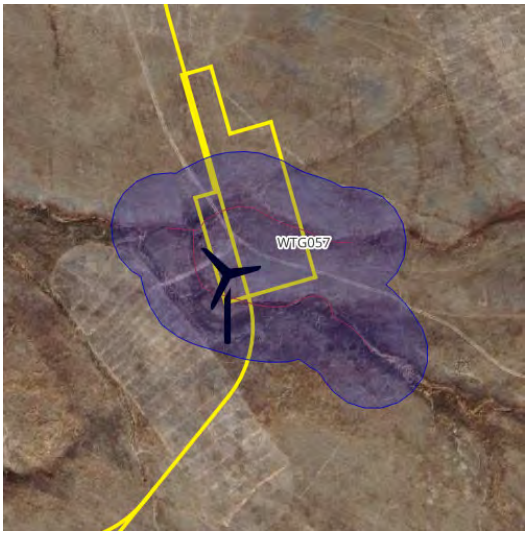
The location of these WTGs are shown in Figure 13-14 and their location in relation to identified potentially significant water resources, including foundation and hardstand areas, are shown in Figure 13-15.

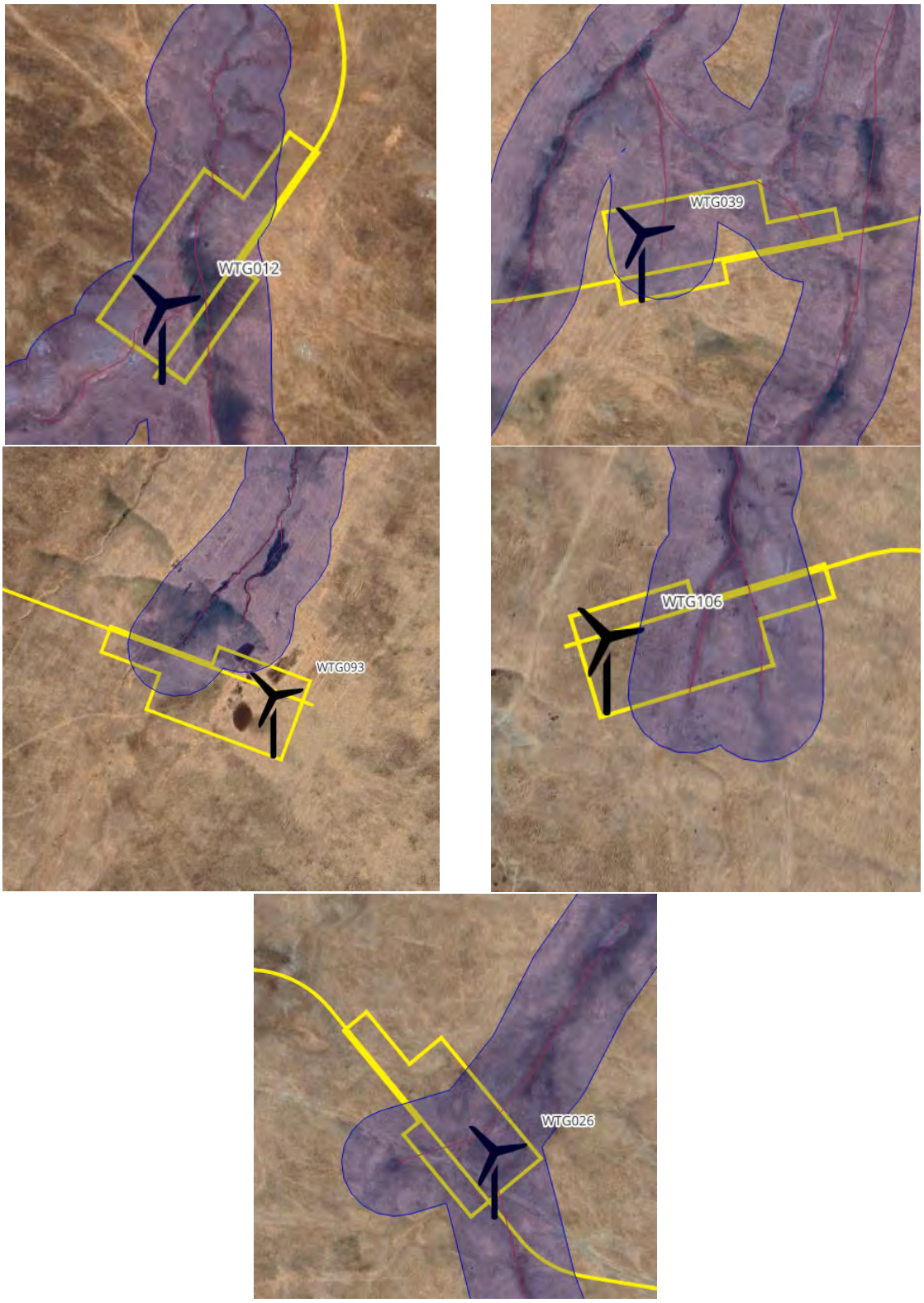
Figure 13-14: WTGs close relocation in relation to key water intake points
Figure 13-15: WTGs that lie within 50 m of identified water resources -showing WTG installation footprint



overlapping perennial water areas







All significant springs (limnocrenes) within the WPP area are considered important resources for grazers and farmers using the area. Accordingly, the locations of all identified springs are presented in Table 13-6

to inform any potential future iterations of the WTG layout design.

Table 13-6: Spring locations

Spring no.	N	E	Spring no.	N	E	Spring no.	N	E
1	43.29819	69.80801	**21**	43.30904	69.77704	**41**	43.34732	69.7796
2	43.30027	69.81105	**22**	43.31856	69.77948	**42**	43.41614	69.73799
3	43.27479	69.86342	**23**	43.31488	69.77908	**43**	43.42084	69.71728
4	43.27134	69.87204	**24**	43.31816	69.78305	**44**	43.27708	69.85186
5	43.26828	69.88049	**25**	43.3216	69.76361	**45**	43.28906	69.87962
6	43.26063	69.88044	**26**	43.32613	69.78342	**46**	43.29758	69.87099
7	43.26072	69.89596	**27**	43.32747	69.76737	**47**	43.29411	69.8716
8	43.25534	69.89467	**28**	43.33058	69.76985	**48**	43.32664	69.77126
9	43.26375	69.8888	**29**	43.33661	69.75898	**49**	43.33275	69.77491
10	43.27664	69.86555	**30**	43.34423	69.76582	**50**	43.42406	69.74648
11	43.28082	69.85461	**31**	43.33851	69.75098	**51**	43.33591	69.77627
12	43.27238	69.84253	**32**	43.34701	69.74196	**52**	43.33323	69.80018
13	43.275	69.84591	**33**	43.34087	69.73967	**53**	43.313	69.79855
14	43.2839	69.83498	**34**	43.34958	69.7434	**54**	43.3163	69.80164
15	43.28673	69.83498	**35**	43.35599	69.75295	**55**	43.31909	69.81008
16	43.30184	69.82705	**36**	43.3631	69.73056	**56**	43.27168	69.85942
17	43.29284	69.82498	**37**	43.36305	69.74726	**57**	43.37962	69.73554
18	43.29688	69.82872	**38**	43.40308	69.71978	**58**	43.39149	69.78298
19	43.30661	69.79466	**39**	43.4129	69.72342	**-**	-	-
20	43.30583	69.79835	**40**	43.40436	69.73449	**-**	-	-

Specific Considerations for the OHTL Corridors

The OHTLs traverse a much wider set of catchments and intersect several major rivers and numerous ephemeral watercourses. Construction of tower foundations and temporary access tracks may locally disrupt sheetflow and surface-runoff patterns, especially where works occur on slopes or in erosion-prone soils.

While the footprint is narrow, repeated vehicle movements or poorly placed temporary works may initiate erosion channels or redirect runoff into adjacent land, with potential impacts extending downslope into tributaries feeding larger river systems.

Sections of both OHTLs pass through WPZ associated with several rivers; however, permanent infrastructure is avoided within WPL. Where OHTL access tracks intersect watercourses or drainage lines, culverts or equivalent cross-drainage structures will be installed; no permanent in-channel works are proposed, and any construction within WPZ will be temporary and fully reinstated following completion.

14.5.1.2 Impacts on Surface-Water and Groundwater Quality

General Construction-Phase Effects (WPP and OHTLs)

Construction works generate several pathways for water-quality degradation, including:

- sediment mobilisation from exposed soils;

- increased suspended solids entering ephemeral streams and natural ponds;
- accidental releases of fuels, oils, hydraulic fluids, or concrete additives;
- discharge of untreated greywater, blackwater, or wash-down effluent from construction camps or batching areas; and
- mobilisation of sediment-bound contaminants (including naturally occurring arsenic) from disturbed sediments in livestock-used ponds.

These risks apply across the entire Project footprint but may be more pronounced in locations where works are close to springs, smaller tributaries, and livestock-dependent water bodies.

Sediment and Erosion-Related Water-Quality Impacts

Earthworks for turbine pads, tower foundations, access roads, and cable trenches can generate large volumes of loose material that may be washed into nearby watercourses during rainfall or snowmelt.

In the WPP area, these sediment pulses can:

- increase turbidity in natural ponds;
- affect shallow springs by clogging discharge points; and
- reduce the quality of water available for livestock.

Along the OHTL routes, sediment mobilisation may affect the rivers crossed by the corridors, including the Shabakty, Kyrshabakty, Tamdy, Berkutti, Ushbas and others, and may be transported downstream into areas used for grazing.

Pollution Risks from Spills and Hazardous Materials

Fuel handling, refuelling, generator operation, concrete works, and storage of hazardous substances create a risk of pollutants infiltrating into shallow aquifers or entering surface water during runoff events.

The risk is higher in perched aquifer areas within the WPP site and at tower sites located near small watercourses along the OHTLs.

Wastewater Discharge and Sanitary Effluent

Construction camps, temporary sanitary facilities, vehicle wash-down areas and batching operations may generate wastewater that, if inadequately contained or managed, could increase nutrient loading, organic matter, or bacterial contamination in nearby springs, ponds and small water bodies. Such discharges could reduce water quality for livestock and elevate the risk of eutrophication in small standing water bodies within the WPP AoI.

To prevent these risks, all sanitary wastewater from worker facilities will be collected in sealed septic tanks or other closed systems, with regular removal by licensed contractors for disposal at approved municipal facilities. No discharge of untreated or partially treated wastewater to land, surface water, or natural depressions will be permitted. Vehicle wash-down areas will be located on impermeable surfaces with drainage fully captured and directed to contained systems to prevent the release of contaminated wash water.

The wastewater management is discussed in more detailed in Section 16 (Waste and Wastewater), which provides the Project's approach to managing sanitary and process wastewater during construction.

14.5.1.3 Impacts Associated with Water Sourcing

Construction activities will require significant volumes of water for concrete production, dust suppression, soil compaction, equipment cleaning, and domestic use in construction camps. Water demand during construction is substantially higher than during operation and therefore requires careful planning to ensure that sourcing does not adversely affect local water resources.

The Project has confirmed that all construction water will be supplied to site via tankered delivery from licensed municipal or commercial providers, and that no direct abstraction from springs, watercourses, or shallow groundwater within the WPP area is planned.

Based on 140 WTGs, and the concrete quantities required for WTG foundation works, the estimated water demand for batching plant operations is estimated as follows:

Table 13-7: Water Demand Estimate for Concrete Batching Plant

Concrete Type	Quantities (m^3)	Water Ratio (L/m^3)	Water Needs (m^3)
C40/50	1,430	170	243
C35/45	93,574	170	15,908
C50/60	5,029	150	754
Total			**16,905**

Assuming a production rate of three foundations per week, the batching plant would require approximately 365 m^3/week for concrete production.

To account for additional construction water needs—including dust suppression, building construction, vehicle wash-down, general site maintenance, and camp operations—it is reasonable to apply a conservative factor of two. This results in an estimated 700 m^3/week, equating to a daily construction water requirement of approximately 100 m^3/day.

All drinking water supplied for construction camps and worker facilities must comply with WHO Guidelines for Drinking-water Quality, and the EPC contractor will be required to ensure that water delivered to site meets these standards; this can be achieved through delivery of bottled drinking water.

Potential Water Sources

Although the Project intends to rely exclusively on tankered water deliveries, it is possible that the EPC contractor may propose limited supplementary abstraction from licensed groundwater wells. Any such abstraction would be subject to:

- formal permitting by the competent authority,
- hydrogeological assessment demonstrating no adverse effects,
- compliance with national sanitary-protection requirements, and
- confirmation that abstraction will not affect springs, perched aquifers or groundwater-dependent ecosystems.

No abstraction from springs, surface ponds or ephemeral channels within the WPP area will be permitted.

Potential Hydrological Impacts

If groundwater abstraction were pursued without appropriate controls, potential impacts could include:

- Lowering of shallow groundwater levels, particularly in areas where perched aquifers support springs;
- Reduction in discharge from springs used by herders for livestock watering;
- Decreased recharge to small natural ponds within the WPP area, which may affect grazing conditions for livestock;
- Exacerbation of already poor water quality, as reduced spring flow could concentrate naturally occurring contaminants such as arsenic, nickel, or suspended solids.

Given the sensitive hydrogeological conditions identified during baseline studies, indiscriminate groundwater abstraction could reduce water availability for livestock and influence the quality of water in local springs and depressions.

The WPP area contains numerous perched-spring systems and shallow depressions that local herders rely upon for watering livestock. Even modest abstraction from wells located near these recharge areas may alter spring flow or water availability. For this reason, the Project will require that the EPC contractor:

- avoids abstraction from hydrologically connected shallow aquifers;
- locates any permitted wells outside the recharge areas of identified springs;
- relies primarily on tankered water deliveries; and
- implements monitoring of groundwater levels and spring discharge if abstraction is approved.

Water requirements for construction of the OHTLs are significantly smaller and more dispersed than within the WPP area. Nevertheless, abstraction from small rivers, shallow wells or livestock-watering points along the corridor could cause localised hydrological or water-quality impacts. Accordingly, all water use along the OHTL routes should be supplied via:

- licensed commercial or municipal tanker delivery; or
- permitted groundwater wells only where a hydrogeological assessment demonstrates negligible hydrological or ecological effect.

14.5.1.4 Summary of Construction Impacts

Construction of the WPP, BESS, internal access roads, the two 220 kV OHTLs, ancillary facilities and temporary construction camps has the potential to affect hydrology and hydrogeology through three principal pathways:

- impacts on natural drainage processes,
- impacts on surface-water and groundwater quality, and
- impacts associated with sourcing of construction water.

The following summarises the types of impacts anticipated during construction and the significance ratings prior to mitigation.

Impacts on Natural Drainage Processes

Construction earthworks—including excavation, grading, foundation preparation, trenching for underground cables and the construction of access roads—may alter natural drainage pathways within the WPP area and along the OHTL corridors. These activities can disrupt hydrological connectivity, divert surface runoff, reduce infiltration due to soil compaction and temporarily affect perched springs or shallow depressions used by herders for livestock watering.

Localised increases in surface runoff and temporary flooding may occur where compacted working areas or stockpiles reduce infiltration, particularly during intense rainfall or snowmelt. Along the OHTL routes, works at river and gully crossings may temporarily disturb banks, influence channel morphology or create short-term scour and sedimentation risks.

Activity/Impact/Aspect					
Modification of natural drainage processes (excavation, grading, access roads, turbine/tower foundations, stockpiling)					
Type	**Duration**	**Extent**	**Scale of Impact**	**Frequency**	**Likelihood (unplanned events)**
Direct	Short to medium term	On-site/local	Distinguishable (but localised)	Continuous	Possible (localised flow diversion, erosion)

Receptor	Sensitivity	Magnitude	Significance of Impact
Springs, ponds, ephemeral watercourses, shallow groundwater, downstream rivers	Low - Medium	Medium	Minor - Moderate
Herders, livestock and users of local water resources	Medium	Medium	Moderate

Impacts on Surface-Water and Groundwater Quality

Construction activities may increase sediment mobilisation through soil stripping, vegetation clearance, heavy-vehicle movement and exposure of bare earth. Without appropriate controls, sediment-laden runoff may enter springs, natural ponds, ephemeral drainage lines or downstream rivers such as the Shabakty, Ushbas and Berkutti.

Accidental spills of fuels, lubricants, hydraulic fluids or concrete additives may contaminate surface water or infiltrate shallow aquifers. Mobile construction activities and vehicle wash-down areas along WPP and OHTL work fronts present additional risks if wash-water or wastewater is not fully contained. These wastewater-related risks are addressed in detail in Section 16 (Waste and Wastewater), which outlines the proposed containment and disposal methods that will be applied.

Given the poor baseline water quality in several springs and small water bodies, including elevated arsenic, nickel, cadmium and suspended solids, any additional inputs of sediment or pollutants could further degrade water resources critical for livestock watering.

Activity/Impact/Aspect					
Degradation of surface-water or groundwater quality (sediment mobilisation, wastewater mismanagement, accidental spills)					
Type	**Duration**	**Extent**	**Scale of Impact**	**Frequency**	**Likelihood (unplanned events)**
Direct	Short-term	On-site/local (occasional downstream transport)	Distinguishable	Intermittent	Possible (minor spills, sediment pulses)

Receptor	Sensitivity	Magnitude	Significance of Impact

Springs, ponds, ephemeral watercourses, shallow groundwater, downstream rivers	Low - Medium	Low - Medium	Minor - Moderate
Herders, livestock and users of local water resources	Low - Medium	Low - Medium	Minor - Moderate

Impacts Associated with Sourcing of Construction Water

Construction requires significant volumes of water for concrete batching, dust suppression, equipment cleaning and domestic use. Peak construction demand is estimated at approximately 100 m^3/day, primarily driven by batching plant demand.

The Project has confirmed that all construction water will be supplied via licensed tanker delivery, with no abstraction from springs, ponds, or shallow aquifers in the WPP area.

Should the EPC contractor seek to supplement water supplies through licensed groundwater abstraction, this would require formal permitting, hydrogeological assessment and confirmation that abstraction would not reduce spring flows or affect perched aquifers.

Activity/Impact/Aspect					
Water sourcing for construction activities (tanker delivery; potential groundwater abstraction requiring permits)					
Type	**Duration**	**Extent**	**Scale of Impact**	**Frequency**	**Likelihood (unplanned events)**
Direct	Short term	Local	Limited; reversible	Occasional	Possible (if abstraction from shallow aquifers occurs)

Receptor	**Sensitivity**	**Magnitude**	**Significance of Impact**
Springs, ponds, ephemeral watercourses, shallow groundwater, downstream rivers	Low - Medium	Low	Negligible- Minor
Herders, livestock and users of local water resources	Low	Low	Negligible

The magnitude ratings presented in the tables above are based on the expected scale, duration and reversibility of effects during the construction phase:

Medium magnitude for impacts on natural drainage processes reflects the potential for temporary but meaningful disturbance of drainage lines, ephemeral channels, perched springs and livestock-watering points. These risks are reduced through design measures that avoid placing WTGs and internal roads in drainage channels or natural ponding areas, though some localised disturbance may still occur.

Low–Medium magnitude for surface-water and groundwater quality recognises sediment mobilisation as the main driver, particularly during rainfall or snowmelt. While sediment pulses and occasional spills may occur, these effects are typically short-term and manageable with standard controls.

Low magnitude for water sourcing impacts is appropriate because the Project will rely on tankered water from licensed sources, avoiding direct pressure on springs or shallow groundwater. Groundwater abstraction is unlikely and would require strict permitting if ever proposed.

14.5.2 Operation Phase

Although the operational phase of the Project involves far less land disturbance and substantially lower water demand than the construction phase, some residual hydrological and hydrogeological impacts may still occur. These impacts are substantially lower in magnitude due to the static nature of operational infrastructure and the absence of intensive surface-disturbing activities. As with the construction phase, operational impacts are grouped under the following three pathways:

- Impacts on natural drainage processes
- Impacts on surface-water and groundwater quality
- Impacts associated with water sourcing.

The sections below describe the potential operational-phase impacts for both the WPP area and the OHTL corridors.

14.5.2.1 Impacts on Natural Drainage Processes

General Operational Considerations (WPP and OHTLs)

Once construction is complete, most hydrological disturbance ceases, and permanent infrastructure interacts only minimally with natural drainage features. Nevertheless, certain long-term effects may occur where infrastructure is located near shallow watercourses, ephemeral channels, depressions or spring-fed areas.

Permanent infrastructure such as WTG pads, internal access roads, underground cable routes and OHTL tower platforms may:

- slightly modify surface-runoff behaviour during rainfall events;
- maintain reduced infiltration rates due to hardstanding;
- act as minor barriers to diffuse sheetflow; or
- concentrate runoff along road edges or shallow roadside drains.

These effects are expected to be low in magnitude, long-term and highly localised, as the WTG layout and road network were intentionally designed to avoid drainage lines, spring locations and natural ponding areas.

Specific Considerations for the WPP Area

The WPP area contains multiple perched-spring systems, shallow depressions and perennial watercourses that are used by herders for livestock watering. These features are hydrologically sensitive and can be influenced by changes in local drainage patterns or surface-runoff behaviour. As described in Section 1.5.1.1, all identified springs were mapped and a 50-m buffer applied to determine potential interactions with the proposed WTG layout. This analysis identified 7 WTGs whose hardstanding areas initially fell within the buffer and which are therefore recommended for micro-siting or relocation to avoid impacts on spring recharge and livestock-watering features.

During design development, turbines located near watercourses were positioned along the upper edges of these watercourses, outside their functional flow corridors, to ensure natural drainage is maintained. Masdar has confirmed that the WTG layout was refined using outputs from the project drainage study, which mapped natural drainage pathways across the WPP area and informed the safe siting of WTGs away from drainage lines.

With the implementation of these construction-phase design refinements, including the micro-siting of

the 7 WTGs identified in Section 1.5.1.1, operational-phase effects on natural drainage within the WPP area are expected to be very limited. Recharge to spring-fed depressions should remain largely unaffected, and the hydrological functioning of livestock-watering features is expected to remain intact. Any remaining effects will be confined to minor, localised modifications to surface runoff around turbine pads or access-road shoulders, which can be effectively managed through routine maintenance.

Specific Considerations for the OHTL Corridors

The operational footprint of both the Jambyl and Kentau OHTL routes is limited to tower foundations, access tracks and small areas of hardstanding at tower locations. During operation:

- tower platforms do not obstruct or alter natural drainage patterns;
- access tracks may marginally influence runoff in isolated locations, but impacts are expected to be negligible;
- no hydrological modification occurs at river crossings as there is no in-channel infrastructure when the lines are in service.

Accordingly, operational drainage-related impacts along the OHTL corridors are considered very low.

Activity/Impact/Aspect					
Presence of permanent infrastructure influencing natural runoff pathways (WTG pads, internal roads, cable routes, OHTL tower platforms)					
Type	**Duration**	**Extent**	**Scale of Impact**	**Frequency**	**Likelihood (unplanned events)**
Direct	Long term	On-site/local	Very limited; localised	Continuous (passive)	Unlikely

Receptor	**Sensitivity**	**Magnitude**	**Significance of Impact**
Springs, ponds, ephemeral watercourses, shallow groundwater, downstream rivers	Low - Medium	Low	Negligible- Minor
Herders, livestock and users of local water resources	Medium	Low	Negligible- Minor

Operational-phase drainage impacts are expected to be very limited and localised, with negligible–minor significance, owing to the design-led avoidance of drainage features and the micro-siting of turbines that previously lay within spring-buffer areas.

14.5.2.2 Impacts on Surface-Water and Groundwater Quality

General Operational Considerations (WPP and OHTLs)

The Project does not involve industrial processes, chemical use, or routine wastewater discharges during operation. Apart from minimal domestic wastewater, including greywater, generated at the O&M compound, the operational phase presents few water-quality risks. Potential impacts may include:

- small volumes of domestic wastewater from operational staff;
- accidental releases of small quantities of lubricants or hydraulic fluids during turbine or substation maintenance;
- stormwater runoff carrying minor sediment, dust, or hydrocarbons from hard surfaces.

These risks are small in scale and frequency, and can be avoided through routine housekeeping, maintenance of equipment, and implementation of established spill-prevention procedures. Requirements for the storage, containment, and off-site disposal of sanitary wastewater are detailed in Section 16: Waste and Wastewater, which also addresses operational wastewater management.

Specific Considerations for the WPP Area

Minor accidental releases during maintenance activities could theoretically reach nearby springs or small ponds if not properly contained. However, given the design-led avoidance of drainage features and the distances between WTGs and water bodies, the likelihood of such events causing any measurable water-quality deterioration is very low.

Specific Considerations for the OHTL Corridors

OHTL towers and their equipment do not store fuels or hazardous materials during operation. Maintenance activities are infrequent, typically small-scale, and short in duration. Only trace amounts of lubricants or oils are used for component servicing, and the risk of these entering watercourses or groundwater systems is negligible.**Activity/Impact/Aspect**					
Minor releases from turbine or substation maintenance; domestic wastewater from O&M compound; stormwater runoff containing trace hydrocarbons or sediment					
Type	**Duration**	**Extent**	**Scale of Impact**	**Frequency**	**Likelihood (unplanned events)**
Direct	Long-term	On-site/local	Very limited	Intermittent	Possible (small accidental leaks)

Receptor	**Sensitivity**	**Magnitude**	**Significance of Impact**
Springs, ponds, ephemeral watercourses, shallow groundwater, downstream rivers	Low - Medium	Low	Negligible- Minor
Herders, livestock and users of local water resources	Low - Medium	Low	Negligible- Minor

With routine maintenance, good housekeeping and adherence to Section 16 wastewater requirements, operational water-quality impacts are negligible–minor in significance and readily manageable.

14.5.2.3 Impacts Associated with Water Sourcing During Operation

Operational water demand is modest and relates primarily to domestic use at the O&M compound and occasional maintenance activities. Based on the estimated operational workforce of 60–80 personnel, daily potable and sanitary water requirements are expected to be approximately 3–4 m^3/day, with short-term increases to 5–7.5 m^3/day during outages or major maintenance periods when up to 100–150 personnel may be on site. All potable water used during the operational phase must comply with the WHO Guidelines for drinking-water quality, which will be ensured through the use of bottled water and tankered potable-water deliveries from licensed suppliers.

Additional operational water use is associated with turbine blade-cleaning cycles, undertaken approximately every 3–5 years, requiring around 1 m^3 of water per WTG. For the full turbine fleet, this results in an estimated ~150 m^3 per cleaning cycle, representing an infrequent and low-intensity demand spread across several years.

The Project will meet operational water requirements primarily through licensed tanker delivery, and no abstraction from springs, surface ponds or shallow aquifers within the WPP area is planned. Should the operator propose to supplement water supplies via a dedicated groundwater well, this would require:

- full regulatory permitting;
- a hydrogeological assessment demonstrating no adverse effects on perched aquifers or spring discharge; and
- confirmation that abstraction will not reduce water availability for herders or livestock-watering points.

Given the low daily water demand and the reliance on external tankered supply, operational water sourcing is not expected to influence groundwater levels, hydrological connectivity, or spring flow, and associated impacts are therefore assessed as negligible.

Activity/Impact/Aspect					
Water sourcing for operational needs (primarily tankered; potential groundwater abstraction subject to permitting)					
Type	**Duration**	**Extent**	**Scale of Impact**	**Frequency**	**Likelihood (unplanned events)**
Direct	Long term	Local	Very limited; reversible	Occasional	Very unlikely

Receptor	**Sensitivity**	**Magnitude**	**Significance of Impact**
Springs, ponds, ephemeral watercourses, shallow groundwater, downstream rivers	Low - Medium	Negligible - Low	Negligible
Herders, livestock and users of local water resources	Low	Negligible - Low	Negligible

Because all operational water will be sourced off-site via tanker delivery and overall demand is low, operational water-sourcing impacts are negligible and will not affect local surface-water or groundwater systems.

14.6Mitigation, Management & Residual Impacts

This section presents the mitigation and management measures recommended to avoid, minimise and control potential impacts on hydrology and hydrogeology during both the construction and operational phases of the Project. Measures have been developed in line with GIIP, the findings of the ESIA process, and the hydrological and drainage assessments. The tables below summarise the key mitigation actions and expected residual impacts following implementation of the proposed controls.

14.6.1 Construction Phase

Table 13-8: Construction-Phase Hydrology & Hydrogeology Mitigation, Management and Residual Impacts

Impact Pathway	Pre- mitigation	Mitigation and Management Measures	Residual Significance
Impacts on Natural Drainage Processes	**Moderate** (Localised alteration of runoff, reduced infiltration, disturbance to springs or natural ponding areas; temporary effects on livestock watering points if not well managed.)	• Obtain all required permits and approvals from the relevant Basin Inspection for construction activities within WPZ, and carry out such works strictly in accordance with permit conditions, including controls on construction methods, pollution prevention, protection of surface water and groundwater, and site reinstatement; maintain ongoing consultation with the Basin Inspection throughout construction. • Maintain natural drainage lines, ephemeral channels and spring-fed depressions, avoiding blockage, diversion or infilling, and ensure no construction works, hardstanding areas, stockpiles or machinery encroach within a 50-m buffer of identified drainage channels, perennial/ephemeral watercourses or mapped springs/livestock-watering depressions. • Install cross-drainage structures (culverts/box culverts/fords) at all road crossings of natural drainage lines, as required by the project Drainage Sizing Report, ensuring that road construction does not obstruct or divert ephemeral channels and maintains natural flow connectivity in accordance with hydrological design criteria. • Ensure all WTGs, internal access roads and permanent infrastructure remain located outside drainage channels and spring areas, consistent with the project drainage study; apply a minimum 50-m setback from the nearest edge of the WTG platform/hardstanding to all mapped springs or drainage features. • Avoid placing stockpiles, spoil heaps or construction materials within the 50-m buffer; where unavoidable due to terrain constraints, install bypass drains around stockpiles to maintain flow paths. • Install cross-drainage structures (culverts, swales, cross-drains) where roads intersect drainage lines, sized based on hydrological modelling. • Minimise soil compaction; re-rip and restore compacted areas after works to re-establish infiltration capacity. • Apply erosion-control measures (silt fences, fibre rolls, geotextiles, sediment traps, check dams) particularly down-gradient of turbine pads and within 50 m of drainage features.	**Minor** (Short-term and localised changes in runoff behaviour effectively controlled through siting, drainage measures and reinstatement.)

Impact Pathway	Pre- mitigation	Mitigation and Management Measures	Residual Significance
		• Implement stormwater-runoff management measures (rainwater harvesting tanks, directed infiltration zones) to reduce uncontrolled flow and promote infiltration. • Reinstate disturbed surfaces promptly (grading, reseeding, surface stabilisation). • No abstraction from springs, surface ponds or ephemeral channels within the WPP area will be permitted.	
Impacts on Surface-Water and Groundwater Quality	**Minor – Moderate** (Potential sediment mobilisation, minor spills or mismanaged wastewater affecting springs, ponds, ephemeral channels and downstream rivers.)	• Implement erosion and sediment-control measures: silt fences, sediment traps, diversion channels, and limit any construction activities to be at least 50m from springs, watercourses, or drainage channels. • Designate concrete wash-out areas and batching wastewater ≥50 m from watercourses and ensure containment; prohibit any discharge within 50 m of any drainage feature, spring or natural pond. • Manage sanitary wastewater in sealed closed systems, with no discharge within or near the 50-m buffers. • Implement tank and hose inspection regime to prevent leaks (weekly inspection). • Ensure no fuel storage, chemical storage, batching activities, refuelling or vehicle maintenance occurs within 50 m of springs, watercourses, or drainage channels. • Undertake refuelling only in designated bunded areas with spill kits and drip trays. • Implement a Spill Prevention and Response Plan, with training and reporting. • Conduct regular inspections for sediment, wastewater or spill issues and remediate promptly.	**Minor – Moderate** (Residual water-quality effects limited to small, short-duration sediment pulses or minor spill risks, controlled through good practice.)
Impacts Associated with Construction-Phase Water Sourcing	**Negligible-Minor** (Because all construction water will be sourced via tankered delivery, avoiding abstraction from springs or shallow aquifers; only negligible indirect impacts expected.)	• Source all construction water exclusively via licensed tanker delivery, as committed by the Project. • Prohibit any groundwater abstraction within the WPP area or along the OHTLs unless expressly permitted and supported by hydrogeological assessment (expected to be unnecessary). • Prohibit Project use of water from perched springs, natural ponds, or ephemeral channels used by herders. • Apply water-conservation measures to reduce overall demand and avoid unnecessary abstraction: water-saving fixtures, avoidance of potable water use for construction, low-water techniques, and shut-off controls.	**Negligible** (Water sourcing has no hydrological effect when tanker-based; only negligible residual impact remains.)

Impact Pathway	Pre- mitigation	Mitigation and Management Measures	Residual Significance
		• Promote reuse of treated greywater, harvested stormwater and rainwater (where quality allows) to reduce tanker reliance. • Monitor and record water consumption on a monthly basis, tracking potable/non-potable/recycled volumes, including monitoring of any abnormal increases. • Include toolbox talks on protecting springs and drainage corridors, with emphasis on the mandatory 50-m buffer rule for all construction teams. • Reuse treated greywater for dust suppression where permissible by national regulation.	

With full application of the proposed mitigation measures and adherence to good international practice, residual construction-phase impacts on hydrology and hydrogeology are anticipated to be minor adverse to negligible.

14.6.2 Operation Phase

Table 13-9: Operation-Phase Hydrology & Hydrogeology Mitigation, Management and Residual Impacts

Impact Pathway	Pre- mitigation	Mitigation and Management Measures	Residual Significance
Impacts on Natural Drainage Processes	**Minor** (Permanent infrastructure may slightly modify surface runoff or infiltration patterns.)	• Maintain the design-led avoidance of ephemeral drainage channels, natural depressions and spring-fed areas for all permanent infrastructure (WTGs, roads, OHTL towers), ensuring a minimum 50-m setback between the nearest edge of any WTG hardstanding area (pads, crane pads, laydown zones, cable corridors) and all surface-water features. • Micro-site or move the following WTGs 012, 026, 039, 057, 093, 106 and 133, such that they have a 50 m buffer from the identified spring area (see Section 1.5.1.1). • Protect significant springs (limnocrenes), refer to Table 13-6 (spring locations), to guide any future WTG layout refinements. • Apply additional micro-siting during final design if hydrological monitoring or grazing-use changes indicate renewed interaction between infrastructure and spring-fed or drainage-sensitive areas. • Operate and maintain all WTGs, pads and internal access roads in accordance with the project drainage design, ensuring no encroachment into mapped drainage pathways or spring recharge areas.	**Negligible – Minor** (long-term effects on natural drainage are minimal when buffers and micro-siting are consistently maintained).

Impact Pathway	Pre- mitigation	Mitigation and Management Measures	Residual Significance
		• Maintain access-road drainage structures (culverts, roadside ditches, cross-drains) to prevent blockage, erosion or diversion of natural flows. • No new operational infrastructure (storage, small buildings, laydown, solar lighting poles, telecom fibre boxes) shall be installed within the 50-m hydrological buffer zone. • Repair any erosion or drainage issues identified during routine inspections. • Maintain vegetative cover and stabilised surfaces to support infiltration and reduce runoff concentration.	
Impacts on Surface-Water and Groundwater Quality	**Negligible – Minor** (Water-quality risks limited to small maintenance-related spills or domestic wastewater from the O&M compound.)	• Maintain good housekeeping and spill-prevention procedures during turbine and substation maintenance; store lubricants and oils in contained areas with secondary containment and maintain spill-response kits at the O&M compound and substation.. • Ensure no refuelling, no hazardous-material storage and no waste storage occurs within 50 m of springs, ponds, drainage channels or ephemeral watercourses. • Manage all sanitary wastewater from the O&M compound using sealed systems and licensed off-site disposal, consistent with Section 16 (Waste & Wastewater). • Inspect WTG pads, substations and access roads periodically for signs of leaks, waterlogging, rilling or erosion that could affect water quality. • Maintain stormwater controls around operational hardstanding areas to minimise sediment entrainment and runoff concentration, and ensure stormwater is directed through stabilised and vegetated areas where possible to reduce sediment and hydrocarbon transport. • Train maintenance staff on handling of oils, lubricants and spill prevention.	**Negligible – Minor** (Residual water-quality risks are extremely low and readily manageable through routine operational practices.)
Impacts Associated with Operational Water Sourcing	**Negligible** (Operational water demand is minimal and will be met via tankered delivery; no planned abstraction from groundwater or springs.)	• Source all operational water via licensed tanker delivery, as committed by the Project. • Prohibit any groundwater abstraction during operation unless formally permitted, justified by hydrogeological assessment, and demonstrated not to affect spring flows or shallow aquifers. • Prohibit any abstraction from springs, surface ponds, or ephemeral channels used by herders and livestock. • Monitor operational water use at the O&M compound and optimise consumption to minimise demand.	**Negligible** (No hydrological impact when water is supplied entirely by tanker.)

With effective application of the proposed operational mitigation measures, residual impacts on hydrology and hydrogeology are expected to remain negligible to minor.

15 Geology and Soils

15.1 Introduction and Overview of Assessment Methodology

This section presents the assessment of potential impacts of the Project on geology and soils. The assessment considers all Project components, including the WPP, BESS, the two OHTLs, access roads, construction compounds, laydown areas, material storage locations, temporary construction camps, substations, and associated transport routes.

Geology and soils are primarily relevant to the Project during the construction phase, when earthworks, excavation, foundation installation, and traffic movements may result in soil disturbance, compaction, erosion, or contamination. During operation, potential impacts are limited and highly localised, largely associated with the permanent footprint of infrastructure and routine maintenance activities.

The purpose of this assessment is to:

- characterise existing geological and soil conditions within the defined Area of Influence (AoI);
- identify potential impact pathways associated with construction and operation activities;
- evaluate the significance of potential impacts on soil quality, stability, and subsoil conditions; and
- define mitigation and management measures in accordance with national legislation and GIIP.

The assessment has been undertaken in accordance with the Environmental Code of the Republic of Kazakhstan, the Land Code, and the Subsoil and Subsoil Use Code, together with applicable sanitary standards for soil quality. The assessment is also aligned with international lender requirements, including IFC Performance Standard 1 (Assessment and Management of Environmental and Social Risks and Impacts) and Performance Standard 3 (Resource Efficiency and Pollution Prevention), and relevant World Bank Group Environmental, Health and Safety (EHS) Guidelines.

The geology and soils assessment follows the overarching ESIA methodology described in Section 4 and comprises the following steps:

- **Legislation and Standards Review**: Review of applicable national legislation governing soil protection, land use, subsoil management, soil quality standards, and land rehabilitation, alongside relevant international lender standards and GIIP.
- **Baseline Characterisation**: Use of existing baseline data, including desk-based geological and soil mapping, field observations, and laboratory analysis of soil samples collected during baseline surveys, to characterise geological structure, soil types, fertility, and background contamination levels within the Project area.
- **Definition of the Area of Influence (AoI)**: Adoption of a topic-specific AoI reflecting the localised nature of soil and geological impacts. The AoI encompasses the WPP site, OHTL corridors, access roads, construction compounds, material storage areas, temporary facilities, substations, and associated transport routes, and is defined as 50 m from construction and earthworks areas, consistent with the baseline assessment.
- **Identification and Assessment of Impacts**: Identification and evaluation of potential impacts to soils and geology arising during construction, operation, and decommissioning, including soil erosion, compaction, loss of topsoil, contamination from accidental spills, and localised geological disturbance. Impact significance is determined by combining the magnitude of change with receptor sensitivity, in accordance with the ESIA significance matrix.

- **Mitigation and Management Measures**: Identification of mitigation measures in line with the mitigation hierarchy, including soil stripping and reinstatement, erosion control, spill prevention, and good construction practice measures.
- **Residual Impact Assessment**: Evaluation of residual impacts following implementation of mitigation measures to confirm compliance with national requirements and lender standards.

Given the predominantly localised footprint of Project activities and the temporary nature of most construction works, significant long-term impacts to geology and soils are not anticipated, provided that appropriate soil management and reinstatement measures are implemented.

15.2Applicable Requirements & Standards

15.2.1 National Regulations

The foundations of soil and subsoil protection are established in the Environmental Code of the Republic of Kazakhstan, which defines these components as part of the natural environment.

The Code also establishes the requirement to develop and ensure compliance of soils and land with environmental quality standards. In this context, “land” refers not only to soils but also to other environmental components (including subsoil) located within defined boundaries. Quality standards also serve as indicators of soil contamination, which may be anthropogenic or naturally occurring.

In addition to compliance with quality standards, the Code requires the assessment and monitoring of soils and land, as well as their protection from:

- anthropogenic contamination of the land surface and soils;
- littering of the land surface;
- soil degradation and depletion.

In cases where damage is caused to soils or land, the Code requires land rehabilitation to restore them to the condition they were in at the time the land was brought into use. At the same time, contaminated soils lying in their natural state cannot be classified as waste, and uncontaminated soils cannot be considered waste at all.

Similar provisions apply to subsoil:

- The quality and use, as well as the intended use of the subsoil, must be considered in the National EIA;
- Subsoil is subject to state monitoring;
- The discharge of wastewater into subsoil is prohibited;
- Subsoil and groundwater users must protect subsoil and develop measures for its protection.

In addition to the Environmental Code, subsoil is regulated by the Subsoil and Subsoil Use Code dated 27 December 2017 No. 125-VI ZRK. The Code defines the regime of subsoil use. Its main objectives include:

- protecting the state's property rights to subsoil;
- implementing state policy and regulating relations in the field of subsoil use;
- ensuring the interests of the state, citizens of the Republic of Kazakhstan, and subsoil users;
- increasing the mineral resource base of Kazakhstan;
- establishing the grounds, conditions, and procedures for the emergence, exercise, modification, and termination of subsoil use rights;
- providing the legal basis for sustainable subsoil use;

- creating conditions for attracting investment in geological exploration and subsoil use.

The principles of subsoil management include rationality, environmental safety, payment, good faith and stability of subsoil use, as well as access to information on subsoil-related activities.

According to the Code, subsoil belongs to the people of Kazakhstan and is managed by the State.

The law regulates mineral resources, technogenic mineral formations, and the subsoil space.

Another key legislative act is the Land Code dated 20 June 2003 No. 442. One of its objectives is to regulate land relations for the purposes of ensuring the rational use and protection of land, restoring soil fertility, preserving and improving the natural environment, and adapting to climate change.

One of the obligations of landowners established by the Code is the prevention of soil contamination, littering, degradation, and loss of fertility, as well as the prohibition on removing the fertile soil layer for sale or transfer to third parties, except in cases where such removal is necessary to prevent irreversible loss of fertile soil.

If the use of a land plot or part of it leads to a significant decrease in the fertility of agricultural land or to environmental damage, the landowner or land user is required to remediate the damage. Thus, soil fertility represents a soil quality standard. Its quantitative assessment is carried out through soil bonitet evaluation.

Soil fertility is assessed using the bonitet system, a nationally applied soil quality and productivity index. Bonitet is assessed in accordance with the Order of the Minister of Agriculture of the Republic of Kazakhstan dated 26 October 2022 No. 342 “On approval of the Methodology for soil bonitet assessment,” which includes mapping of the site and sampling of soils based on parameters such as humus content, absorbed sodium and magnesium, salinity and stoniness, as well as hydromorphism. Additionally, soil texture and salinity in the 0–50 cm layer may be assessed. The bonitet score is then used for calculating compensations.

The main legal act establishing soil quality standards is the Order of the Minister of Health of the Republic of Kazakhstan dated 21 April 2021 No. QR DSM-32 “On approval of Hygienic requirements for environmental safety,” which sets sanitary standards. Requirements for chemical parameters are provided in Table 14-1, Table 14-2 and Table 14-3.

Table 14-1: Maximum permissible concentrations (MPCs) of chemical substances in soils

Parameter	MPC value µg/kg soil considering background	Limiting indicator
mobile form		
cobalt	5.0	general sanitary
fluorine	2.8	translocation
chromium	6.0	general sanitary
water-soluble form		
fluorine	10.0	translocation
benzo(a)pyrene	0.02	general sanitary
xylenes (ortho-, meta-, para-)	0.3	translocation
arsenic	2.0	translocation
organic fertilizers	3000.0	water and general sanitary
mercury	2.1	translocation
lead	32.0	general sanitary
lead + mercury	20.0 + 1.0	translocation
elemental sulphur	160.0	general sanitary

Parameter	MPC value µg/kg soil considering background	Limiting indicator
hydrogen sulphide	0.4	air
sulfuric acid	160.0	general sanitary
styrene	0.1	air
formaldehyde	7.0	-
potassium chloride	560.0	water

Table 14-2: Soil hazard level examination parameters

Hazard level	Pollution level	MPC exceedance factor for chemical substances	Radioactive contamination indicator
Safe	Clean	<1	Natural level
Hazardous	Heavily contaminated	from 1 to 10	Exceedance of natural level by 1.5 times
Extremely hazardous	-	from 10 to 25	Exceedance of natural level by 2 times
Ecological disaster	-	>25	Exceedance of natural level by 3 times

Table 14-3: Criteria for physical degradation and indicators of chemical and biological contamination of soil

Indicators	ecological disaster	ecological emergency	Relatively satisfactory situation
radioactive contamination, Ku/km^2:			
cesium-137	above 40	40-15	up to 15
strontium-90	above 3	from 3 to 1	up to 1
plutonium (sum of isotopes)	above 0.1	0.1-0.05	up to 0.05
exceedance of MPC for chemical substances:			
1st hazard class (including benzo(a)pyrene, dioxins)	more than 3	from 3 to 2	up to 2
2nd hazard class	more than 10	from 10 to 5	up to 5
3rd hazard class (including oil and petroleum products)	more than 25	25-10	up to 10

15.2.2 Lender Requirements

The IFC Performance Standard 3 (Resource Efficiency and Pollution Prevention) establishes the requirement to avoid, or where avoidance is not possible, to minimize adverse impacts on human health and the environment by reducing pollution from project activities, including pollution of land. The Standard recommends relying on existing national standards and GIIP.

The WBG General EHS Guidelines set out a framework for the assessment of contaminated land based on the identification of potential contaminants, receptors, and exposure pathways. A detailed risk assessment is required only where a complete source–pathway–receptor linkage is identified.

Where contamination is confirmed, measures are recommended to control and prevent exposure to identified receptors. National or international standards may be applied to evaluate contaminant concentrations. Where necessary, project-specific standards may be developed based on a detailed risk assessment.

15.3Baseline Conditions and Receptors

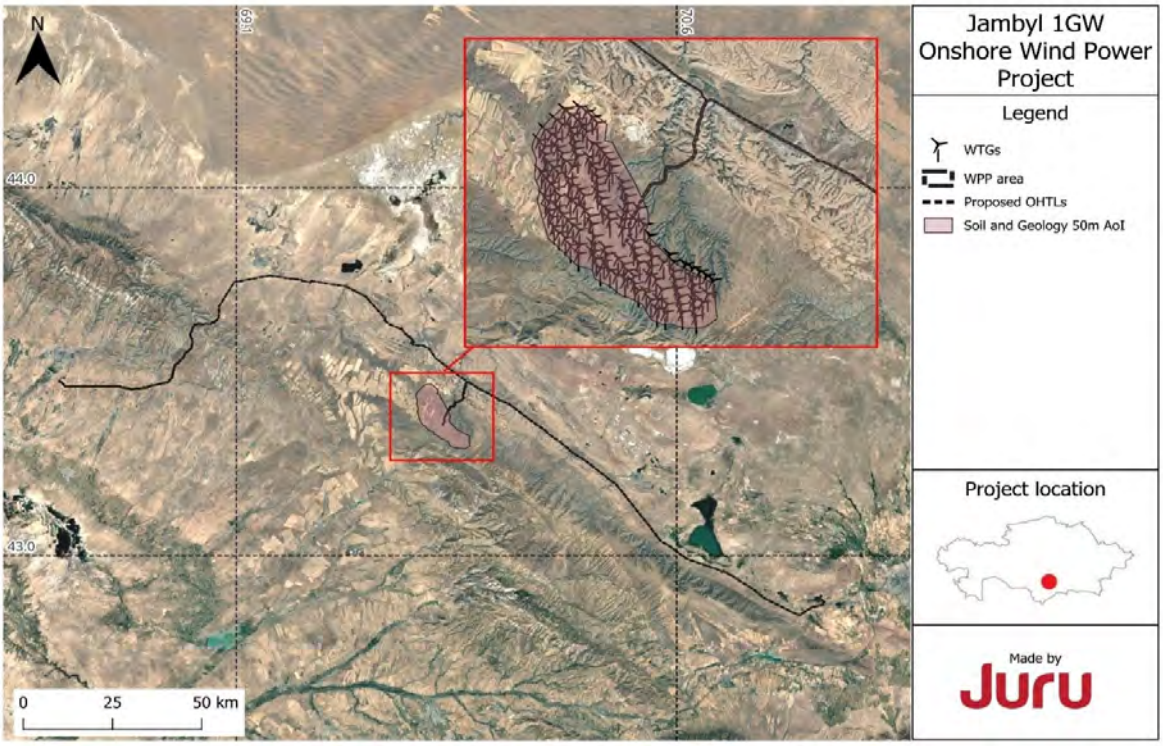
15.3.1 Area of Influence

The Area of Influence (AoI) for soil quality and geology is defined as the area where project-related activities may lead to the deterioration of the considered natural components through contamination, the activation of erosion processes, or physical displacement from their natural locations. Thus, the AoI includes the WPP site, the OHTL corridors, access roads, laydown areas, batching facilities, material storage areas (including liquid materials), temporary construction camps, and substations and other locations where construction activities will take place.

Since soil and geological substrates are solid materials, the specific nature of the Project's impact on these components is the localisation of contaminants at the point of release and their subsequent transport by agents such as water or air, with vertical migration at the point of spill being more characteristic than horizontal dispersion. Erosion processes tend to occur at locations where earthworks are conducted, which can serve as initiation points and zones of expansion. Soil displacement will be associated with earthworks.

Considering the limited horizontal extent of the impact, the AoI is set at 50 m from construction sites (including the WPP site and OHTL RoW) as well as along transport routes used for material delivery. The AoI is shown in Figure 14-1.

Figure 14-1: Soil and Geology AoI map

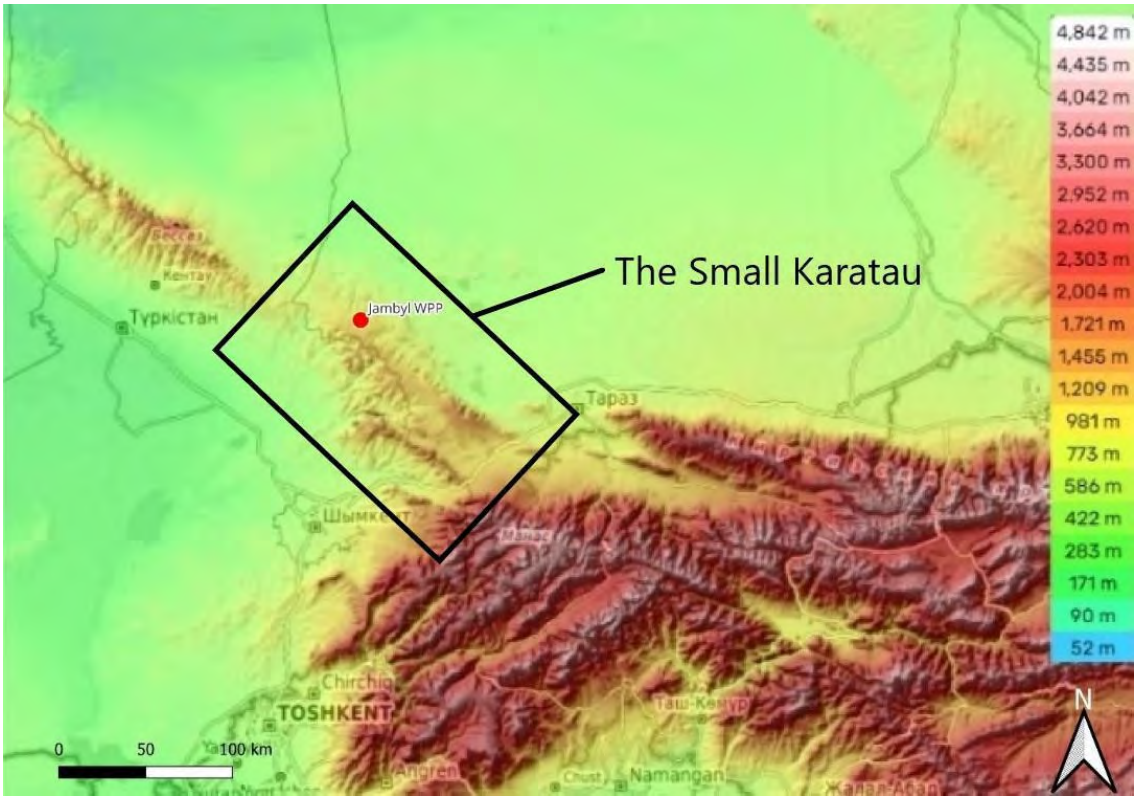


15.3.2 Topography

The mid-mountainous relief of the Karatau Ridge, resulting from tectonic denudation processes, forms

the relief of the south-western part of the country[264]. The territory of the site has a number of distinctive geographical characteristics. The topographic map of the region shows that the Project area elevations vary from approximately 800 m to 1,050 m, reflecting the varied topography, which consists of rolling hills, gentle slopes, and erosional valleys[265].

Figure 14-2:Topographic map of Jambyl region including the project site[266].



The Karatau Range was most actively formed during the Alpine orogeny. Orogeny refers to a geological process resulting from horizontal and vertical shifts of the Earth's crust, leading to the formation of complex structures within the Earth's crust. It is often associated with the movement of tectonic plates and can occur on various scales, from small structures to massive mountain ranges. In this context, Alpine orogeny denotes a period of intense tectonic movements that occurred approximately 50 million years ago. During the Alpine stage, there were block movements here, which resulted in the current height of the Karatau ridge varying between 500 and 2,200 meters.

Currently, the relief of the ridge is formed as a result of physical weathering and deflation in arid conditions; glaciers are absent. The Small Karatau, where the project site is located, consists of alternating ridges and intermountain depressions. The relief forms often depend on the composition of rocks: positive relief forms are associated with durable rocks resistant to weathering, while depressions are associated with areas where siliceous-shale deposits are widespread.

The relief of the Small Karatau is characterized by an epigenetic hydrographic network. River valleys cross

[264] National Atlas of the Republic of Kazakhstan. Volume 1: Natural Conditions and Resources; National Atlas of the Republic of Kazakhstan: Almaty, Kazakhstan, 2006.
[265]https://dspace.spbu.ru/bitstream/11701/11532/1/Rekashova_VKR.pdf
[266]https://dspace.spbu.ru/bitstream/11701/11532/1/Rekashova_VKR.pdf

the ridges and intermountain depressions. Fine gravel and easily eroded loamy soil are formed in the depressions. The depressions themselves cannot be considered as normal erosional valleys because they lack signs of fluvial origin; their relief is rather residual, aeolian-denudational.

Due to significant denudation processes on the ridge, quests and denudational basins are prominently expressed. Some basins are occupied by lakes and salt flats such as Biylyu-Kul, Akchokur, and Nasyn-Kul. The deepening of basins occurs due to wind erosion of sandy-dusty products of physical weathering of native rocks, loose salt flats, and takyr crust. Eluvial clays and loams with a thickness of 0.5-2.0 m are exposed at the bottom of the basins[267].

A photo showing the view to the elevated project area from the KN-1 highway from the northeast side is presented in Figure 14-3.

Figure 14-3: Photograph from KN-1 highway showing view toward elevated site area



The majority of both transmission lines pass through the foothills of the Karatau range. The Jambyl OHTL runs along the Small Karatau, while the Kentau OHTL runs along both the Small Karatau and the Big Karatau. These foothills represent transitional zones between the mountain range and the surrounding deserts or river valleys. On the eastern side of the Karatau slopes, the topography transitions from mountains to the more level river valleys of the Talas and Shu rivers, and further to the Moyynkum Desert (approximately 80 km from the Jambyl OHTL and about 30 km from the nearest point of the Kentau OHTL). On the western side of Karatau, there is a transition into the Syr Darya river valley (approximately 50 km from the nearest point of the Kentau OHTL). The Kentau OHTL also crosses the Big Karatau through one of its erosional gorges.

Figure 14-4: Photograph of topography in the vicinity of Moyynkum Desert

[267]Kriger N.I., Bezygin N.P., Zyablikova G.D. Deflation in the History of Relief of Arid Regions (on the Example of the Small Karatau). Geomorphology. 1975;(2):86-95. https://doi.org/10.15356/0435-4281-1975-2-



Figure 14-5: Entrance to the gorge within the Big Karatau



15.3.3 Geology

The main geological structures of Southern Kazakhstan include platforms, shields, and orogenic-folded regions. The western part of the region lies within the Turan Plate of the Epigeric Platform, characterized by a highly deformed basement with a relatively undisturbed Meso-Cenozoic sedimentary cover. The southern, central, and eastern parts are formed by the folded mountain systems of the Northern Tien Shan and Dzungarian Alatau, as well as their extensions - the Karatau and Kendyk-Tas ridges, and the southern and southeastern areas of Central Kazakhstan, including the Chu-Ili mountains and the Betpak-Dala Desert.

In addition to residual mountains, this region contains uplifts affected by recent tectonic activity. Significant structural elements of the folded area include large depressions such as the Alakol-Balkhash and Ili basins, as well as a number of smaller structural troughs. The geological composition of both platform and orogenic areas is represented by various sedimentary rock complexes ranging in age from the Precambrian to the present, with ancient sequences containing effusive and intrusive formations of various geological periods. Surface deposits in the plains are primarily represented by clays and loams, as well as gravelly-clastic formations with clay and sand matrix[268].

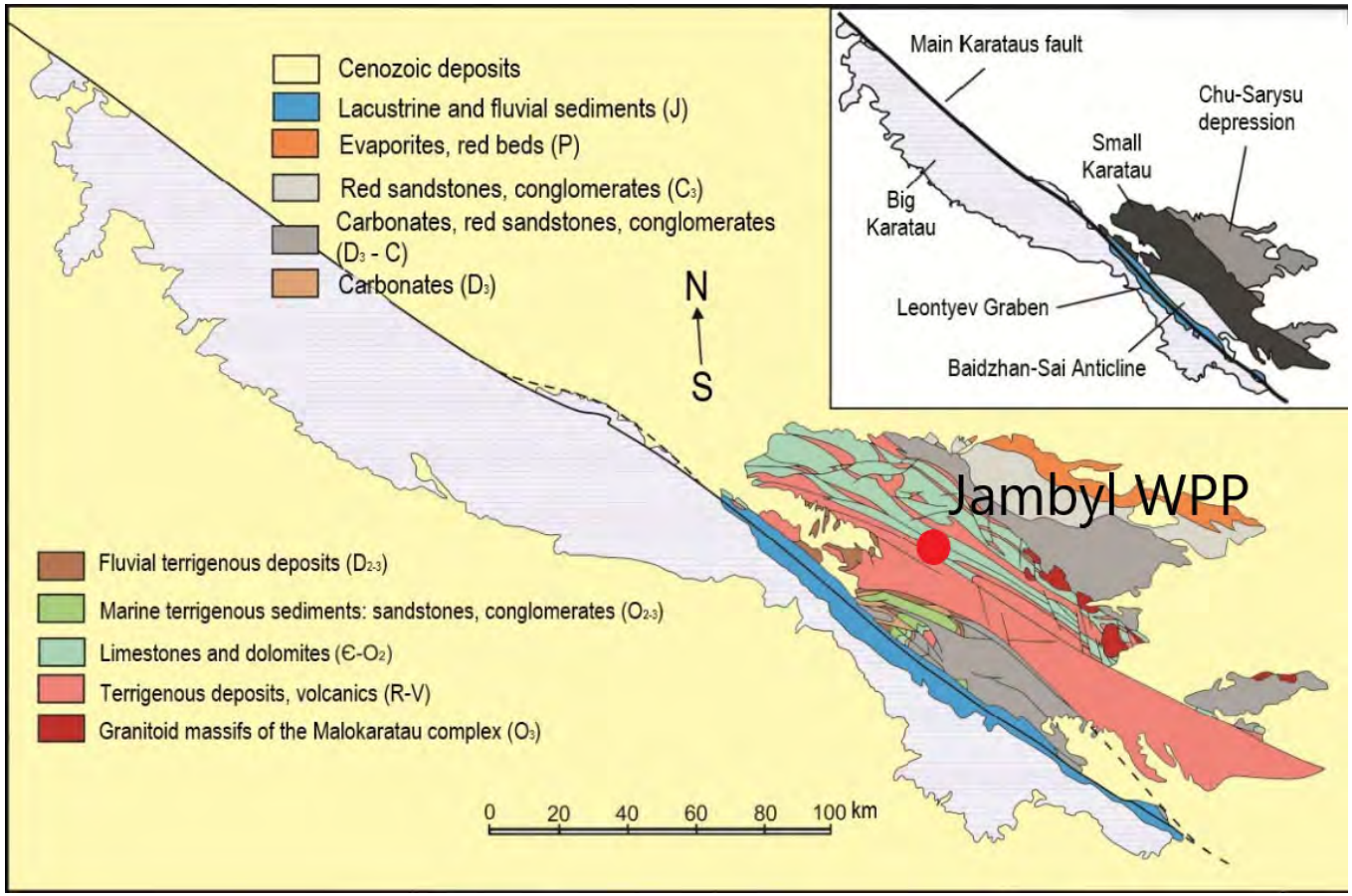
The Jambyl WPP site is situated on an elevated plateau within the Small Karatau mountain range, which is geologically characterized by a complex arrangement of sedimentary formations primarily from the Cambrian to Middle Ordovician periods. These formations include carbonates, shales, and siliceous rocks,

[268] Geotechnical Investigation Report for Zhambyl Wind Power Plant 500MW with 125km of 220kV OHTL (July 2025)

influenced by historical tectonic activities, notably the Main Karatau Fault.

Figure 14-6 shows geological structure of the Small Karatau.

Figure 14-6: Schematic geological map of Small Karatau[269]



[269] https://dspace.spbu.ru/bitstream/11701/11532/1/Rekashova_VKR.pdf

According to borehole data obtained during geotechnical investigations, the geological section beneath the soil-vegetation layer consists of loose, thin Quaternary deposits, including:

- Loams with gravel and rubble inclusions with thickness ranging from 0.1 m to 7.3 m;
- Sandy loams with fine gravel inclusions, thickness ranging from 0.5 m to 5.7 m;
- Sands, both well- and poorly sorted, with or without gravel and rubble inclusions; some layers contain individual pebbles, boulders, and lenses of loam and clay, with thickness ranging from 0.3 m to 9.6 m.
- Coarse-clastic deposits: materials represented by gravelly soils, rubbly soils, gravel-rubble soils, gravel-pebble soils, and boulder soils, usually mixed with loamy, clayey, or sandy matrix, containing fragments of bedrock and isolated boulders. Thickness ranges from 0.2 m to 9.7 m.

The underlying bedrock belongs to the Lower Cambrian and is represented in various locations by:

- Weakly metamorphosed shales, characterized by fissured structures with cracks often filled with clay material, thickness ranging from 2.8 m to 9.8 m.
- Medium-strength conglomerates, thickness from 0.7 m to 7.6 m.
- Weathered argillites of medium strength, thickness from 1.5 m to 9.7 m.
- Quartz-rich sandstones and tuffaceous sandstones, fine- to medium-grained, fissured, thickness from 0.4 m to 5.0 m.
- Fine-grained, quartz-rich, very strong granites, with limited distribution, encountered in borehole No. 85 with a thickness of 7.0 m.
- Interbedded conglomerates and sandstones, thickness 7.5 m.
- Interbedded sandstones and argillites containing gravel lenses, thickness 6.0 m.

15.3.4 Soils

15.3.4.1 Classification and description

One of the most complete, universal, and well-developed soil classifications for the territory of Kazakhstan is the Soviet classification; however, the World Reference Base (WRB) international classification will also be used.

Soil types at the Project site are predominantly mountain soils, including kastanozem, chernozem, chernozem-like, and mountain brown soils[270]. These soils are generally thin, fragile, and susceptible to erosion, especially from wind and water runoff. The humus layer depth varies significantly, typically ranging from 30 to 80 cm, and humus content can be high (up to 12% in certain soil types), enhancing their fertility but simultaneously increasing their vulnerability to erosion if disturbed.

According to the WRB classification, these soils are defined as Kastanozems, Humic Luvisols/Luvic Phaeozems, Umbrisols/Umbric Leptosols respectively.

Figure 14-7 shows the soil map of the Republic of Kazakhstan, and Figure 14-8 to Figure 14-10 show different soil types in the project area.

Anthropogenic activities at the Project site are currently limited with the area mostly used for livestock grazing. Due to its irregular topography the potential for agricultural development is limited. Existing land

[270] Classification and Diagnosis of Soils of the USSR. V.V. Egorov et al. Moscow. 1977.

use, combined with fragile soil conditions, highlights the importance of careful soil management during Project construction to prevent erosion and degradation.

Figure 14-7: Scheme of Kazakhstan's soil zones (Pachikin K. et al, 2013)



Figure 14-8: The presence of kastanozems



Figure 14-9: Mountain brown soil



Figure 14-10: Chernozem-like and/or chernozem soils



The OHTL crosses all of the soil types described above, depending on the alignment within the terrain. However, since the OHTL route also passes through more level areas, Serozems are also widely distributed within the RoW.

Serozems tend to occupy flat semi-desert areas and are mainly found along the portion of the OHTL passing through the Turkestan region. An example of serozems is shown in Figure 14-11.

The soil profile is not differentiated by silica or metal oxides; humus content in the upper horizons ranges between 1.5% and 3%, and the pH is alkaline. Soils also have low cation exchange capacity and carbonate content throughout the profile. The carbon-to-nitrogen ratio (C:N) varies between 6 and 9. In terms of grain-size composition, soils are mostly silty, light- or medium-loams, with rarely heavy loams. These soils support high biological activity.

According to the WRB classification, these soils are defined as Haplic Calcisols or Yermic Calcisols.

Figure 14-11: Example of Serozems



15.3.4.2 Soil quality survey

Soil sampling and testing were carried out within the WPP area and along the OHTL RoW to confirm the findings of the literature review and visual surveys presented in Section 14.3.4.1 above, as well as to assess the potential for historical soil contamination and/or elevated concentrations of specific contaminants due to natural conditions.

The investigations were conducted in autumn 2024 and 2025 and included six sampling locations within the WPP area, four locations in the surrounding area, and four locations along the OHTL RoW (2 along Jambyl and 2 on Kentau OHTL) to provide a general overview of soil quality along the route. The sampling locations are shown in Figure 14-12.

Soil sampling was performed under two analytical programmes: a basic and an extended programme. The extended programme was applied at six locations within and in proximity to the WPP area (S1, S2,S3, S4, S5, S6), and at all four locations along the planned OHTLs. This approach supported the determination of baseline conditions in more remote areas and addressed established expert recommendations. The basic programme included pH and heavy metals, while the extended programme additionally covered benzo(a)pyrene, salinity, petroleum hydrocarbons, soil organic matter, and nitrates, as well as a Kazakhstan-specific parameter - acute toxicity of soil extracts to Daphnia (a crustacean invertebrate), which is highly sensitive to the overall toxicity of soils for aquatic biota. Sampling and laboratory analyses were conducted by ILAC-accredited laboratories.

Within the WPP area, soils in the northern and central parts of the project comply with background conditions typical of mountain soils and with national regulatory standards. However, in areas under agricultural use, pH values were slightly lower than the typically alkaline values characteristic of regional soils, which may be associated with agricultural practices; this is partially supported by elevated nitrate

concentrations compared to natural background levels. Nevertheless, nitrate concentrations are moderate and remain below applicable regulatory thresholds. Similar results were obtained for the sample collected at the planned substation foundation area.

In the southern part of the project, one sample collected near an area of intensive livestock grazing showed the highest nitrate concentration recorded across the project area (while still complying with sanitary standards), as well as a slightly elevated copper concentration. In addition, the soil extract from this sample required dilution to eliminate toxic effects on Daphnia, which may be related to nitrates and other substances introduced into the soil via livestock manure. An additional sample was collected nearby in an area without concentrated livestock presence; at this location, nitrate concentrations were low.

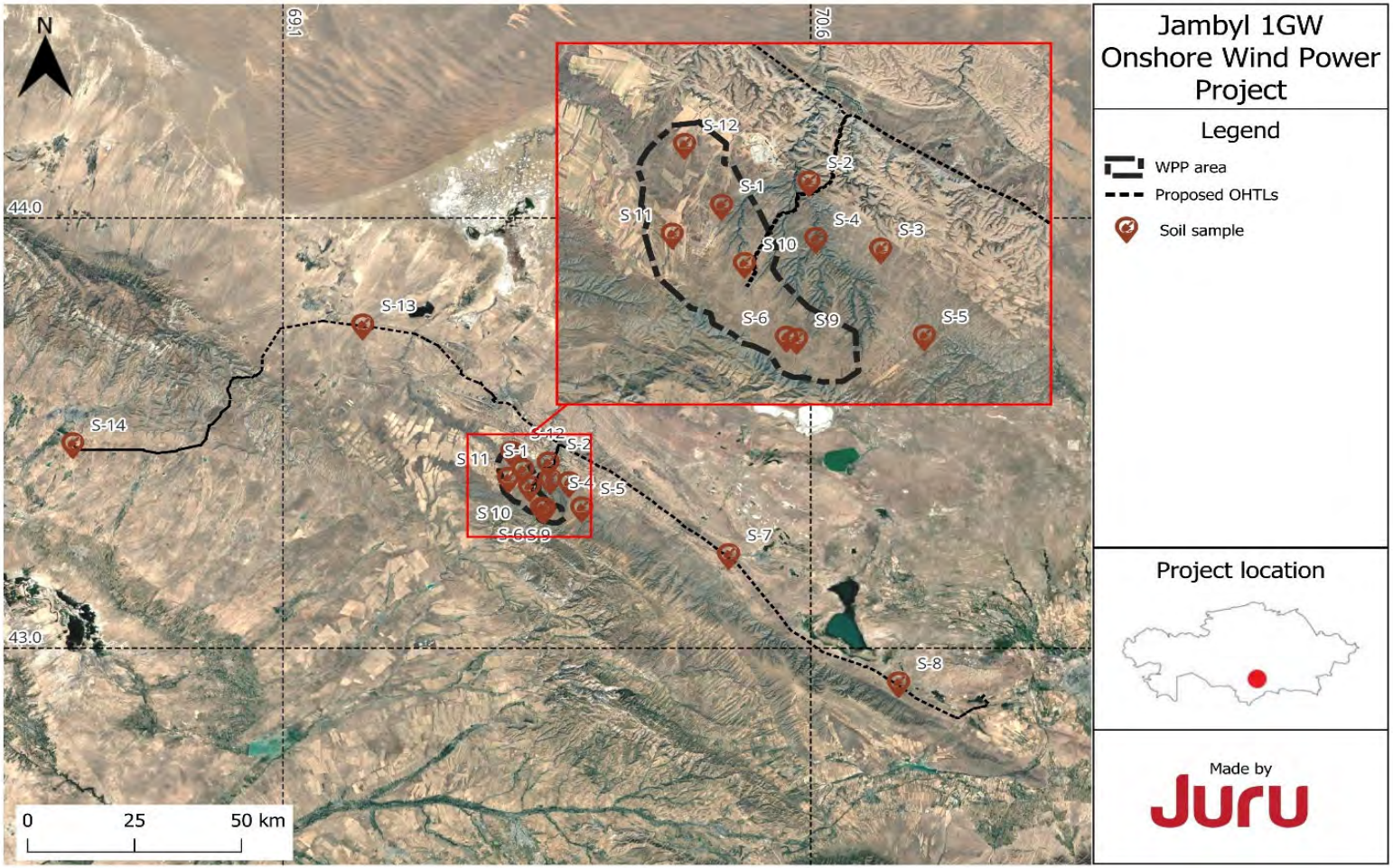
In the flat areas surrounding the project, soil data generally confirmed the patterns observed within the WPP area. Nitrate concentrations tended to be higher near livestock congregation areas, and locally elevated copper concentrations were also identified. One sampling point was located within gullies formed by erosion channels originating within the WPP area, representing an accumulative landscape where substances transported by surface runoff may concentrate. Concentrations of the analysed parameters at this location remained within applicable standards; however, nitrate levels were elevated above natural background values, despite the sandy-loam texture of the soil, indicating potential transport of nitrates from livestock areas via surface water flows.

Soils along the Jambyl OHTL exhibit pronounced alkalinity (pH > 8) compared to soils within the WPP area, which is typical of more arid environments. Nevertheless, these soils show no signs of salinisation or elevated heavy metal concentrations.

Along the Kentau OHTL, soils have pH values closer to neutral (approximately 7.0–7.5) and show slightly elevated concentrations of copper and zinc relative to background levels; however, these exceedances are minor and are considered indicative of natural enrichment related to bedrock geology. One sample collected near the Kentau substation shows elevated salt content, approaching the threshold of moderate salinisation.

The complete soil quality report is presented within ESIA Volume III: Technical appendices.

Figure 14-12: Soil sampling locations



15.3.5 Seismic Conditions and Natural Hazards

The Jambyl region is situated within a seismically active zone. The Detailed Seismic Zoning (DSZ) maps for the Jambyl region (Figure 14-13) show that the Peak Ground Acceleration (PGA)[271] level increases from north to south, towards the highly seismic regions along the southern border of Kazakhstan. At a probability of exceedance of 10% in 50 years, the PGA values range from 0.025 g to 0.468 g. At a probability of 2% in 50 years, the PGA values range from 0.074 g to 0.960 g (Silacheva N. 2023)[272].

Figure 14-13: Preliminary DSZ maps of the Jambyl oblast in PGA for 10% (left) and 2% (right) probability of exceedance in 50 years (Silacheva N. 2023)

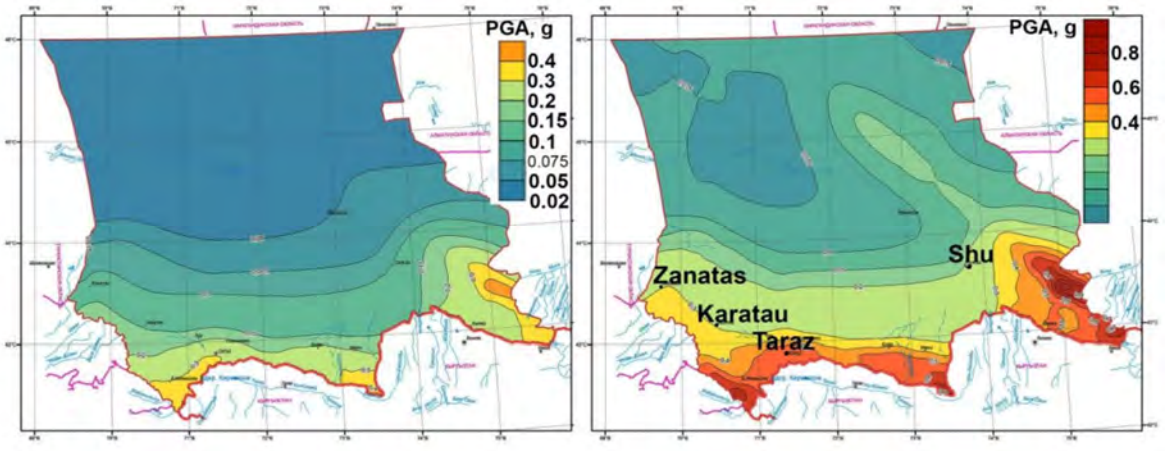


Table 14-4: Nearest settlements of the project area, located in seismic zones, with indication of seismic hazard for them (CR RK 2.03-30-2017) 273.

Settlements	Intensity in points on the MSK-64(K) scale		Peak ground accelerations (in fractions of g) for rocky soils	
	GSZ-2_{475}[274]	GSZ -2_{2475}[275]	GSZ -$1_{475\ (agR}$[276]$_{(475))}$	GSZ-$1_{2475\ (agR\ (2475))}$
Zhanatas	7	7	0,052	0,095
Karatau	7	8	0,11	0,19

[271] PGA (Peak Ground Acceleration) is expressed as a fraction of the acceleration due to gravity *g* (gravitational constant). It characterizes the maximum rate at which the ground accelerates at a specific point during an earthquake

[272] Silacheva, N. (2023). Up-to-date Detailed Seismic Zoning of Regions in Kazakhstan (PGA Case). RT&A, Special Issue No. 5 (75), Volume 18, November 2023, 275.

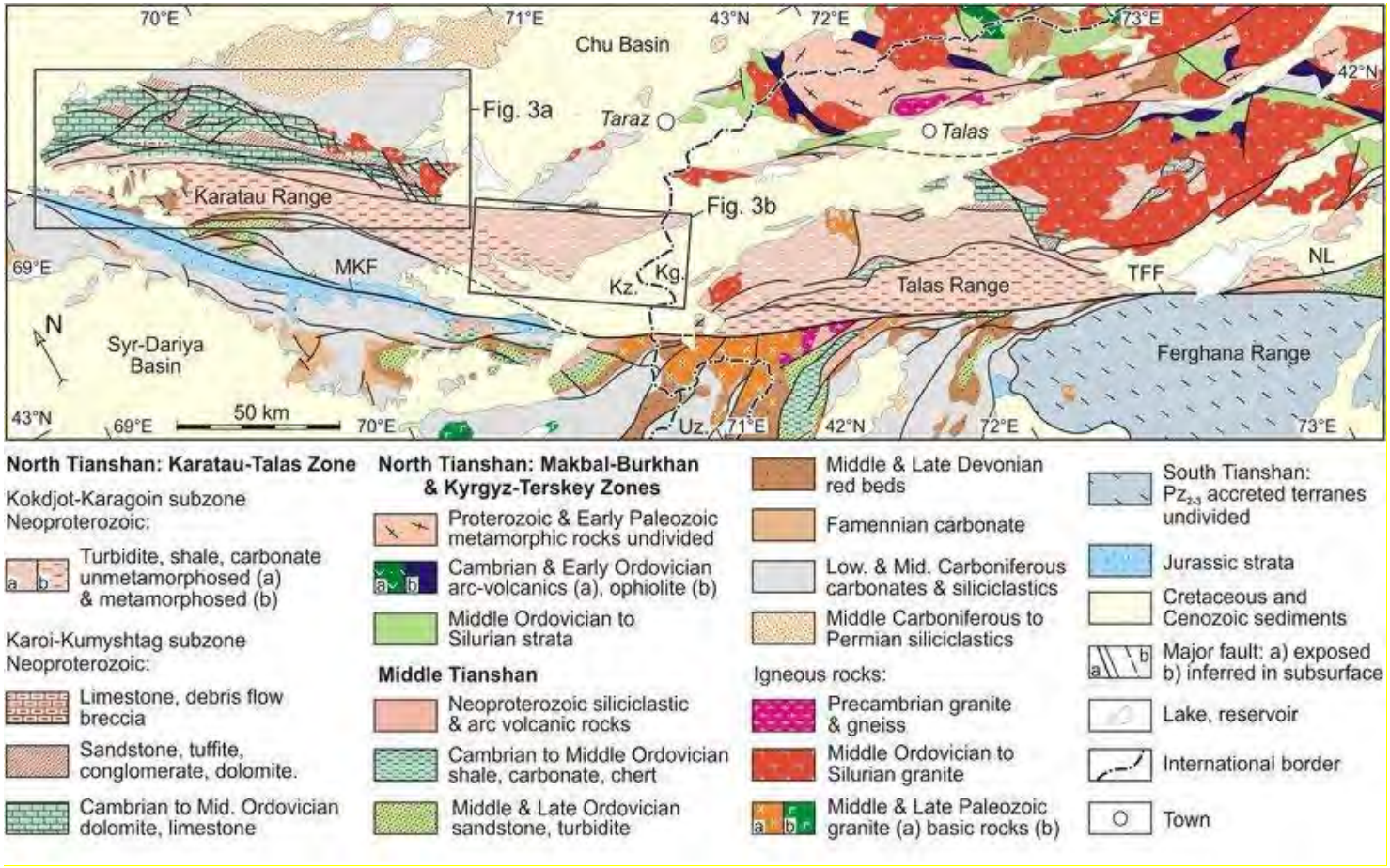
[273] Construction in seismic areas Republic of Kazakhstan. (2017). СП РК 2.03-30-2017; ҚР ҚЖ 2.03-30-2017.

[274] General seismic zoning GSZ -1(475) and GSZ -2(475) - reflect a 10% probability that the seismic intensity values indicated on them may be exceeded within 50 years (the average recurrence period of such seismic shocks is 475 years)

[275] GSZ -1(2475) and GSZ -2(2475)- reflect a 2 % probability that the seismic intensity values indicated on them may be exceeded within 50 years (the average recurrence period of such shocks is 2475 years)

[276] The seismic hazard indicators agR(475) and agR(2475) refer to rocky and rock-like geological formations

Figure 14-14: Geological map of the Karatau-Talas region. (Alexeiev et al) Abbreviations: MKF – Main Karatau Fault, TFF – Talas-Ferghana Fault, NL – Nikolaev Line, Kz. – Kazakhstan, Kr. – Kyrgyzstan, Uz. – Uzbekistan



As part of the geotechnical investigations, site-specific seismic characteristics have been assessed for both the WPP and the OHTL infrastructure. Based on the geotechnical report and in accordance with SP RK 2.03-30-2017, the Project site is located within a seismically hazardous zone, with a seismic intensity of 7 MSK for a 10% probability of exceedance in 50 years (OSZ-2475) and 8 MSK for a 2% probability of exceedance in 50 years (OSZ-22475).

The site is classified as Soil Category IB, and peak ground accelerations for rock soils are 0.11 g and 0.19 g for the respective return periods. Design horizontal and vertical accelerations have been defined within the geotechnical report and will be incorporated into the detailed engineering design of Project infrastructure.

Seismicity is therefore considered a baseline condition relevant to structural and geotechnical design rather than an environmental impact arising from Project activities.

Steeper terrain and erosional features occur locally within the wider WPP area, while the Kentau OHTL includes sections where the route crosses mountainous terrain and erosional gorges. These areas may present a higher susceptibility to localised slope instability and erosion during earthworks and will therefore be considered in the geohazard assessment and design-stage optimisation.

15.3.6 Receptors

For the purposes of the geology and soils assessment, receptors comprise soils, subsoil and geological materials within the Project AoI. This includes soils within the WPP site, OHTL corridors, access roads, construction compounds, material storage areas, and associated transport routes, with particular consideration given to agricultural and grazing soils, erosion-prone areas, and disturbed ground subject to earthworks.

Local land users, including grazers and farmers, are not considered sensitive receptors in the context of the geology and soils assessment; however, they are indirect beneficiaries of soil quality and land productivity. Potential effects on land use and livelihoods are therefore addressed separately within the Socio-economic chapters of the ESIA.

15.4Potential Impacts

15.4.1 Construction Phase

Construction activities associated with the Project have the potential to result in temporary and localised impacts on geology and soils. These impacts are primarily related to ground disturbance arising from site preparation, earthworks, excavation, foundation installation, construction of access roads, installation of OHTL foundations, establishment of temporary construction facilities, and construction traffic movements.

Given the solid nature of soil and geological substrates, potential impacts are generally confined to the immediate vicinity of construction activities and are largely reversible, provided that appropriate management and reinstatement measures are implemented.

The following principal potential construction-phase impacts are described below:

- soil disturbance, compaction and loss of topsoil
- soil erosion and sediment transport
- soil and subsoil contamination
- physical disturbance of geological substrates

- slope stability and landslide hazards
- seismic and geotechnical considerations.

Soil Disturbance, Compaction and Loss of Topsoil

Construction activities will require stripping of topsoil and excavation of subsoil at turbine foundations, crane pads, access roads, OHTL tower locations, substations, and temporary facilities. These activities may result in localised soil disturbance, compaction from heavy machinery, and temporary loss or degradation of the fertile topsoil layer.

Soil compaction may reduce soil structure and permeability, potentially affecting drainage characteristics and vegetation re-establishment following construction. Impacts are expected to be limited to the construction footprint and are not anticipated to extend beyond the defined AoI.

Soil Erosion and Sediment Transport

Earthworks, removal of vegetation cover, and creation of temporary slopes during construction may increase the susceptibility of soils to wind and water erosion, particularly on slopes and in areas intersected by natural drainage features or gullies.

Erosion processes are most likely to occur during periods of intense rainfall or strong winds and may result in localised sediment mobilisation. Given the generally localised nature of construction activities and the limited horizontal extent of soil impacts, erosion-related effects are expected to be spatially confined and temporary.

Soil and Subsoil Contamination

There is a potential risk of localised soil and subsoil contamination associated with accidental spills or leaks of fuels, lubricants, hydraulic fluids, concrete washout, or other hazardous substances during construction. Such events could result in contamination of surface soils and vertical migration into underlying subsoil at the point of release.

The likelihood of widespread contamination is low, as potential releases would be localised and associated with specific construction activities or equipment. No legacy contamination has been identified within the Project area that would pose a constraint to construction.

Physical Disturbance of Geological Substrates

Excavation for foundations, particularly for wind turbines and OHTL structures, will result in the removal and disturbance of shallow geological materials. In areas where bedrock is encountered at shallow depth, blasting or mechanical breaking may be required, leading to localised alteration of geological substrates.

These impacts are inherent to construction and are limited to discrete locations. No regionally significant geological features or geohazards have been identified within the Project AoI that would be adversely affected by the proposed works.

Slope Stability and Landslide Hazards

Parts of the wider WPP area include localised steep terrain, erosional slopes, and gullies, while sections of the Kentau OHTL traverse mountainous terrain where access roads, tower foundations, and temporary works may interact with steeper slopes. Although turbine locations will be micro-sited to avoid steep and unstable ground, construction activities associated with access routes, crane pads, and OHTL structures may locally increase the risk of slope instability if not appropriately managed.

Construction activities such as cut-and-fill earthworks, excavation on slopes, removal of vegetation cover, and modification of natural drainage pathways may increase susceptibility to localised slope failure, shallow landslides, or erosion, particularly during periods of intense rainfall, rapid snowmelt, or freeze–thaw cycles. These risks are most relevant at discrete locations where construction interfaces with sloping terrain, including the Kentau OHTL mountain crossing.

The potential for slope instability and mass movement during construction is considered a geotechnical hazard rather than a widespread environmental impact and is expected to be highly localised and temporary. With appropriate geohazard screening, detailed geotechnical assessment at sensitive locations, and implementation of engineering and construction controls, the likelihood of significant slope instability or landslide events is expected to be low.

Seismic and Geotechnical Considerations

The Project area is located within a seismically active region; however, construction activities are not expected to induce seismic events or alter regional seismic conditions. Seismicity is considered a baseline condition relevant to engineering design rather than a construction-phase environmental impact and does not represent a Project-induced hazard.

Geotechnical conditions identified through site investigations will inform foundation design to ensure structural stability and minimise risks associated with ground conditions during construction.

Activity/Impact/Aspect					
Site preparation, earthworks, excavation and foundation construction resulting in soil disturbance, compaction, erosion and potential localised contamination					
Type	**Duration**	**Extent**	**Scale of Impact**	**Frequency**	**Likelihood (unplanned events)**
Direct	Short-term	Local	Distinguishable	Intermittent	Low

Receptor	**Sensitivity**	**Magnitude**	**Significance of Impact**
Soils and subsoil within the Project footprint and AoI	Medium	Small	Minor

Overall, construction-phase impacts on geology and soils are expected to be localised, temporary, and largely reversible, with effects confined to the Project footprint and immediate surroundings. With the implementation of standard good construction practice and soil management measures, construction-related impacts are anticipated to be of low to moderate significance, with no long-term adverse effects on regional geological or soil resources.

15.4.2 Operation Phase

During the operational phase, the Project is not expected to give rise to significant impacts on geology and soils. Operational activities are limited in scale and frequency and are largely confined to the permanent footprint of infrastructure established during construction.

Potential impacts during operation are therefore expected to be minimal, highly localised, and stable over the long term. The following principal potential operation-phase impacts are described below:

- permanent land take and soil sealing
- localised soil disturbance from maintenance activities
- risk of soil contamination

- geological stability.

Permanent Land Take and Soil Sealing

Operation of the Project will involve the long-term presence of wind turbines, OHTL structures, substations, access roads, and ancillary infrastructure. These elements result in permanent land take and localised soil sealing at foundation footprints and along retained access roads.

While these changes represent a permanent alteration of soil conditions at specific locations, the overall footprint is small relative to the Project area and does not materially affect regional soil resources or land productivity.

Localised Soil Disturbance from Maintenance Activities

Routine operation and maintenance activities, including periodic inspection of turbines, substations, and OHTL structures, will involve limited vehicle movements along existing access routes. Minor localised soil disturbance may occur, particularly during adverse weather conditions.

Such effects are expected to be short-term and confined to previously disturbed areas, with no requirement for additional earthworks or soil stripping during normal operation.

Risk of Soil Contamination

There is a low risk of soil contamination during operation, primarily associated with the handling of oils, lubricants, and other maintenance-related materials at turbine nacelles or operational facilities. Any accidental releases would be localised and limited in volume.

Operational controls and maintenance procedures are expected to minimise the likelihood and consequences of such events, and no widespread or long-term contamination of soils or subsoil is anticipated.

Geological Stability

The operational phase does not involve activities that would alter geological structures, increase erosion processes, or affect regional geotechnical stability. The Project infrastructure will be designed in accordance with applicable geotechnical and seismic requirements, ensuring long-term structural integrity under prevailing ground and seismic conditions.

Localised geotechnical considerations during operation relate primarily to the long-term stability of cut slopes, drainage features, and foundation platforms constructed during the construction phase, particularly in areas of steeper terrain and along sections of the Kentau OHTL that traverse mountainous terrain. With appropriate design, drainage control, and routine inspection and maintenance, the risk of slope instability or progressive erosion during operation is expected to be low.

Activity/Impact/Aspect					
Operation and maintenance of WPP and OHTL infrastructure resulting in permanent land take, soil sealing, minor localised disturbance from maintenance activities, and a low risk of localised contamination.					
Type	**Duration**	**Extent**	**Scale of Impact**	**Frequency**	**Likelihood (unplanned events)**
Direct	Long-term	Local	Barely distinguishable	Infrequent	Very Low
Receptor		**Sensitivity**	**Magnitude**	**Significance of Impact**	

Soils and subsoil within the Project footprint and AoI	Medium	Negligible	Insignificant

Overall, operational-phase impacts on geology and soils are expected to be negligible to minor in magnitude, highly localised, and limited to the permanent footprint of Project infrastructure. With appropriate operational controls and maintenance practices in place, no significant adverse impacts on soil quality, geological stability, or land productivity are anticipated during the operational life of the Project.

15.5Mitigation, Management & Residual Impacts

This section summarises the mitigation and management measures proposed to address potential impacts on geology and soils during construction and operation of the Project. Measures have been identified in line with the mitigation hierarchy and GIIP. Given that the majority of potential impacts to geology and soils arise during construction, mitigation measures are presented within a single consolidated table, with operation-phase measures included where relevant. Where relevant, mitigation relating to hazardous materials handling and storage, and the prevention of soil contamination, is addressed through the Project's Hazardous Materials and Waste Management Plan (HMWMP) as described in Section 16 (Waste and Wastewater). The residual significance of impacts following implementation of these measures is also presented.

Activity/Aspect	Pre- mitigation	Mitigation and Management Measures	Residual Significance
Site preparation, earthworks and excavation (soil disturbance, compaction and loss of topsoil)	Minor–Moderate	• Limit disturbance to defined construction footprints and access routes. • Strip, store and reinstate topsoil separately from subsoil where practicable. • Avoid unnecessary trafficking of heavy machinery on exposed soils. • Reinstate disturbed areas progressively following completion of works.	Minor
Earthworks on slopes and in erosional areas (slope stability and mass movement risk)	Minor–Moderate	• Avoidance of steep or unstable terrain through micro-siting and route refinement where practicable. • Undertake geohazard screening and site-specific geotechnical assessment for works in sloping terrain, including the Kentau OHTL mountain crossing. • Design and implement appropriate cut-and-fill geometry, benching, drainage controls, and foundation solutions where works on slopes are unavoidable. • Inspect slopes and earthworks following heavy rainfall or rapid snowmelt events.	Minor
Construction activities on erosion-prone soils (erosion and sediment mobilisation)	Minor–Moderate	• Implement erosion and sediment control measures appropriate to site conditions (e.g. drainage management, slope protection, controlled discharge points). • Sequence works to minimise exposure of bare soils. • Stabilise disturbed surfaces as soon as practicable following earthworks.	Minor
Storage and handling of fuels, oils, chemicals and concrete (soil and subsoil contamination)	Minor–Moderate	• Store hazardous materials in designated, bunded areas away from drainage pathways. • Implement spill prevention and response procedures. • Manage hazardous materials, waste and wastewater in accordance with the Project's Hazardous Materials and Waste Management Plan (HMWMP) under the c HSSE MS, as described in Section 16 (Waste and Wastewater).	Minor
Operation and maintenance activities (permanent land take,	Insignificant	• Confine operational traffic to existing access roads and hardstands. • Maintain drainage and erosion control features to ensure long-term stability of slopes and foundations.	Insignificant

Activity/Aspect	Pre- mitigation	Mitigation and Management Measures	Residual Significance
soil sealing and minor localised disturbance)		• Manage oils, lubricants and wastes in accordance with the operational HMWMP and relevant management plans. • Undertake routine inspections of foundations, slopes and drainage features, particularly in areas of steeper terrain.	

Following implementation of the mitigation and management measures outlined above, potential impacts on geology and soils during construction are expected to be reduced to Minor significance, while operational-phase impacts are assessed as Insignificant. Impacts are anticipated to remain localised and largely reversible, with no long-term adverse effects on soil resources, geological stability, or land productivity.

16 Waste and Wastewater

16.1 Introduction and Overview of Assessment Methodology

This section assesses the potential environmental effects associated with the generation, handling, treatment, and disposal of solid and liquid waste arising from the construction and operation of the Project. The assessment encompasses all main Project components, including the WPP, BESS, the two OHTLs, and associated access roads, as well as construction of related facilities and activities, including temporary construction camps, and laydown areas.

The purpose of the assessment is to:

- identify the types waste streams and wastewater expected to be produced throughout the Project lifecycle,
- evaluate potential environmental and health risks associated with their mismanagement; and
- define mitigation and management measures consistent with national requirements and GIIP.

The assessment has been undertaken in line with relevant Lender standards, including IFC Performance Standard 3 (Resource Efficiency and Pollution Prevention) and the WBG EHS Guidelines for Wind Energy, Electric Power Transmission and Distribution, and General EHS Guidelines.

The methodology follows the general ESIA impact assessment process as described in Section 4, and includes:

- Baseline Review – identification of the Project rea of Influence (AoI) and sensitive receptors, compilation of available data on existing waste-handling practices and disposal routes and infrastructure in the Project AoI.
- Identification of Waste and Effluent Sources – Characterisation of waste streams likely to arise during each phase of the Project (e.g., construction debris, packaging, domestic refuse, used oils, hazardous materials, and sewage).
- Assessment of Potential Impacts – Evaluation of risks of soil, surface- and groundwater contamination, nuisance, and health impacts due to improper waste storage, handling, or discharge.
- Determination of Impact Significance – Application of the standard significance evaluation combining magnitude of effect and receptor sensitivity.
- Mitigation and Management Measures – identification of measures based on the waste-management hierarchy of avoidance, minimisation, reuse/recycling, recovery, and disposal, and determination of residual impacts.

Construction-phase waste management represents the most significant aspect of this assessment, as the majority of waste will be generated during site preparation, civil works, and installation activities. This will include inert construction debris, packaging, scrap metal, and domestic waste from the workforce. In contrast, the operation phase of a wind farm produces only limited quantities of waste and wastewater, primarily domestic refuse and small volumes of maintenance-related materials, which can be readily managed through standard procedures and licensed local disposal facilities.

Given the temporary nature of construction activities and the small operational workforce, significant impacts associated with waste and wastewater management are not anticipated provided that standard

GIIP waste management measures are implemented.

16.2Applicable Requirements & Standards

16.2.1 National Regulations

Basic requirements of waste management in Kazakhstan are set out in the Environmental Code of the Republic of Kazakhstan (EC RK). The Code establishes concepts of various types of waste management related activities, such as collection, disposal, treatment, as well as delineating responsibility for waste management.

The EC RK defines the necessity of categorizing any economic activity (referred to as "enterprise" in the law) according to levels of impact on the environment. Enterprises of Category 1 are considered the most hazardous to the environment, with their impact classified as significant. For enterprises of Categories 2 and 3, the impact is categorized as moderate and insignificant, respectively, while Category 4 enterprises are deemed to have no impact on the environment. The categorization is determined according to the Annex to the Environmental Code, which lists over a hundred types of economic activities. Wind farms are not mentioned in the Annex and therefore do not automatically fall into Categories 1-3. However, the project category will be clarified during the Environmental Impact Assessment (EIA) procedure.

Category I and II projects (as defined under the EIA process) that generate waste are required to obtain a Waste Management Plan and gain approval form CERC under the Environmental Code, and to maintain compliance with permit conditions on waste generation, storage, transfer, and disposal. For Category III projects, they are required to include their calculated volumes and waste management in the relevant declaration and coordinate it with the Natural Resources Department of the regional Akimat.

Enterprises (Projects) of 1st and 2nd categories are required to develop limits for waste generation and disposal (Waste Management Plan), while there are no such obligations for enterprises of 3rd and 4th categories. The responsibility for developing this documentation falls on the project operator during the operational phase. Generation and disposal limits for waste are determined for each enterprise; requirements for limits are defined by separate subordinate acts:

- Order of the acting Minister of Ecology, Geology and Natural Resources of the Republic of Kazakhstan dated July 19, 2021 No. 261 On approval of the Rules for the development and approval of waste accumulation limits and waste disposal limits, submission and control of reporting on waste management;
- Order of the Minister of Ecology, Geology and Natural Resources of the Republic of Kazakhstan dated June 22, 2021 No. 206 On approval of the methodology for calculating waste accumulation limits and waste disposal limits.

Orders establish the requirement for the development of a waste management program by enterprises of categories 1 and 2, which includes determining limits for waste generation and accumulation. The established limits must provide scientific and technical justification for preventing environmental harm caused by the waste generated and include a list of waste management activities. Additionally, in accordance with legislative acts, the waste generator is obligated to report the implementation of the program to the Ministry of Ecology.

The EC RK outlines several pathways for waste management:

- Accumulation: Temporary storage of waste in designated areas for no more than six months before being transported to a facility for further waste management or on-site management procedures;
- Collection: Organized receipt of waste from individuals and legal entities by specialized organizations for subsequent recovery or disposal. Entities engaged in waste collection must ensure separate collection of waste. Separate collection is carried out for the following fractions: "dry" (paper, cardboard, metal, plastic, and glass); "wet" (food waste, organic matter, etc.);
- Transportation: The activity of moving waste using specialized transport vehicles between places of waste generation, accumulation, collection, sorting, processing, recovery, or disposal;
- Recovery: Operations aimed at reducing waste volumes, primarily using waste to perform a useful function, thereby replacing other materials that would otherwise have been used for that function;
- Disposal: Any operation that is not recovery, involving the burial or destruction of waste, including preparatory operations for waste burial or destruction.

Recovery operations include several permissible activities:

- Preparation for Reuse: Checking, cleaning, and/or repairing products or components that have become waste, preparing them for reuse without further processing;
- Recycling: Mechanical, physical, chemical, and/or biological processes aimed at extracting useful components, raw materials, and/or other materials from waste for further use;
- Utilization: Using waste for purposes other than recycling, including as a secondary energy resource for generating heat or electricity, producing various types of fuel, or as a secondary material resource for construction, filling voids (backfilling, infill), or engineering purposes in creating or altering landscapes.

Disposal operations also include several possible activities:

- Waste Burial: Storing waste in designated areas for safe, indefinite storage without the intention of retrieval;
- Waste Destruction: Removing waste through thermal, chemical, or biological processes that significantly reduce the volume and/or mass and change the physical state and chemical composition of the waste, but without the primary goal of producing goods or extracting energy.

Waste generators and owners must follow a hierarchy of measures for waste prevention and management, listed in order of decreasing preference for environmental protection and sustainable development of the Republic of Kazakhstan:

- Prevention of waste generation;
- Preparation for reuse;
- Recycling;
- Utilization;
- Disposal.

Waste is the property of the legal entity responsible for its management according to the available options, following the "polluter pays" principle.

Entrepreneurial activities related to the collection, sorting, and/or transportation of non-hazardous waste, recovery, and/or destruction of non-hazardous waste are conducted in a notification manner.

The initiator must notify the Ministry of Ecology of the start and end of such activities.

Waste disposal sites have three categories - hazardous, non-hazardous, and solid household - 1st, 2nd, and 3rd class respectively.

Waste is categorized based on the waste classifier approved by the Ministry of Ecology (Order of the Minister of Ecology, Geology and Natural Resources of the Republic of Kazakhstan (dated August 6, 2021) No. 314), which currently includes several hundred names. Each type of waste is identified by assigning a six-digit code. Waste classification and determination of whether waste is hazardous or non-hazardous, as well as assigning the appropriate code from the waste classifier, is done by the waste owner independently.

Hazardous waste includes waste with the following properties:

- HP1 Explosiveness;
- HP2 Oxidizing properties;
- HP3 Flammability;
- HP4 Irritating effect;
- HP5 Specific systemic toxicity (aspiration toxicity on target organs);
- HP6 Acute toxicity;
- HP7 Carcinogenicity;
- HP8 Corrosiveness;
- HP9 Infectious properties;
- HP10 Toxicity for reproduction;
- HP11 Mutagenicity;
- HP12 Formation of toxic gases on contact with water, air, or acid;
- HP13 Sensitization;
- HP14 Ecotoxicity;
- HP15 Ability to exhibit hazardous properties listed above, which are released from initial waste indirectly;
- C16 Persistent Organic Pollutants (POPs). Other waste is considered non-hazardous; however, hazardous waste requires the development of the corresponding passport. Transportation of hazardous waste should be minimized.

Wastes buried at the landfill must be stable, and the landfill must prevent potential impacts on the environment. Waste disposal is prohibited in settlement, recreational, and other socially significant areas, in groundwater recharge zones, and in the areas of mineral deposits.

In relation to wastewater, the Water Code of the Republic of Kazakhstan (2003, as amended 2025) and the Environmental Code regulate the discharge of wastewater into surface and groundwater bodies. Discharge is only permitted under an environmental permit establishing discharge limits. Industrial wastewater discharged to municipal sewer systems is regulated by the Rules for the Acceptance of Wastewater into Municipal Sewerage Systems (Order No. 546 of the Minister of National Economy, 20 July 2015), which set requirements on temperature (≤ 40°C), pH (6.5–9.0), maximum concentrations of pollutants, and prohibit flammable, toxic, clogging or odorous substances that could disrupt treatment processes.

16.2.2 Lender Requirements

IFC Performance Standard 3 – Resource Efficiency and Pollution Prevention:

Requires projects to apply pollution prevention principles, including waste minimisation, reuse, and recycling, and to develop waste management plans consistent with the following waste management hierarchy:

- **Avoidance** – Prevent waste generation at the source wherever possible.
- **Reduction** – Minimise the quantity and toxicity of waste produced through efficient design, materials selection, and process control.
- **Reuse** – Reuse materials and products in their original form where feasible.
- **Recycling/Recovery** – Recycle or recover useful resources or energy from waste streams.
- **Treatment and Disposal** – Treat residual waste and dispose of it in an environmentally sound and safe manner, using licensed facilities that prevent contamination of soil, surface water, or groundwater.

Hazardous waste must be handled by trained personnel, with proper storage, labelling, and chain-of-custody documentation for offsite transfer.

Projects must avoid or minimize water pollution by implementing wastewater management measures, including collection, treatment, and discharge in compliance with national regulations or internationally accepted standards. Wastewater treatment systems should be designed to prevent contamination of surface water and groundwater, and effluent quality must be monitored regularly.

IFC/WBG General Environmental, Health and Safety (EHS) Guidelines (2007):

Sections 1.5 and 1.6 provide guidance on hazardous materials management and waste management, respectively, including the need to:

- Establish waste management priorities at the outset of project activities;
- Avoid or minimise waste generation;
- Ensure waste that cannot be reused or recycled is treated and disposed of in an environmentally sound manner; and

Maintaining documentation for waste transfer and treatment.

Sections 1.3 and 1.4 address water conservation and wastewater management, requiring projects to reduce water consumption and wastewater generation, ensure wastewater is collected, treated, and discharged in compliance with applicable standards, and monitor effluent quality to prevent contamination of soil, surface water, or groundwater.

AIIB Environmental and Social Framework

Projects are required to apply resource efficiency and pollution prevention principles to minimize waste and manage wastewater. Key elements include:

- **Hierarchical Waste Management**: Projects must develop and implement Waste Management Plans consistent with the following hierarchy:
    - **Avoidance** – Prevent waste generation at the source through design and planning.
    - **Reduction** – Minimize the quantity and toxicity of waste through efficient material selection and process control.
    - **Reuse** – Reuse materials and products in their original form where feasible.

- **Recycling/Recovery** – Recover useful resources or energy from waste streams.
- **Treatment and Disposal** – Treat residual waste and dispose of it in an environmentally sound manner using licensed facilities that prevent soil and water contamination.

- **Hazardous Waste Handling**: Hazardous waste must be segregated, securely stored, clearly labelled, and transferred off-site with proper documentation, managed by trained personnel.
- **Wastewater Management**: Projects must establish wastewater management systems covering domestic, industrial, and stormwater streams. These systems should ensure collection, treatment, and discharge in compliance with national regulations or, where these are insufficient, internationally recognized standards. Regular monitoring and reporting are required to demonstrate compliance.
- **Documentation and Oversight**: Projects must maintain comprehensive records of waste and wastewater management, including permits, treatment logs, and monitoring data.

16.3Baseline Conditions and Receptors

16.3.1 Area of Influence (AoI)

The Area of Influence (AoI) for waste and wastewater management covers all areas where Project-related activities could directly or indirectly generate, store, transport, treat, or dispose of waste or wastewater, and where associated environmental or social impacts could occur.

During the construction phase, the AoI includes:

- WPP site and its associated infrastructure, including turbine foundations, internal access roads, laydown areas, and temporary waste storage and/or segregation locations;
- OHTLs and their right-of-way (RoW), including tower foundation sites, construction corridors, temporary access routes, and any associated laydown or storage areas where waste (e.g. packaging, conductor offcuts, insulator debris) may be generated or temporarily stored;
- Construction camps and worker accommodation areas, including kitchens, sanitary blocks, and greywater systems;
- Ancillary facilities such as maintenance yards, fuel and lubricant storage areas, and vehicle wash-down or servicing zones;
- Access roads and transport corridors used for the movement of construction materials; and
- Off-site waste and wastewater management facilities, including licensed municipal landfills, recycling plants, or treatment plants that will receive, process, or dispose of Project-generated waste and effluent.

For the operation phase, the AoI is narrower and primarily limited to:

- The O&M compound, including offices, workshops, and small sanitary facilities for the operational workforce;
- Designated collection and disposal routes for domestic and maintenance-related waste; and
- The receiving waste management and treatment facilities that will handle waste transported from the Project during operation.

Accordingly, the AoI for waste and wastewater management reflects both the physical footprint of on-site activities and the extended influence arising from waste transfer, treatment, and disposal processes beyond the Project boundary.

16.3.2 Sensitive Receptors

Waste and wastewater generated during construction and operation may interact with a range of human, environmental, and cultural heritage receptors. These receptors differ in their proximity to Project activities, their likelihood of exposure, and their inherent sensitivity to waste-related impacts.

16.3.2.1 Human Receptors

Human receptors include the construction workforce, nearby communities, and herders and farmers who use the WPP area and the OHTL Right-of-Way (RoW). These receptors may be affected by inadequatewaste handling, accidental spills, wastewater leakages, hazardous materials storage, or poor site housekeeping activities. Potential impacts include nuisance effects such as odour, wind-blown litter, and the attraction of vermin, as well as reduced amenity and accidental exposure to contaminated soil or water from mismanaged waste or wastewater releases. For herders and farmers, additional risks include livestock exposure to improperly managed waste and litter, which may pose health or safety risks to animals and, indirectly, to land users who depend on them.

Construction workers experience the most direct and frequent exposure pathways, including handling hazardous materials, proximity to domestic waste, potential contact with contaminated surfaces or soil, and reliance on temporary sanitation systems. This results in a higher sensitivity classification. In contrast, nearby communities, herders, and other land users are generally located outside active work areas, meaning their exposure pathways are less direct and occur with lower frequency. As such, their overall sensitivity to waste- and wastewater-related impacts is assessed as low. Accordingly, construction workers are assessed as medium sensitivity, while nearby communities, herders, farmers, and cultural heritage sites are assessed as low to medium sensitivity depending on proximity and exposure pathways.

16.3.2.2 Environmental Receptors

Environmental receptors comprise soils, surface watercourses, and shallow groundwater resources within or adjacent to the WPP footprint and along OHTL corridors. These receptors may be affected by contaminated run-off, spills or leaks from waste storage areas, and improper wastewater management.

Surface water receptors relevant to the Project include the following rivers and tributaries:

- WPP Area: Rivers Shabakty, Ushbas, Berkutti, Shayan, and associated smaller tributaries and springs.
- Jambyl OHTL Corridor: Rivers Kyrshabakty, Shabakty, Tamdy, Koktal, and associated minor watercourses.
- Kentau OHTL Corridor: Rivers Shabakty, Ushbas, Berkutti, Baba-Ata, Kokkia, Ibata, Kurusai, and smaller tributaries.

Soils and groundwater beneath the WPP area and OHTL RoW are also considered sensitive due to potential exposure to leaks, infiltration, or contaminated run-off.

Soils, surface water and groundwater are assessed as low-medium sensitivity due to their vulnerability to spills and contaminated run-off.

16.3.2.3 Cultural Heritage Receptors

Cultural heritage receptors such as the Ushbas cemetery, Kamar-Aulie, and nearby burial mounds could experience visual degradation or reduced amenity if litter or poor housekeeping occurs. As no waste storage or handling will take place close to these sites, their exposure pathways are limited and they are

considered to have low sensitivity.

Given these differing exposure pathways and degrees of proximity, receptors located outside the WPP area or away from OHTL construction activities have limited potential for interaction with waste and wastewater. This reduced exposure is reflected in their lower sensitivity classifications in the impact assessment. The relevant receptors and their assigned sensitivities are summarised in the table below.

Table 15-1: Summary of Identified Sensitive Receptors Relevant to Waste & Wastewater

Receptor Category	Receptor Name/Group	Sensitivity
Human Receptors	Construction Workforce	Medium
	Ushbas Community	Low
	KazPhosphate Summer Camp	Low
	Herders and farmers using WPP area and OHTL RoW	Medium
	Local communities along Jambyl OHTL (Auliekol, Aktogay)	Low - Medium
	Local communities along Kentau OHTL (Zhanaaryk, Oyik)	Low - Medium
Environmental Receptors (within WPP area and OHTL corridor)	Soils	Medium
	Surface Water Bodies	Low–Medium
	Groundwater Lenses	Low–Medium
Cultural Heritage Receptors	Cemetery near Ushbas; Kamar-Aulie; burial mounds (kurgans)	Low

16.3.3 Waste and Wastewater Management Facilities

In Kazakhstan, there are two types of state waste management licences:

- **Non-hazardous waste** collection, transportation, and storage - the operator is required to submit a notification of activities to the Ministry of Ecology, following approval of a national EIA and associated emission and wastewater discharge calculations for the facility.
- **Hazardous waste** processing, utilisation, neutralisation, and destruction – which requires a formal licence issued by the Environmental Regulation Committee (the same authority that reviews EIAs).

At present, there is no unified registry in Kazakhstan that identifies all waste management enterprises

in the country. The most widespread facilities are municipal solid waste disposal landfills for non-hazardous waste, with several such facilities in each region; while landfills for industrial and hazardous waste tend to be located near major industrial centres where demand is highest.

Alongside the conventional state licensing system, Kazakhstan also has Self-Regulatory Organisations (SROs) in various sectors. These are voluntary associations of legal entities whose members commit to standards that may exceed minimum legal requirements. SROs are authorised to conduct internal reviews to verify that their members continue to meet required standards. SRO membership is not mandatory for waste-management operators and does not replace state licensing. SRO membership may provide an indication of higher-quality operations but is not a requirement for landfill or hazardous-waste facility operation.

A state-owned company, JSC "Zhasyl Damu," operates in Kazakhstan for the management of recyclable waste and manages the EcoQolday registry. The registry allows legal entities to declare the availability of recyclable materials, determine corresponding prices, and connect with waste management companies.

Through communication with the akimats the location of the nearest waste management facility was identified as the solid waste landfill disposal site located in the Talas District, 2.3 km north of the city of Karatau (approximately 44 km from the proposed WPP area) – 'Karatau landfill'. The Karatau landfill is a municipal (non-hazardous) waste disposal facility and was established in 1963. Based on the conclusion of the state environmental review KZ42VCY00234359 dated March 29, 2019, the landfill's operational period extends until 2030. The area of the landfill, according to the act of permanent land use rights, is 10 hectares. The landfill has a capacity of 197,300 tons, with 1 hectare allocated for construction waste. According to the Talas District waste management plan, between 800 and 1,500 tons of waste have been buried annually over the past three years at the Karatau landfill. Since July 2022, the landfill has been under the trust management of LLP "Taza Qala-Qaratau". There is no indication that the operator is part of an SRO, nor is SRO membership required for landfill operation.

During the consultations with the akimat of Sarysu, it was also identified that another landfill is under development, in Sarysu district approximately 12 km northeast of the city of Zhanatas (26 km from the WPP area); however, detailed information about this landfill is currently unavailable and as this facility is not yet operational it has not been considered for Project waste disposal.

The location of the Karatau and proposed Zhanatas landfills are shown in Figure 15-1 below.

During consultations with residents and administrations of local communities close to the project area, it was identified that most of them have disposal sites nearby to their communities, with an area ranging from one to several hectares. Local residents use these sites for disposing of their municipal waste. However, the legal status of such facilities is currently unknown and therefore not considered for the Project.

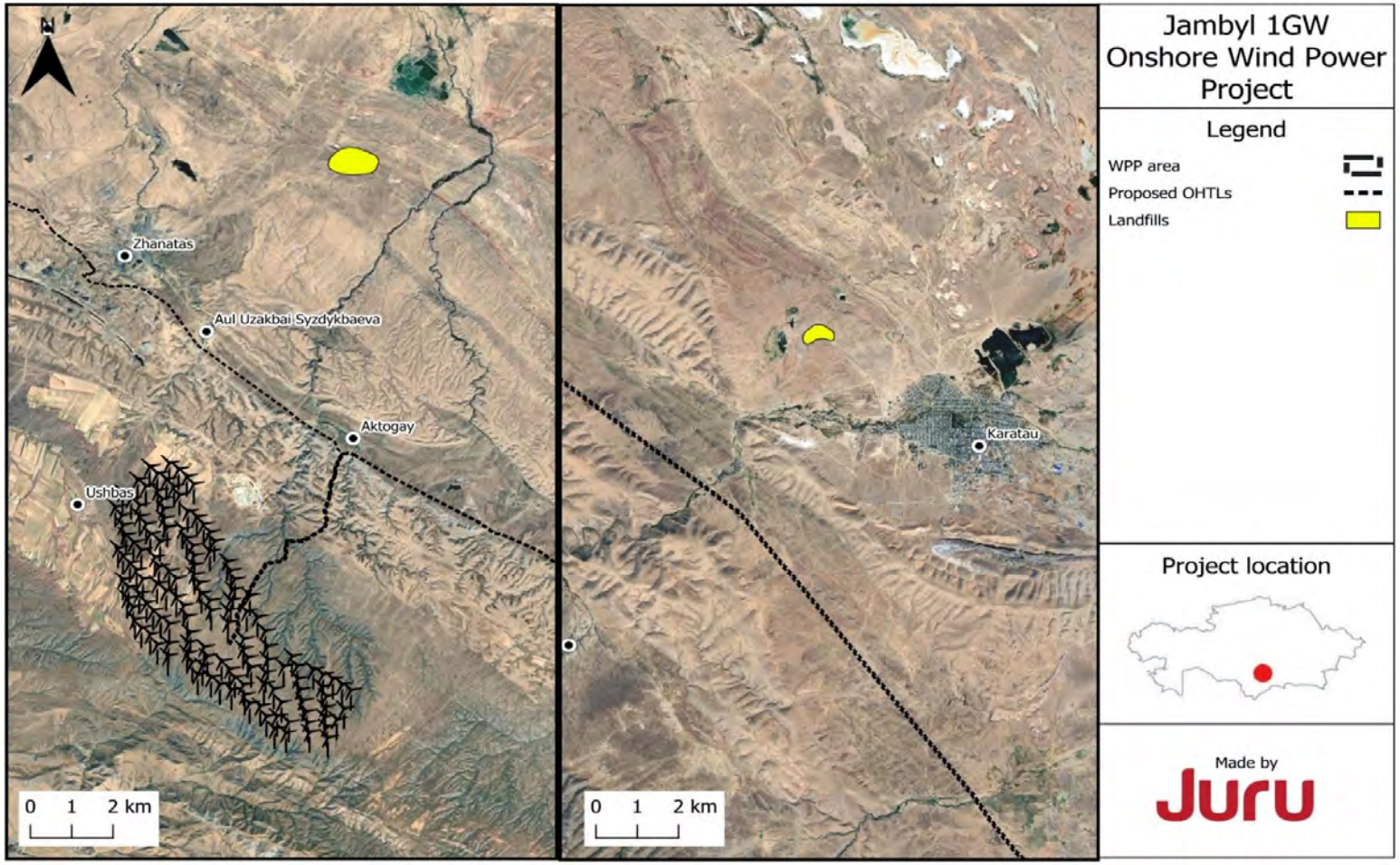
For hazardous waste streams, no licensed hazardous-waste facilities were identified within Jambyl Region. Contractors providing hazardous-waste services typically operate through market mechanisms rather than local authority referrals. The EPC Contractor will therefore be required to identify and contract a licensed hazardous-waste handler based on the specific waste types generated (e.g., oils, solvents, WEEE) and verify their permits prior to use.

There will be no direct discharge of wastewater to surface water bodies from the Project. Wastewater generated during both construction and operation will be stored in sealed septic tanks prior to removal.

The EPC Contractor and, subsequently, the Project Operator will be required to identify and engage a licensed organisation with the appropriate permits and technical capacity to collect and transport wastewater from the septic tanks to an authorised treatment facility.

The EPC Contractor will need to verify all waste-management operators by reviewing their state licences or activity notifications and will not rely solely on SRO membership or recommendations from local authorities.

Figure 15-1: Waste disposals in Talas and Sarysu districts of Jambyl region



16.4Potential Impacts

16.4.1 Introduction

This section assesses the potential impacts associated with the generation, handling, storage, and disposal of waste and wastewater during the construction and operational phases of the Project. Waste-related impacts may arise from a range of Project activities, including civil works, installation of electrical and mechanical components, operation of the WPP and associated infrastructure, and the presence of construction and operational workforce. These impacts have the potential to affect human and environmental receptors if waste and wastewater is not managed in accordance with good practice. Overall, the construction phase will generate the majority of waste and wastewater due to the scale of works and workforce involved; the operational phase will produce only limited quantities of waste.

In line with GIIP and Kazakhstan's Environmental Code, waste can be classified into four broad categories, reflecting differences in composition, handling requirements, and potential environmental risk.

Table 15-2: Waste Categorisation

Category	Examples (Project-Relevant)
Inert Waste	Soil, subsoil, rock, concrete, asphalt, inert aggregates.
Non-hazardous Waste	Domestic waste (food waste, paper, plastics), packaging (paper, cardboard, plastic, wood, metal scrap), glass, pallets, inert construction waste and debris.
Hazardous Waste	Waste oils, lubricants, contaminated containers, paints, solvents, adhesives, oily rags, used filters, batteries, fluorescent lamps, chemical residues, contaminated soil, and Waste Electrical and Electronic Equipment (WEEE).
Wastewater (Liquid Waste)	Black water (toilets), grey water (showers, kitchens), concrete washout, vehicle washing water, and surface run-off possibly contaminated by fuel or oils.

Subsequent sections describe the activities that will generate waste and wastewater during the construction and operational phases, the potential impacts arising from these activities, and the mitigation and management measures required to minimise environmental and health risks.

16.4.2 Construction Impacts

Waste generation during construction will represent the most significant waste-related impact across the Project lifecycle, given the scale of civil works, the size of the workforce, and the establishment of temporary facilities. The principal sources of waste and wastewater will arise from both construction activities and workforce-related operations.

16.4.2.1 Construction Activities and Sources of Waste

Waste will be generated from a range of construction activities, including earthworks, concrete works, road and hardstanding preparation, electrical and mechanical installation, and general site activities associated with the WTGs, OHTL, substation, and BESS. The following sub-categories describe the main activities/sources that generate waste and wastewater during the construction phase.

Table 15-3: Construction-Phase Waste & Wastewater Sources

Activity/Source Category	Description of Waste and Wastewater Generation
Site Preparation and Earthworks	Excavation, grading, and foundation works will generate inert spoil (soil, subsoil, and rock) and limited vegetation debris. Topsoil will be stripped and reused for reinstatement and landscaping.
Civil and Structural Works	Concrete batching, foundation pouring, and reinforcement activities will generate concrete washout water, surplus cementitious materials, metal scrap, packaging, and formwork waste.
WTG Assembly and Erection	Construction of turbine foundations and crane pads will generate concrete residues, rebar offcuts, and gravel waste. Prefabricated tower and component installation will produce packaging waste (wood, cardboard, plastics) and small quantities of lubricants.
OHTL Construction	Excavation for tower foundations, stringing works, and assembly of prefabricated structures will produce spoil, packaging materials, conductor offcuts, and small quantities of resins or paint residues. As OHTL construction mainly involves assembly of pre-fabricated components, overall waste volumes will be limited.
Construction Camps and Workforce Facilities	Solid domestic waste (food waste, paper, plastics) and wastewater (black and grey water) will be generated from kitchens, sanitary blocks, and showers. Poor waste management at camps can create visual impacts, odour, and attract vermin.
Workshops, Equipment and Vehicle Maintenance Areas	Small quantities of hazardous waste includes lubricants, used oil, oily filters and rags, contaminated soil, and spent batteries. Fuel storage and refuelling will be undertaken in designated, bunded areas with a minimum 110% containment capacity.
Hazardous Materials Storage and Handling	Temporary storage of fuels, paints, solvents, and chemicals presents a risk of leakage or spills. Wastes include used containers, spill residues, and absorbent materials, all of which will be stored in bunded and labelled areas.
Wastewater from Construction Activities	Includes concrete washout, vehicle and equipment washing, and stormwater run-off from laydown and storage areas. Black and grey water from sanitation facilities will also be generated.
Vegetation Clearance Activities	Clearance of low scrub and small trees for access roads and OHTL corridors will generate small amounts of organic material, which will be mulched, composted, or reused for ground stabilisation.

16.4.2.2 Solid Waste and Hazardous Materials

Solid waste from construction activities will include both non-hazardous and hazardous fractions.

Based on Project estimates, up to 10 tonnes/day of domestic waste may be generated during peak construction. This will be segregated (metal, wood, concrete, and domestic) and stored within dedicated storage areas and collected and transferred by a certified licensed local contractor for transfer to licensed disposal or recycling facilities.

Non-hazardous solid waste is typically inert and does not pose a direct risk to human health or the environment; however, improper management may result in secondary impacts such as dust emissions, litter, visual nuisance, or unnecessary consumption of disposal capacity. Additional risks may arise if waste is transported by unlicensed contractors or disposed of at unauthorised facilities; therefore, contractor verification and tracking will be required.

Given that the construction of the OHTL will comprise the assembly of prefabricated structures, the amount of solid waste that will be generated along the OHTL route will not be significant. However,

inappropriate handling, storage, transport and/or disposal of these solid wastes may also result in environmental contamination.

Hazardous waste generated during construction is expected to be minimal, and will consist of small quantities of fuel residues, lubricants, paints, solvents, oily rags, contaminated soil from spill clean-ups, used filters, and chemical containers. Although these materials are limited in quantity, they require careful handling because improper storage, transfer, or transport could result in soil or groundwater contamination and pose occupational health risks, particularly in the event of leaks or spills.

Maintenance of construction machinery and vehicles will not be undertaken within the construction areas; as such, the generation of associated vehicle-related waste such as oil filters, spent filtration cartridges, and machinery lubricants is not expected at the project construction sites.

All hazardous waste will be temporarily stored in designated bunded, roofed, and fenced areas with impermeable flooring, clear safety signage, and labelled containers to prevent cross-contamination and ensure safe handling. These storage areas will provide a minimum 110% containment capacity for liquids and will be routinely inspected under the cESMS.

The Karatau municipal landfill is expected to have sufficient capacity to accept the non-hazardous construction waste generated by the Project, including domestic waste from construction camps and non-hazardous solid waste from civil and installation works, subject to confirmation and agreement with the landfill operator. As no licensed hazardous-waste disposal facilities has been identified within the immediate Project area, the EPC Contractor will be required to identify and engage a licensed regional hazardous-waste contractor or facility with the appropriate capacity and authorisation to accept these waste streams. The EPC Contractor will be responsible for verifying all relevant state licences and ensuring that hazardous waste is transported, treated, and disposed of in accordance with national regulatory requirements and in line with international lender requirements.

The EPC Contractor will be required to coordinate with local authorities to identify licensed collection and disposal contractors and sites and ensure compliance with national permitting requirements.

16.4.2.3 Wastewater Management

Wastewater will primarily consist of sanitary, domestic, and construction-related effluent. Based on expected workforce numbers (averaging 800–1,000 workers and peaking at approximately 2,200 during turbine installation), sanitary wastewater generation is estimated at approximately 0.1 m^3 per person per day, equating to around 80–100 m^3/day under normal conditions and up to 220 m^3/day at peak construction.

The construction areas will include temporary ditches, collection pits, and sedimentation tanks. There will be no direct discharges into natural water bodies (refer to Section 14 for more information related to drainage matters and potential impacts of local hydrology).

Improper management of sanitary wastewater could cause localised soil or groundwater contamination; therefore all wastewater will be collected in septic tanks equipped with sediment traps and impermeable containment, and periodically removed by a licensed contractor for treatment at approved facilities. The EPC Contractor will be required to identify and engage appropriately licensed wastewater contractors to ensure that all wastewater is transported and treated in accordance with national regulatory requirements and Lender standards.

16.4.2.4 Summary and Significance

Waste and wastewater impacts during the construction phase are expected to be moderate, localised, and temporary, primarily confined to the Project site, construction camps, and designated waste-

handling areas. Effective implementation of the Project's HMWMP under the cESMS, including proper segregation, handling, storage, and documentation of all waste streams, together with routine inspections, staff training, and the use of licensed waste and wastewater contractors, will minimise potential impacts on soil, surface water, groundwater, workers, and nearby communities.

Activity/Impact/Aspect					
Generation, handling, and disposal of solid and liquid wastes from construction activities within the WPP, along the OHTL, and at associated facilities (including batching plants, laydown areas, and camps).					
Type	**Duration**	**Extent**	**Scale of Impact**	**Frequency**	**Likelihood (unplanned events)**
Direct	Short-term	On-site Local	Distinguishable	Continuous during construction	Possible (minor spills, leakage, or littering)
Magnitude					
Medium					
Receptor		**Sensitivity**		**Significance of Impact**	
Local communities, grazers, and workers within vicinity of construction areas, as well as soil, and water receptors.		Low to medium		Minor to moderate	

The generation of waste and wastewater during construction is expected to be moderate and temporary, with impacts confined mainly to the Project site, construction camps, and approved waste management facilities. Implementation of the HMWMP under the cESMS, supported by staff training, regular inspections, and use of licensed contractors, will ensure compliance with Kazakh regulations and international standards.

Following implementation of the mitigation measures identified in Section 13.6 residual impacts on soil, surface water, groundwater, and community health are anticipated to be minor adverse to negligible following proper management and mitigation.

16.4.3 Operation Impacts

16.4.3.1 Operation Activities and Sources of Waste

During the operational phase, waste generation will be very limited compared to construction and will be managed under the relevant operational management plans and associated procedures within the ESMS. Waste and wastewater will arise primarily from routine maintenance activities, office operations, and the small number of personnel stationed at the WPP. Approximately 60–80 staff will be employed during normal operations, with numbers temporarily increasing to 100–150 during major maintenance or outage events.

The main sources of waste during operation phase are summarised in the table below. Further discussion of waste stream and their management requirements are provided in the subsequent subsections.

Table 15-4: Operation-Phase Waste & Wastewater Sources

Activity/Source Category	**Description of Waste and Wastewater Generation**
Routine WTG Operation and Maintenance	Small quantities of non-hazardous waste (packaging, rags, minor metal parts) and limited hazardous waste (used oils, lubricants, filters, cleaning agents) from scheduled maintenance.

Activity/Source Category	Description of Waste and Wastewater Generation
Substation, BESS and Electrical Equipment	Occasional small quantities of electrical components, fuses, lighting equipment (fluorescent tubes), and hazardous maintenance wastes (dielectric oils, cleaning fluids). BESS battery modules will remain in place; no battery disposal will occur during operational lifetime of the Project.
OHTL Operation and Maintenance	Very small volumes of waste from inspections and minor repairs (offcuts, insulator fragments). Hazardous waste generation expected to be negligible.
Office, O&M Building, and Welfare Facilities	Domestic solid waste (paper, plastics, food waste). Sanitary wastewater (black and grey water) generated in small quantities; collected in sealed septic tanks for off-site disposal by licensed contractors.
Stormwater and Drainage	Run-off from hardstands and access roads may carry low levels of suspended sediment; managed via drainage systems. No process wastewater generated.
Organic Waste (Livestock Carcasses)	Occasional livestock carcasses from local grazing activities may require removal to avoid attracting scavenging birds to the WPP area.
Emergency Repairs/Unplanned Events	Infrequent generation of damaged components, contaminated soil, or spill clean-up materials; managed as hazardous waste in line with the ESMS.

16.4.3.2 Solid and Hazardous Waste

Non-hazardous waste will include general office and domestic waste (paper, cardboard, plastics, and packaging), minor scrap metal and used components from maintenance, and canteen or sanitary waste from the operations compound. These wastes will be stored in designated, labelled containers and regularly collected by licensed waste contractors for recycling or disposal at authorised municipal facilities.

Small quantities of hazardous waste are anticipated, primarily from maintenance activities, including used oils, lubricants, oily filters, rags, cleaning agents, paints, and solvents. Other hazardous materials may include batteries, lighting equipment (e.g. fluorescent tubes), and electronic components (WEEE) that reach the end of their service life. These wastes will be stored in sealed and bunded areas and removed by authorised hazardous waste contractors for treatment or disposal at licensed regional facilities.

The BESS has been designed with sufficient internal capacity and physical space to accommodate additional battery units over time. As individual battery modules naturally degrade, they will remain in place within the BESS structure and new modules will be added alongside them, rather than replacing or removing the original units. Masdar has confirmed that the system layout and land allocation allow for future expansion without the need to extract or dispose of degraded batteries during the operational phase. As a result, no battery disposal is anticipated within the operational lifetime of the Project, and waste impacts associated with BESS battery replacement are expected to be negligible.

A key risk during the operational phase is the inappropriate storage or disposal of organic and food waste, which could attract birds and other fauna to the site. This will be managed through good housekeeping, covered waste bins, and regular collection by licensed waste services.

Furthermore, given that herders and grazers use the WPP area and its surroundings, occasional livestock carcasses may occur within or near the Project site during operation. If not promptly removed, carcasses can act as an attractant for scavenging birds, increasing the risk of bird presence within the wind farm and potentially elevating collision risk with turbines. Although this waste stream is not generated by the Project itself, it is an important operational consideration and requires coordinated management with

local land users to prevent attractant-related impacts.

The Karatau municipal landfill is expected to be capable of accommodating the non-hazardous solid waste generated during the operational phase of the Project, subject to agreement with the facility operator. Only small quantities of hazardous waste are anticipated during operation. As no licensed hazardous-waste disposal facilities were identified within Jambyl Region, the Project will be required to identify an appropriate licensed hazardous-waste contractor for the collection, transport, and disposal of this waste stream. Verification of relevant licences and disposal routes will form part of the Project's operational ESMS requirements.

16.4.3.3 Wastewater Management

Liquid waste during operation will consist primarily of domestic wastewater from sanitary facilities at the O&M building and substation. Given the small operational workforce, volumes will be minimal. All sanitary wastewater will be collected in sealed septic tanks and periodically removed by a licensed wastewater contractor for treatment and disposal at an authorised facility, in accordance with national standards and the WBG General EHS Guidelines. The Project Operator will be responsible for verifying that appointed contractors hold the appropriate licences and disposal permits.

Small amounts of liquid hazardous waste may arise from turbine or transformer maintenance, such as waste oil, hydraulic fluids, or cleaning solutions. These materials will be stored in bunded and clearly labelled containers and removed off-site by licensed hazardous-waste handlers to prevent soil or water contamination.

Stormwater will be managed through the Project's drainage system to prevent uncontrolled run-off or cross-contamination with wastewater or hazardous substances. During operation, turbine cleaning will be undertaken using biodegradable detergents, and the resulting washwater will be permitted to enter the stormwater drainage system. Only uncontaminated washwater and clean run-off will be allowed into this system; any hazardous liquids, oils, or chemical residues will be segregated, securely stored, and removed off-site by licensed contractors.

16.4.3.4 Summary and Significance

Given the limited workforce and low material throughput, waste and wastewater generation during operation will be minimal. Impacts are expected to be negligible to minor adverse provided that waste and wastewater continue to be managed under the Operational ESMS, in accordance with national and lender requirements.

Activity/Impact/Aspect					
Generation, handling, storage, and disposal of solid waste, hazardous waste (e.g. oils, filters, cleaning agents, batteries, WEEE), and domestic wastewater arising from routine operation and maintenance activities at the WPP, BESS, substation, and O&M compound.					
Type	**Duration**	**Extent**	**Scale of Impact**	**Frequency**	**Likelihood (unplanned events)**
Direct	Long-term	On-site	Distinguishable but low level	Intermittent (routine maintenance) Continuous (domestic waste)	Possible (minor spills, leakage, or littering)
Magnitude					
Small					
Receptor		**Sensitivity**		**Significance of Impact**	

Local communities, grazers, and workers within vicinity of operation areas, as well as soil, and water receptors.	Low to medium	Negligible - Minor

16.5Mitigation, Management & Residual Impacts

If improperly managed, solid and liquid wastes have the potential to contaminate soil, surface water, and groundwater, create odours and litter, attract vermin, and pose health risks to workers. Key controls will include:

- Waste segregation and labelling at source;
- Storage in appropriate covered and bunded facilities;
- Use of licensed waste contractors for collection and disposal;
- Regular monitoring, record-keeping, and audits under the ESMS; and
- Strict prohibition of open burning or on-site burial.

The Project will apply the waste management hierarchy (avoidance, reduction, reuse, recycling/recovery, treatment, and safe disposal) across all waste streams.

The tables below summarise the proposed management and control measures for the key sources of waste generation and wastewater discharge during for the construction phase and operation phase, along with the expected residual significance following implementation.

16.5.1 Construction Phase

The Project's Hazardous Materials and Waste Management Plan (HMWMP) under the Construction Environmental and Social Management System (cESMS) will serve as the overarching framework for waste and wastewater management supported by other relevant management plans such as the, Water Management Plan, and Traffic and Transportation Management Plan (TTMP). The plan will define segregation, storage, handling, transport, and disposal procedures consistent with national regulations and Good International Industry Practice (GIIP).

Table 15-5: Construction-Phase Waste & Wastewater Mitigation, Management and Residual Impacts

Activity/Source	Pre- mitigation	Mitigation and Management Measures	Residual Significance
General Waste Management (All Construction Activities)	Minor	• Implement and enforce a Project-wide Hazardous Materials and Waste Management Plan (HMWMP) under the cESMS, covering all contractors and sub-contractors. • Apply the waste hierarchy (avoidance, reduction, reuse, recycling/recovery, treatment, and safe disposal) to all waste streams. • Provide clearly marked segregated containers (e.g. inert, recyclables, domestic, hazardous) at all work fronts, laydown areas, and construction camps. • Prohibit open burning, uncontrolled dumping, and burial of any waste on site. • Require all contractors to use only licensed waste and liquid-waste service providers and maintain copies of licences and permits on file. • Maintain a simple waste register (type, quantity, storage location, destination, contractor) to support tracking and reporting under the cESMS. • Include waste management and housekeeping requirements in site inductions and toolbox talks for all workers and sub-contractors. • Undertake regular site inspections and audits (by EPC and Owner's E&S team) to check segregation, storage, housekeeping, and documentation.	Negligible - Minor
Non-Hazardous Construction Waste (Inert and Recyclable Materials) (Spoil, concrete waste, asphalt, scrap metal, timber, plastic, packaging, cable offcuts, glass, etc.)	Minor	• Maximise the reuse of excavated material (e.g. backfilling, landscaping, reinstatement) and avoid unnecessary off-site disposal. • Store inert spoil in designated, stabilised stockpiles away from drainage lines and sensitive receptors; reinstate and re-vegetate as soon as practicable. • Segregate recyclable materials (scrap metal, timber, cardboard, plastics) and send to licensed recycling or recovery facilities where available. • Store non-hazardous construction waste in covered or enclosed containers to prevent wind-blown litter and nuisance to local receptors.	Negligible - Minor

Activity/Source	Pre- mitigation	Mitigation and Management Measures	Residual Significance
		• Arrange regular collection of non-hazardous waste by licensed contractors and ensure disposal only at authorised municipal or industrial landfills (e.g. Karatau landfill, subject to agreement and capacity). • Require transporters to cover loads and secure loose items to prevent littering along access roads.	
Domestic Waste and Construction Camps (Food waste, packaging, sanitary waste from kitchens, canteens, welfare facilities and accommodation camps)	Minor	• Provide clearly labelled bins for domestic waste at all welfare facilities and accommodation areas, with secure lids to prevent access by animals, reduce odour and avoid wind-blown litter. • Collect domestic waste daily or at appropriate frequency and transfer to designated, fenced waste storage areas for collection by licensed municipal contractors. • Prohibit disposal of food waste on the ground and require immediate clean-up of spillages to avoid attracting vermin and scavenging wildlife. • Implement a pest and vermin control programme at camps, including regular housekeeping and, if required, pest control by a competent provider. • Provide adequate sanitary facilities (toilets, washrooms) sized for workforce numbers, connected to septic tanks as described in the Wastewater section. • Include camp waste management and personal hygiene requirements in worker inductions and camp rules.	Negligible - Minor
Hazardous Materials and Hazardous Waste (Oils, lubricants, fuels, solvents, paints, resins, adhesives, contaminated rags, used filters, aerosol cans, chemical containers, contaminated soil, spill-kit waste, WEEE, batteries)	Minor - Moderate	• Store all hazardous materials and hazardous waste in dedicated, bunded, and roofed storage areas with impermeable flooring and a minimum 110% containment capacity for liquids. • Clearly label all containers with contents and hazard information; keep Material Safety Data Sheets (MSDS) readily available in storage areas. • Limit the volume of hazardous materials stored on site to that required for safe and efficient operations; apply “just-in-time” delivery where practicable. • Provide spill kits (absorbents, booms, pads) at all refuelling points, workshops, and hazardous storage areas, and train staff in their proper use. • Prohibit any washing or servicing of vehicles and plant in non-designated areas; maintenance to be undertaken only in designated, contained workshops or off-site facilities. • Collect used oils, lubricants, filters, oily rags, solvent residues, paint cans, contaminated soil and spill-kit materials in sealed, labelled containers for off-site treatment/disposal by a licensed hazardous-waste contractor. • Ensure no hazardous waste is disposed of at municipal landfills or unlicensed facilities; verify the disposal route and permits as part of contractor selection.	Negligible - Minor

Activity/Source	Pre- mitigation	Mitigation and Management Measures	Residual Significance
		• Provide specific training to relevant personnel on hazardous materials handling, labelling, storage, spill response and waste segregation.	
Wastewater/Liquid Waste Management (Sanitary and domestic wastewater; black and grey water from camps and welfare facilities; vehicle/equipment washwater; concrete washout; other non-hazardous liquid waste)	Minor - Moderate	• Collect all sanitary and domestic wastewater (black and grey water) in sealed septic tanks or equivalent containment systems sized for peak workforce numbers. • Engage licensed wastewater/liquid-waste contractors to periodically empty septic tanks and transport liquid waste to an authorised treatment facility; retain records of volumes removed and disposal locations. • Design and operate concrete washout areas with impermeable bases and containment to prevent uncontrolled discharge; allow solids to settle and dispose of hardened concrete as inert construction waste. • Carry out vehicle and equipment washing only in designated, contained areas where washwater can be managed as liquid waste, not discharged to the ground. • Prohibit any direct discharge of wastewater or liquid waste to natural watercourses, drainage channels, or unlined ground. • Inspect septic tanks, collection pits, and washout areas regularly for leaks, overtopping, or structural damage, and repair promptly if issues are identified.	Negligible - Minor
Organic and Vegetation Waste (Scrub, small trees, brush and roots from site clearance and access preparation; minor organic waste from reinstatement)		• Clearly demarcate vegetation clearance limits to avoid unnecessary removal of vegetation beyond the design footprint. • Where practicable, chip or mulch suitable woody material and reuse on site (e.g. for erosion control, slope stabilisation, or rehabilitation of temporary work areas). • Avoid burning of vegetation waste; burning is prohibited under the Project's waste and air-quality requirements. • Stockpile organic material away from drainage lines to prevent it being washed into watercourses. • Incorporate retained or mulched vegetation into site restoration plans to support soil stabilisation and natural regeneration.	Negligible - Minor
OHTL-Specific Waste Streams (Foundation spoil, packaging, conductor offcuts, insulator fragments, small hardware, vegetation clearance along	Minor	• Apply the same segregation, storage, and disposal procedures as for the main WPP construction, ensuring that remote OHTL work fronts have adequate bins and containers. • Collect conductor offcuts, metal hardware, and insulator fragments and return them to central laydown areas for recycling or disposal; do not leave waste along the RoW.	Negligible - Minor

Activity/Source	Pre- mitigation	Mitigation and Management Measures	Residual Significance
OHTL RoW)		• Ensure that any temporary laydown or stringing areas used for OHTL works are cleared of waste and reinstated following completion of activities. • Manage vegetation clearance along the OHTL RoW in line with the Organic and Vegetation Waste measures above.	
Emergency Events and Spill Response (Fuel and oil spills, chemical leaks, septic tank failure, accidental discharge of liquid waste, damage to containment systems)	Moderate (unmitigated worst-case)	• Develop and implement a Spill Prevention and Response Procedure as part of the HMWMP, covering fuel, oils, chemicals, and liquid waste. • Ensure spill kits and fire-fighting equipment are available at all fuel storage areas, workshops, and other high-risk locations, and that staff know how to use them. • Train all relevant personnel in emergency response, including first response to spills, internal reporting, containment, and clean-up procedures. • In the event of a spill, contain and recover spilled material immediately, collect contaminated soil and absorbents, and store as hazardous waste for off-site treatment/disposal. • Investigate significant incidents, implement corrective actions, and update procedures or training where needed. • Notify relevant authorities and lenders where required by law or project commitments, in line with the incident reporting procedures in the cESMS.	Negligible - Minor

With effective implementation of the identified measures and adherence to good international practice, residual impacts related to waste and wastewater management during construction are anticipated to be minor adverse to negligible.

16.5.2 Operation Phase

Although waste volumes are low during operation, improper handling of hazardous waste, domestic waste, wastewater, or livestock carcasses could cause localised soil or water contamination, attract scavenging wildlife, or create nuisance for workers and nearby land users. These risks will be managed through the Operational HMWMP, routine inspections, good housekeeping, and strict segregation, storage, and disposal procedures under the ESMS.

Table 15-6: Operation-Phase Waste & Wastewater Mitigation, Management and Residual Impacts

Activity/Source	Pre- mitigation	Mitigation and Management Measures	Residual Significance
General Operational Waste Management All Facilities)	Minor	• Implement and enforce the Operational Waste Management Plan (OWMP) under the ESMS for all operational waste streams. • Apply the waste hierarchy (avoidance; reduction; reuse; recycling/recovery; treatment; safe disposal). • Provide clearly marked, segregated containers for domestic waste, recyclables, and hazardous waste at the O&M building, substation, BESS, and maintenance areas. • Prohibit open burning, burial, or uncontrolled disposal of waste. • Maintain a waste register (type, quantity, storage location, contractor) with transfer documentation. • Ensure only licensed contractors are used for non-hazardous and liquid waste removal; verify licences annually. • Include waste management and housekeeping requirements in staff induction and refresher training. • Conduct routine ESMS inspections and audits at all operational facilities. |	Negligible - Minor
Routine WTG Maintenance (including Turbine Cleaning & Washwater) (Non-hazardous waste: packaging, rags, scrap metal; hazardous waste: oils, lubricants, filters, cleaning agents; biodegradable washwater)	Minor	• Segregate and containerise all maintenance waste; return waste to the O&M compound for consolidation. • Store all waste in covered, labelled containers and ensure regular collection by licensed contractors. • Use only biodegradable detergents for turbine cleaning. • Allow turbine washwater to enter only the Project's stormwater drainage system; prevent discharge directly to natural watercourses. • Any washwater contaminated with oil, chemicals, or paint residues to be collected and managed as hazardous liquid waste. • Ensure all turbine maintenance areas remain tidy and free of wind-blown waste.	Minor
Substation and BESS Operation & Electrical Equipment Maintenance (Electronics, fuses, lighting equipment, small quantities of hazardous liquids; BESS	Minor - Moderate	• Segregate maintenance waste and store in covered, labelled containers. • Collect hazardous wastes (e.g. dielectric oil, hydraulic fluids, cleaning agents, fluorescent lamps, WEEE) in sealed, bunded storage. • Engage licensed hazardous-waste contractors for collection and off-site treatment/disposal. • Maintain a hazardous waste inventory and MSDS for all chemicals stored or used.	

Activity/Source	Pre- mitigation	Mitigation and Management Measures	Residual Significance
batteries remain in situ)		• Implement Masdar's in-situ battery strategy: degraded BESS modules remain in place; no battery disposal during operations. • Ensure electrical waste and components are transferred to authorised recycling or disposal facilities.	
Hazardous Materials and Hazardous Waste (Used oils, lubricants, oily rags, paints, solvents, transformer fluids, batteries, WEEE)	Minor - Moderate	• Store hazardous waste only in designated bunded and roofed areas with impermeable flooring and 110% containment capacity. • Keep all hazardous waste in sealed, clearly labelled containers with Safety Data Sheets available. • Ensure all hazardous waste is removed by licensed hazardous-waste contractors to authorised regional facilities. • Segregate hazardous waste streams (oily waste, solvents, batteries, WEEE, fluorescent lamps) to avoid cross-contamination. • Maintain a hazardous waste inventory and transfer notes as required by the ESMS. • Prohibit storage near drainage pathways or stormwater systems. • Provide training to all staff handling hazardous materials.	Negligible - Minor
OHTL Operation and Maintenance (Minor waste: offcuts, insulator fragments, packaging; negligible hazardous waste)	Minor	• Provide bins and containers at remote OHTL work fronts and ensure waste is returned to central storage. • Collect and recycle metal hardware and return insulator fragments for correct disposal. • Prevent waste accumulation along the RoW and reinstate any temporary access areas.	Negligible - Minor
Domestic Waste from O&M Building and Welfare Facilities (Food waste, kitchen waste, office waste, recyclables)	Minor	• Provide covered and labelled bins for food waste, recyclables, and office/domestic waste. • Arrange regular collection by licensed municipal waste contractors. • Maintain strict housekeeping to avoid odours, litter, and attraction of wildlife. • Ensure cleaning staff follow waste segregation rules and keep storage areas tidy.	Negligible - Minor
Wastewater/Liquid Waste Management (Sanitary wastewater; small volumes of hazardous liquid waste from maintenance)	Minor - Moderate	• Collect all sanitary wastewater in sealed septic tanks sized for operational workforce levels. • Arrange periodic emptying by licensed wastewater contractors, retaining disposal documentation. • Verify contractor licences and disposal permits under ESMS requirements.	Negligible - Minor

Activity/Source	Pre- mitigation	Mitigation and Management Measures	Residual Significance
		• Store hazardous liquid waste (waste oils, hydraulic fluids, cleaning solutions) in bunded, labelled containers for removal by licensed hazardous-waste handlers. • Prohibit any discharge of wastewater or liquid waste to natural water bodies.	
Organic Waste (Livestock Carcasses) from Grazing Areas	Minor	• Establish a system for prompt identification and removal of livestock carcasses within or near the WPP area. • Coordinate with herders on appropriate disposal to avoid attracting scavenging birds. • Maintain clean operational areas to avoid wildlife attractants.	Negligible - Minor
Emergency Events and Spill Response (Fuel/oil spills, chemical leaks, septic tank failure, accidental releases)	Moderate (unmitigated worst-case)	• Maintain an Operational Spill Prevention and Response Procedure under the ESMS. • Provide spill kits at all relevant areas (substation, BESS, maintenance areas). • Train staff in spill response, containment, reporting, and clean-up. • Contain spills immediately and collect contaminated absorbents/soil as hazardous waste. • Implement corrective actions following incidents and update procedures accordingly. • Notify authorities where required by law.	Negligible - Minor

With effective implementation of the identified measures and adherence to good international practice, residual impacts related to waste and wastewater management during operation are anticipated to be negligible.

17 Air Quality

17.1 Introduction and Overview of Assessment Methodology

This section describes the approach adopted to assess the potential air-quality impacts associated with the development of proposed Project. The assessment considers all construction-related activities for the WPP, the two 220 kV Overhead Transmission Lines (OHTLs) and supporting infrastructure. Potential impacts from the operational phase have been scoped out on the basis that wind-power generation is a non-combustion process and does not give rise to routine emissions to air that could materially affect local air quality.

The objective of the air-quality assessment is to identify the likely sources of air-emission and dust-generation during construction, evaluate the potential for short-term degradation of local air quality, and propose mitigation and management measures in accordance with national standards and GIIP. The assessment has been undertaken in accordance with the Republic of Kazakhstan Environmental Code (2021, as amended 2023), as well Lender requirements.

Given that the Project does not include combustion sources or other continuous emission points, a qualitative assessment approach has been adopted, supported by baseline information on regional air quality and meteorological conditions. The assessment is informed by:

- Review of available baseline data for the Jambyl Region, including information on prevailing wind patterns, temperature, and precipitation from national hydrometeorological datasets;
- Air quality baseline data collected in the Project area;
- Identification of potential emission sources during construction, including:
    - Fugitive dust from site clearance, excavation, road works, turbine-foundation construction, and cable trenching;
    - Exhaust emissions from construction vehicles, generators, and heavy machinery; and
    - Dust generated from material transport along access roads and unpaved routes.
- Consideration of receptor sensitivity in accordance with the generic criteria presented in Section 4; and
- Evaluation of potential cumulative effects in combination with other ongoing or planned projects within the Project Area of Influence.

Where appropriate, professional judgement and qualitative criteria have been used to characterise the magnitude, spatial extent, and duration of impacts. Magnitude has been defined based on the scale and intensity of dust or gaseous emissions, while receptor sensitivity reflects the proximity and vulnerability of nearby residential areas, agricultural land, and other sensitive uses.

The significance of each potential impact is determined by combining the magnitude of the effect with the sensitivity of the receptor, in line with the ESIA's overarching methodology. Impacts are described using standard significance categories (negligible, minor, moderate, major). Given the temporary and localised nature of construction activities, most impacts are expected to be of short-term duration and minor or negligible significance following application of standard dust-suppression and equipment-maintenance measures.

17.2Applicable Requirements & Standards

17.2.1 National Regulations

Kazakhstan has implemented National Environmental Standards (NES) aimed at overseeing environmental quality and ensuring public health. NES refers to the environmental quality standards developed and revised in accordance with Article 36 of the Environmental Code of the Republic of Kazakhstan. These standards are not a standalone piece of legislation, but are instead established through secondary regulations — specifically, the Rules on the Development and Revision of Environmental Quality Standards, adopted under Paragraph 15 of Article 36 of the Code.

These standards define permissible levels of chemical, physical, and biological indicators of environmental quality and are developed separately for: ambient air, surface and groundwater, soils and land, physical impacts (noise, vibration, electric, electromagnetic, magnetic fields, radiation, heat).

The NES serve as a regulatory tool to ensure a healthy environment and minimize adverse effects on human health and ecosystems, forming a critical component of state environmental regulation. Since 2021, the government has been working on improving these standards.

The provisions below are based on the Order of the Minister of Health of the Republic of Kazakhstan (dated August 2, 2022, No. KR DSM-70), on the Approval of Hygienic Standards for Atmospheric Air in Urban and Rural Settlements and in the Territories of Industrial Organizations.

This Order was registered with the Ministry of Justice of the Republic of Kazakhstan on August 3, 2022 (No. 29011) and sets forth permissible concentrations of pollutants in ambient air to ensure public health and environmental safety.

The NES for air quality establishes maximum permissible concentrations of pollutants in the air. The standards apply to a range of pollutants, including sulphur dioxide (SO_2), nitrogen oxide and dioxide (NO_2), particulate matter ($PM_{2.5}$, PM_{10}), and carbon monoxide (CO). The NES also establish requirements for monitoring air quality and reporting data to the government.

The law is based on two standardizing indicators of air pollutants:

- Maximum Permissible Concentrations (MPC); and
- Reference Safe Levels (RSL).

MPCs and RSLs are established for

- Substances in urban and rural areas
- Substances in the air of working zones.

The air of the working zone refers to the space up to two (2) meters above the floor level in areas of permanent or temporary presence of personnel. The standard for workplace air quality is based on exposure to pollutants at the specified levels to not cause significant harm to workers' health, even if they are exposed for up to eight (8) hours per day over their entire working life. The standard for residential areas is more stringent than that of workplace. The law provides lists of substances and permissible concentrations.

As RSLs are listed for very specific industrial pollutants, MPCs are only relevant for the Project.

Table 16-1 presents the MPC for the primary and relevant pollutants; however, it is noted that the total number of substances listed amounts to several thousand.

Table 16-1: National Air Quality MPCs

Pollutant	Kazakhstan MPC (µg/m³)	
	Maximum one-time	24 Hour
Nitrogen Dioxide (NO_2)	200	40
Nitrogen Oxide (NO)	400	60
Sulphur Dioxide (SO_2)	500	50
$PM_{2.5}$	160	35
PM_{10}	300	60
Carbon Monoxide (CO)	5,000	3,000

17.2.2 Lender Requirements

IFC Performance Standards and WBG EHS Guidelines

The IFC Performance Standard 3 (Resource Efficiency and Pollution Prevention) establishes the requirement to avoid or, where avoidance is not possible, minimise adverse impacts on human health and the environment by reducing pollution from project activities.

It specifically requires that emissions to air be controlled through application of technically and financially feasible mitigation measures consistent with GIIP, and that ambient air-quality levels are maintained in line with internationally accepted limits.

For air quality, the applicable numerical standards are provided in the World Bank Group General EHS Guidelines (2007), which reference the World Health Organization (WHO) Ambient Air Quality Guidelines (2005). These provide the guideline values for key pollutants as presented in Table 16-2, which should be applied where national standards are less stringent:

Table 16-2: WHO Ambient Air Quality Guidelines

Pollutant	Averaging Period	Concentration
$PM_{2.5}$	24 hour	15 µg/m³
$PM_{2.5}$	Annual	5 µg/m³
PM_{10}	24 hour	45 µg/m³
PM_{10}	Annual	15 µg/m³
NO_2	Hourly	200 µg/m³
NO_2	Annual	10 µg/m³
NO_2	24 hour	25 µg/m³
SO_2	24 hour	40 µg/m³
CO	Maximum daily 8 hour mean	10,000 µg/m³

The EHS Guidelines further recommend that dust and particulate emissions during construction be controlled

through standard management practices such as water suppression, speed control, and proper handling of materials and spoil.

Both AIIB and the Equator Principles require application of the IFC Performance Standards and the World Bank Group Environmental, Health and Safety (EHS) Guidelines. Accordingly, these Guidelines represent the benchmark standards adopted for this assessment.

17.3 Baseline Conditions and Receptors

17.3.1 Area of Influence

The Area of Influence (AoI) for air quality is defined as the area where construction activities associated with the Project could reasonably affect air quality through the generation of dust and exhaust emissions. The AoI therefore includes the WPP site, the OHTL corridors, access roads, laydown areas, batching facilities, temporary construction camps and substations where construction activities will occur.

The extent of influence is primarily governed by the distance over which particulate matter (PM) and gaseous pollutants disperse before concentrations return to background levels. Based on international good practice, fugitive dust generated during site preparation and vehicle movement is typically deposited within approximately 200 m of the source (under normal meteorological conditions). Beyond this distance, dust concentrations rapidly decline due to dilution and gravitational settling.

Given the open, semi-arid steppe conditions of the Jambyl Region, with frequent winds that facilitate dispersion of airborne particles, potential effects are expected to be short-lived and localised. Therefore, the AoI for air-quality assessment has been defined as up to 200 m around active construction areas, unpaved access routes, and material-handling locations. For vehicle emissions along public roads used for material delivery, the AoI will only extend to the immediate roadside environment (within about 50 m of the carriageway), as dispersion beyond this distance results in negligible contribution to ambient pollutant levels.

The Institute of Air Quality Management (IAQM) Guidance on the Assessment of Dust from Demolition and Construction (2014) and the Design Manual for Roads and Bridges (DMRB) HA207/07: Air Quality (2017) make recommendations for buffer distance as follows:

- Human receptor (residential, public infrastructure, etc.)
    - 350m buffer from construction site boundary
    - 50m buffer for construction vehicles on public roads (within 500 m from construction site)
- Ecological receptor (protected areas and other significant environmental features)
    - 50m buffer of the construction site boundary
    - 50m buffer for construction vehicles on public roads (within 500 m from construction site).

In conclusion, the potential dust impacts are expected to extend no more than 200 m, however, applying a conservative approach to sensitive human receptors, such as dwellings a 350 m buffer zone around construction works should be applied. For ecological receptors, impacts are expected to be negligible beyond 50 m of active work areas or access roads. For vehicle emissions along public roads the AoI will only extend up to 50 m of the carriageway. Within these limits, all air-quality effects are expected to be minor and localised, with rapid dispersion under typical regional wind conditions.

17.3.2 Sensitive Receptors

Sensitive receptors within the AoI are limited due to the remote and sparsely populated nature of the Project area. The nearest permanent receptors include a small number of residential properties and farmsteads located within the surrounding communities, which lie outside the AoI for the WPP area, however there are five residential areas and several dwellings or farms that are located within 350m of the OHTL route corridors. Other potential receptors include grazers, workers and livestock, and road users along access and transport routes. Temporary construction workers may also experience short-term exposure within active work areas. No schools, hospitals, or other community facilities are located in proximity to construction sites.

In the WPP area, movable structures (wagons) are typical, and only one permanent structure (a one-room building) located within the WPP which is used as a temporary shelter during the grazing season. This is located over 1 km from the nearest WTG and therefore will lie more than 200 m from any construction activities.

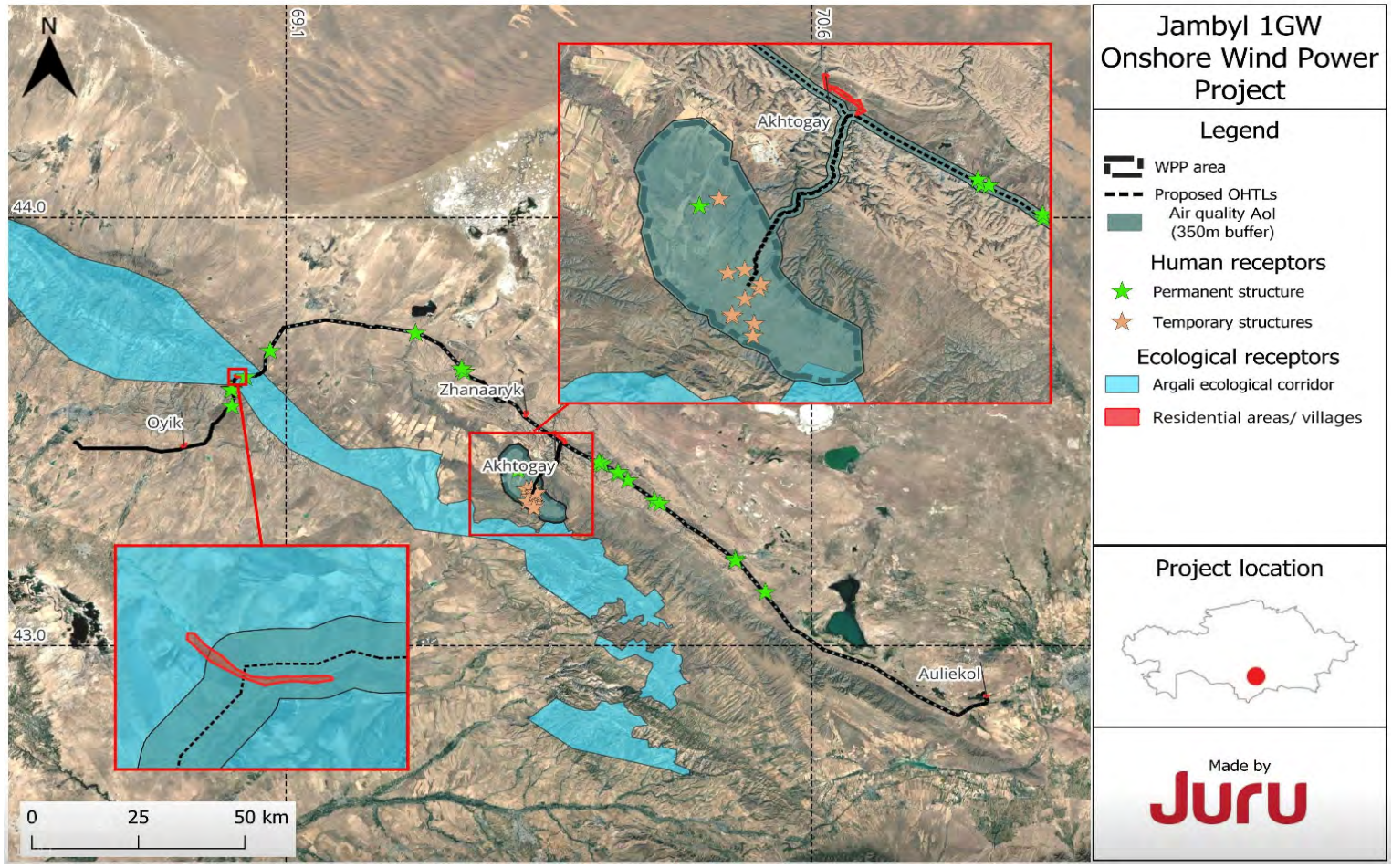
For Jambyl OHTL, farms represent the typical permanent receptors along the route. Nine farms are situated within a 100-200m buffer of OHTL RoW; two are located within a 200-350m buffer; and only one is situated within a 100m buffer. Only one village is located within the OHTL AoI - Akhtogay village; the closest structure in this village is 65 m from the RoW, and the nearest residential house is 90m, while other buildings are situated farther, within 200-350 m distance from the RoW.

By the Kentau OHTL route, farms are also the typical receptors. Only one farm is situated within a 100-200 m buffer of the OHTL, and one residential building is near the Ushtobe dam. Six farms and households in Zhanaaryk and Oyik villages are located at a distances ranging from200 to 350 m from the RoW.

Overall, as most receptors are located at distances that provide a natural buffer from dust and exhaust emissions, thereby substantially reducing exposure, the sensitivity of receptors is considered medium, while the magnitude of impact is assessed as small, resulting in an overall minor significance.

Locations of fixed (sensitive) air quality receptors, such as residential areas and structures, within the established AoI are shown in Figure 16-1.

Figure 16-1: Sensitive receptors within Air quality AoI



17.3.3 Baseline Air Quality Survey

There are already existing anthropogenic emission sources in the wider Project area that can negatively impact air quality. The closest and largest potential emissions source is the Eurochem mining area, which is located 2.5km east of the WPP project site. Other potential sources include the KN-1 highway, neighbouring villages (during heating seasons), as well as a large industrial cluster near Zhanatas city. The locations of these potential emission sources are shown below in Figure 16-2. Local air pollution may be caused by mine dusting, vehicle engine emissions at the mine and roads, residential heating equipment, and industrial emissions from Zhanatas city area. The primary potential pollutants are CO, SO_2, NO, NO_2, and Particulate Matter ($PM_{2.5}$, PM_{10}).

In addition, a natural source of potential impact on local air quality is from dust storms since the project is located between two large deserts - the Kyzylkum and the Moyynkum , which can significantly impact local air quality. This aspect is discussed in more detail in Chapter 19 (Climate).

Monitoring surveys of air quality were conducted in the project area in September 2024 and 2025, at 11 locations close to the nearest sensitive receptors using AQ Mesh equipment (certificates for equipment are provided within the technical annexes). This included 5 locations within the project area, including the only permanent structure within the WPP area, movable shelters', and areas close to springs, which are the source of water and more extensive stay; and 7 locations outside the Project area near the closest settlements or residential buildings, including the villages of Ushbas, Turkestanskiy, and Akhtogay; farms to the southeast and east of the Project; Kamar-Aulie, the local pilgrimage site (near Ushbas), and the summer camp. The locations of the monitoring points are shown in Figure 16-3.

The surveys revealed generally uniform air quality across the project area, with pollutant levels within national and international standards for CO, SO_2, NO, and PM (both $PM_{2.5}$ and PM_{10}). At most sampling points, SO_2 and NO concentrations were below detectable limits.

However, elevated levels of NO_2 were observed at all surveyed locations that exceed the WHO annual average standards, although levels were below Kazak 24-hr limits. This elevated level of NO_2 is likely associated with industrial activity in the Jambyl region, particularly emissions from phosphate-processing facilities and from centralised and private heating systems. Nitric oxide (NO), emitted from combustion processes, readily oxidises in the atmosphere to form NO_2, potentially contributing to the observed concentrations. SO_2 was determined only at the NA-11 location, at a detectable concentration. This may have been attributable to localised combustion by herders, as SO_2 was detected only in the evening.

The results of the air quality monitoring campaign are presented in Table 16-3 below.

Figure 16-2: Sources of air pollution

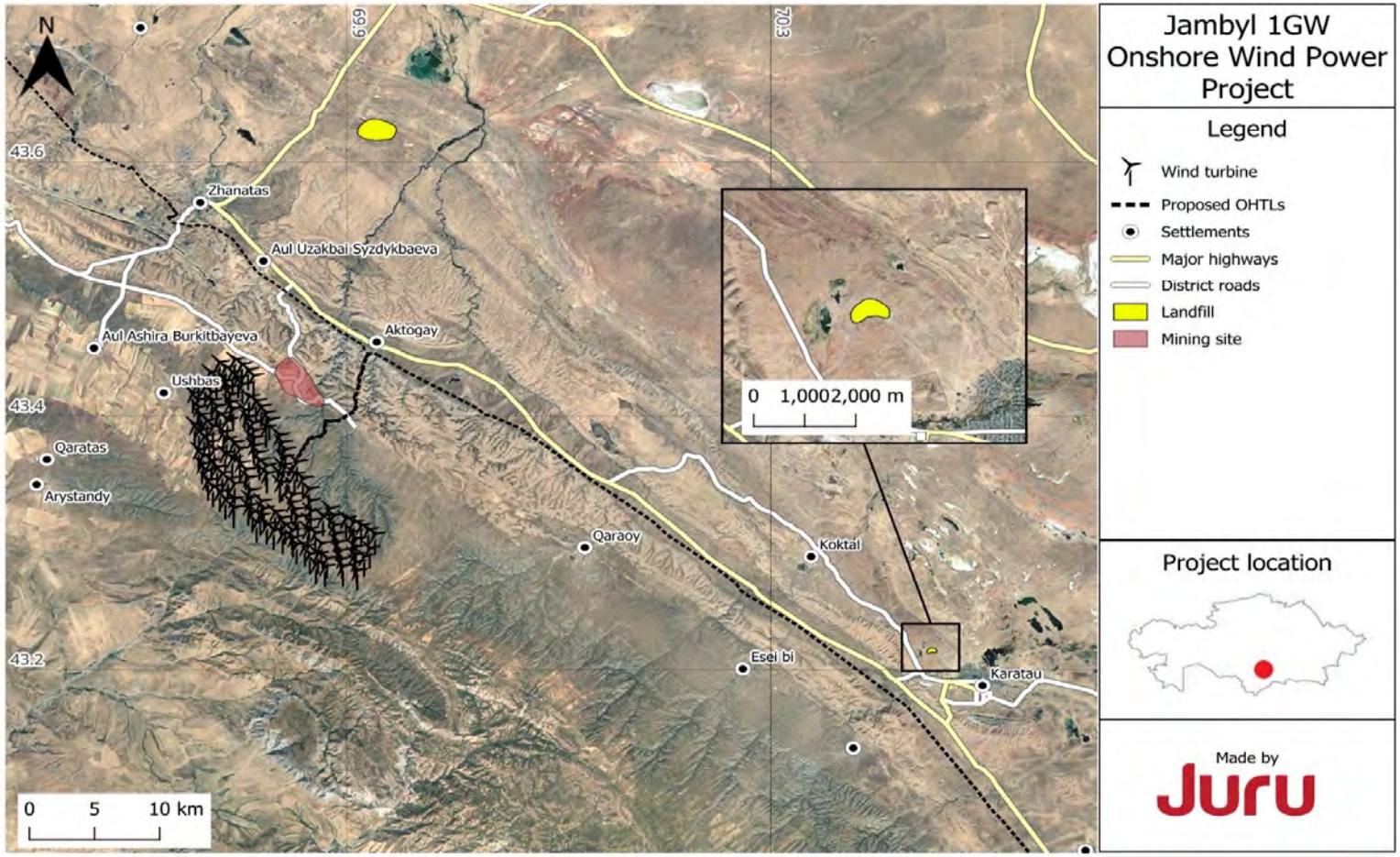


Figure 16-3: Air Quality monitoring locations

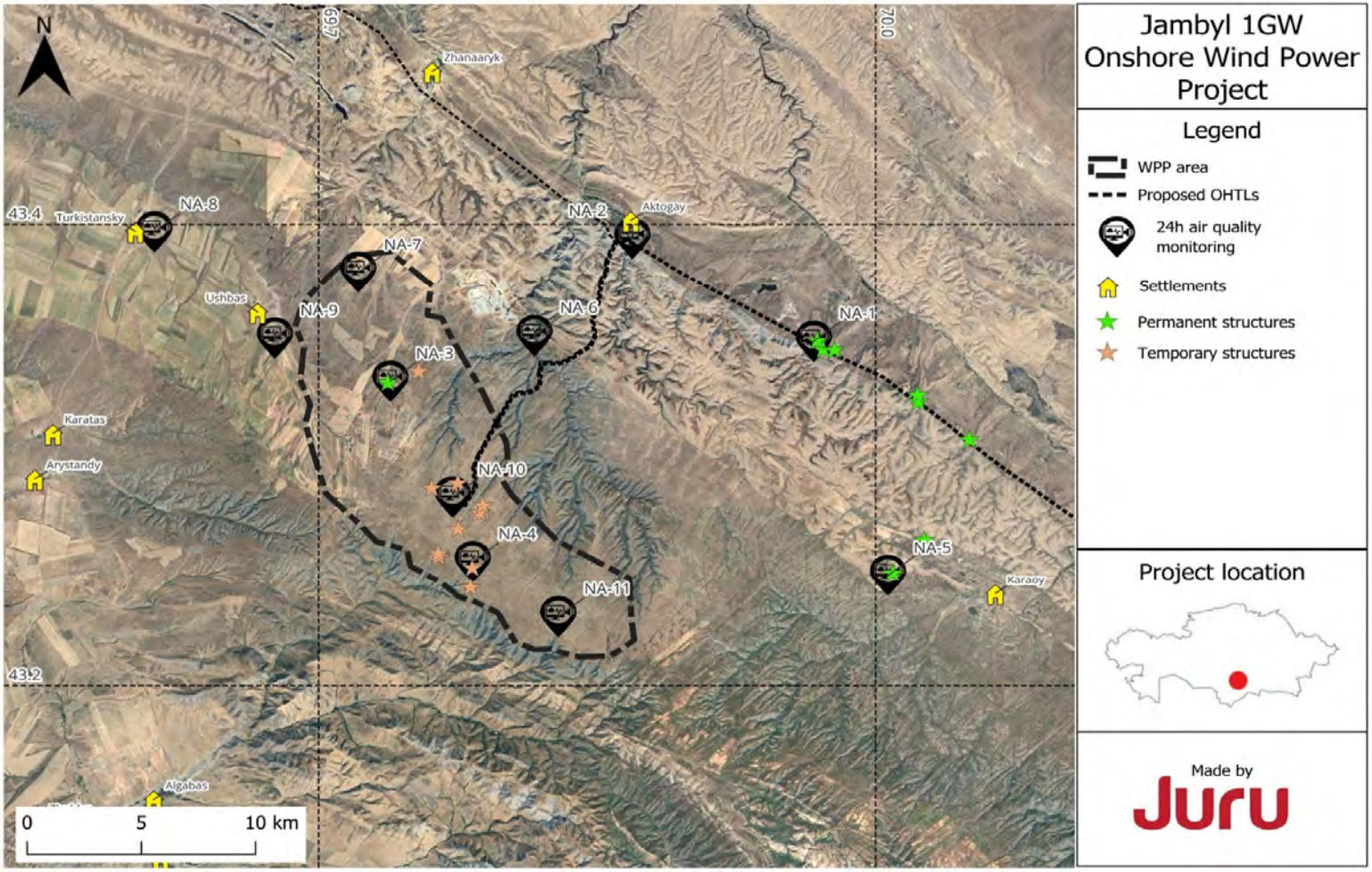


Table 16-3: Air Quality Survey Results

Location / Date		NA 1 27-28 Sep 2024	NA 2 30-1 Oct 2024	NA 3 22-23 Sep 2024	NA 4 29-30 Sep 2024	NA 5 24-25 Sep 2024	NA 6 23-24 Sep 2024	NA7 25-26 Sep 2025	NA8 26-27 Sep 2025	NA9 23-24 Sep 2025	NA10 24-25 Sep 2025	NA11 21-22 Sep 2025	Daily/one-time MPC National/ WHO
CO	**avg**	57.529	16.897	4.678	73.418	-[277]	95.075	71.721	93.163	100.802	139.782	217.159	**3000/10000**
CO	**max**	239.23	409.25	103.36	221.25	-[277]	321.61	150.474	212.495	218.03	267.322	1669.04	**5000/-**[278]
CO_2, ppm	**avg**	754.394	755.249	733.77	725.851	731.686	747.949	740.488	737.802	741.292	717.638	767.64	**-[2]/-[2]**
CO_2, ppm	**max**	860.84	767.21	781.21	729.54	739.22	762.9	896.08	750.72	748.88	737.84	3172.16	**-[2]/-[2]**
NO	**avg**	-[277]	-[277]	-[277]	-[277]	-[277]	-[277]	-[277]	-[277]	-[277]	-[277]	-[277]	**60/-[2]**
NO	**max**	-[277]	-[277]	-[277]	-[277]	-[277]	-[277]	-[277]	-[277]	-[277]	-[277]	-[277]	**400/-[2]**
NO_2	**avg**	14.47	18.444	15.712	18.772	18.181	17.31	13.795	15.978	10.917	12.603	13.054	**40/25**
NO_2	**max**	35.07	45.55	24.03	29.39	28.5	32.07	38.16	45.59	28.7	28.7	41.45	**200/200**
SO_2	**avg**	-[277]	-[277]	-[277]	-[277]	-[277]	-[277]	-[277]	-[277]	-[277]	-[277]	16.223	**50/40**
SO_2	**max**	-[277]	-[277]	-[277]	-[277]	-[277]	-[277]	-[277]	-[277]	-[277]	-[277]	128.11	**500/-[2]**
$PM_{2.5}$	**avg**	1.531	4.066	2.366	2.117	3.207	2.021	0.876	0.869	0.72	1.291	1.686	**35/15**
$PM_{2.5}$	**max**	3.46	56.4	7.79	3.38	7.89	5.85	2.04	2.34	1.34	2.79	5.07	**160/-[2]**

[277] Below detection limit
[278] Not specified

Location / Date		NA 1 27-28 Sep 2024	NA 2 30-1 Oct 2024	NA 3 22-23 Sep 2024	NA 4 29-30 Sep 2024	NA 5 24-25 Sep 2024	NA 6 23-24 Sep 2024	NA7 25-26 Sep 2025	NA8 26-27 Sep 2025	NA9 23-24 Sep 2025	NA10 24-25 Sep 2025	NA11 21-22 Sep 2025	Daily/one-time MPC National/ WHO
CO	**avg**	57.529	16.897	4.678	73.418	-[277]	95.075	71.721	93.163	100.802	139.782	217.159	**3000/10000**
CO	**max**	239.23	409.25	103.36	221.25	-[277]	321.61	150.474	212.495	218.03	267.322	1669.04	**5000/-[278]**
CO_2, ppm	**avg**	754.394	755.249	733.77	725.851	731.686	747.949	740.488	737.802	741.292	717.638	767.64	**-[2]/-[2]**
CO_2, ppm	**max**	860.84	767.21	781.21	729.54	739.22	762.9	896.08	750.72	748.88	737.84	3172.16	**-[2]/-[2]**
NO	**avg**	-[277]	-[277]	-[277]	-[277]	-[277]	-[277]	-[277]	-[277]	-[277]	-[277]	-[277]	**60/-[2]**
NO	**max**	-[277]	-[277]	-[277]	-[277]	-[277]	-[277]	-[277]	-[277]	-[277]	-[277]	-[277]	**400/-[2]**
NO_2	**avg**	14.47	18.444	15.712	18.772	18.181	17.31	13.795	15.978	10.917	12.603	13.054	**40/25**
NO_2	**max**	35.07	45.55	24.03	29.39	28.5	32.07	38.16	45.59	28.7	28.7	41.45	**200/200**
SO_2	**avg**	-[277]	-[277]	-[277]	-[277]	-[277]	-[277]	-[277]	-[277]	-[277]	-[277]	16.223	**50/40**
SO_2	**max**	-[277]	-[277]	-[277]	-[277]	-[277]	-[277]	-[277]	-[277]	-[277]	-[277]	128.11	**500/-[2]**
PM_{10}	**avg**	4.191	7.599	8.186	5.961	5.331	4.299	2.158	3.774	2.045	2.916	9.478	**60/45**
PM_{10}	**max**	36.22	64.17	83.34	26.88	9.89	7.69	10.87	16.34	7.44	19.29	38.4	**300/-[2]**

17.4Potential Impacts (Construction)

During construction of the Project, activities such as site clearance, earthworks, material handling, and vehicle movement will generate short-term emissions to air. The principal source of air pollution is dust, accompanied by combustion exhaust from machinery and transport vehicles.

Dust consists mainly of larger airborne particles that typically settle within a short distance of their source. These emissions are therefore localised and temporary, and while they do not cause long-term deterioration of air quality, they can lead to short-term nuisance or soiling of nearby surfaces if not adequately controlled.

The magnitude and extent of dust emissions depend on several factors, including the scale of activity, soil moisture, weather conditions (particularly wind speed and direction), and local topography. Given the open steppe landscape, the limited number of nearby receptors, and the high natural dispersion rates, impacts are expected to be short-lived and geographically confined.

The following construction activities are expected to contribute to air-quality impacts. These have been grouped into the following categories for the purposes of this assessment.

Table 16-4: Key Air-Quality Impact Sources During Construction

Activity/source	Description	Magnitude
Vehicle Movements and Construction Traffic	• Movement of heavy goods vehicles (HGVs) and construction machinery on unpaved access roads and haul routes; • Delivery of materials, plant, and major project components; • Use of internal roads during construction and reinstatement. Main pollutants include dust (suspended particulate matter, mainly PM_{10}), nitrogen dioxide (NO_2), carbon monoxide (CO), and minor hydrocarbons. Emissions occur during working hours and are greatest during dry, windy conditions. Dust is typically deposited within 100–200 m of the road corridor.	Small - Medium
Combustion Exhaust from Equipment and Generators	• Use of diesel-powered generators, cranes, trucks, and light vehicles. Main pollutants include nitrogen oxides (NO_x), sulphur dioxide (SO_2), carbon monoxide (CO), and particulate matter. Given the intermittent of the sources; concentrations diminish rapidly with distance.	Small
Earthworks and Material Handling	• Excavation and backfilling of turbine foundations and tower bases; • Soil stripping, grading, and compaction; • Handling, loading, and dumping of spoil, aggregates and sand; • Stockpiling and storage of loose materials. Main pollutants include coarse dust particles and fine particulates (PM_{10}, $PM_{2.5}$). Dust levels increase during active excavation and may disperse up to 200 m from the activity.	Medium
Vegetation Clearance and Site Preparation	• Removal of surface vegetation and topsoil at the start of construction; • Exposure of bare surfaces prior to road building or concrete placement; • Restoration and landscaping activities after construction. Main pollutants include wind-blown dust from exposed surfaces. Emissions are short-term and localised, reducing quickly once ground surfaces are stabilised or re-vegetated.	Small - Medium

Activity/source	Description	Magnitude
Construction and Concrete Activities	• Cement handling, unloading and transfer; • On-site concrete pouring and curing • Operation of temporary batching or mixing plants. Main pollutants include cement dust, PM_{10}, minor quantities of NO_2 from generator exhausts. Emissions occur intermittently at discrete batching areas; potential for nuisance limited to <100 m from source.	Small

Depending on wind speed and turbulence, most dust will settle within approximately 200 m of its source. As mentioned in Section 16.3.2 there are no residential properties within the WPP area and no permanent structures lie within 200m of construction activities. For the Jambyl OHTL only one residential house lies within this buffer area (90 m) and 9 farms have been identified to lie between 100 to 200 m from the OHTL RoW, and for the Kentau OHTL only one farm lies within 100 to 200 m of the OHTL RoW. These properties could experience temporary dust nuisance if mitigation is not applied; however, the overall significance is expected to be minor once standard control measures are implemented.

Exhaust emissions from vehicles and machinery may slightly increase local concentrations of NO_2 and PM_{10} near access routes and work sites, but no exceedance of national or international air-quality standards is anticipated.

Potential impacts of construction traffic on nearby communities, such as nuisance dust or short-term reductions in roadside air quality, are addressed further in Section 18 (Traffic and Transportation), which provides assessment and mitigation measures for road-use-related impacts.

Activity/Impact/Aspect					
Impact of construction activities within the WPP and along OHTL, and movement of construction related vehicles along public roads					
Type	**Duration**	**Extent**	**Scale of Impact**	**Frequency**	**Likelihood (unplanned events)**
Direct	Short-term	On-site	Distinguishable	Intermittent	N/A
Magnitude					
Small to Medium					
Receptor		**Sensitivity**		**Significance of Impact**	
Local communities, grazers and workers within vicinity of construction areas and road users.		Medium		Minor	

Overall, construction-phase air-quality impacts are predicted to be short-term, reversible, and of low to medium magnitude, with the majority of the dust emissions likely to occur only during working hours. Implementation of the mitigation and management measures set out in Section 1.5 will ensure compliance with Kazakhstan's national air-quality standards and the IFC/WBG guidelines.

Although overall exposure is small, the visible and intermittent nature of dust emissions during active construction justifies assigning a low-to-medium magnitude, resulting in an overall minor adverse significance prior to mitigation.

17.5Mitigation, Management & Residual Impacts

Air-quality management during construction will be implemented through the cESMS and associated Emissions Management Plan, and supported with other relevant plans for water, waste, and transport etc. The table below summarises the proposed management and control measures for the main identified emission sources and expected residual significance after implementation.

Following implementation of the identified mitigation and management measures, residual impacts on ambient air quality are anticipated to be **insignificant to minor** adverse.

Table 16-5: Construction-Phase Air Quality Mitigation and Residual Impacts

Activity/Source	Pre-mitigation	Mitigation and Management Measures	Residual Significance
General (All construction activities)	Minor	• Where permanent or temporary residential receptors are located within approximately 200 m of construction activities, the EPC Contractor shall provide advance notification of planned construction activities, including the nature and duration of works and the potential for temporary dust generation, together with contact details for the Project grievance mechanism. • Daily weather checks; suspend dust-generating works during high winds (>15 km/h). • Provide induction and toolbox training for workers on dust, exhaust, and no-idling measures. • Maintain a log of dust control, inspections, and any community complaints under the Grievance Mechanism. • Use non-potable or recycled water for dust suppression. • Prohibit open burning of any waste or vegetation. • Implement emergency dust-storm procedures. • Include air-quality controls and monitoring in weekly ESHS inspections and monthly reporting. • Keep construction worksite and roads clean and tidy and free from loose/friable materials. • Where practical, compact the ground in areas that are heavily used by vehicles and machinery.	Minor - negligible
Vehicle Movements and Construction Traffic	Minor	• Apply water spraying on unpaved roads/haul routes during dry or windy periods. • Impose speed limits (30km/h at the main access road; 20 km/h within the project area; and 10km/h within working areas.). • Cover all haulage trucks carrying friable or dusty materials; clean vehicle wheels at designated washing bays before exiting onto public roads. • Restrict traffic to designated routes only. • Switch off idling engines; provide driver waiting zones. • Conduct regular inspection and maintenance of vehicles (with emission certification and service records).	Minor

Activity/Source	Pre-mitigation	Mitigation and Management Measures	Residual Significance
		• Schedule deliveries to avoid peak traffic and prolonged queuing. • Regularly maintain haul roads and promptly repair damaged surfaces. • Include traffic-related dust controls in the Contractor's Traffic Management Plan (refer Section 11).	
Combustion Exhaust from Equipment and Generators	Minor	• Use modern, well-maintained plant and vehicles meeting EU Stage III A/US Tier 3 (or equivalent) emission standards. • Operate generators at rated load; fit catalytic converters or particulate filters where practicable. • Use low-sulphur diesel fuel where available. • Switch off engines when idle for extended periods ("no idling" policy). • Locate stationary generators away from work camps and accommodation areas, and other sensitive receptors (≥ 200 m) with exhausts directed downwind. • Undertake routine servicing in accordance with manufacturer specifications. • Maintain records of fuel use and equipment maintenance as part of the ESMS.	Negligible
Earthworks and Material Handling	Minor	• Phase works to minimise open ground. • Suspend works during strong winds or dust storms. • Apply water to exposed surfaces, excavation faces, and stockpiles during dry or windy weather. • Design low, stable stockpiles; use tarpaulins or windbreaks for fine materials, and locate downwind of receptors and outside prevailing-wind corridors. • Avoid material drop heights > 2 m during loading/unloading where practicable. • Ensure haul routes and storage yards are clearly defined and compacted. • Re-vegetate or stabilise completed areas promptly.	Negligible
Vegetation Clearance and Site Preparation	Minor	• Limit clearance strictly to the required footprint; retain vegetation buffers wherever possible to act as windbreaks. • Schedule clearance outside periods of high winds. • Compact or stabilise exposed surfaces immediately after grading. • Re-vegetate disturbed areas promptly following construction to reduce wind erosion. • Maintain topsoil stockpiles at low height (< 2 m) and seed if stored for > 1 month. • Re-vegetate disturbed areas promptly and integrate with the Reinstatement Plan.	Negligible
Construction and Concrete Activities	Minor	• Fit dust-extraction or shrouding systems on batching-plant transfer points where feasible. • Enclose cement and sand storage; seal silos when not in use. • Avoid over-filling of mixers and limit drop heights. • Avoid unloading dusty materials during high winds; cover transport containers.	Negligible

Activity/Source	Pre-mitigation	Mitigation and Management Measures	Residual Significance
		• Clean spilled materials immediately. • Water or sweep hardstanding daily; clean spills immediately. • Locate batching plants and mixing areas > 200 m from sensitive receptors where practicable. • Maintain all generators powering batching operations to control exhaust emissions. • Locate mixing plants > 200 m from receptors and downwind of settlements. • Fit dust-collection or bag-filter systems on mixers. • Collect washout water in lined pits and dispose of dried residues appropriately.	

Implementation of the above measures, together with the relevant management plans of the CESMS, should ensure that emissions remain within the limits of Kazakhstan's National Environmental Standards and IFC/WBG EHS Guidelines. Residual air-quality impacts are therefore expected to be short-term, localised and of insignificant to minor adverse significance.

18 Traffic and Transportation

18.1 Introduction and Overview of Assessment methodology

This section presents the assessment of potential traffic and transportation impacts associated with the construction and operation of the Project. The assessment considers traffic movements generated by all Project components, including the WPP, BESS, the two OHTLs, associated access roads, construction compounds and laydown areas.

Traffic and transportation impacts are primarily associated with the construction phase of the Project and relate to the delivery of large and abnormal loads, increased volumes of Heavy Goods Vehicles (HGVs), workforce transport, and localised road upgrades or temporary traffic management measures. These activities have the potential to affect road safety, driver delay, pedestrian amenity, severance, and community health and safety along external access routes and within local settlements. In contrast, traffic associated with the operational phase of the Project is expected to be limited in scale and largely confined to periodic maintenance activities.

The purpose of this assessment is to:

- characterise baseline traffic and access conditions along key transport corridors and within the Project Area of Influence (AoI);
- identify sensitive receptors that may be affected by Project-related traffic movements;
- evaluate the magnitude and significance of potential traffic and transportation impacts during each phase of the Project; and
- define mitigation and management measures to avoid or minimise adverse effects in accordance with national requirements and GIIP.

The assessment has been undertaken in line with the overarching ESIA methodology described in Section 4 and with reference to relevant international guidance for transport impact assessment. Particular consideration has been given to potential impacts on local communities and road users, consistent with the requirements of IFC Performance Standard 1 (Assessment and Management of Environmental and Social Risks and Impacts) and IFC Performance Standard 4 (Community Health, Safety and Security), as well as the World Bank Group Environmental, Health and Safety (EHS) Guidelines.

The assessment is based on a qualitative review of:

- applicable national legislation and relevant international good practice;
- existing transport infrastructure and access conditions within the Project Area of Influence (AoI);
- the external and internal transport routes proposed to be used by the Project; and
- sensitive receptors that may be affected by changes in traffic conditions or road use.

Potential traffic-related impacts associated with the construction and operation phases of the Project are identified and assessed in terms of their likely magnitude and the sensitivity of affected receptors. Impact significance is determined using the ESIA significance framework set out in Section 4.

Where potentially adverse impacts are identified, appropriate mitigation and management measures are proposed to avoid or minimise effects. Residual impacts are then evaluated following the application of mitigation.

18.2Applicable Requirements and Standards

18.2.1 National Regulations

Traffic and transportation impacts associated with the Project are regulated through the general environmental and transport legislation of the Republic of Kazakhstan. National legislation does not prescribe a specific methodology or quantitative thresholds for traffic impact assessment; instead, traffic-related effects are addressed through the Environmental Impact Assessment (EIA) process and applicable road-safety and transport requirements.

The Environmental Code of the Republic of Kazakhstan (2021, as amended) provides the overarching framework for environmental protection and requires identification, assessment and mitigation of environmental and social impacts arising from project activities, including indirect impacts such as traffic and access during construction and operation.

Transport in Kazakhstan is regulated by separate laws for each type, including the Law “On Motor Roads” (dated 17 July 2001 No. 245), the Law “On Railway Transport” (dated 8 December 2001 No. 266), and the Law “On the Use of Airspace of the Republic of Kazakhstan and Aviation Activities” (dated 15 July 2010 No. 339-IV).

The Law “On Motor Roads” establishes key definitions, including the national road management operator (currently Joint Stock Company “NC QazAvtoJol”), users of motor roads, special categories of vehicles (e.g. heavy vehicles), as well as land relations associated with motor roads.

Under the Law, motor roads are classified into public roads, economic (private) roads, and streets of settlements. Public roads are further subdivided into international, republican, regional, and district roads. All types of roads are subject to official registration.

Public roads may be transferred for use under public–private partnership projects or provided for gratuitous use to legal entities. Private roads are owned by individuals and legal entities.

Motor roads have roadside protection zones (measured from the boundary of the road right-of-way) established to ensure public safety and proper operating conditions:

- not less than 50 m for international and republican public roads;
- not less than 40 m for regional and district public roads.

Road safety requirements include favourable conditions for drivers’ visual orientation, safe connections and intersections, adequate tyre adhesion to the road surface, and other measures.

During construction, reconstruction, and repair of roads, measures must be taken to ensure safety and environmental protection. When selecting construction methods and mechanisation equipment, compliance with applicable sanitary standards and maximum permissible emission limits for atmospheric pollutants must be taken into account.

Noise levels, vibration, and pollution of air and water resulting from road traffic, road maintenance, and operation must comply with established standards.

Users of motor roads operating vehicles that exceed permissible dimensions, weight, and/or axle load limits are required to obtain a special permit for travel on public roads.

Road safety is further regulated by the Law "On Road Traffic" (dated 17 April 2014 No. 194-V). This Law establishes the priority of safety, accessibility, and sustainability of road traffic. In addition, Article 38 of the Law sets out additional requirements for roadside protection zones, within which the following activities are prohibited:

- carrying out works not related to the construction, reconstruction, major repair, repair, and maintenance of roads or the placement of road service facilities;
- construction or placement of buildings, structures, or other facilities not intended for road operation, construction, reconstruction, or major repair;
- ploughing of land plots, mowing of grass, logging and damage to forest and other perennial vegetation, removal of turf, and excavation of soil, except for activities related to road right-of-way maintenance or road repair.

In the event of road works, the Law imposes obligations on responsible parties to organise alternative routes in compliance with all safety requirements.

The Law also establishes requirements for maintaining vehicles in proper technical condition.

Traffic rules are directly established by Order of the Minister of Internal Affairs of the Republic of Kazakhstan dated 30 June 2023 No. 534 "On Approval of the Traffic Rules, Basic Provisions for Admitting Vehicles to Operation, and the List of Operational and Special Services Whose Vehicles Must Be Equipped with Special Light and Sound Signals and Marked with Special Colour Schemes." This Order sets out practical requirements governing the behaviour of all road users (vehicles, pedestrians, and their interaction with other types of transport).

For the transportation of oversized and heavy cargo, the above regulations require obtaining the relevant approvals from the Ministry of Transport of the Republic of Kazakhstan. These approvals are issued in the form of a Special Permit for the movement of heavy and/or oversized vehicles and are granted electronically via submission of cargo information through the state portal "elicense.kz".

The Laws "On Railway Transport" and "On the Use of Airspace of the Republic of Kazakhstan and Aviation Activities" regulate safety on the respective transport routes and key infrastructure elements, and define licensing requirements, tariffs, and conditions for passenger and cargo transportation.

The Law on the Use of Airspace also establishes the requirement to obtain a Permit to Carry Out Activities That May Pose a Threat to Flight Safety. The responsible authority for issuing such permits is the Ministry of Transport of the Republic of Kazakhstan. Permits are issued electronically through submission of project information via the state portal "elicense.kz".

Activities that may pose a threat to flight safety include construction of structures, installation of power transmission lines, and placement of other facilities that constitute obstacles within aerodrome areas and along air routes; activities resulting in radio-wave, visual, acoustic, or other types of emissions in airspace; placement of facilities that create conditions for mass bird congregation or reduce flight visibility; as well as any other activities not directly related to the use of airspace but affecting flight safety, aircraft equipment, and the safety of persons on board.

18.2.2 Lender Requirements

The traffic and transportation assessment has been undertaken with reference to the environmental and social requirements of the international lenders supporting the Project. The assessment is aligned with the

International Finance Corporation (IFC) Performance Standards (2012) and relevant World Bank Group (WBG) Environmental, Health and Safety (EHS) Guidelines.

The following IFC Performance Standards are considered particularly relevant:

- **IFC Performance Standard 1 – Assessment and Management of Environmental and Social Risks and Impacts**: Requires the identification, assessment and management of environmental and social risks associated with project activities, including indirect impacts arising from traffic movements and logistics during construction and operation. PS1 also requires that mitigation measures are proportionate to risk and consistent with GIIP.
- **IFC Performance Standard 4 – Community Health, Safety and Security**: Requires projects to evaluate and manage risks to communities arising from project-related activities, including traffic safety risks, interactions between construction vehicles and local road users, and potential nuisance or disturbance associated with increased traffic volumes. Measures must be implemented to avoid or minimise risks to community health and safety, particularly where heavy or abnormal loads are involved.

In addition, the assessment has been informed by relevant sections of the World Bank Group EHS Guidelines, including the General EHS Guidelines and the EHS Guidelines for Wind Energy and Electric Power Transmission and Distribution. These guidelines emphasise the need for effective traffic management during construction, safe routing of heavy vehicles, clear communication with affected communities, and implementation of traffic control measures where required to protect public safety.

18.3 Area of Influence

The Area of Influence (AoI) for traffic is defined as all roads that will be used for the transportation of project components (tower sections, blades, nacelles, transformers, OHTL towers, and other construction materials) during the construction phase, both within Jambyl Region and along the transportation routes through other regions of the Republic of Kazakhstan.

Traffic loads during the operational phase will be minimal and will consist of the transportation of personnel, consumables, and the removal of waste according to a defined schedule.

Accordingly, the traffic AoI includes public roads of all categories (international, republican, regional, and local) and, depending on the selected access option, private roads (including those constructed as part of the Project). Due to infrastructure constraints, the width of impact will be limited to the right-of-way (RoW) of existing and planned roads and their roadside protection zones.

The indicative transportation route of wind turbines from the Nur Zholy Kazakhstan–China border crossing to the access points to the WPP area is shown in Figure 17-1. Access routes from public roads to the WPP area are shown in Figure 17-2.

The sources of supply for OHTL towers and other construction materials have not yet been determined and may be located in different parts of the Republic of Kazakhstan. Nevertheless, the closest available options will be selected.

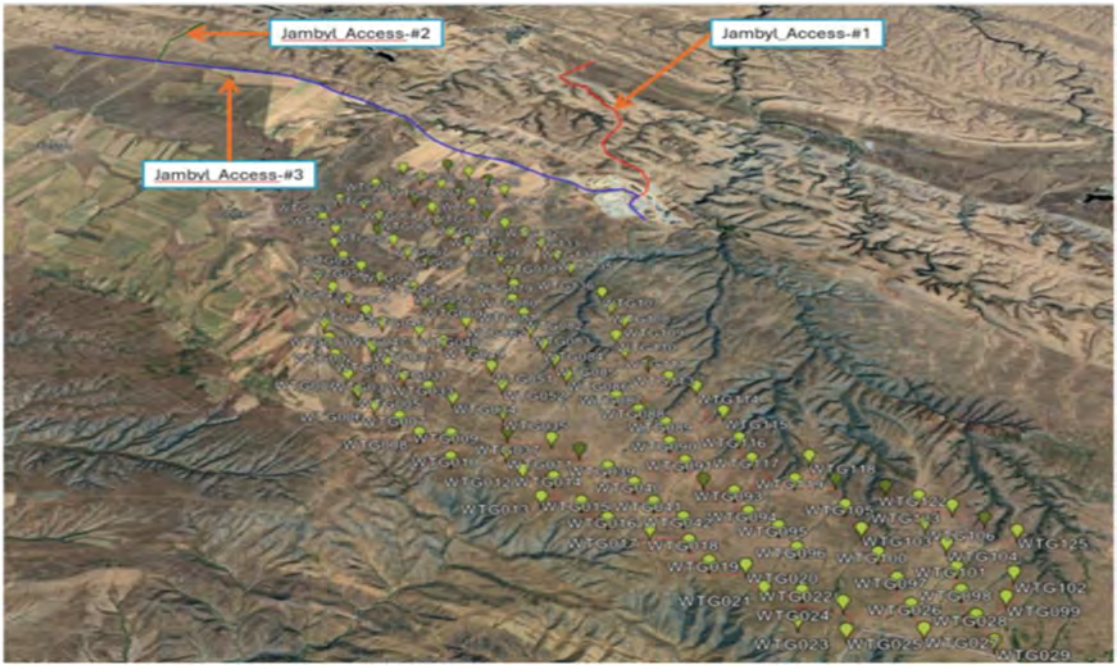
Figure 17-1: Transportation route (Chinese border to WPP area)[279]



Figure 17-2: Access road (WPP area)[280]

[279] Road survey from Khorgos till Zhanatas (Zhambyl region) (Sarens, June 2024)

[280] Feasibility study for the transportation of Wind components from Main Road to Site Road for Jambyl 500 MW Wind Farm (Sarens, January 2024)



Thus, the traffic AoI connected to wind turbine delivery covers roads across three regions: Jetisu Region (approximately 80 km), Almaty Region (approximately 400 km), and Zhambyl Region (approximately 500 km), along the following routes:

- AN-5 republican road – from the border with China to the Almaty city ring road (toll bypass of the A-5 highway);
- R-67 (Big Almaty Ring Road) republican road – from its intersection with AN-5 to the exit onto A-2;
- A-2 international road – from the exit from R-67, bypassing the city of Taraz, to the exit onto KN-1;
- KN-1 regional road – from the exit from A-2 to the town of Zhanatas;
- Access options to the WPP area – local and/or private roads (a local road connecting the town of Zhanatas and the village of Turkestansky; private roads owned by EuroChem/KazPhosphate.

In addition to the roads listed above, construction materials may also be delivered from the Turkestan Region. Traffic would use the international E123 highway, from which access is available via the outskirts of the city of Turkestan to the regional road KH-56. This road provides access to the RoW of the Kentau OHTL and, at the boundary with the Zhambyl Region, connects to the KN-1 road.

18.4Transport and Public Infrastructure

Access to the Sarysu District of the Zhambyl Region, where the WPP area is located, is available by road and rail transport.

18.4.1 Road access

Major highways are located relatively close to the project area. The KN-1 highway runs approximately 8 km from the WPP area, while local roads approach the project area at a distance of about 2 km (the road to Ushbas village). The example of local road is shown in Figure 17-3.

Figure 17-3: Example of local roads



In addition to public roads, there is a private EuroChem road leading to a quarry. This road also passes at a distance of about 2 km from the WPP area and is currently used for transporting extracted raw materials; however, it is not used for general public access.

Zhanatas city, the nearest major settlement to the WPP area (approximately 15 km north), can be accessed by road mainly from the southern and western directions.

From the south, the KN-1 highway leads toward Zhanatas, connecting the Sarysu District with the main transport artery of southern Kazakhstan - the A-2 highway. Via the A-2, access is provided eastward to the regional centre, Taraz, and westward to the regional city of Shymkent. The KN-1 is predominantly a straight asphalt road with one lane in each direction (see Figure 17-4).

Figure 17-4: KN-1 road



From the west, access to Zhanatas is provided by the KH-56 road, which originates in Kentau city in the Turkestan Region and crosses the Big Karatau ridge through one of the gorges before intersecting with KN-1. Similar to KN-1, KH-56 is generally a straight asphalt road with one lane in each direction, becoming winding only in the mountainous section where it crosses the ridge (see Figure 17-5). KH-56 is connected to the international E123 highway via the street network of Turkestan city, the capital of the Turkestan Region. The streets of Kentau city include both single-lane and dual-lane roads in each direction and pass through areas of low-rise residential development with private houses and plots.

Figure 17-5: KH-56 road



The E123 highway runs from southern Kazakhstan toward the Ural region and connects Kazakhstan with Europe. In the vicinity of the project area, it links the cities of Shymkent, Turkestan, and Kyzylorda. The road is a divided highway with a central median and two lanes in each direction.

North of Zhanatas, the KN-25 road leads toward KN-10, which continues eastward and thus forms one of the routes to northern Kazakhstan. These roads pass through sparsely populated desert areas and are relatively straight, with one lane in each direction.

Regular public bus services between Zhanatas and major cities are not available, as the city does not have a bus terminal. This function is partially replaced by private transport services such as minibuses (shared taxis). Bus stops can be found in villages near Zhanatas; however, there are no clear signs of regular use. According to data from the Kazakhstan Transport Union "Kazlogistics," six regular public transport operators were active in the Zhambyl Region as of 2021[281]. Regular intercity bus routes in Kazakhstan are generally concentrated between major cities and operate through bus terminals.

18.4.2 Rail access

The nearest railway station to the WPP area is located in Zhanatas city (Figure 17-6), approximately 15 km away. The primary use of this station is industrial, related to the activities of EuroChem and KazPhosphate in the city. From Zhanatas, rail lines run only southward to Taraz, where they connect to the national railway network. From Taraz, railways extend eastward to Uzbekistan and northward via Turkestan; westward toward Almaty, northern Kazakhstan, and Kyrgyzstan. From Almaty, the railway continues toward China.

Figure 17-6: Zhanatas railway station[282]

[281] PROJECT REPORT: "Study of the state of passenger road transport in international and interregional communications, analysis of development paths and development of recommendations for solving problems" (Kazlogistics, 2021)
[282] https://yandex.ru/maps/org/zheleznodorozhny_vokzal_zhanatas/197351842685/



During the winter period, there are daily passenger rail[283] services from Zhanatas to Taraz, passing through Kentau city and the settlement of Assa.

18.4.3 Air transport

The closest air facility to the project area is the Birlik aerodrome[284], located approximately 40 km southwest of the WPP area. According to publicly available information, it is intended for general aviation, training, and practice flights. The runway is suitable for An-2 aircraft and other light aircraft types.

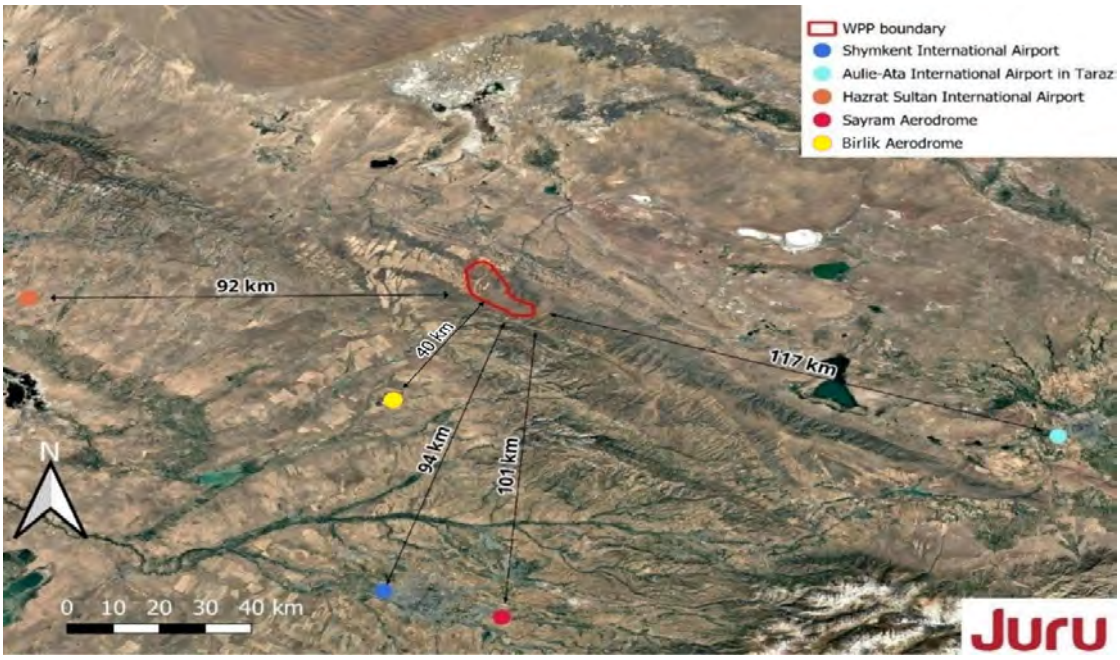
The other nearest facilities include:

- Shymkent International Airport (94 km from WPP area) – a major airport in southern Kazakhstan, featuring a 3,300 m runway and a new passenger terminal opened in 2024, supporting both domestic and international flights.
- Taraz International Airport (117 km from the WPP area)– serving the Jambyl Region, with a 3,500 m runway and modern terminal infrastructure for passenger and cargo operations.
- Turkestan International Airport – Hazret Sultan (92 km from the WPP area) – opened in 2020, with a 3,300 m runway and facilities supporting international travel and regional tourism.
- Sairam Airdrome (101 km from WPP area) – a local airfield near Shymkent used for organization of parachute jumps. Conducting parachuting competitions and training camps and search and rescue activities.

The map of neighboring air facilities is shown in Figure 17-7.

[283] https://www.inform.kz/ru/zheleznodorozhnyy-marshrut-taraz-zhanatas-vozobnovlyayut-v-zhambylskoy-oblasti_a3589843
[284] https://www.ans.kz/AIP/Aerodromes/AD/PDF/H/birlik.pdf

Figure 17-7: Air facilities in the vicinity of the WPP area



18.5Transportation of WTG Components to Site

18.5.1 Abnormal Load Transport Route

WTG components will be transported via an extensive abnormal load route from manufacturing facilities, likely originating in China (Baiyin City), through Kazakhstan, and into the Jambyl region.

The primary logistical undertaking involves transporting massive and oversized wind turbine components, including nacelles, hubs, tower sections, and blades, from external ports to the construction site. These materials are classified as abnormal loads due to their size, with the longest turbine blades measuring up to 110 metres and the heaviest nacelles weighing 170 tons.

The transportation of the 111 WTGs requires 999 deliveries of oversized components (1,998 total trips). Oversized components include: tower sections (4 loads per WTG), blades (3 loads per WTG), nacelles (1 load per WTG), and transformers (1 load per WTG). The project logistics provider (Sarens) has the fleet capability to transport up to eight complete WTG sets in a single convoy.

A Road Survey[285] was conducted by Sarens to assess the transportation routes. As part of the study, based on vehicle dimensions (considering the maximum anticipated cargo sizes), the road widths, clearance heights of interchanges, bridges, and other structures along the route were assessed, and solutions were proposed for organizing transportation at locations where constraints are expected.

In total, approximately 40 overhanging structures were identified along the surveyed routes, of which around 10 require the development of detour solutions (the minimum acceptable clearance height was

[285] Road survey from Khorgos till Zhanatas (Zhambyl region) – Sarens (June 2024)

defined as 5.75 m).

Several typical types of constrained locations were identified:

Overpass bridges of grade-separated interchanges (Figure 17-8).

Figure 17-8: Example of bridge on the route (A-2 highway) (Source: Road survey)



The solution proposed in the study is to enter the interchange, cross the bridge at the upper level, and then return to the main road. Two different types of interchanges were identified; examples of how each type can be crossed are shown in

Figure 17-9 and Figure 17-10.

Figure 17-9: Example of crossing an interchange type 1 (Source: Road Survey)

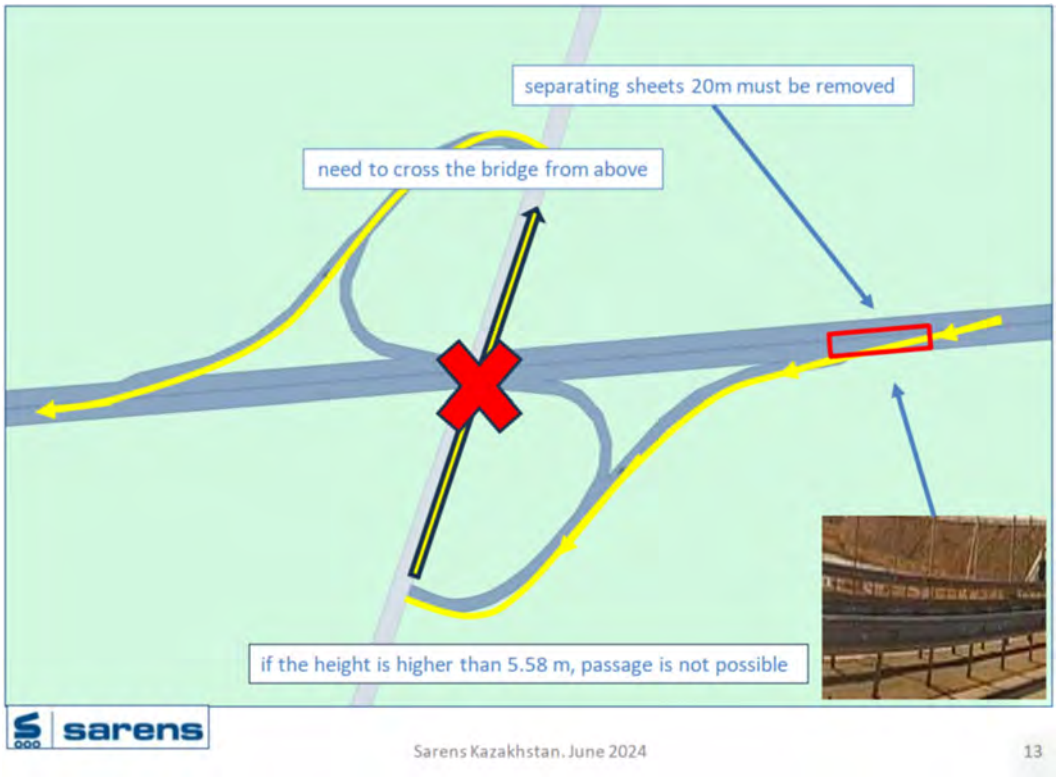
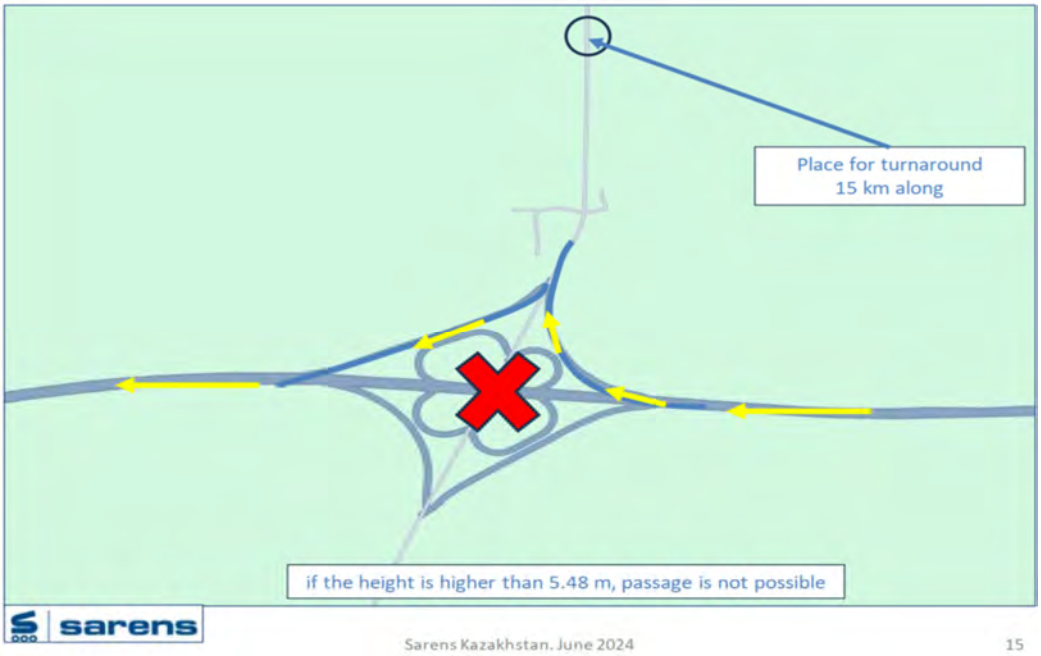


Figure 17-10: Example of crossing an interchange type 2 (Source: Road Survey)



1. Overhanging structures (road signs or pedestrian overpasses) (Figure 17-11)

Figure 17-11: Example of overhanging structure (Source: Road survey)



The proposed solution is the construction of a temporary bypass road (Figure 17-12).

Figure 17-12: Example of alternative road for overhanging structure (Source: Road survey)



2. Toll road checkpoints with canopies (Figure 17-12)

Figure 17-13: Example of toll road checkpoint (Source: Road survey)



The use of alternative access lanes is proposed; the survey confirmed their availability for the A-2 highway (Figure 17-14).

Figure 17-14: Alternative line for toll road checkpoint (Source: Road survey)



18.5.2 External Access Roads to the WPP Area

Access to the WPP area is currently limited to a small number of informal single-track routes, which are typically inaccessible between November and April due to weather conditions. The Project therefore requires the construction or upgrade of dedicated access roads capable of accommodating heavy and

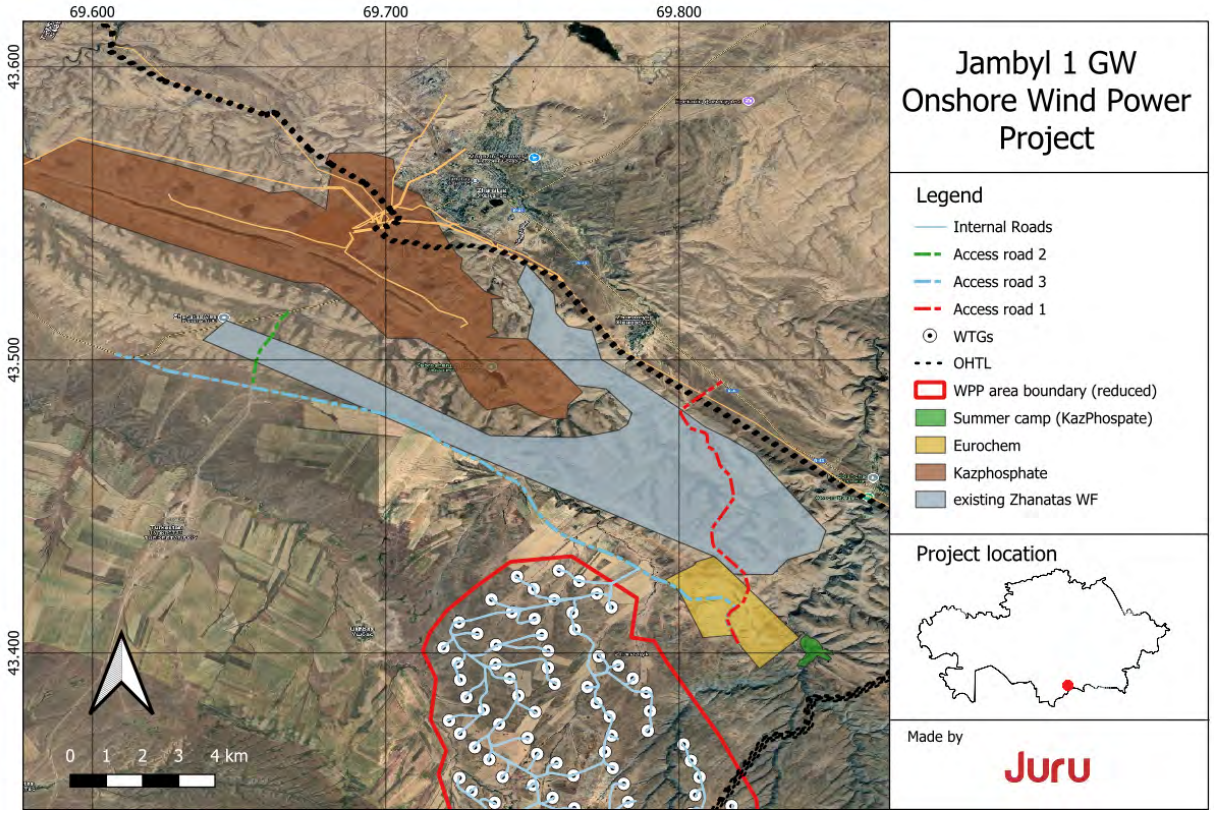
oversized wind turbine components, including blades of up to 110 m in length and nacelles weighing up to approximately 170 tonnes.

Sarens Kazakhstan LLP undertook a feasibility study to assess three potential access routes (Access Roads 1, 2 and 3) connecting the existing public road network to the WPP site (Figure 17-15). All access options utilise, in part, an existing asphalt road constructed by EuroChem LLP. Two of the options pass through or adjacent to the existing Zhanatas wind farm area.

The external access roads will connect the main highway network to the internal site road network and are anticipated to require approximately 12 to 21 km of new or upgraded road infrastructure, depending on the final route selection.

Detailed assessment of road structural integrity and engineering design of route modifications is outside the scope of this ESIA and is addressed through dedicated route surveys and EPC-led logistics planning.

Figure 17-15: Access roads



18.5.2.1 Route Options Overview

Table 17-1: Description of Access road options

Route Name	Length (Approx.)	Key Constraints	Feasibility Conclusion
Access-road 1	12 km	Max gradient 12.5% (requires additional puller). Corner modification (550m^2) required. 6.2m high tension cable needs raising. Original route passes through a mining area.	Recommended (Alternative Alignment): Utilise gravel bypass at PK 73 to avoid the mining area. Suitable with modifications.
Access-2	4 km	Alignment passes through Zhanatas city, posing risks due to dense public movement and heavy traffic. Steep descending slope (12%) requiring careful trailer angle adjustment.	Operationally viable but less favourable due to urban constraints.
Access-3	22 km	Longest route. Several steep sections requiring backfilling or grading to meet safe transport requirements. Drive train transport requires additional puller on steep slopes.	Technically suitable, but road improvements preferred over routine traction assistance

18.5.2.2 Preferred Route and Modifications

The preferred option is the alternative alignment of Access road 1, utilizing a well-compacted gravel road section at PK 73 to bypass the sensitive mining area, offering a more direct approach to the site.

Required physical modifications for the preferred route include:

- Widening the corner left turn connecting the Main Road to the branch road (approximately 550m^2 area).
- Reducing the steep gradient (near PK 18–19) through compacted soil or asphalt filling for smoother trailer passage.
- Raising the high tension cable measuring 6.2m to meet national safety standards.
- Constructing a concrete slab road where underground cable pipes are present.
- Use of additional pullers will be necessary for transporting heavy and oversized components (blade, nacelle, hub, towers) on required slopes.

The project will also establish an internal road network approximately 170 km long, constructed with compacted gravel surfaces.

18.5.3 Internal Road Network within the WPP Area

In addition to external access roads, an internal road network will be required within the WPP area to provide construction, operation and maintenance access to wind turbine locations, hardstandings, substations and associated infrastructure.

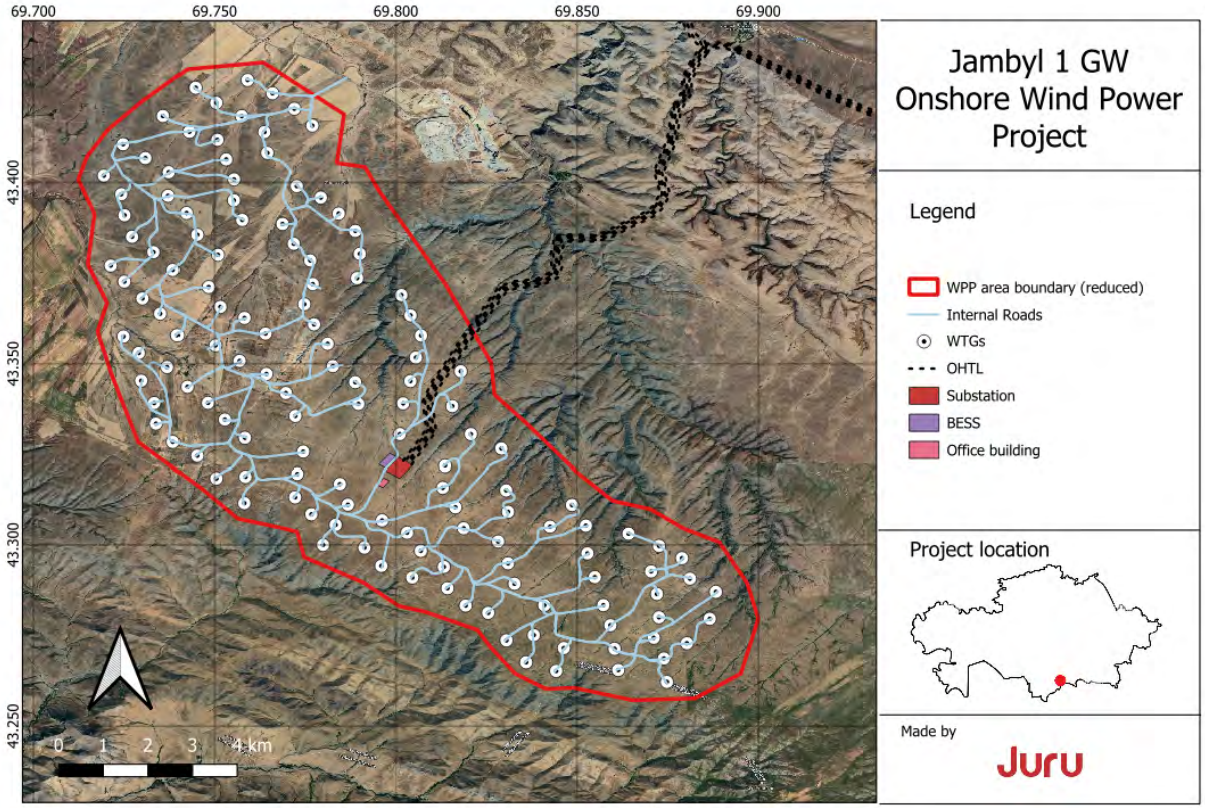
Internal access roads will typically comprise compacted gravel or stone surfaces and will generally be approximately 5–7 m in width. These roads will provide access for construction plant, delivery vehicles and O&M traffic throughout the operational life of the Project. Underground electrical cables are expected to

be installed parallel to internal roads where practicable.

The internal road layout has been defined on a preliminary basis for the purposes of the ESIA, with detailed design to be finalised by the EPC Contractor.

Based on the preliminary layout, the internal road network is expected to extend approximately 170 km in total and shown in Figure 17-16. The construction of internal roads will significantly improve year-round access within the WPP area compared to existing conditions, particularly during winter months when current tracks are often impassable.

Figure 17-16: Internal roads inside Project WPP area



18.6Potential Impacts

18.6.1 Construction Phase

The construction phase, lasting 36 months, represents the period of greatest potential traffic and transportation impact, due to the movement of construction materials, equipment, workforce vehicles and abnormal wind turbine component loads along external access routes and within the WPP area. Construction-related traffic will occur intermittently throughout the construction period, with periods of increased activity associated with delivery of turbine components and bulk construction materials.

Seasonal weather conditions, particularly during winter months, may further constrain abnormal load movements and will require careful scheduling and traffic management to maintain safety.

Construction traffic has the potential to give rise to the following impacts.

- **Road safety and accident risk:** Increased movements of Heavy Goods Vehicles (HGVs) and abnormal loads may increase the risk of traffic incidents affecting other road users, particularly during complex manoeuvres along access routes, including turning movements, gradient changes and temporary traffic control measures. Prior to the implementation of specific traffic management and safety measures, impacts on road safety are assessed as Minor to Moderate adverse.
- **Driver delay, pedestrian amenity and severance**: Temporary delays may occur where abnormal load movements require traffic control or short-term stoppages to allow safe passage, particularly at junctions and along sections of road undergoing improvement works. While the preferred access route avoids major urban centres, localised delays and temporary disturbance to road users and pedestrians may occur near settlements or along local access roads. These impacts are expected to be temporary, localised and reversible, and are assessed as Minor to Moderate adverse (pre-mitigation).
- **Access restrictions for land users within the WPP area**: The construction and upgrading of external access roads and the internal road network may temporarily restrict access for land users within the WPP area, including herders and seasonal grazers. Such restrictions are most relevant during the main construction period and may affect movement across grazing land and access to customary routes. Access constraints are exacerbated during wetter periods and winter months, when existing tracks become difficult to use due to snow and water-logged ground conditions, increasing the reliance on constructed access roads during construction. Prior to mitigation, this impact is assessed as Moderate adverse, reflecting the temporary nature of the effect and the importance of seasonal land use.

Overall, construction-phase traffic impacts are expected to be temporary, localised and reversible. With the implementation of appropriate traffic management, access controls and stakeholder engagement measures, residual impacts are anticipated to be reduced to Minor or Insignificant.

Activity/Impact/Aspect					
Construction traffic associated with delivery of materials, equipment, workforce and abnormal wind turbine component loads; construction and upgrading of access roads and internal road network.					
Type	**Duration**	**Extent**	**Scale of Impact**	**Frequency**	**Likelihood (unplanned**

					events)
Indirect	Temporary (construction phase)	Local (along external transport routes, internal site roads and WPP area)	Evident	Intermittent (periods of increased activity)	Low to Medium

Receptor	**Sensitivity**	**Magnitude**	**Significance of Impact**
Local road users and nearby communities along Project access routes	Low	Small to Medium	Minor
Land users within the WPP area (including herders and seasonal grazers)	Medium	Medium	Moderate

18.6.2 Operational Phase

During the operation phase (expected minimum 25 years), transport impacts are minimal. Traffic movement is limited primarily to light vehicles used by the estimated 60-80 operations personnel for maintenance and routine access.

HGV movements would only occur on an exceptional basis, such as during major component replacement, and are not expected to result in sustained changes to traffic conditions. As a result, the effect of operational traffic movements on local road users and nearby communities is assessed as Insignificant impact.

A positive residual impact is the retention of the constructed access roads and the internal network, improving connectivity and mobility for local land users within the WPP area, including during winter months when access has historically been limited.

Wind turbines and OHTLs represent tall structures that can present an obstacle hazard to aircraft, particularly during take-off/landing and low-level flight activity, and may also interact with aviation navigation/radar systems depending on the location and flight procedures. In line with international practice, a 30 km radius has been treated as the primary ("detailed") screening area for airports/airfields, with a wider ~60 km screening radius applied to identify any additional aerodromes or potential approach corridors that could be influenced by local topography. This is consistent with the approach adopted in other regional wind farm ESIAs (e.g., Zarafshan, which applied a 30 km study area for airports/airfields).

Based on the baseline review, no international airports are located within 60 km of the WPP area. The closest aviation facility is Birlik aerodrome, located approximately 40 km from the WPP area, which is reported to be used for general aviation, training and practice flights using light aircraft.

Given the separation distances to the identified air facilities and the absence of airports within 60 km, the Project is not expected to result in significant impacts on commercial aviation operations or airport approach/departure procedures. Notwithstanding this, the Project will be progressed in accordance with Kazakhstan's airspace and aviation safety requirements, including obtaining a Permit to Carry Out Activities That May Pose a Threat to Flight Safety where applicable, and implementing any aviation marking/lighting or other measures required by the competent authorities.

Activity/Impact/Aspect					
Operation and maintenance traffic associated with routine inspection, maintenance and servicing of the WPP, BESS, OHTLs and associated infrastructure.					
Type	**Duration**	**Extent**	**Scale of Impact**	**Frequency**	**Likelihood (unplanned events)**
Indirect	Long-term (operational life of the Project)	Local (limited to existing access roads and site infrastructure)	Small	Low and intermittent	Low

Receptor	**Sensitivity**	**Magnitude**	**Significance of Impact**
Local road users and nearby communities along Project access routes	Low	Small	Insignificant
Land users within the WPP area (including herders and seasonal land users)	Medium	Beneficial	Minor (beneficial)
Aviation receptors/airspace users (including Birlik aerodrome)	Medium	Negligible	Insignificant

18.7Mitigation and Monitoring

Mitigation measures will be integrated into the design, pre-construction planning, and management systems, predominantly through the development and implementation of a Traffic and Transportation Management Plan (TTMP). The EPC Contractor shall be responsible for developing and implementing the TTMP in accordance with the Framework ESMP and Masdar's cESMS/

18.7.1 Pre-Construction Mitigation

1. The EPC Contractor must complete all physical modifications identified for the preferred route, including corner widening and gradient reduction on Access #1, and successfully raise the 6.2m high tension cable. All necessary permits for abnormal load movements and temporary road use must be secured.

Figure 17-17: Access road 1 (blue)



2. The establishment of internal access tracks must be prioritised early in the project to minimise vehicle movement on uncontrolled or untracked areas.

3. Local authorities and communities along the access corridors must be consulted and notified in advance regarding abnormal load delivery dates and times.

18.7.2 Construction Mitigation

1. Strict controls must be enforced to prevent wildlife mortality and harassment and manage safety risks.

- Strict controls must include speed limits of 20 km/h on designated on-site roads and tracks and 10 km/h in off-road areas within working zones.
- There must be a ban against driving outside delineated access roads. Driving and machinery operation should be restricted to daylight hours[286].
- Prohibit night-time driving, driving in icy conditions, and ensure vehicles are not overloaded. Provide driver awareness training.

2. Movement of abnormal loads shall be restricted to outside of peak traffic periods to minimize community delays.

3. Regular road maintenance must be implemented, including watering and smoothing to suppress dust and inspecting/repairing stormwater systems. A post-construction road survey must be completed, with the EPC Contractor responsible for necessary repairs identified as caused by project traffic[287].

[286] Masdar Jambyl WPP BMP BMEP
[287] Environmental & Social Impact Study| Technical Summary (Revision 04 11-11-2025)

4. A formal Carcass Management procedure must be implemented, requiring the immediate removal of any carcasses (road-kills or otherwise) found by designated trained personnel to a designated area outside the project boundary[288].
5. Schedule major construction activities to avoid, where possible, the prime grazing season. Access restrictions to local pasture routes must be minimized.
6. Emergency Response: Robust safety protocols and emergency procedures must be established for complex tasks such as lifting operations and abnormal load movements, covering risks like loss of communication, load control failure, and ground stability issues.

18.8Residual Impacts

Despite comprehensive planning and implementation of the TTMP, the cumulative impact of managing numerous abnormal loads and substantial heavy traffic (for concrete/stone delivery) over the 36-month construction period will likely result in a temporary effect on the local and regional road network, assessed as having Minor to Moderate significance.

During the operation phase, the residual impact from regular traffic movements is deemed Negligible. The improved and permanent access roads will remain, providing a Minor benefit by enhancing mobility for local land users and site maintenance activities.

[288] Masdar Jambyl WPP BMP BMEP

18.9Mitigation, Management and Residual Impacts

18.9.1 Construction Phase

The mitigation and management measures presented in the table below address the potential traffic and transportation impacts identified for the construction phase of the Project. Construction represents the period of greatest traffic activity, associated primarily with the transport of abnormal and oversized loads, increased volumes of HGVs, workforce transport, and the construction and upgrading of access roads and internal site roads.

The measures are designed to minimise risks to road safety, community health and safety, access for local land users, and the integrity of the public road network, and to ensure that traffic-related activities are managed in accordance with national requirements, lender standards, and GIIP. Mitigation measures will be implemented through the Contractor's Traffic and Transportation Management Plan (TTMP) and the Project's cESMS). Residual impacts are assessed following the application of these measures.

Activity/Aspect	Pre- mitigation	Mitigation and Management Measures	Residual Significance
Abnormal load and HGV movements on public roads and access routes (road safety and CHS)	Minor–Moderate	• Develop and implement a Traffic and Transportation Management Plan (TTMP) in accordance with Masdar cHSSE MS. • Obtain all required permits and approvals for abnormal loads and use of public roads. • Implement defined haul routes, traffic controls, signage and use of trained banksmen/flagmen where required. • Provide driver induction and training, including defensive driving and adverse weather procedures.	**Minor**
Physical constraints and required route modifications on preferred access route	Moderate	• Complete all route modifications identified in feasibility studies prior to abnormal load movements (e.g. corner widening, gradient adjustment, protection or raising of overhead utilities). • Confirm safe clearance at overhead and underground utilities and implement permit-to-work procedures where applicable.	**Minor**
Driver delay and temporary disruption to other road users	Minor–Moderate	• Schedule abnormal load movements, where practicable, outside peak traffic periods. • Provide advance notification to local authorities and communities of abnormal load movements via established engagement channels. • Use traffic marshals and temporary traffic control measures at junctions and constrained locations.	**Minor**

Activity/Aspect	Pre- mitigation	Mitigation and Management Measures	Residual Significance
Temporary access restrictions for land users within the WPP area (herders and seasonal grazers)	Moderate	• Establish internal access roads early to minimise uncontrolled vehicle movements across grazing land. • Minimise temporary access restrictions and maintain agreed access routes where practicable. • Communicate construction schedules and access constraints in advance through the CLO and stakeholder engagement processes.	**Minor–Moderate**
Seasonal safety constraints (snow, ice, water-logged ground conditions)	Minor–Moderate	• Apply weather-related driving restrictions, including prohibition of driving in icy or unsafe conditions. • Adjust construction and transport scheduling as required to maintain safety during adverse weather conditions.	**Minor**
Temporary deterioration of road condition, dust and surface damage attributable to construction traffic	Minor–Moderate	• Implement routine road maintenance on unpaved sections (e.g. grading, watering where required). • Ensure vehicles are maintained in roadworthy condition and comply with load limits. • Undertake a post-construction road condition survey and repair damage attributable to Project traffic.	**Minor**
Construction traffic and access associated with OHTL installation (foundations, stringing, tower erection, maintenance access)	Minor–Moderate	• OHTL construction access routes shall, where practicable, follow existing tracks, roads, or previously disturbed corridors to minimise additional land take and avoid unnecessary traffic across undisturbed areas. • New access tracks shall be avoided where feasible; where unavoidable, they shall be temporary, minimised in width, and reinstated following completion of construction works. • Access planning for OHTL works shall be coordinated with findings from biodiversity, hydrology, soils and cultural heritage assessments, including adherence to defined buffer zones around sensitive receptors. • Vehicle movements along the OHTL corridor shall be restricted to designated routes, with off-track driving prohibited except where explicitly approved. • Seasonal constraints shall be applied where necessary, with particular consideration given to periods of snow cover, waterlogged ground conditions, and pasture use by herders, to reduce safety risks and ground damage. • Temporary access arrangements shall include appropriate erosion control and surface protection measures, particularly on slopes, near drainage features, and in soft ground conditions.	**Minor**

Activity/Aspect	Pre- mitigation	Mitigation and Management Measures	Residual Significance
		• Following completion of OHTL construction, temporary access routes shall be removed and land reinstated, unless retained by agreement with land users or landowners. • OHTL construction traffic and access controls shall be incorporated into the TTMP and relevant method statements prepared by the EPC Contractor.	
Traffic incidents, unsafe driving behaviour and community complaints	Moderate	• Implement TTMP procedures for incident and near-miss reporting, investigation and corrective actions. • Enforce compliance with speed limits, designated routes and working-time controls. • Provide access to the Project grievance mechanism for traffic-related complaints.	**Minor**

With the implementation of the mitigation and management measures outlined above, including the application of the TTMP, construction-phase traffic impacts are expected to be temporary, localised and reversible. Residual impacts on local road users, nearby communities and land users within the WPP area are assessed as Minor to Minor–Moderate and are considered acceptable in the context of national requirements, lender standards and GIIP.

18.9.2 Operation Phase

The mitigation and management measures presented below address the limited traffic and transportation considerations associated with the operational phase of the Project. During operation, traffic movements are infrequent and primarily associated with routine inspection, maintenance and servicing activities. Measures focus on ensuring ongoing compliance with applicable safety requirements and maintaining safe access arrangements for local road users and land users within the WPP area.

Sensitive Receptor	Pre-mitigation	Mitigation and Management Measures	Residual Significance
Routine operation and maintenance (O&M) traffic on public roads and internal access roads	Insignificant	• Manage routine O&M traffic in accordance with standard operational procedures and applicable road safety requirements. • Maintain internal access roads in a safe condition for Project and authorised third-party use.	**Insignificant**
Occasional heavy vehicle movements for major component replacement	Minor	• Plan infrequent heavy vehicle movements in advance and apply appropriate traffic controls where required. • Obtain any permits required for abnormal or heavy loads and coordinate with relevant authorities.	**Insignificant**

Sensitive Receptor	Pre-mitigation	Mitigation and Management Measures	Residual Significance
Aviation safety associated with the presence of WTGs and OHTLs	Insignificant	• Consult with the relevant civil aviation authority and any affected aerodrome operators to confirm applicable safeguarding requirements. • Obtain any required aviation permits or approvals prior to operation. • Implement aviation marking and lighting in accordance with national aviation requirements and authority guidance.	**Insignificant**
Retention of access roads and internal road network (beneficial impact for land users)	Beneficial	• Maintain permanent access roads and internal road network to allow continued safe access for land users and Project operations.	**Beneficial**

With the implementation of the measures outlined above, traffic and transportation impacts during the operational phase are assessed as Insignificant, with no additional mitigation required beyond standard operational management. The retention of access roads and the internal road network represents a Minor beneficial residual impact, improving connectivity and mobility for land users within the WPP area.

19 Climate

19.1 Introduction and Overview of Assessment Methodology

This section identifies and presents risks to the Project associated with current and future climatic conditions and covers the requirement for a Climate Change Risk Assessment (CCRA) to be prepared in accordance with the Equator Principles IV (2020)[289] (EP4), In line with that guidance, the scope of work includes consideration of climate-related 'Physical Risks' as defined by the Task Force on Climate-Related Financial Disclosure (TCFD)[290].

Note that combined Scope 1 and Scope 2 greenhouse-gas emissions from the Project are not expected to exceed 100,000 tCO_2e per year. Accordingly, the CCRA is focused on the assessment of physical climate-related risks only. Consideration of transition risks—typically policy, technology, market, and reputational risks—is not applicable for this Project, as the development of wind power in Kazakhstan is consistent with national policy objectives and renewable-energy targets.

The assessment evaluates the Project's long-term climate resilience and considers whether the Project may influence the wider vulnerability and adaptive capacity of neighbouring receptors.

This section aims to identify the likelihood of future climate hazards and their potential impacts on the operation of the Project, Project workers and neighbouring communities. This is fundamental for informing the prioritization of climate action and adaption and resilience management requirements for the Project.

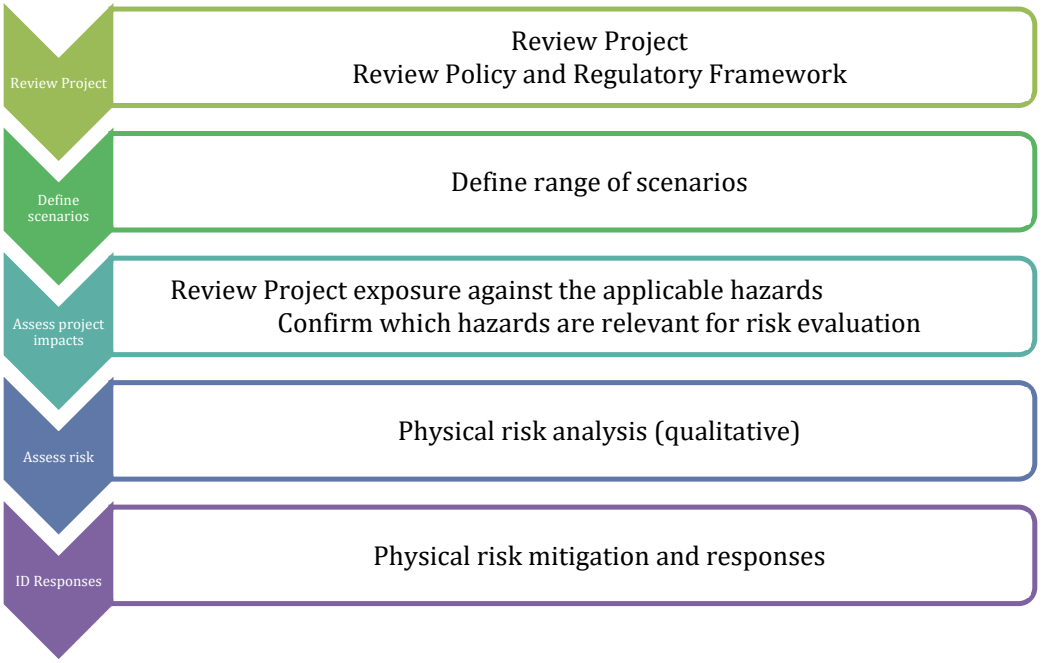
In line with EP4 and the recommendations of the TCFD, the CCRA considers climate-related physical risks—both acute and chronic—that could affect the Project during construction and operation. These include extreme-weather events, gradual climatic shifts, and secondary effects such as water stress or soil instability.

Figure 18-1 outlines the main steps to complete a qualitative assessment for physical risks aligned with the TCFD process for applying scenario analysis of climate related risks and opportunities suitable for wind projects.

[289] https://equator-principles.com/app/uploads/The-Equator-Principles_EP4_July2020.pdf

[290] https://www.fsb-tcfd.org/

Figure 18-1: Process for climate change risk assessment



19.2Applicable Requirements & Standards

19.2.1 National Regulations

Kazakhstan's climate policy framework is anchored in the Environmental Code (2021), which consolidates environmental regulation and embeds state control functions, public participation, EIA requirements and the "polluter pays" principle. The Code establishes the legal basis for greenhouse-gas (GHG) regulation, including state regulation of GHG emissions and removals and the preparation and implementation of the country's Nationally Determined Contributions (NDCs) under the Paris Agreement[291].

Kazakhstan has adopted a long-term carbon-neutrality target by 2060, approved by Presidential Decree No. 121 (2 February 2023)[292]. The Strategy on Achieving Carbon Neutrality by 2060 sets sectoral transformation pathways (energy, industry, transport, buildings, Agriculture, Forestry and Other Land Use (AFOLU)), investment needs and governance arrangements for delivery, with wind projects forming part of this strategy.

At the national planning level, Kazakhstan pursues a Green Economy transition. The Concept for Transition to a Green Economy (2013) remains a central policy driver; related power-sector objectives include scaling renewables and modernising networks. Recent national policy statements reiterate an electricity target of 50% alternative and renewable sources by 2050[293].

Under the Paris Agreement, Kazakhstan's updated NDC (2023) confirms:

- Unconditional target: 15% reduction below 1990 GHG levels by 2030.
- Conditional target: 25% reduction below 1990 by 2030, subject to international support and

[291] https://adilet.zan.kz/eng/docs/K2100000400

[292] Government of Kazakhstan, Environmental Code No. 400-VI, 2021 https://unfccc.int/documents/641563

[293] Decree of the President of the Republic of Kazakhstan No. 577, "Concept for Transition to a Green Economy", 2013; Government of Kazakhstan

technology transfer.

These mitigation targets are accompanied by adaptation priorities across climate-sensitive sectors[294].

Kazakhstan also operates an Emissions Trading System (ETS) under the Environmental Code (updated framework since 2021), used as the principal market instrument for GHG mitigation[295].

Law on Industrial Safety and Environmental Control (2021, amended 2023) establishes comprehensive requirements for safety and environmental control in industrial and energy projects. It requires the development of emergency plans considering technological and natural hazards, including climate-related extremes (e.g., storms, temperature fluctuations).

KazHydroMet Climate Adaptation Framework (2022) provides technical guidelines for climate-risk assessment and adaptation planning at project level. It includes standard climate indicators (temperature, precipitation, drought indices, wind extremes) and recommends the integration of probabilistic climate scenarios into EIA studies.

Overall, the Project is aligned with Kazakhstan's national policy and regulations, and their commitment to the Paris Agreement commitments, by displacing fossil-fuel generation and reducing emission intensity in the national grid mix.

2.1.1. Lender Requirements

International Finance Corporation (IFC)

IFC's Performance Standard 1 should consider the emissions of greenhouse gases (GHGs), the relevant risks associated with a changing climate and the adaptation opportunities, and potential transboundary effects, such as pollution of air, or use or pollution of international waterways.

Under PS 3 projects that are expected to generate more than 25,000 tonnes of CO_2 equivalent (t CO_2e) per year are required to quantify direct and indirect GHG emissions; however, the 25 000 t CO_2e per year threshold for mandatory quantification relates to annual operational emissions, as these represent the ongoing contribution to atmospheric greenhouse gases. As a renewable-energy facility the Project will have negligible direct emissions and limited auxiliary electricity use, and therefore its combined Scope 1 and Scope 2 emissions are far below the 25 000 t CO_2e per year threshold, and detailed quantification is not required. Therefore the focus of this assessment is on the Project's climate-resilience objectives.

Equator Principles

EP4 also sets out obligations for CCRA in line with the recommendations of the TCFD. Following the EP4 guidance note on CCRA[296], a CCRA is required in the following instances:

- For Category A and, as appropriate, Category B projects. For these projects the CCRA is to include consideration of relevant climate-related 'Physical Risks' as defined by the TCFD.
- For all projects, in all locations, when combined Scope 1 (direct) and Scope 2 (indirect electricity) emissions are expected to be more than 100,000 (tCO2e) per year. For these projects the CCRA is to include consideration of climate-related 'Transition Risks' (as defined by the TCFD)[297].

[294] UNFCCC NDC Registry, "Republic of Kazakhstan Updated NDC 2023" https://unfccc.int/NDCREG.

[295] https://www.gov.kz/memleket/entities/ecogeo?lang=en

[296] https://equator-principles.com/app/uploads/CCRA_Guidance_Note_Sept2020.pdf

[297] The TCFD sets out a process for scenario risk to climate related risks and opportunities to support the integration of scenario analysis into strategic planning and project risk management.

In accordance with the TCFD and EP4, consideration of “transition risk” applies primarily to projects whose combined Scope 1 and 2 greenhouse-gas (GHG) emissions are expected to exceed 100,000 t CO_2e per year, as such activities may be exposed to policy, legislative, market or technological shifts designed to reduce national emissions. The Project will generate electricity from renewable sources and therefore contributes to, rather than is affected by, the transition to a low-carbon economy. Its direct (Scope 1) and indirect (Scope 2) operational emissions are negligible and well below the 100,000 t CO_2e per year materiality threshold. Consistent with TCFD guidance, transition risks are considered non-material, and detailed quantification of Scope 1 and 2 emissions is therefore not required; the assessment instead focuses on physical climate-related risks relevant to project design, operation and resilience.

19.3Baseline Climate Overview and Conditions

19.3.1 Overview

The climate of the project area is characterized by low precipitation, high evaporation, and significant daily and annual variations in air temperature, resulting in sharp continentality and aridity.

According to the National Atlas[298], five main natural zones are identified across the country's territory: forest-steppe (in the far north of the country), steppe (in the north), semi-steppe (central belt), desert (southern half of the country's territory), and the altitudinal zonation (high-altitude zone) in the southeastern and eastern parts of the country. According to the Köppen-Geiger classification, 13 climate types are identified across Kazakhstan, the dominant ones being Dfb (Cold, no dry season, warm summer), BSk (arid, steppe, cold), and BWk (arid, desert, cold).

The project territory is located in the altitudinal zonation and desert zones according to the National Atlas, and in the Dsa (Cold, dry summer, hot summer) and BSk zones according to Köppen-Geiger (Figure 18-2 and Figure 18-3).

The data in this chapter is derived from the detailed climate conditions assessment, which was conducted in the hydrological report (see **ESIA Volume III**) prepared by IDOM for the project.

The 4 weather stations closest to the project area are located in the cities of Taraz, Zhanatas, Karatau, and the Kozhakhmetov settlement. The closest one to the WPP site is located in Zhanatas (about 20 km from the WPP area), and this data is relevant for the eastern foothills of the Small Karatau. For the OHTL Kentau, data from the Kozhakhmetov weather station is more appropriate, which is located west of the Karatau ridge. The locations of the weather stations are provided in Table 18-1 below.

Table 18-1: Locations of climatic station

Name of weather station	Elevation (m.a.s.l.)	Recorded period	Coordinates (WGS-84 system)	
			Latitude	Latitude
Zhanatas	519	2010-2023	43°33'26.38"N	69°42'39.27"E
Kozhahmetov (Old name Shayan)	326	2000-2023	43° 1'17.07"N	69°21'56.08"

[298] National atlas of the Republic of Kazakhstan, volume 1, Natural conditions and resources. - Almaty, 2010. - P. 119.

Figure 18-2: Natural zones of Kazakhstan[299]

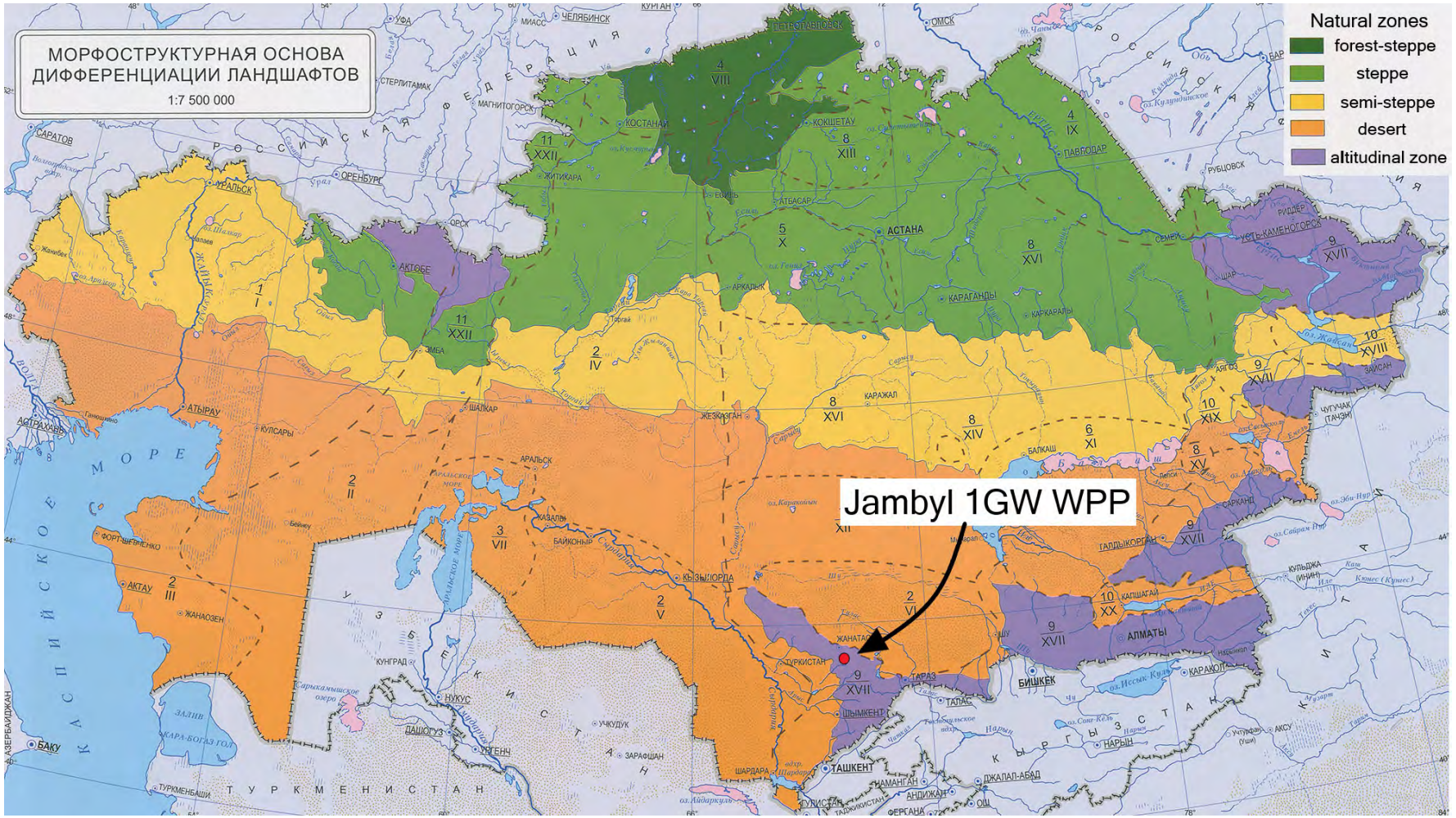
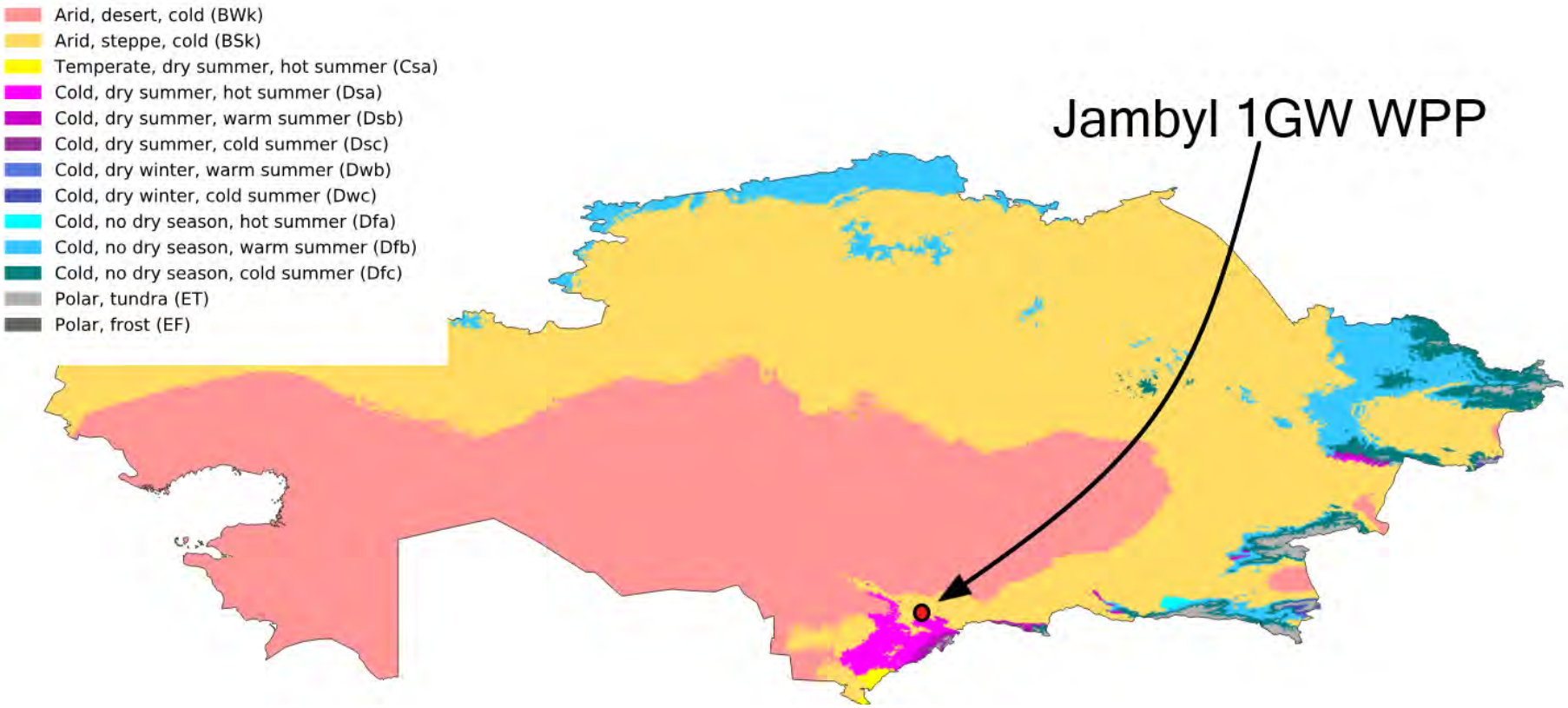


Figure 18-3: Climatic classification of Kazakhstan by Köppen–Geiger[300]



[299] National atlas of the Republic of Kazakhstan, volume 1, Natural conditions and resources. - Almaty, 2010. - P. 119

[300] Beck, H.E., Zimmermann, N. E., McVicar, T. R., Vergopolan, N., Berg, A., & Wood, E. F. "Present and future Köppen-Geiger climate classification maps at 1-km resolution". Nature Scientific Data. DOI:10.1038/sdata.2018.214.

19.3.2 Temperature

The temperature regime in the Turkestan and Zhambyl regions near the Small Karatau are similar, with a 1-2 degree difference between mean temperatures, and a tendency for higher temperatures on the Turkestan side.

Table 18-2 and Table 18-3 present the temperature data for the Zhanatas (Jambyl region) and Kozhahmetov (Turkestan region) stations respectively: in terms of mean, mean maximum, and mean minimum temperature by month; visualization of the data is also provided in Figure 18-4 and Figure 18-5.

Table 18-2: Monthly average temperatures at Zhanatas station

Month	Average temperature (°C)		
	Min.	Mean	Max.
January	-6.8	-3.6	0.6
February	-5.5	-2	2.4
March	1.5	5.8	11.2
April	8.6	13.8	19.8
May	13.8	20.1	26.6
June	19.3	25.8	32.2
July	21.2	28.0	34.5
August	18.9	25.6	32.4
September	13.0	19.2	26
October	6.1	11.1	17.2
November	-1.2	2.6	7.5
December	-5.8	-2.5	1.7

Table 18-3: Monthly average temperatures at Kozhahmetov station

Month	Average temperature (°C)		
	Min.	Mean	Max.
January	-7.0	-2.6	2.8
February	-4.4	0.2	6.0
March	2.7	8.1	14.7
April	8.5	14.6	21.3
May	13.6	20.8	28.0
June	17.8	26.3	33.8

Month	Average temperature (°C)		
	Min.	Mean	Max.
July	20.4	28.7	36.0
August	19.2	27.2	34.5
September	13.0	20.8	28.8
October	5.6	12.3	20.2
November	-0.4	4,7	11,5
December	-5.6	-1.4	4.2

Figure 18-4: Monthly average temperature regime (Zhanatas station)

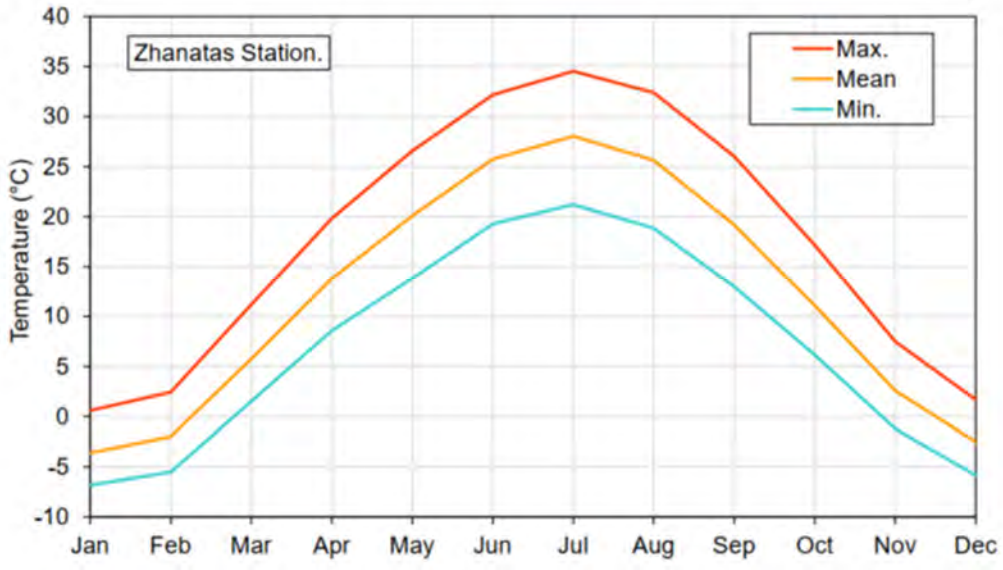
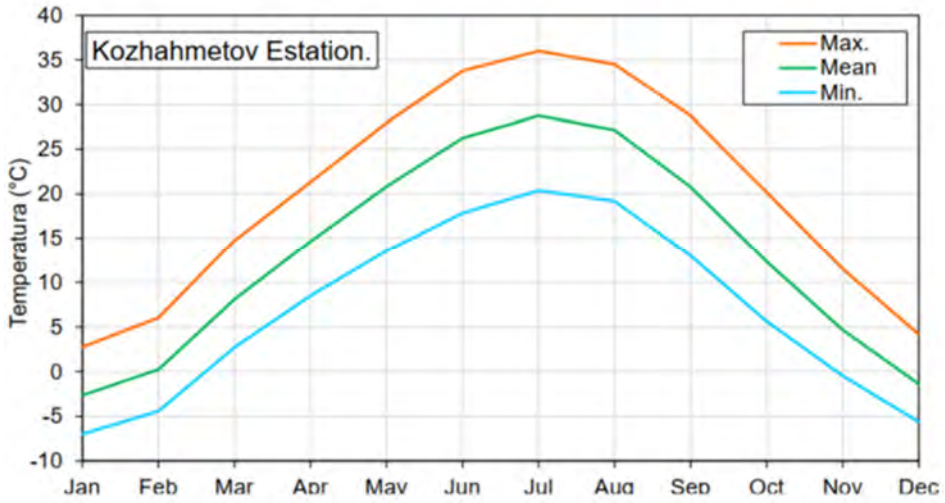


Figure 18-5: Monthly average temperature regime (Kozhahmetov station)



Absolute temperature data is available for the Karatau city, with the highest temperature reaching +41.2 °C in July and the lowest temperature dropping to -35.3 °C in January[301]. According to media reports, the temperature in Karatau set a new minimum temperature record of -37.2 °C in 2024[302].

According to Construction standards and regulations (SNiP RK 2.04-01-2010: Categorization of territories of the Republic of Kazakhstan for construction needs), the average air humidity in Taraz (the closest city to the project area among those listed in the document) for the coldest month is 76% and 40% for the warmest; for Turkestan, humidity data at 3 PM is provided for the coldest and warmest months, which are 74% and 17%, respectively.

19.3.3 Precipitation

Mean precipitation at both stations (Zhanatas and Kozhahmetov) are similar, although on average, the Kozhakhmetov station observed 5-10 mm more precipitation per month. The wettest months are April and October-November. From January to March and from November to December, snow accounts for the majority of precipitation in the project area.

Data on mean precipitation at the stations are presented in Table 18-4 and Table 18-5, and graphically shown in Figure 18-6 and Figure 18-7.

Table 18-4: Monthly average precipitation at Zhanatas station

Month	Monthly mean rainfall (mm)		
	Min.	Mean	Max.
January	17	32	71
February	5	31	92
March	5	45	116
April	9	33	71
May	4	20	58
June	0	17	44
July	0	3	17
August	0	4	12
September	0	2	10
October	3	26	57
November	4	34	104
December	4	34	83

Table 18-5: Monthly average precipitation at Kozhahmetov station

[301] Kazhydromet: climate report for the Zhambyl region (https://meteo.kazhydromet.kz/database_meteo/ Combination with that article)

[302] https://tengrinews.kz/kazakhstan_news/temperaturnyiy-rekord-62-letney-davnosti-pobit-v-kazahstane-523216/

Month	Monthly mean rainfall (mm)		
	Min.	Mean	Max.
January	19	51	115
February	6	47	102
March	8	56	138
April	11	48	111
May	2	35	118
June	0	9	30
July	0	3	12
August	0	4	22
September	0	3	13
October	0	29	80
November	7	45	93
December	12	47	85

Figure 18-6: Average precipitation graph (Zhanatas station)

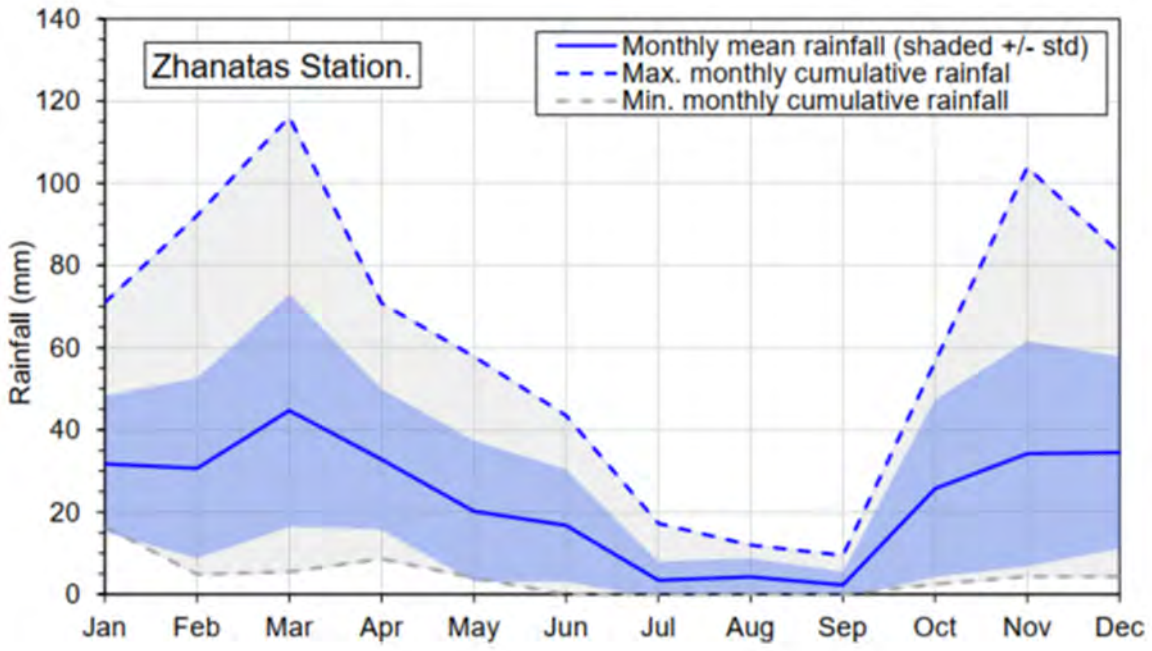
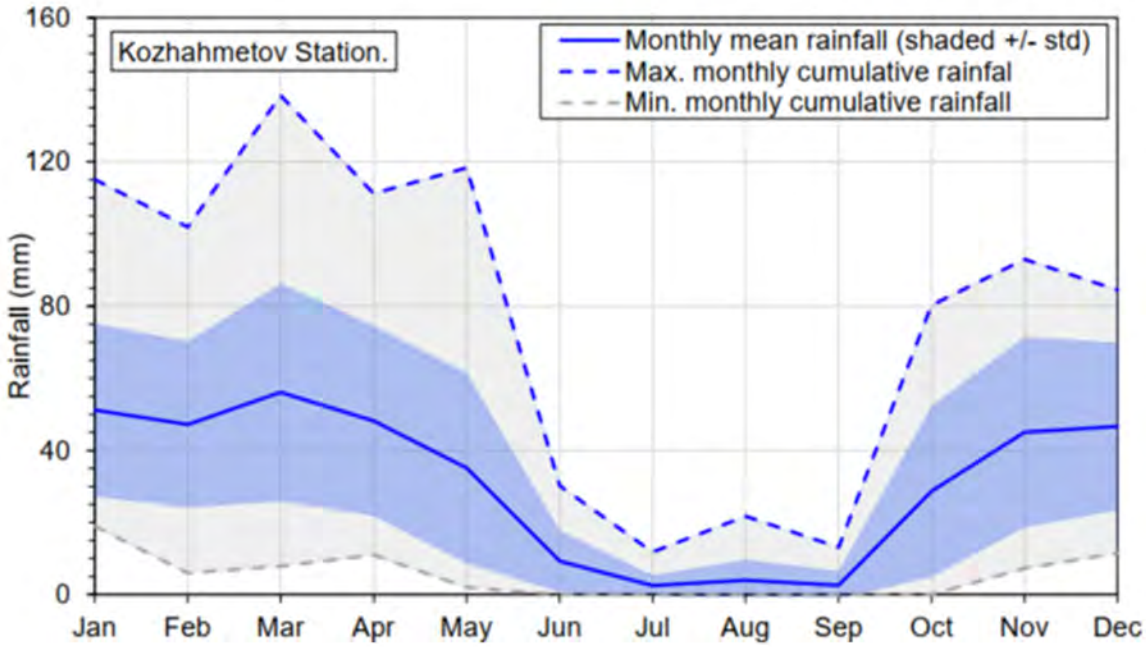


Figure 18-7: Average precipitation graph (Kozhahmetov station)



Maximum and minimum precipitation for 24 hours for the period between 2000 and 2023 are shown in Table *18-6*.

Table 18-6: 24-hr Precipitation extremums for the period 2000 – 2023 (Zhanatas weather station).

	Zhanatas	Kozhahmetov
Maximum (mm)	37.9	41.2
Mean (mm)	24.6	26.6
Minimum (mm)	13.0	17.8

A frequency analysis was performed on the long-term extreme precipitation data for return periods ranging from 1 to 500 years, the results of which are presented in Table 18-7.

Table 18-7: Return periods for 24-hour precipitation

Return period (years)	Zhanatas	Kozhahmetov
1.01	10	15
2.33	25	27
5	32	32
10	37	37
20	43	41

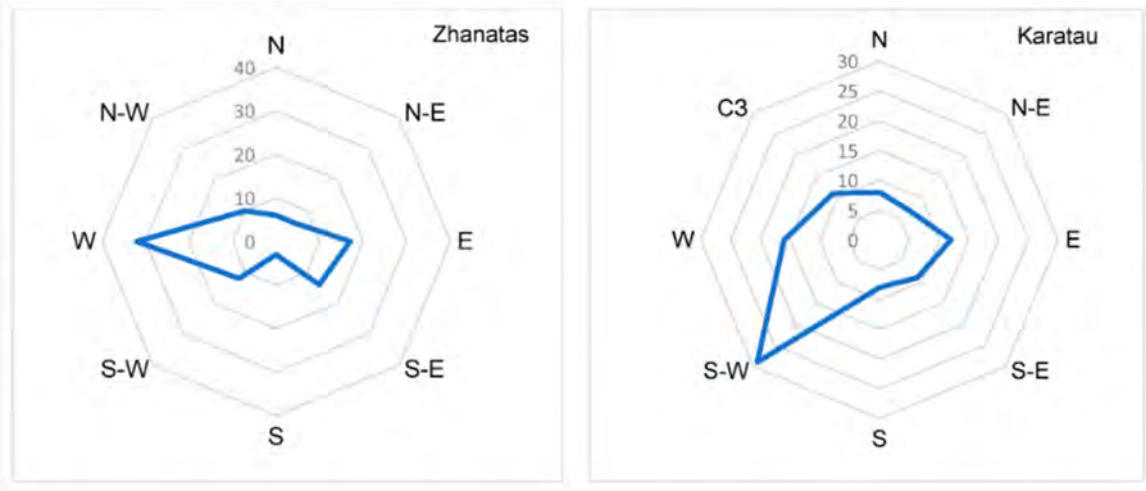
Return period (years)	Zhanatas	Kozhahmetov
25	44	42
30	46	43
50	49	46
100	54	50
200	60	54
500	66	60

The snow cover depth in the project area on March 31 has ranged from 0.2 to 0.6 m over the last 15 years[303].

19.3.4 Wind

According to published literature data the average wind speed in Zhanatas is 2.5 m/s, while in Karatau it is 1.2 m/s, with the maximum wind speed in Zhanatas and Karatau being 30 m/s and 27 m/s respectively. In Kentau, the prevailing wind direction is north-west, with the most frequent wind speeds ranging from 20 to 30 m/s[304] (Figure 18-8).

Figure 18-8: The wind roses for the cities of Zhanatas and Karatau, 2022 (compiled by the Kaimuldinova K., based on Kazhydromet data)



The elevated position of the WPP area from its surroundings means that it experiences significantly higher average wind speeds thus making it suitable for the location of a wind project. Annual wind speed monitoring at a height of 130m showed a mean wind speed of 9 m/s, with a mean monthly maximum of 9.5 m/s (December–January), and a minimum of 8 m/s (June–July). The data is presented in Figure 18-9.

[303] Review of the Climate Characteristics in the Territory of Kazakhstan for 2022. Kazhydromet. Astana. 2023.

[304] https://www.meteoblue.com/ru/1522751

Figure 18-9: Results of annual wind speed monitoring for Jambyl WPP (130m height)



19.3.5 Existing Climate-Related Hazards

The Jambyl region has been frequently impacted by severe weather conditions in recent years, including strong winds, drought, and high temperatures[305]. The Turkestan region has experienced droughts, extremely high temperatures during the summer, and sudden heavy snowfalls in winter[306]. Both regions are subjected to dust storms.[18]

Over the past 15 years, several extreme wind events have occurred in the Zhambyl region: in 2013, cases of damage to the OHTL and central heating system were recorded in Zhanatas and Karatau cities (Figure 18-10); in 2021 and 2023, hurricanes occurred, leading to the tearing off of roofs of residential buildings and damage to the OHTL (Figure 18-11)[17].

Since the Kyzylkum desert is located to the west of the project area, and the Moiynkum desert to the east, the project is located in a zone affected by dust storms with a frequency of about 10 times per year in the foothills. Nevertheless, because the WPP area is located higher in the mountains, the frequency may be lower. A map of the expected dust storm frequency is presented in Figure 18-12.

[305] Kaimuldinova, K., Aliaskarov, D., Laiskhanov, S., Wendt, J. A., & Muzdybayeva, K. (2024). Exposure to wind as a threat to the sustainable development of small towns in the Jambyl Region (Kazakhstan). Sustainability, 16(5), 2144. https://doi.org/10.3390/su16052144

[306] Zh.K. Isabekova et al. Overview of natural hydrometeorological phenomena, observed on the territory of the Republic of Kazakhstan. Hydrometeorology and Ecology. N.1. 2023. DOI: 10.54668/2789-6323-2023-108-1-42-77

Figure 18-10: Damage caused by the strong wind in Zhambyl region in 2013



Figure 18-11: Example of damage caused by the strong wind in Zhambyl region in 2021



Droughts are another common problem for Kazakhstan, with the increase in droughts in Southern Kazakhstan leading to the shallowing of rivers and crop failures. The project area is located in severely arid territories within the borders of the Turkestan region and arid territories in the Zhambyl region (according to the proposed hydrothermic index, based on the ratio of precipitation amount to the sum of active temperatures) (Figure 18-13)[307].

[307] Analysis of dry conditions in Kazakhstan Republic. SITUATIONAL ANALYSIS: Drought in Central Asia. R. Mirzadinov, R. Iskhojaev. Almaty, 2021.

Figure 18-12: Annual dust storm frequency for Kazakhstan[308]

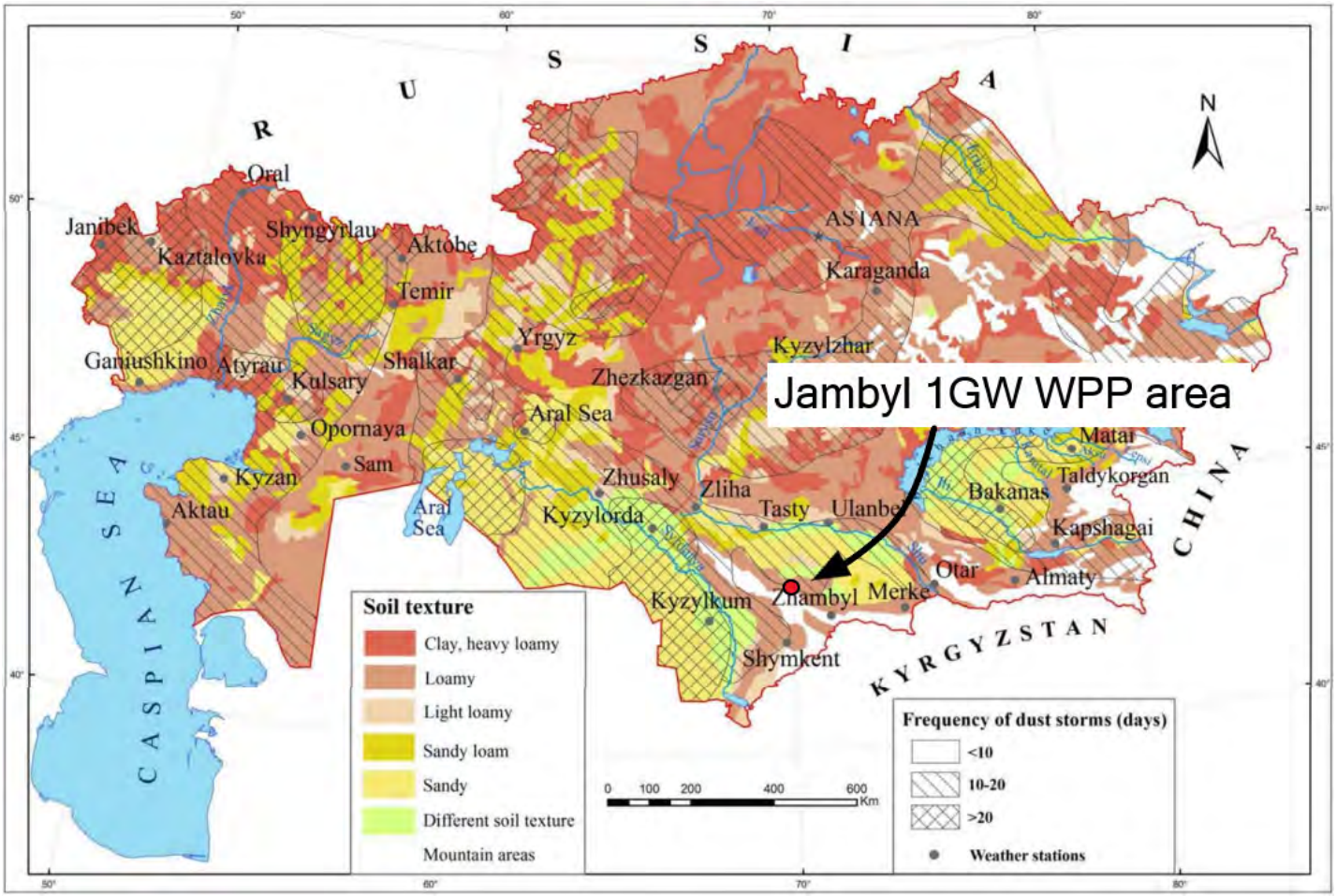
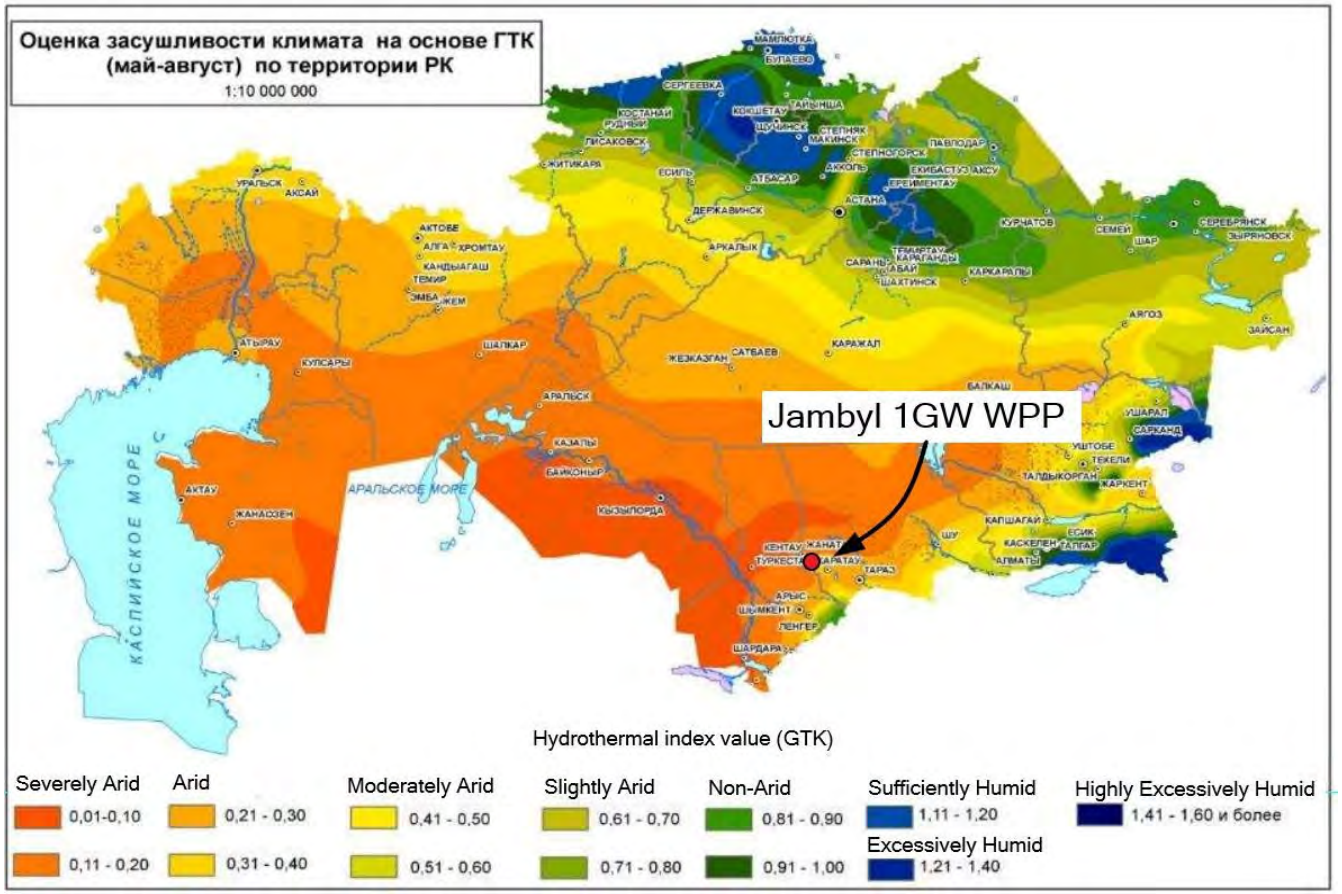


Figure 18-13: Hydrometric index values within Kazakhstan[309]



[309] Analysis of dry conditions in Kazakhstan Republic. SITUATIONAL ANALYSIS: Drought in Central Asia. R. Mirzadinov, R. Iskhojaev. Almaty, 2021.

19.4Climate Change Trends and Projections

This section summarises projected changes in temperature, precipitation and associated climate hazards for Kazakhstan, with emphasis on the southern region encompassing the Jambyl Project site. The projections are drawn primarily from the *Eighth National Communication and Fifth Biennial Report of the Republic of Kazakhstan to the UNFCCC (2022*[310]*)*, *Climate Fact Sheet for Kazakhstan (GERICS, 2018)*[311], supplemented by the *World Bank/ADB Climate Risk Country Profile for Kazakhstan (2021)*[312].

Together, these sources provide the most authoritative datasets for national climate scenarios under the latest IPCC climate pathways (SSP2-4.5 and SSP5-8.5). The Shared Socioeconomic Pathways (SSPs) are a set of global climate scenarios developed by the Intergovernmental Panel on Climate Change (IPCC) to explore how future greenhouse gas (GHG) emissions and social development trends may influence the Earth's climate by the end of this century. SSP2-4.5 (Intermediate Pathway): Represents a "middle-of-the-road" scenario. SSP5-8.5 (High-Emission Pathway): Represents a fossil-fuel-intensive development trajectory with rapid economic growth and high energy demand, where global CO_2 emissions continue to rise throughout the century.

19.4.1 Temperature Projections

The Eighth National Communication (Section 6.4; Table 6.7 and Figures 6.15–6.17) presents multi-model ensemble results for surface air-temperature change relative to the 1986–2005 baseline:

- **By 2041–2060:**
    - *SSP2-4.5:* +2.3 – 2.6 °C average annual increase.
    - *SSP5-8.5:* +3.0 – 3.5 °C average annual increase.
- **By 2081–2100:**
    - *SSP2-4.5:* +3.3 – 3.9 °C increase.
    - *SSP5-8.5:* +6.2 – 7.3 °C increase.

Warming is projected to be strongest in winter and spring, particularly in northern and eastern oblasts, though the southern regions including Jambyl and Turkistan will also experience substantial increases in hot days and heatwaves.

The report projects a lengthening of the warm season by 20–40 days by 2050 and a

reduction in frost days of 20–40 %.

The model ensemble projects an increase (albeit with high uncertainty) in the number of days with temperatures above 35°C, with an ensemble median increase from around 8 days per year to 38 days per year over the 21st century[24].

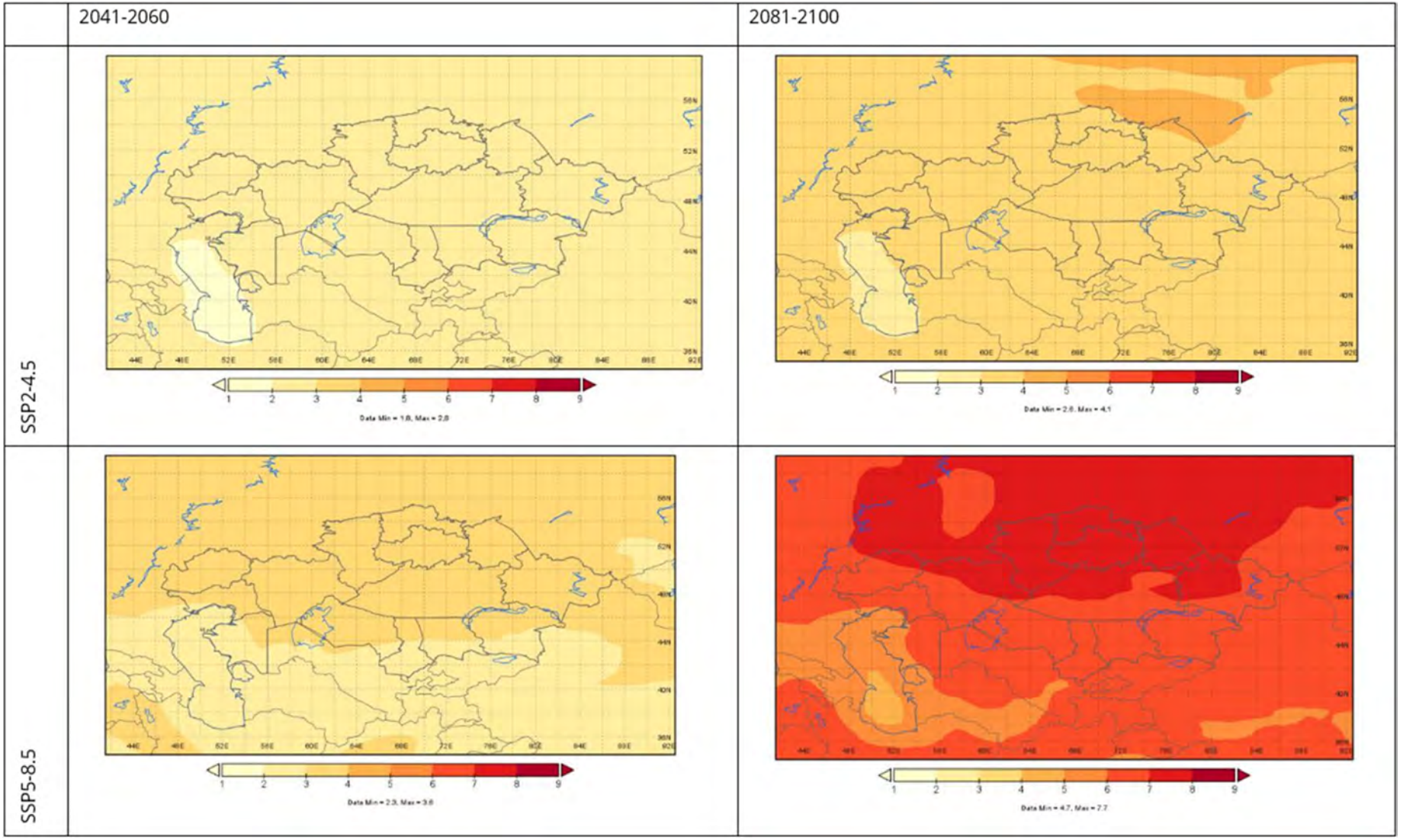
The projected change in average temperatures under the SSP2-4.5 and SSP5-8.5 scenarios are presented in Figure 18-14.

[310] https://www.undp.org/kazakhstan/publications/8th-national-communication-and-5th-biennial-report-republic-kazakhstan-un-framework-convention-climate-change

[311] https://www.climate-service-center.de/products_and_publications/fact_sheets/climate_fact_sheets/ index.php.en

[312] https://www.adb.org/publications/climate-risk-country-profile-kazakhstan

Figure 18-14: Probable change in average annual air temperature under scenarios of changes in the concentration of greenhouse gases SSP2-4.5 and SSP5-8.5



The data from the UNFCCC (2022) report is in harmony with the GERICS report (2015), according to which:

- The likely range for the increase in average temperatures will be from +1.5 to +2.5°C by 2030, from +2.0 to +3.8°C by 2050, and from +2.3 to +6.1°C by 2085.
- The very likely range will be +1.2 to +3.0°C by 2030, +1.4 to +4.4°C by 2050, and +1.3 to +7.4°C by 2085.

According to the Representative Concentration Pathway (RCP) scenario system, an annual average temperature increase of 2.2°C - 2.7°C by mid-century is expected (ESCAP, 2022). Detailed forecasts based on different RCP scenarios are presented in Table 18-8.

Table 18-8: Projected anomaly (changes °C) for temperatures in Kazakhstan for 2040–2059 and 2080–2099, from the reference period of 1986–2005 for all RCPs[313]

Scenario	Average Daily Maximum Temperature		Average Daily Temperature		Average Daily Minimum Temperature	
	2040-2059	2080-2099	2040-2059	2080-2099	2040-2059	2080-2099
RCP2.6	1.7 (-1.0, 4.7)	1.6 (-1.1, 4.5)	1.7 (-0.7, 4.4)	1.6 (-0.8, 4.2)	1.8 (-0.5, 4.1)	1.6 (-0.6, 4.1)
RCP4.5	2.9 (-0.4, 5.0)	2.9 (0.5, 5.9)	2.1 (-0.3, 4.6)	2.9 (-0.5, 5.6)	2.3 (0.0, 4.6)	3.1 (0.6, 5.7)
RCP6.0	2.0 (-0.6, 4.7)	3.6 (1.0, 6.8)	2.0 (-0.4, 4.5)	3.6 (1.3, 6.5)	2.0 (-0.3, 4.4)	3.7 (1.4, 6.3)
RCP8.5	2.8 (0.2, 5.7)	5.7 (2.9, 9.0)	2.8 (0.5, 5.4)	5.7 (3.3, 8.6)	3.0 (0.7, 5.4)	6.1 (3.4, 8.7)

19.4.2 Precipitation Projections

According to UNFCCC (2022, Table 6.8 and Figures 6.18–6.20), Kazakhstan will experience modest but spatially variable increases in total precipitation, with more pronounced seasonal redistribution:

Period	Scenario	Annual Change (%)	Seasonal Pattern
2041–2060	SSP2-4.5	+6.9 % (mean)	Winter +14 %, Spring +7.6 %, Summer -2.2 %, Autumn +5.5 %
	SSP5-8.5	+8.1 % (mean)	Winter +17.2 %, Spring +8.9 %, Summer -2.2 %, Autumn +4.3 %
2081–2100	SSP2-4.5	+11.2 % (mean)	Winter +19.7 %, Spring +13.3 %, Summer ≈ 0 %, Autumn +7.1 %
	SSP5-8.5	+13.8% (mean)	Winter +35.2 %, Spring +16.5 %, Summer -12.1 %, Autumn +6.7 %

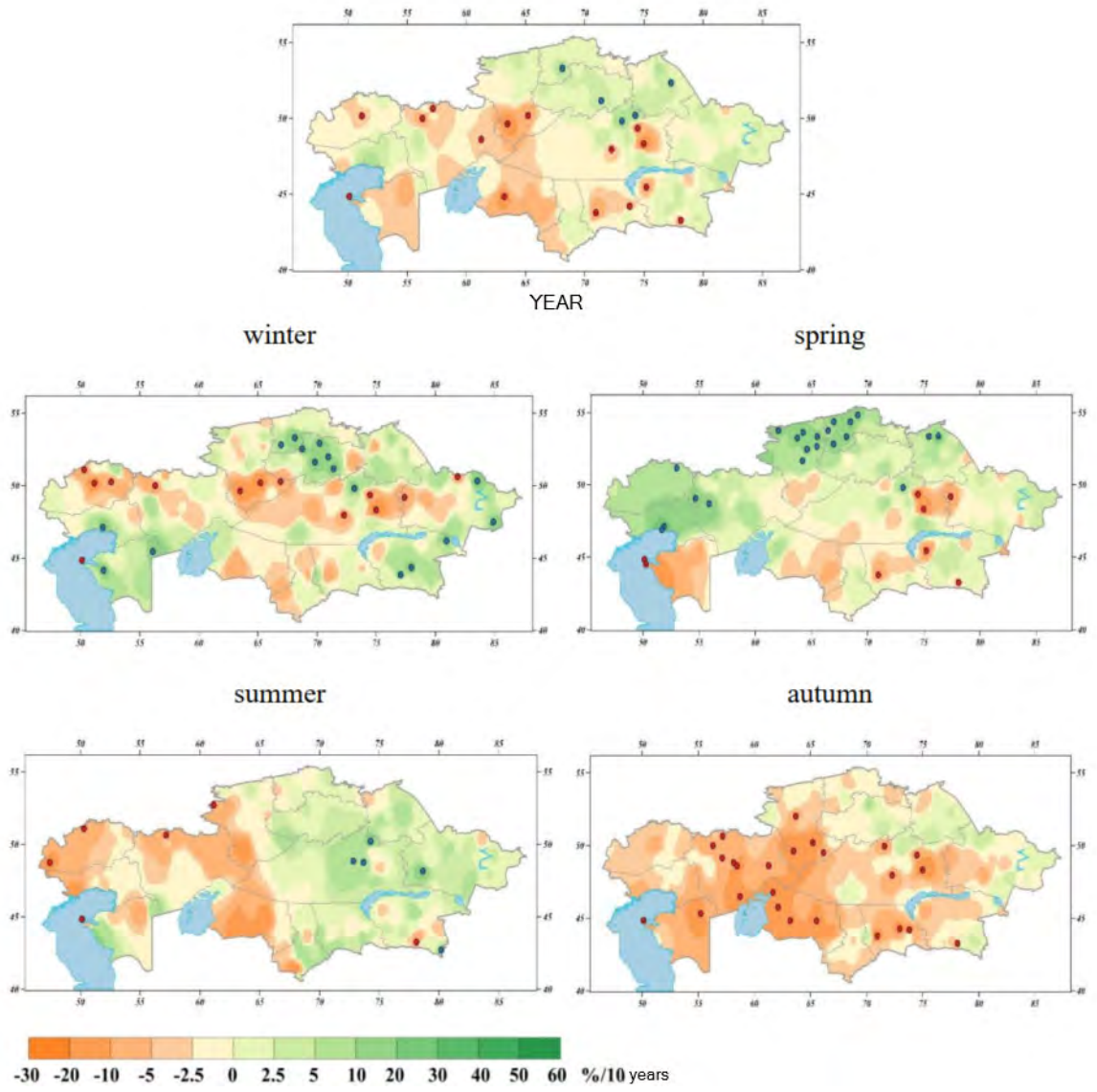
Despite overall annual increases, southern Kazakhstan may see a summer drying trend of –10 % to –12

[313] Kazakhstan - Climate Change and Disaster Risk Profile; https://www.unescap.org/sites/default/d8files/event-documents/Kazakhstan

% and greater intra-annual variability, increasing drought and flash-flood frequency.

Trends in precipitation change over the past 50 years are shown in Figure 18-15.

Figure 18-15: The rate of change in seasonal precipitation (%/10 years) on the territory of Kazakhstan in the period 1976–2021.



Data from the GERICS (2015) report evaluate seasonal precipitation changes for October-May and June-September (by 2085).

- The likely range projects changes from -9 to +42% (October to May) and from -14 to +28% (June to September).
- The very likely range projects changes from -16 to +53% (October to May) and from -16 to +53% (June to September), which is also consistent with the UNFCCC report (2022).

The RCP scenario system expects a 1.7-1.8~mm rise in average monthly precipitation by 2040-2059, mainly during the winter and spring seasons (ESCAP, 2022).

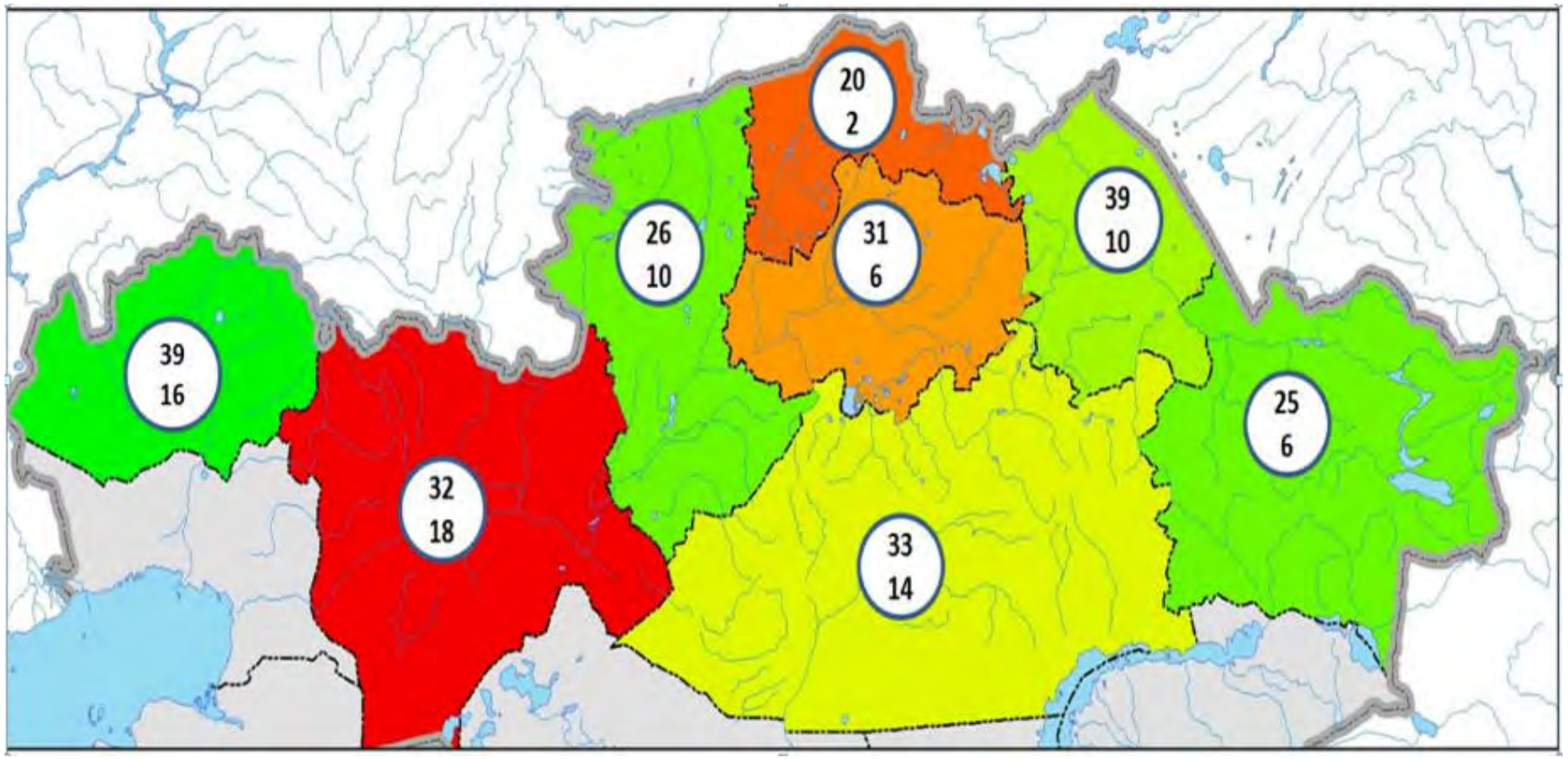
19.4.3 Changes in Extreme Events and Climate Hazards

The UNFCCC (2022, Sections 6.6 and 6.10) and World Bank (2021) profiles identify consistent trends in climatic extremes:

- **Heatwaves**: Frequency and duration expected to double by 2050, with > 40 °C days becoming common in southern oblasts.
- **Droughts**: Frequency increase of 30–50 % by mid-century (SSP5-8.5), particularly in steppe and desert areas.
- **Heavy precipitation**: More intense rainfall events (+10–25 %) though occurring less often, raising flash-flood and erosion potential.
- **Snowmelt flooding**: Shift of peak runoff to earlier in the year; greater winter rainfall and melting could increase spring flood hazard in the Chu–Talas basin.
- **Extreme winds and dust storms**: Limited change in mean wind speeds, but potential rise in gustiness and convective storm intensity.
- **Wildfire risk**: Length of the fire-weather season projected to increase 10–30 % by 2050 due to higher temperatures and lower soil moisture.

A map of drought frequency by region in Kazakhstan is shown in Figure 18-16.

Figure 18-16: Frequency of drought (top in circles)/severe drought (bottom in circles) in Kazakhstan, %



19.4.4 Implications for the Jambyl Project Area

For the Jambyl region specifically:

- Mean annual temperature expected to rise by ~2.5 °C (mid-century) and 4–6 °C (end-century) (UNFCCC 2022; World Bank 2021).
- Spring and summer rainfall projected to become more variable (an increase of 8-9% in spring precipitation and a 2% decrease in summer by mid-century), with heavier but less frequent events; summer dryness likely to intensify.
- More frequent heatwaves and droughts could increase dust generation, affect worker health, and heighten grass-fire potential.
- Wind extremes and icing events remain the most critical hazards for energy infrastructure, though turbine design (IEC Class I) provides sufficient margin of safety.

These projections inform the hazard ratings and adaptive-design measures assessed in Section 1.5.

At the local level, similar temperature increase trends are expected for both the southern and northern project areas (Sholakkorgan and Taraz cities):

- Under the SSP3-7.0 scenario, the temperature rise is projected at 1.4 °C by 2040, 2.4 °C by 2060, and 4.8 °C by 2100.
- Under the SSP5-8.5 scenario, the temperature rise is projected at 1.7 °C, 3.0 °C, and 6.2 °C by 2040, 2060, and 2100, respectively[314].

These values are closer to the lower figures of expected warming for Kazakhstan as a whole; however, it is important to consider that temperatures in the southern regions are already high, making any further increase more sensitive.

Regional studies of precipitation dynamics show the following forecasts for the city of Sholakkorgan (60 km to the Northwest of the WPP area):

- An increase of 2.9% by 2040 and 4.8% by 2100 relative to the baseline period (1981-2010) under the SSP3-7.0 scenario.
- An increase of 5.9% by 2040, 10.5% by 2060, and 18.7% by 2100 relative to the baseline period (1981-2010) under the SSP5-8.5 scenario.

For the city of Taraz (approximately 120 km southeast of the WPP area), the forecasted indicators are 0.2-0.9% lower than for Sholak-Korgan due to greater distance from the mountains.

19.5Climate Risk Assessment

This Climate Risk Assessment (CRA) identifies, evaluates, and qualitatively ranks potential climate-related risks to the Wind Power Project and supporting infrastructure, including the 220 kV OHTLs, substations, BESS, internal cable routes, and access roads. As discussed previously in Section 1.2.2 transition risks — such as changes in policy, technology, markets, or reputation — are not considered relevant for large-scale renewable energy projects, since these developments support the transition to low-carbon energy and are part of the climate change solution. Therefore this section focuses on the potential physical impacts/risks

[314] Zh.K. Naurozbaeva, G.E. Monkaeva, M.A. Zhunisova, E.E. Beldeubaev, N.E. Pakhmatulla, Zh.Kh. Kenzhina. ANALYSIS OF FUTURE CHANGES IN TEMPERATURE AND PRECIPITATION IN THE SHU-TALAS BASIN (KAZAKHSTAN). Hydrometeorology and Ecology. 119 (4). 2025.

climate change may pose on the Project and its activities,

The physical risk analysis approach follows the impact assessment methodology as set out in Section 4. It considers the sensitivity (or vulnerability) of the receptor (i.e., the Project or the workforce) and the magnitude of impact/risk for each relevant hazard identified. SSPs8.5 scenarios have been qualitatively considered for impact magnitude to apply a conservative approach.

The assessment builds on the baseline climate conditions and projections described in Sections 1.3 and 1.4, in order to identify the key associated climate hazards, and identify the risks that these hazards pose to the relevant sensitive receptors.

Each hazard–receptor combination is evaluated for likelihood and consequence (magnitude), producing an indicative risk level (Low/Medium/High/Very High).

The hazard evaluation uses the qualitative risk classification framework applied throughout this ESIA, consistent with Section 4. Hazards are characterised using the following scales:

- **Likelihood**: Unlikely, Possible, or Likely
- **Consequence**: Minor, Moderate, or Major
- **Relevance/Magnitude**: Low, Medium, or High (reflecting the combined influence of likelihood and consequence)

19.5.1 Climate-Related Natural Hazards and Risks

The following table presents a summary of the climate-related natural hazards identified as relevant to the Project. Each hazard has been evaluated in terms of its typical effects or risks, its likelihood of occurrence under current and projected climate conditions, and the potential consequence for the Project. These risks have been identified and assessed based on the baseline climatic conditions and future climate projections described in Sections 1.3 and 1.4, and have been informed by international sources including the Eighth National Communication of Kazakhstan to the UNFCCC (2022), the World Bank/ADB Climate Risk Country Profile (2021), and the Climate Fact Sheet for Kazakhstan (2018).

The results summarised in Table 18-9 provide a baseline understanding of the existing and potential future climate-related risks affecting the Project area. These findings inform the subsequent analysis of receptor sensitivity (Section 1.5.2) and the evaluation of risk significance for construction and operation (Sections 1.5.3 and 1.5.4).

This section provides an overview of the principal climate-related natural hazards that may affect the Project during its construction and operational phases. It identifies key climatic drivers and associated risks that have potential to impact the Project's infrastructure, workforce and supporting environment.

Climate physical risks result from climate change, which involves event-driven (acute) or longer-term shifts (chronic) in climate patterns. Acute physical risks refer to those that are event-driven, including increased severity of extreme weather events such as cyclones, hurricanes, or floods. Chronic physical risks refer to longer-term shifts in climate patterns (e.g., sustained higher temperatures) that may cause chronic heat waves. With reference to the TCFD list of potential climate hazards, the following climate related hazards were identified:

- Extreme heat/temperature rise
- Extreme cold events (< –20 °C)
- Icing and snow accumulation

- High Winds and Severe Convective Storms (including downbursts, gusts, hail, and intense rainfall)
- Lightning and Electrical Storms
- Intense rainfall/flash flooding/Seasonal flooding (snowmelt or runoff)
- Prolonged drought/soil desiccation
- Dust storms/reduced visibility
- Wildfire (grass fires).

The above climate related hazards are discussed more detail in Table 18-9 below along with determination of their potential magnitude of risk.

Table 18-9: Identified Climate-Related Hazard

Climate-Related Hazard	Typical Effects/Risks	Likelihood	Consequence	Relevance/Magnitude
Extreme heat/temperature rise	High summer temperatures are a normal feature of the Jambyl region's continental climate, with daytime values frequently exceeding 35 °C and occasionally reaching or surpassing 40 °C. These conditions already create heat-related stress for construction and maintenance activities and influence the performance of temperature-sensitive components. Average temperatures in southern Kazakhstan have increased by about 1 °C since the mid-twentieth century and are projected to rise by a further 2.5 °C on average by 2050, with upper-bound estimates approaching 4 °C under high-emission scenarios (SSP5-8.5) (see Section 1.4.1 above). Higher baseline and peak temperatures accelerate the thermal ageing of materials, reduce the efficiency of electrical and electronic systems such as transformers, switchgear, and battery units, and increase cooling requirements for enclosed equipment. Prolonged hot periods can also affect curing times for concrete, soil stability in surface works, and the scheduling of outdoor tasks. Climate change is expected to extend the duration and intensity of heatwaves, leading to longer periods of elevated temperatures and increasing the overall exposure of infrastructure and operational activities to thermal stress.	Likely	Moderate	**Medium**
Extreme cold events (< –20 °C)	Severe cold events remain a normal seasonal feature in the Jambyl Region, with minimum daily air temperatures periodically falling below –20 °C between December and February and historical extremes near –35 °C recorded in Taraz. Climate projections indicate that, although average winter temperatures are expected to rise by about 1.5 – 2.5 °C by mid-century, episodic cold spells will continue to occur through 2050–2080, with minimum temperatures still likely to reach –25 °C or lower in continental southern regions. Such low-temperature events can: ● Increase brittleness and reduce mechanical tolerance of steel structures, tower bolts, and composite materials; ● Thicken hydraulic and lubricating fluids, impairing equipment function; ● Slow or interrupt concrete curing and foundation works during construction;	Possible	Major	**Medium/Large**

Climate-Related Hazard	Typical Effects/Risks	Likelihood	Consequence	Relevance/Magnitude
	● Create health and safety risks for outdoor workers, including frostbite, slips, and reduced dexterity; and ● Delay maintenance or emergency response due to frozen ground and impaired access. While the frequency of prolonged cold periods may decrease slightly under climate change, their persistence as short-duration extremes means that cold-weather engineering design, materials selection, and OHS protocols will remain important throughout the Project's lifetime.			
Icing and snow accumulation	Seasonal snowfall is a regular climatic feature of the Jambyl Region, with snow cover typically present for several months each winter. During freezing and thawing cycles, icing may form on turbine blades, nacelles, transmission conductors, insulators, and meteorological sensors, particularly under conditions of high humidity and sub-zero temperatures. For wind turbines, ice accretion can reduce aerodynamic efficiency and energy yield, increase mechanical loading on blades and moving parts, and, in some cases, lead to the shedding of ice fragments ("ice throw") near turbine bases. For OHTLs, accumulated ice on conductors and fittings can increase line tension and mechanical loading on towers, potentially leading to sagging, vibration, or localised component fatigue. Heavy snow or ice buildup may also disrupt electrical transmission or necessitate temporary de-energisation and clearance. Snow accumulation on access roads, substations, and maintenance areas can obstruct movement of vehicles and crews, delaying construction, inspection or repair activities and temporarily limiting site access. Although average winter temperatures are projected to rise under future climate scenarios, episodes of freezing rain, frost, and high-humidity cold air are expected to persist, especially at elevated or exposed locations such as turbine hubs and OHTL corridors. These conditions could maintain or slightly increase the frequency and variability of icing events, even as total snow duration decreases. Snow and icing will therefore remain recurring and climatically relevant hazards throughout the	Likely	Moderate/Major	**Large**

Climate-Related Hazard	Typical Effects/Risks	Likelihood	Consequence	Relevance/Magnitude
	Project's lifetime, influencing both operational efficiency and site accessibility during winter and early spring.			
High Winds and Severe Convective Storms (including downbursts, gusts, hail, and intense rainfall)	Strong winds and convective storms are a characteristic feature of the Jambyl region and are already recognised as an existing hazard affecting the area. The site regularly experiences episodes of sustained high winds and occasional severe storm cells, particularly during spring and early summer, when convective activity can generate short-duration but intense gusts, localised downbursts, hail, lightning, and brief heavy rainfall. These events can impose high mechanical and aerodynamic loads on wind turbine structures, blades, and tower components, cause 'galloping' of overhead transmission lines, and affect cranes and lifting operations during construction. Hail impact can contribute to surface wear on turbine blades and exposed equipment, while intense rainfall associated with storm systems may produce short-term surface runoff, erosion, or local drainage congestion. Climate projections for Kazakhstan indicate that while mean wind speeds are unlikely to change significantly, the frequency of extreme gust events and convective storm intensity may increase under warmer atmospheric conditions with higher moisture content. This could lead to more variable and localised high-wind events, occasionally accompanied by hail and lightning. As such, wind and storm hazards will remain a persistent and potentially intensifying climatic risk throughout the Project's operational life.	Likely	Major	**Large**
Lightning and Electrical Storms	Electrical storms and lightning strikes are a regular seasonal hazard across southern Kazakhstan, typically occurring during spring and summer when convective thunderstorm activity is most frequent. The Jambyl region experiences periodic lightning events that can result in damage to elevated or exposed infrastructure such as wind turbine generators, substations, and overhead transmission lines, and can pose safety risks to personnel working outdoors. Lightning strikes can cause equipment failure, electrical surges, or temporary power interruptions, and in rare cases may initiate small grass or steppe fires under dry conditions. Climate projections suggest that increased atmospheric instability and moisture availability under warmer conditions could slightly enhance the frequency or geographic range of convective storms that produce lightning. While the overall annual number of lightning days is expected to remain within	Likely	Moderate	**Medium**

Climate-Related Hazard	Typical Effects/Risks	Likelihood	Consequence	Relevance/Magnitude
	current variability, the intensity of individual storm events may increase, producing stronger electrical discharges and greater associated wind and rainfall. Consequently, lightning will remain an ongoing and potentially intensifying hazard throughout the Project's lifetime, necessitating continued focus on electrical protection and operational safety measures.			
Intense rainfall/flash flooding/Seasonal flooding (snowmelt or runoff)	Episodes of intense rainfall and seasonal flooding are existing climatic hazards in the Jambyl region. Although mean annual precipitation is modest (about 250–400 mm), most rainfall occurs in short, high-intensity bursts, particularly in spring and early summer when convective storms are common. These downpours can generate localised surface runoff, erosion of unsealed tracks and slopes, and temporary ponding in low-lying areas or cable trenches. During the spring snowmelt period, the site routinely experiences very soft ground conditions as thawing snow saturates soils and drainage channels, rendering some areas temporarily inaccessible for vehicles and construction activities. Climate projections indicate that while total annual precipitation may rise slightly, a larger share will occur as intense, short-duration rainfall events, raising the likelihood of flash-flooding and erosion. Warmer winter and spring temperatures are also expected to trigger earlier and faster snowmelt, prolonging periods of saturated ground and limiting access during early spring. Consequently, these hydrological hazards are anticipated to remain regular seasonal features, with potential for greater frequency and intensity under future climate conditions.	Likely	Moderate	**Medium**
Prolonged drought/soil desiccation	Dry conditions and extended drought periods are existing climatic characteristics of the Jambyl region, which lies within a semi-arid steppe zone receiving relatively low and variable annual precipitation (250–400 mm). Periods of little or no rainfall already occur seasonally, leading to dry, compacted soils and sparse vegetation cover, particularly during late summer and early autumn. Under these conditions, exposed soils are susceptible to desiccation cracking, erosion, and windblown dust generation, which can affect surface stability along access roads and construction areas. Reduced soil moisture can also impair vegetation growth and delay natural regeneration of disturbed surfaces. Climate projections for southern Kazakhstan indicate a higher likelihood of prolonged dry periods and more intense droughts as temperatures continue to rise and evapotranspiration increases. The UNFCCC (2022) and World Bank (2021) assessments suggest drought frequency may increase by 30–50 % by	Likely	Minor	**Low**

Climate-Related Hazard	Typical Effects/Risks	Likelihood	Consequence	Relevance/Magnitude
	mid-century, with a longer duration of rain-free intervals. These trends are expected to exacerbate soil drying, vegetation stress, and dust emission, particularly following disturbance or during the operational phase when maintenance traffic may further loosen surface materials. Consequently, drought and desiccation will remain recurrent hazards at the site, with climate change likely to amplify their occurrence and associated effects on soil stability and dust control.			
Dust storms/reduced visibility	The Jambyl Wind Power Plant site is located within a semi-arid steppe environment that generally maintains a seasonal vegetation cover, limiting the extent of natural dust generation under normal conditions. However, during prolonged dry and windy summer periods, vegetation can become desiccated and surface soils may loosen, particularly on disturbed ground such as construction areas, access roads, and cable routes. Under these circumstances, strong winds can create localized dust plumes that temporarily reduce visibility, pose minor safety risks for vehicle movements and lifting operations, and cause fine dust deposition on electrical and mechanical components or sensors, increasing cleaning and maintenance requirements. Regional dust storms are a known climatic feature of southern Kazakhstan, particularly during late spring and early summer when strong winds coincide with dry surface conditions. While the Project site itself is not located within an area of extensive sand fields, periodic regional dust events and localised dust mobilisation are expected to persist and may intensify seasonally as vegetation dries and wind speeds peak. Dust generation is closely linked to drought and soil desiccation patterns, which are existing seasonal features of the region. Climate-change projections indicate that rising temperatures and longer dry spells may exacerbate surface drying and vegetation stress, marginally increasing the likelihood of dust mobilisation. Such events can temporarily reduce visibility, affect air quality for workers, and increase dust deposition on electrical and mechanical components, leading to short-term maintenance requirements.	Possible	Minor/Moderate	**Small/Medium**
Wildfire (grass fires)	Wildfire is not currently identified as a significant hazard in the Jambyl region, and no major fire	Unlikely	Moderate	**Small**

Climate-Related Hazard	Typical Effects/Risks	Likelihood	Consequence	Relevance/Magnitude
	incidents have been reported by project-affected communities. The project area consists mainly of open steppe with sparse, low-lying vegetation, which generally limits the potential for large or sustained fire spread under existing climatic conditions. However, during very dry and windy periods in late summer or early autumn, localized grass or rangeland fires can occur naturally or as a result of human activity, potentially affecting visibility or temporarily restricting site access. Although wildfire risk is presently low, climate change is expected to increase the potential for ignition and spread of vegetation fires in southern Kazakhstan. Higher summer temperatures, reduced soil moisture, and longer dry periods may create more favourable conditions for grass fires, particularly in areas of disturbed or unmanaged vegetation. These fires would likely remain small and short-lived but could still cause localised damage to surface infrastructure, disrupt power or communication systems, or pose safety risks to personnel if occurring near active work areas. As such, while the overall wildfire hazard for the Project is currently low, its potential relevance is expected to increase modestly under future climate conditions and warrants continued monitoring.			

Summary of Potential Climate-Related Hazards and Risks

The evaluation confirms that all identified climate-related hazards are already present under baseline conditions at the Project site and may be influenced or intensified by projected climatic changes over the Project's lifetime. Their relative relevance to the Project is summarised below:

- Rising average and extreme temperatures – medium to high relevance.
- Extreme cold events (< –20 °C) – medium relevance as a recurrent seasonal hazard.
- Icing and snow accumulation – medium to high relevance for turbine and OHTL performance and site accessibility.
- Strong winds, gusts, and convective storms (including hail and downbursts) – medium to high relevance, particularly for safety and operational continuity.
- Short-duration intense rainfall, snowmelt, and localised flooding – medium relevance.
- Periodic drought and soil desiccation – low to medium relevance.
- Dust storms and reduced visibility – medium relevance as intermittent but manageable hazards.
- Lightning and electrical storms – medium relevance.
- Wildfire (grass fires) – low relevance under current conditions but may increase slightly with warmer, drier summers.

Most hazards are assessed as Likely to occur with Moderate consequence under both current and projected climate conditions. The most relevant hazards for the Project are extreme winds, heatwaves, and icing events, which should be accounted for through engineering design standards and adaptive operational controls. These results provide the basis for the receptor-specific and phase-specific risk assessments presented in Sections 1.5.3 and 1.5.4.

19.5.2 Sensitive Receptors

This section identifies the key receptors that could be affected by the climatic hazards described in Section 1.5.1 and assesses their sensitivity to such hazards and their capacity to cope, adapt, or recover from projected climatic changes. Sensitivity reflects the degree to which a receptor could be adversely affected by climate variability and extremes, considering its exposure, function, and inherent adaptive capacity. For the purposes of this assessment, receptor sensitivity is categorised as Low, Medium, or High, in accordance with the qualitative methodology described in Section 4. The receptors considered are grouped into the following categories:

- Project infrastructure and assets
- Project workforce
- Local land users and communities
- Supporting environmental systems.

The relevance and severity of each climate-related hazard will vary between receptors depending on their exposure, function, and adaptive capacity. These relationships are explored further in Sections 2.5.3 and 2.5.4, which assess the significance of identified hazards for each receptor group during the construction and operational phases of the Project.

Infrastructure and Assets

This receptor group includes all physical components of the Project that may be directly exposed to climatic hazards during construction and operation. Sensitivity reflects the degree to which these assets may be affected by temperature extremes, strong winds, icing, precipitation, or other meteorological events, and

their ability to continue functioning effectively under such conditions.

During the construction phase, only a limited number of physical assets will be present. These will comprise temporary facilities and mobile equipment such as cranes, heavy-lifting and transport vehicles, batching plants, temporary site offices, storage areas, and worker compounds. Such assets are typically short-lived and designed for mobility, but can be disrupted or damaged by acute weather events such as high winds, lightning, dust storms, or extreme heat.

During the operational phase, the Project's principal assets will comprise:

- Wind turbine generators (WTGs) and foundations
- 220 kV overhead transmission line (OHTL) and associated towers and foundations
- On-site substations and underground/overhead cabling
- Battery Energy Storage System (BESS) and associated cooling and safety systems
- Internal access roads and drainage infrastructure
- Temporary and permanent buildings and facilities.

All permanent assets will be designed in accordance with international engineering standards and climate-resilient design criteria, including IEC 61400 (Wind Class I, 50 m/s design wind speed) and relevant structural and electrical codes for operation within a –25 °C to +45 °C temperature range. Consequently, overall structural sensitivity is assessed as low to medium, reflecting robust design criteria and the capacity to accommodate projected climatic variations.

Specific components exhibit differing levels of sensitivity to particular climate hazards:

- **WTGs**: High sensitivity to extreme gusts, icing, and turbulence, which can influence fatigue life and energy yield. Exposure to extreme cold may temporarily affect hydraulic or lubrication systems during winter operations.
- **OHTLs**: Medium sensitivity to strong winds, icing, and lightning, although design standards and grounding minimise risk. Localised erosion or soil movement due to intense rainfall or drought-related desiccation can affect tower foundations if not maintained.
- **BESS and electrical systems**: Medium sensitivity to prolonged high ambient temperatures, potential dust ingress, and electrical surges associated with lightning events. Sensitive to both overheating and humidity fluctuations during seasonal transitions.
- **Access roads and drainage**: Medium sensitivity to intense rainfall, erosion, and snowmelt saturation, but manageable through proper design and maintenance. Prolonged drought or dry-season conditions can reduce surface cohesion and increase dust and wildfire susceptibility in surrounding vegetation zones.

Project Workforce

The Project workforce comprises all personnel engaged in on-site activities during both the construction and operation phases, including construction workers, turbine assembly crews, electrical and civil specialists, maintenance staff, drivers, and support personnel. Workers represent a key receptor group due to their direct exposure to local climatic conditions and the need to work safely in open or elevated environments.

During the construction phase, workforce numbers are expected to average around 600-800personnel, potentially peaking at 1,700, most of whom will work outdoors across a wide area of the site. Project workers—particularly those engaged in heavy civil works, turbine erection, or crane operations—are directly exposed to climatic extremes and associated hazards, including:

- Heat stress risks during summer months, which may increase in frequency and severity with rising ambient temperatures;
- Cold exposure and icing hazards during winter operations, affecting manual dexterity, equipment function, and safety at height;
- Difficult working conditions during snow cover, when access roads and open ground become slippery, uneven, or partially frozen, limiting mobility and safe equipment handling; and
- High winds, lightning, and dust storms, which may interrupt lifting or crane operations and reduce visibility or stability on site.

While these risks are generally manageable through appropriate scheduling, temporary work stoppages, training, and the use of personal protective equipment (PPE), workers have limited control over their exposure to weather extremes. Given the combination of high workforce numbers, continuous outdoor activity, and the physical nature of tasks, the construction-phase workforce is considered **high** sensitivity to climatic hazards.

During the operational phase, the workforce will reduce to approximately 25 on-site personnel, supported periodically by specialist maintenance or inspection teams. Operational work will remain largely outdoors but can be planned and scheduled around forecast weather conditions, significantly reducing direct exposure to acute climatic events. Maintenance teams may still encounter hazards such as extreme temperatures, icing, snow accumulation, or lightning—particularly when working at height on turbines or overhead lines—but these risks can be more readily managed through established operational controls and weather-based work planning. Consequently, the operational workforce is assessed as having **medium** sensitivity to climatic hazards.

Local land users and communities

The local land users and communities surrounding the Project area include residents of nearby settlements and individuals who use the surrounding land for seasonal grazing, herding, or transit along existing unsealed tracks. These receptors are indirectly exposed to climatic hazards that influence agricultural productivity, access, and mobility across the steppe environment. Their overall sensitivity reflects both existing climatic exposure and the potential for interaction with Project infrastructure during periods of extreme weather.

Under current climate conditions, local land users already experience the effects of temperature extremes, drought, and snow cover, which shape grazing patterns and seasonal land use. The Project site is typically unoccupied between November and March/April, as cold temperatures, heavy snowfall, and subsequent snowmelt make access impractical and ground conditions too soft for vehicle or livestock movement. These months therefore represent a period of low exposure for land users, with access resuming once the ground has dried sufficiently in late spring.

In the longer term, projected climatic changes—particularly increasing summer heat, more variable precipitation, and drought intensification—may affect pasture quality, forage availability, and surface-water resources, potentially heightening community vulnerability to climate variability. At the same time, the Project's development of permanent access roads may improve year-round access to the site. While this could provide local mobility benefits, it may also increase the likelihood of community presence during winter, when icy conditions, snow accumulation, or ice throw from turbines could present safety risks if site access is not controlled.

Local land users and communities could therefore be indirectly affected by certain Project-related climate hazards, including:

- Ice throw from WTGs during winter icing conditions, presenting a localised physical safety risk to people or livestock if access occurs near turbine locations;
- Slippery or frozen access roads during winter or snowmelt periods, posing hazards for vehicles or shared road users;
- Dust generation along access routes during dry, windy periods, potentially affecting visibility and nuisance levels; and
- Temporary drainage changes or flooding following intense rainfall or rapid snowmelt, affecting local tracks or grazing areas adjacent to Project facilities.

Overall, the sensitivity of local land users and communities to climate-related hazards in the context of the Project is assessed as **medium**, reflecting their baseline climatic exposure, seasonal land use, and potential indirect interaction with Project infrastructure. While future climate change and improved year-round access may marginally increase these sensitivities, most risks are localised and can be effectively managed through design measures, access management, and community engagement.

Supporting Environmental Systems

The supporting environmental systems include the natural soil, vegetation, surface-water, and drainage features that influence the Project area's ability to buffer and adapt to climatic hazards. These systems play an important role in maintaining the stability and resilience of the site by regulating runoff, preventing erosion, supporting vegetation cover, and contributing to the natural dissipation of extreme weather impacts. Their sensitivity is defined by their current condition and their capacity to absorb, recover from, or adapt to the effects of increasing temperature, variable precipitation, and other climate-related stresses.

Under existing conditions, the Project area is characterised by steppe terrain typical of a semi-arid climate, with thin, erosion-prone soils, seasonally variable vegetation (dense in spring, dry and sparse in autumn), and occasional natural drainage channels. These environmental systems are already exposed to natural hazards such as drought, intense rainfall, wind erosion, and snowmelt flooding. Vegetation cover and soil structure currently provide a limited but important stabilising effect, helping to reduce dust generation, control runoff, and maintain infiltration capacity. However, these systems are inherently sensitive to disturbance: clearance, compaction, or drainage alteration can reduce their resilience to climatic variability.

Projected climate change trends, including warmer and drier summers, more variable precipitation, and more intense rainfall events, may progressively reduce soil moisture and vegetation cover, increasing susceptibility to erosion, desiccation, and dust generation. Conversely, more intense rainfall and rapid snowmelt events could increase runoff and surface scouring in poorly vegetated areas. These shifts highlight the need for careful management of surface stability, erosion control, and drainage design to maintain the environmental systems' capacity to moderate local climate hazards.

The Project's interaction with these supporting systems is addressed in detail in Section 14 (Hydrology and Hydrogeology) and Section 15 (Geology and Soils) of this ESIA. From a climate-resilience perspective, the Project must ensure that construction and operation do not diminish the adaptive capacity of these natural systems—for example, by avoiding unnecessary vegetation removal, maintaining stable drainage pathways, and managing runoff and erosion. Strengthening these functions will help to preserve the site's natural resilience against both current and future climate hazards such as flash flooding, dust storms, and drought-related soil instability.

Overall, the sensitivity of the supporting environmental systems is assessed as **medium**, reflecting the

current semi-arid and erosion-prone nature of the site and their limited adaptive capacity under projected climate trends. Maintaining and enhancing these systems' natural buffering functions will be essential to sustaining the Project's long-term climate resilience.

Summary

The sensitivity of the receptors identified above varies according to their exposure to climatic conditions, adaptive capacity, and the duration or intensity of their interaction with Project activities, and can be summarised as follows:

- **Project infrastructure and assets** are assessed as having **low to medium** sensitivity, reflecting robust engineering standards but recognising exposure to extreme weather events.
- **Project workforce** exhibits **medium to high** sensitivity, particularly during the construction phase when large numbers of outdoor workers are active under variable climatic conditions.
- **Local land users and communities** are considered to have **medium** sensitivity, due to their seasonal exposure to climatic variability and potential indirect interaction with Project infrastructure during extreme events.
- **Supporting environmental systems** are also rated as **medium** sensitivity, given their limited capacity to adapt to increasing climatic stress without management of soil, vegetation, and drainage stability.

Overall, the Project area and associated receptors are already subject to a wide range of climatic conditions, and future climate change may amplify the frequency or intensity of several key hazards. These sensitivity ratings provide the basis for the subsequent climate risk assessment presented in Sections 1.5.3 and 1.5.4, which evaluate the significance of climate-related risks for each receptor group during the construction and operational phases.

19.5.3 Construction phase impacts

The construction phase of the Project is expected to last approximately three years, representing a relatively short time horizon compared with long-term climate projections. Consequently, this assessment focuses on the existing climatic conditions and their potential to affect construction activities, workforce health and safety, and temporary site infrastructure. Risks associated with long-term climate change scenarios are not considered material for this phase but are addressed for the operational period in Section 1.5.4.

Given the temporary nature of construction activities and the limited number of permanent assets at this stage, infrastructure-related climate risks are expected to be minor. However, short-term climatic hazards may still affect construction schedules, safety, and environmental management. Potential risks arise primarily from acute weather events such as high winds, extreme heat or cold, intense rainfall, lightning, and dust storms, which can disrupt operations, damage materials or equipment, or temporarily compromise worker safety.

The assessment presented below identifies the climate-related hazards most relevant during the construction phase (as defined in Section 1.5.1), evaluates their magnitude, and considers their potential impacts on the receptors defined in Section 1.5.2, namely:

- Project infrastructure and assets (temporary and early-stage construction facilities),
- Project workforce,
- Local land users and communities, and
- Supporting environmental systems.

The overall significance of each risk or impact has been determined qualitatively based on the combination of hazard magnitude and receptor sensitivity, in line with the assessment methodology described in Section 4. Significance is expressed as **Insignificant**, **Minor**, **Moderate**, or **Major**, representing the integrated judgement of likelihood, consequence, and receptor vulnerability.

The following table summarises the potential risks associated with each identified climate-related hazard during the construction phase. Each risk is characterised in terms of hazard magnitude, receptor sensitivity, and potential implications for Project safety, schedule, and environmental management. The results provide the basis for identifying appropriate mitigation and adaptation measures, which are presented in Section 1.6.

Table 18-10: Construction Phase Risk Assessment

Climate Hazard	Magnitude	Receptor	Sensitivity	Description of Risk/Impact	Significance of risk
Extreme heat	Medium	Infrastructure and Assets	Low - Medium	Most construction assets (vehicles, cranes, batching plants) are temporary and robust; however, high ambient temperatures (> 35–40 °C) can reduce equipment efficiency, accelerate material curing, and degrade cable insulation if stored or installed in direct sun. Minor heat deformation or premature drying of concrete can occur without proper protection.	Minor
		Workforce	High	Workers will be continuously outdoors during summer months; elevated temperatures increase risk of dehydration, heat stress, fatigue, and reduced productivity. Outdoor tasks such as turbine assembly or lifting operations may require rescheduling or additional rest breaks. Although managed through HSE procedures, exposure remains significant.	Moderate
		Land users and communities	Medium	Local grazers are present within and around the WPP site area during summer months, although not within active construction zones. Their herding practices are already adapted to hot and dry conditions, and the Project will not create additional heat sources or materially alter local temperatures.	Insignificant
		Environmental Systems	Medium	Prolonged high temperatures contribute to soil drying and vegetation stress, increasing susceptibility to erosion and dust generation on disturbed surfaces. Effects are temporary and localised but may require dust suppression and soil-stabilisation measures.	Minor to Moderate
Extreme cold	Medium	Infrastructure and Assets	Low/medium	Cold winter conditions (often below – 20 °C) may temporarily affect mechanical tolerances, reduce hydraulic and lubricant efficiency, and delay concrete works or equipment operation. These effects are short-term and manageable through cold-weather construction procedures.	Minor
		Workforce	High	Construction workers will be exposed to freezing temperatures, snow, and icy surfaces that can affect dexterity, stability, and safety when handling	Moderate

Climate Hazard	Magnitude	Receptor	Sensitivity	Description of Risk/Impact	Significance of risk
				materials or operating equipment. Outdoor work becomes difficult in severe cold, increasing risks of frostbite, slips, or fatigue. Exposure is temporary but recurrent during winter.	
		Land users and communities	Low	Land users are generally absent from the Project area between November and March/April due to snow cover and low temperatures. The Project will not increase cold-weather exposure for these receptors, and no additional risk is anticipated.	Insignificant
		Environmental Systems	Low	Local soils and vegetation are naturally adapted to freezing conditions typical of the region. Construction activity during very cold periods is minimal, and the Project will not alter the frequency or intensity of cold events. No material effect on environmental systems is expected.	Insignificant
Icing and snow accumulation	Large	Infrastructure and Assets	Low - Medium	Snow and ice accumulation can restrict movement of vehicles and personnel within the construction area and temporarily inhibit access to the site. These conditions may delay material deliveries, foundation works, and crane operations, and increase wear on vehicles operating in low-traction or frozen conditions. Ice buildup on cranes, scaffolding, and vehicles can also affect safe handling and cause minor damage to exposed components if not cleared.	Minor to moderate
		Workforce	High	Workers will face challenging conditions due to snow, ice, and freezing precipitation. Slippery surfaces and falling ice increase risks of slips, trips, and falling objects. Icing on structures and machinery can complicate tasks and prolong exposure to cold. Periodic work stoppages will likely be required during heavy snowfall or ice formation.	Moderate

Climate Hazard	Magnitude	Receptor	Sensitivity	Description of Risk/Impact	Significance of risk
		Land users and communities	Low	Land users are generally absent from the site between November and March/April, when snow and ice accumulation occur. The Project does not introduce additional hazards for communities during this period.	Insignificant
		Environmental Systems	Low	Snow accumulation is a normal seasonal occurrence, and the environment is adapted to it. Construction during heavy snow periods will be minimal. Temporary disturbance of compacted snow or frozen soils has no material effect on the wider environment.	Insignificant
High Winds and Severe Convective Storms	Medium	Infrastructure and Assets	Low - Medium	Strong winds, gusts, and storm events can disrupt lifting and turbine-assembly operations, cause instability in cranes or scaffolding, and damage temporary structures or materials stored outdoors. Intense rainfall and hail may temporarily flood low-lying areas, erode unsealed surfaces, and delay concrete pouring or earthworks. Impacts are short-term but can cause delays.	Moderate
		Workforce	High	Workers are directly exposed to strong winds, hail, and heavy rainfall during outdoor construction. Sudden gusts or downbursts can create safety risks for lifting, tower erection, and work at height. Slippery conditions from rain and hail increase accident potential, and temporary halts are likely during high-wind warnings.	Moderate
		Land users and communities	Low	Local communities and grazers are unlikely to be significantly affected by isolated storm events, though short-term surface runoff or muddy tracks could limit access near the site. The Project will not alter the nature or frequency of such natural events. However, strong winds can increase the potential for wind-blown debris or litter from construction areas, particularly from packaging materials or unsecured waste. Such occurrences could cause localised nuisance or minor safety risks if not properly controlled.	Insignificant to Minor

Climate Hazard	Magnitude	Receptor	Sensitivity	Description of Risk/Impact	Significance of risk
		Environmental Systems	Low - Medium	Heavy rainfall and hail associated with convective storms may increase short-term surface runoff and erosion risk on disturbed soils. Effects are localised and temporary but could cause sediment transport if unmanaged. Erosion-control and surface-stabilisation measures will limit impacts.	Minor to moderate
Lightning and Electrical Storms	Medium	Infrastructure and Assets	Low - Medium	Lightning strikes during storm events may damage tall metallic structures such as cranes, turbine towers under assembly, or temporary substations. Electrical surges could harm sensitive construction equipment if not adequately grounded. Impacts are infrequent and short-lived but may cause temporary work interruptions or minor damage.	Minor
		Workforce	High	Workers engaged in outdoor activities, particularly on cranes, turbine towers, or metal structures, face direct safety risks during electrical storms. Lightning can cause severe injury or fatalities if work is not suspended. Strict adherence to storm protocols and shutdown procedures is essential.	Moderate
		Land users and communities	Low	Lightning is a natural regional hazard not influenced by the Project. Local communities or grazers are unlikely to experience increased exposure due to construction activities. No additional risk is anticipated.	Insignificant
		Environmental Systems	Low	Lightning strikes on open ground may cause localised vegetation burns but are rare and isolated. The Project will not influence the frequency or severity of these natural events.	Insignificant
Intense rainfall/flash and Seasonal flooding	Medium	Infrastructure and Assets	Low - Medium	Heavy rainfall or rapid snowmelt can temporarily flood construction areas, access roads, and laydown zones, restricting site access and delaying earthworks or foundation pouring. These effects are short-term and manageable through phased grading, drainage channels, and temporary runoff control.	Minor - moderate
		Workforce	High	Workers may face slippery surfaces and access restrictions during intense rainfall or snowmelt, which can briefly halt activities or increase minor	Minor - moderate

Climate Hazard	Magnitude	Receptor	Sensitivity	Description of Risk/Impact	Significance of risk
				accident potential. Standard HSE controls and weather-based work planning minimise residual risk.	
		Land users and communities	Low - medium	Intense rainfall or snowmelt may temporarily affect local access tracks or grazing routes near the site, particularly where runoff crosses existing paths. The Project will not increase flood risk beyond its footprint, and effects are expected to be short-lived.	Insignificant to Minor
		Environmental Systems	Medium	Heavy rainfall and snowmelt may cause short-term surface runoff, soil erosion, and sediment transport on disturbed ground, especially on slopes or drainage lines. These effects are temporary and controllable with erosion and sediment-management measures.	Minor to Moderate
Prolonged drought/soil desiccation	Small	Infrastructure and Assets	Low - Medium	Extended dry periods may lead to hardening or cracking of surface soils, which could slightly affect ground compaction or foundation preparation. These effects are localised and easily managed through grading and moisture conditioning.	Insignificant to Minor
		Workforce	High	Drought conditions have limited direct impact on construction workers, though dry, compacted ground may increase physical strain or equipment vibration during operation. No material health or safety risk is expected.	Insignificant to Minor
		Land users and communities	Low	Extended drought periods can reduce vegetation growth and pasture productivity, affecting grazing patterns. However, this is a regional climatic effect not influenced by the Project, and the Project will not alter soil moisture or water availability.	Minor
		Environmental Systems	Medium	Prolonged lack of rainfall can reduce soil moisture and vegetation cover, making soils more susceptible to erosion or compaction once disturbed. These changes are reversible and limited to small disturbed areas during construction.	Minor

Climate Hazard	Magnitude	Receptor	Sensitivity	Description of Risk/Impact	Significance of risk
Dust storms/reduced visibility	Medium	Infrastructure and Assets	Low	Wind-driven dust may temporarily reduce visibility and increase cleaning or maintenance needs for vehicles, cranes, and equipment. These effects are short-term and do not affect structural integrity or function.	Insignificant to Minor
		Workforce	Medium	Workers are directly exposed to dust and reduced visibility during strong winds. These conditions can limit crane operations, hinder vehicle movement, and cause minor respiratory or eye irritation if not adequately protected. Activities would be temporarily suspended during severe events.	Minor - moderate
		Land users and communities	Low – Medium	Local grazers and herders may be exposed to occasional regional dust events, but these are natural seasonal occurrences not caused by the Project. Construction activity will not materially increase the likelihood of regional dust storms, though vehicle movement on unsealed roads may contribute locally; this is addressed in Section 17 (Air Quality).	Minor
		Environmental Systems	Medium	Dust mobilisation reflects existing dry-season conditions and soil disturbance rather than a new Project impact. While dust deposition can lightly coat vegetation, it does not cause lasting harm. Re-vegetation and surface stabilisation will limit recurrence.	Insignificant to Minor
Wildfire (grass fires).	Small	Infrastructure and Assets	Low	Wildfires are not a known hazard at the site, and vegetation cover is sparse, limiting ignition and fire spread potential. The Project will not introduce new ignition sources beyond typical vehicle and equipment use, which are subject to strict controls. No material risk to infrastructure is anticipated.	Insignificant
		Workforce	Low	The likelihood of wildfire occurrence during construction is low. Standard HSE protocols and fire-prevention measures will prevent ignition and ensure rapid response in the unlikely event of a localised fire.	Insignificant
		Land users and communities	Low	Wildfires are not currently an issue in the Project area, and construction activities are not expected to increase the likelihood of such events. No	Insignificant

Climate Hazard	Magnitude	Receptor	Sensitivity	Description of Risk/Impact	Significance of risk
				additional risk to surrounding communities or land users is anticipated.	
		Environmental Systems	Low	Grass fires are rare and would have minimal ecological consequence given the sparse vegetation and rapid natural regeneration. The Project will not contribute to fire risk.	Insignificant

19.5.4 Operation phase impact

The operation phase of the Jambyl 1 GW Wind Power Project will extend over approximately 25 to 30 years, during which the Project will operate as a fully commissioned renewable-energy facility with a small permanent workforce on site of around 30 full time employees, with temporary peaks up to ~70 during major maintenance campaigns. Day-to-day activities will be less intensive and more predictable than during construction, consisting mainly of turbine and transmission-line inspection, maintenance, and performance monitoring.

The Project will not generate greenhouse-gas (GHG) emissions during operation, and the electricity produced will displace power that would otherwise be generated wholly or partly from higher-emitting fossil-fuel sources. Accordingly, the Project contributes positively to climate-change mitigation by reducing the carbon intensity of Kazakhstan's electricity supply. As outlined in Section 1.2, no formal GHG quantification is required under IFC Performance Standard 3 or the Equator Principles for this Project.

While operational emissions are negligible, the Project remains subject to long-term physical climate risks. Given its multi-decadal operating life, gradual climatic changes—such as increasing mean temperatures, more variable precipitation, and possible increases in the frequency or intensity of extreme weather events—could influence infrastructure performance, maintenance requirements, and site accessibility. The following assessment evaluates these hazards and their potential implications for the Project's assets, workforce, neighbouring land users, and supporting environmental systems over the operational lifetime.

Each hazard has been assessed according to its magnitude (Negligible, Small, Medium, Large) and its interaction with the sensitive receptors defined in Section 1.5.2. The overall significance of risk or impact is determined qualitatively from the combination of hazard magnitude and receptor sensitivity, consistent with the methodology presented in Chapter 4 – Assessment Methodology. Significance levels are expressed as Insignificant, Minor, Moderate, or Major.

Table 18-11: Operation Phase Risk Assessment

Climate Hazard	Magnitude	Receptor	Sensitivity	Description of Risk/Impact	Significance of risk
Extreme heat	Medium	Infrastructure and Assets	Medium	Rising average and extreme temperatures may reduce the efficiency of electrical components, such as transformers, inverters, and the BESS system, by increasing cooling demand and thermal loading. Over time, higher ambient temperatures may accelerate degradation of insulation, cabling, and electronic components if not adequately ventilated or shielded. Design tolerances (–25 °C to +45 °C) provide resilience to projected near-term conditions, but temperature increases approaching upper design limits by 2050–2060 could slightly shorten component lifespans and raise maintenance needs.	Moderate
		Workforce	Medium	A small on-site workforce (≈30 personnel, plus maintenance teams) will perform periodic outdoor work. Hotter summers may increase heat stress risk during maintenance or emergency repairs, particularly under direct sun exposure or when working on reflective turbine surfaces. Impacts are intermittent and can be managed by work scheduling and HSE procedures.	Minor to Moderate
		Land users and communities	Low	Land users are already adapted to hot, dry summer conditions. The Project will not generate additional heat emissions or alter local microclimate. No material impacts are anticipated from the Project, though extended drought periods may affect grazing conditions independently of Project operations.	Insignificant
		Environmental Systems	Medium	Higher temperatures and prolonged dry periods may reduce soil moisture and vegetation cover, increasing erosion potential on disturbed areas (e.g., roadsides or cable routes). These effects could incrementally weaken natural resilience to wind and runoff over time, but can be offset by vegetation management and erosion-control maintenance.	Minor
Extreme cold	Medium - Large	Infrastructure and Assets	Low - Medium	Prolonged sub-zero temperatures can reduce hydraulic efficiency, affect lubrication, and increase brittleness of materials; however, all major	Minor

Climate Hazard	Magnitude	Receptor	Sensitivity	Description of Risk/Impact	Significance of risk
				components (WTGs, OHTL, and BESS) are designed and certified for continuous operation down to rated –25 °C and short-term exposure below this threshold. Periodic cold spells reaching –25 °C or lower are expected to continue under future climate conditions, but these are within the technical tolerance of installed equipment when standard cold-weather operating procedures are applied. Consequently, no material reduction in performance or design life is anticipated, provided cold-weather maintenance and monitoring protocols are implemented.	
		Workforce	High	Routine maintenance and inspection activities occur year-round. Outdoor work in very cold or icy conditions can affect manual dexterity and safety at height, and road access may be limited by snow or ice. Risks are intermittent and controlled through winter-work procedures and scheduling.	Minor
		Land users and communities	Low	The site is typically unoccupied by land users from November to March/April due to snow and cold conditions. The Project will not alter this pattern or increase community exposure to cold events.	Insignificant
		Environmental Systems	Medium	Local soils and vegetation are naturally adapted to freezing conditions. No additional effects are expected from the Project's presence or operation.	Insignificant
Icing and snow accumulation	Medium	Infrastructure and Assets	Medium	Ice accretion on turbine blades, towers, and OHTL conductors can reduce aerodynamic efficiency, increase mechanical loading, and temporarily interrupt power generation. Accumulated snow and ice may also restrict access to turbines, substations, and internal roads, causing short-term delays to inspection or maintenance activities. However, all key components are engineered for cold-climate operation, and design measures such as anti-icing coatings, temperature-rated materials, blade heating systems, and planned winter access routes substantially mitigate these risks. Icing and snow accumulation are therefore considered seasonal and manageable operational hazards, with no material long-term impact on infrastructure	Minor

Climate Hazard	Magnitude	Receptor	Sensitivity	Description of Risk/Impact	Significance of risk
				integrity or performance.	
		Workforce	Medium - High	Maintenance staff are exposed to slipping and falling hazards on icy surfaces, and risks of falling ice from turbines or structures. Access to turbines and substations may be temporarily restricted due to snow or ice. Safety protocols, PPE, and remote monitoring reduce exposure.	Moderate
		Land users and communities	Medium	Local land users are generally absent from the site between November and March/April, when icing and snow accumulation occur. However, the Project's improved access roads may facilitate occasional entry during these months, increasing the potential for exposure to icy surfaces or rare ice-throw events from WTGs. These risks are low-probability but warrant seasonal access management and public awareness measures.	Minor
		Environmental Systems	Low	Seasonal snow and icing are part of normal climatic conditions. The Project does not affect snowmelt patterns or alter drainage beyond localised areas already addressed in design. No material impacts on soils or vegetation are anticipated.	Insignificant
High Winds and Severe Convective Storms	Medium	Infrastructure and Assets	Medium	Wind turbines are designed to withstand extreme wind speeds (IEC Class I – 50 m/s) and will automatically shut down in high wind conditions. However, severe gusts, downbursts, or hail may cause temporary shutdowns, minor component wear, or superficial damage to blades and tower coatings. Heavy rainfall could temporarily flood access roads or drainage areas, delaying maintenance. All effects are transient and within design tolerances.	Minor
		Workforce	Medium - High	Maintenance and inspection personnel working on turbines or OHTLs are exposed to elevated safety risks during high winds, hail, or intense rainfall. Work at height must be suspended during strong gusts or storms, and visibility reduction can limit travel or emergency response. Strict weather monitoring and safe-work procedures limit exposure.	Moderate

Climate Hazard	Magnitude	Receptor	Sensitivity	Description of Risk/Impact	Significance of risk
		Land users and communities	Low	Local communities are already familiar with strong wind and storm events typical of the region. The Project will not alter the frequency or intensity of these natural occurrences. Temporary surface runoff from storm rainfall may affect nearby grazing paths or tracks but poses no additional hazard from the Project itself.	Insignificant to Minor
		Environmental Systems	Medium	Heavy rainfall or hail during convective storms can cause surface runoff, localised erosion, and sediment displacement on unsealed ground and drainage channels. These effects are localised and controllable through ongoing maintenance of drainage and erosion-control systems.	Insignificant
Lightning and Electrical Storms	Medium	Infrastructure and Assets	Medium	Wind turbines, OHTLs, and substations are susceptible to lightning strikes, which can cause localised damage to blades, transformers, or electrical systems if protective measures fail. The Project incorporates grounding, lightning protection, and surge arrestors in accordance with IEC and utility standards, ensuring that risks are very low and effects limited to minor equipment repairs.	Minor
		Workforce	Medium	Maintenance or inspection staff may be exposed to lightning risk when working outdoors or on elevated structures during storms. Work-at-height and electrical tasks will be suspended under lightning warnings, and safe-work procedures minimise exposure.	Minor - moderate
		Land users and communities	Low	Lightning is a natural regional hazard, and the Project will not alter its frequency or intensity. Improved grounding of infrastructure may slightly reduce the likelihood of stray ground currents, producing a negligible positive effect.	Insignificant
		Environmental Systems	Low	Occasional lightning strikes in the surrounding steppe may cause localised vegetation burns, but such events are rare and not influenced by Project operations. The Project itself does not increase the risk of fire ignition or	Insignificant

Climate Hazard	Magnitude	Receptor	Sensitivity	Description of Risk/Impact	Significance of risk
				electrical discharge to the environment.	
Intense rainfall/flash and Seasonal flooding	Medium	Infrastructure and Assets	Low - Medium	Short, intense rain or rapid snowmelt can cause temporary ponding on access roads and in low-lying areas, slowing maintenance access. Substation yards and cable joint bays may require enhanced drainage upkeep; occasional washouts on unsealed shoulders possible. Assets are designed with graded surfaces, perimeter drains, and sealed enclosures, so effects are operational (access/scheduling) rather than structural.	Minor to Moderate
		Workforce	Medium	Maintenance crews may face slippery surfaces, reduced visibility, or limited site access during heavy rain/snowmelt. Work-at-height and driving may be deferred until conditions improve; exposure is intermittent and controllable via weather-based scheduling.	Minor
		Land users and communities	Low - Medium	Brief surface runoff or soft ground near project roads/track crossings may inconvenience grazing movements or local access after storms or snowmelt. The Project does not increase off-site flood risk; effects are localised and short-lived.	Insignificant to Minor
		Environmental Systems	Medium	Higher peak runoff during downpours or spring melt can mobilise sediments from verges and drains, increasing local erosion risk if maintenance lapses. With routine drainage and erosion-control upkeep, impacts remain contained to project footprints.	Minor
Prolonged drought/soil desiccation	Medium	Infrastructure and Assets	Low - Medium	Extended dry periods can dry and shrink near-surface soils along unsealed road verges and cable routes, causing minor ravelling, cracking, or settlement of shoulders. Foundations for WTGs/OHTL are designed for regional geotechnical conditions; no structural impact anticipated. Increased housekeeping on verges and drains may be required.	Insignificant to Minor
		Workforce	Low - Medium	Routine O&M continues; drought itself poses limited direct safety risk. Hard, desiccated surfaces may reduce traction for vehicles off-shoulder and	Insignificant to

Climate Hazard	Magnitude	Receptor	Sensitivity	Description of Risk/Impact	Significance of risk
				increase discomfort during outdoor work in hot, dry conditions (managed under heat protocols).	Minor
		Land users and communities	Medium	Regional drought can reduce pasture quality and water availability for grazing; these are pre-existing climatic pressures not altered by Project operations. Project does not abstract significant water or significantly alter catchment moisture balance.	Insignificant to Minor
		Environmental Systems	Medium	Soil moisture decline and vegetation stress can reduce ground cover, elevating susceptibility to wind/water erosion and making verges and disturbed strips slower to recover. With ongoing vegetation management and erosion-control maintenance, effects remain localised to project footprints.	Minor
Dust storms/reduced visibility	Small/Medium	Infrastructure and Assets	Low - Medium	Dust storms occur periodically in the region, typically during dry, windy spring or early summer conditions. High winds can transport fine sediment, temporarily reducing visibility and depositing dust on exposed surfaces. This can cause increased cleaning and maintenance requirements for turbine nacelles, transformers, and BESS air filters. Electrical components are sealed against dust ingress, so physical risk to assets is minimal.	Minor
		Workforce	Medium	Reduced visibility and blowing dust can present temporary safety hazards for driving, crane operations, and working at height. These events are short-lived (often hours rather than days) and are manageable through early weather warnings, halting outdoor or elevated work, and following site emergency procedures.	Minor to Moderate
		Land users and communities	Low - Medium	Regional dust storms may reduce visibility and air quality for people moving through the steppe, including herders or vehicle users on nearby tracks. The Project does not increase the frequency or severity of these events but may contribute minor localised dust resuspension from site roads if not	Insignificant to Minor

Climate Hazard	Magnitude	Receptor	Sensitivity	Description of Risk/Impact	Significance of risk
				maintained.	
		Environmental Systems	Low	Wind erosion and dust transport are natural features of the semi-arid steppe system. Project infrastructure may slightly alter surface roughness, but effects remain localised and reversible. Periodic vegetation management and surface stabilisation will prevent any significant contribution to erosion.	Insignificant
Wildfire (grass fires).	Small	Infrastructure and Assets	Low	Wildfires are not a current issue in the Project area due to sparse and discontinuous vegetation. The creation of turbine pads, substations, and all-weather access roads introduces additional firebreaks that reduce the continuity of fuel and therefore lower ignition and spread potential. The Project will not increase, and may in fact decrease, wildfire risk due to introduction of firebreaks.	Insignificant
		Workforce	Low - Medium	Operational personnel may encounter very limited risk from grass fires given the absence of dense vegetation and improved fire control access. Standard fire-safety procedures remain in place, but no credible threat to worker safety is anticipated.	Insignificant
		Land users and communities	Low - Medium	The Project area is already low-risk for wildfire, and new roads and managed verges will help to limit fire spread across grazing lands. Overall, the Project reduces the potential extent of grass-fire propagation.	Insignificant (net positive effect)
		Environmental Systems	Low	Given sparse vegetation cover and the introduction of maintained firebreaks, the Project will not contribute to wildfire occurrence or intensity. No adverse effects on environmental systems are anticipated.	Insignificant

19.6Mitigation, Management & Residual Impacts

Mitigation and management measures have been identified for each climate-related hazard to reduce risks to acceptable levels and enhance the Project's resilience to existing and future climatic conditions. These measures align with Masdar's Construction Environmental and Social Management System (cESMS), its associated management plans, and the design and operational standards adopted for the Project. While many measures apply to both the construction and operational phases, some are phase-specific, and residual risk significance is indicated accordingly.

Although climate change impacts are not expected to be significant over the Project's 25–30-year design life, climate-sensitive components—including WTGs, transmission lines, transformers, and the BESS—will undergo further assessment during detailed engineering to ensure that designs adequately account for potential increases in temperature, flooding, and wind loading. Permanent adaptation measures (e.g. improved drainage, foundation and road design, and suitable equipment specifications) will be incorporated into the civil works and O&M budgets.

Measures to protect worker health and safety during climatic extremes will be integrated into the construction and operational ESMS.

Additional climate-related design and management controls are presented in other topic-specific ESIA chapters, particularly:

- Section 14 – Hydrology and Hydrogeology, which covers drainage, runoff, and flood-management;
- Section 15 – Geology and Soils, which addresses erosion control and ground-stability; and
- Section 17 – Air Quality, which includes dust-management under dry and windy conditions.

Together, these cross-referenced measures form part of an integrated approach to managing the Project's exposure and adaptive capacity to climate-related risks.

Table 18-12: Hazard/Risk Mitigation and Management Measures

Climate Hazard	Pre- mitigation	Mitigation and Management Measures	Residual Significance
Extreme heat/temperature rise	**Moderate** (construction workers and operational assets)	• Specify climate-resilient thermal design: select equipment (transformers, switchgear, controls, BESS HVAC) with operating and warranty limits ≥ +45–50 °C , supported by a thermal derating and ventilation study to account for mid-century climate projections for southern Kazakhstan; include oversized cooling/HVAC, reflective finishes/shading for enclosures, temperature monitoring & high-temp alarms, and maintenance procedures that address accelerated ageing under higher ambient temperatures. • Adjust work hours to avoid peak heat periods; ensure shaded rest areas and drinking water for workers. • Monitor local heat index and enforce heat-stress work/rest protocols. • Maintain fire extinguishers and clear vegetation around work areas to reduce ignition risk. • Monitor and record any temperature-related derating of electrical systems to inform maintenance schedules.	**Minor** (workforce, assets)
Extreme cold events	**Moderate** (construction workers)	• Confirm during detailed design that minimum ambient design temperature assumptions are appropriate for the site (i.e. ≤ –25 °C), and that all major equipment (WTGs, OHTL, BESS, substations) is certified for continuous operation to –20 °C and short-term exposure below that threshold. • Use cold-rated lubricants, hydraulic fluids, and concrete additives suitable for low-temperature curing. • Implement cold-weather work procedures, including worker warm-up breaks and thermal PPE. • Store materials in frost-protected areas; avoid foundation works or lifting operations during severe frost. • Maintain site access through snow clearance, gritting, and use of anti-icing agents. • Inspect turbines and OHTLs for brittleness or ice formation before restart following extreme cold. • Ensure the Emergency Preparedness and Response Plan (EPRP) covers cold-related incidents (e.g. frostbite, vehicle immobilisation, or communication loss during extreme events).	**Minor** (workforce, assets)

Climate Hazard	Pre- mitigation	Mitigation and Management Measures	Residual Significance
Icing and snow accumulation	**Moderate** (workers)	● Clear snow and ice from site roads and crane pads before use; maintain winter access through regular grading. ● Suspend turbine maintenance or tower access during icing events. ● Establish an initial Health and Safety setback distance of 375 m (equivalent to 1.5 × [hub height + rotor radius]) from each wind turbine, consistent with the IFC EHS Guidelines for Wind Energy (2015), to protect against rare ice-throw or blade-fragment events. This distance may be refined following detailed engineering and site-specific risk assessment. Ensure this safety distance is clearly marked and enforced. ● EPC Contractor to develop a Turbine Icing and Ice-Throw Management Procedure, based on the selected turbine model and site-specific climatic conditions. The procedure shall include an ice-throw risk assessment, define detection, curtailment, establish winter access and exclusion zones, and set out communication and signage measures to protect site workers and the public. ● Communicate winter hazards to workers and local land users; install warning signage. ● Workers to be provided with specialized PPE adapted to the site's extreme conditions, including protection against slippery surfaces. ● Monitor ice loads and schedule inspections after severe icing to check for damage or imbalance. ● Maintain a simple climate-event log (icing, flooding, dust, extreme heat) within the ESMS and review annually.	**Minor–Moderate** (construction workforce).
High Winds and Severe Convective Storms (including downbursts, gusts, hail, and intense rainfall)	**Moderate** (workers and construction equipment)	● Suspend lifting, tower assembly, and work at height during strong winds or storm warnings. ● Project schedule to incorporate allowances for windy days when site activities are suspended due to high wind conditions to minimise potential for delays. ● Secure materials, blades, and cranes against high winds when idle. ● Include storm-readiness and high-wind response drills in the EPRP ● Ensure stormwater drains and culverts are clear before heavy rain; provide temporary diversions during storms. ● Halt outdoor work during hail or poor visibility; resume only when conditions stabilise. ● Design roads and drainage to withstand short, intense rainfall and prevent washouts. ● Conduct post-storm inspections of turbine blades, OHTLs, and drainage systems for damage or erosion.	**Minor–Moderate** (workforce).

Climate Hazard	Pre- mitigation	Mitigation and Management Measures	Residual Significance
		• Ensure good on-site waste management and housekeeping practices to prevent wind-blown debris or litter, particularly during periods of strong winds; secure light materials and packaging within designated, covered storage or waste areas.	
Lightning and Electrical Storms	**Moderate** (workers)	• Install grounding and surge protection for turbines, OHTLs, and substations. • Suspend outdoor and elevated work during lightning alerts; workers to shelter in vehicles or site buildings. • Maintain site-wide lightning detection and weather alert systems. • Inspect electrical systems and towers after nearby lightning strikes. • Conduct refresher training for workers on lightning safety procedures.	**Minor** (all receptors).
Intense rainfall/flash flooding/Seasonal flooding (snowmelt or runoff)	**Minor to Moderate** (construction phase Infrastructure, workers & Environmental Systems)	• Design and maintain stormwater drainage and culverts for regional rainfall and snowmelt intensity, incorporating climate-change allowances (e.g. a 10–20 % uplift to design rainfall or peak flow) to reflect projected precipitation increases for southern Kazakhstan. • Micro-site WTGs, crane pads, and permanent infrastructure outside the mapped 1 % AEP (Q100) flood extent, including snowmelt scenarios. Maintain at least 0.5 m vertical freeboard and horizontal buffers of ≥ 50 m from perennial or active channels, or ≥ 30 m from ephemeral gullies; if these cannot be met, conduct a site-specific assessment and implement engineered mitigation (e.g. raised pads, armouring, realigned drains) endorsed by the project hydrologist. • Apply a minimum setback of ≥ 20 m between OHTL structures and access roads and adjacent drainage channels, confirmed through a hydrology review using the adopted climate allowance. • Maintain elevated or sealed bases for electrical equipment in substations and control rooms. • Protect excavation areas and topsoil stockpiles with berms and silt fences to reduce erosion. • Schedule earthworks to avoid peak snowmelt or heavy-rain periods where possible. • Inspect and clear culverts and drains before and after heavy rain or spring thaw. • Reinstate ground cover and re-vegetate disturbed areas promptly after construction.	**Minor - Moderate** (construction)
Prolonged drought/soil desiccation	**Minor**	• Maintain vegetation cover and stabilise exposed soils to prevent drying and erosion. • Use water-efficient dust suppression (recycled water where available). • Limit heavy vehicle traffic on desiccated ground to prevent surface cracking.	**Insignificant–Minor** (environmental

Climate Hazard	Pre- mitigation	Mitigation and Management Measures	Residual Significance
		• Monitor condition of unsealed roads and reinstate grading as needed after dry periods. • Rehabilitate disturbed surfaces with drought-tolerant native species.	systems)
Dust storms/reduced visibility	**Minor to Moderate** (Workers)	• Monitor weather forecasts; suspend vehicle movement and crane operation during dust storms. • Ensure workers wear respiratory and eye protection under dusty conditions. • Maintain safe driving speeds and vehicle spacing when visibility is low. • Water unsealed roads and laydown areas during prolonged dry periods. • Clean sensors, ventilation filters, and optical instruments after dust events.	**Minor** (workforce).
Wildfire (grass fires).	**Insignificant**	• Maintain clear firebreaks around turbines, substations, and laydown areas. • Store fuels and flammable materials in bunded, cleared areas; enforce hot-work permits. • Equip site with firefighting equipment (extinguishers, water tanks, sand buckets). • Coordinate with local emergency services for wildfire response planning. • Manage roadside vegetation through grazing or periodic clearance. • Educate workforce and local land users on fire prevention measures.	**Insignificant** (all receptors; overall reduced fire spread potential due to site infrastructure).

Implementation of the above measures through the Project's Construction Environmental and Social Management System (cESMS) and associated plans will ensure that climate-related risks are effectively managed during both the construction and operational phases. The cESMS provides a framework for continuous monitoring, review, and adaptive management of weather-related hazards, ensuring that control measures remain appropriate under changing climatic conditions. Regular inspections, maintenance, and training will be undertaken to sustain site resilience, safeguard worker health and safety, and protect infrastructure and the surrounding environment.

Overall, after implementation of the proposed mitigation and management measures, the residual climate-related risks for all identified hazards are assessed as Insignificant to Minor, confirming that the Project is climate-resilient and aligned with good international industry practice and the requirements of the IFC Performance Standards, Equator Principles IV, and AIIB E&S Framework (2024).

In addition to the Project's technical and operational adaptation measures, it is recognised that local communities and PAPs generally have limited awareness of climate change processes and their potential long-term implications for local livelihoods, pasture conditions, and water resources. To enhance community resilience and adaptive capacity, the Project is encouraged to support basic climate change awareness and outreach activities, for example through the SEP or community development initiatives. Such engagement could include information materials or discussions on regional climate trends, sustainable land-use practices, and preparedness for extreme weather events.

19.7Summary and Conclusions

All major hazards—extreme heat, cold, icing, strong winds, convective storms, flooding, and drought—are already present under baseline conditions and will remain relevant throughout the Project's 25–30-year lifetime.

While climate change may moderately influence the frequency and intensity of certain hazards, particularly heatwaves, heavy rainfall, and drought events, the Project's identified mitigation measures, engineering design and management systems provide robust resilience consistent with IFC, AIIB E&S Framework, and Equator Principle requirements.

Combining receptor sensitivity and hazard likelihood, the Project's overall exposure to climate-related physical risks is assessed as:

- **Minor to Moderate** during construction, and
- **Minor** during operation.

Residual risks are considered minor and manageable with implementation of the measures described in Section 1.6.

Sensitivity levels are low to medium for infrastructure and environmental systems, and moderate to high for the workforce, reflecting exposure to outdoor climatic extremes during construction and maintenance.

Key operational hazards — such as icing, strong winds, and temperature extremes — are mitigated through turbine control systems, component design standards, and maintenance planning. The residual risk profile remains predominantly low.

Key Findings

- The Project's physical assets will be engineered for operation between –25 °C and +45 °C, with structural and electrical design standards meeting IEC 61400 (Wind Class I, 50 m/s design wind speed).
- Predicted climatic shifts—average temperature increase of up to +2.5 to +3 °C by 2050 and precipitation increase of up to ≈ 19 % by 2080— should be included within the tolerance limits of design assumptions.
- Climate-related risks are short-term and manageable through preventive maintenance, worker safety procedures, and seasonal planning.
- No transition risks are triggered, as the Project's operation contributes to Kazakhstan's NDC targets and Carbon Neutrality Strategy (2060) by displacing carbon-intensive power generation.

Key Recommendations

- Detailed Design and Engineering
    - Verify that all electrical and mechanical systems are rated for minimum design temperature ≤ –25 °C, maximum design temperatures of at least +45 °C and peak wind speeds ≥ 50 m/s, consistent with observed and projected climate conditions.
    - Maintain minimum buffers of ≥ 50 m for WTGs and ≥ 20 m for OHTL structures and access roads from drainage channels or flood-prone areas, and apply a 10–20 % rainfall-intensity uplift to design rainfall and peak flow.
    - Undertake a turbine-icing management and risk assessment, including ice-throw evaluation and setback verification ≥ 375 m per IFC EHS Guidelines and integrating operational curtailment and warning protocols.
- Construction-Phase Management
    - Implement cold- and heat-weather working procedures under the OHS Management Plan, with rest scheduling, hydration, and PPE standards, supported by worker welfare facilities, aligned with IFC EHS Guidelines.
    - Ensure the cESMS integrates climate-responsive plans (e.g. Stormwater Management Plan, Traffic and Transport Plan, Emergency Preparedness and Response Plan).
    - Maintain good housekeeping and waste control to prevent wind-blown litter and blockage of drainage channels.
- Operational Resilience
    - Embed climate-risk considerations within the preventive maintenance programme for WTGs, OHTLs, substations, and the BESS, including inspection following icing, extreme wind, or high-temperature events.
    - Periodically review local meteorological data (via Kazhydromet and on-site SCADA records) to update climate assumptions and operational thresholds.
    - Manage site access seasonally to protect workers, grazers, and local road users during adverse weather or icing conditions.
- Monitoring, Community Engagement, and Adaptive Management
    - Establish a climate performance register tracking weather-related incidents, downtime, and drainage performance to inform adaptive maintenance.
    - Review and update climate risk assessments every five years or if material climate data revisions occur.
    - Coordinate with the local Akimat and Kazhydromet to share site meteorological observations contributing to regional climate-monitoring programmes.

- Promote climate-change awareness among workers and local communities through the Project's Stakeholder Engagement Plan, including information on seasonal hazards (e.g. icing, strong winds, or flooding) and safe site-access practices during adverse weather.

Overall Conclusion

With the mitigation and management measures outlined in Section 1.6, the Project is assessed to have a low residual climate-related risk profile. The Project design should provide robust resilience to current and future climatic conditions.

By implementing the recommended engineering and management measures — and through continued community engagement and climate awareness — the Project will maintain operational reliability, safeguard worker and public safety, and contribute to Kazakhstan's long-term climate resilience and decarbonisation goals.

20 Cumulative Impact Assessment (CIA)

20.1Introduction

Large-scale renewable energy developments can interact with other existing or planned activities within their wider region, resulting in combined or incremental environmental and social changes. These combined effects, referred to as cumulative impacts, may arise when multiple actions influence the same environmental or social receptors over time or across shared spatial areas.

Cumulative impacts are defined in the IFC Good Practice Handbook on CIA, as the "*successive, incremental, and/or combined effects of an action, project or activity when added to other existing, planned and/or reasonably foreseeable future actions*". These effects may be environmental (e.g., habitat disturbance, landscape change), social (e.g., increased traffic or pressure on local services), or cultural (e.g., impacts on the setting of heritage features).

This CIA has been undertaken in line with the requirements of IFC Performance Standard 1 (Assessment and Management of Environmental and Social Risks and Impacts). These standards require project proponents to identify the Valued Environmental and Social Components (VECs) that may be affected by combined project-related and external influences, assess how cumulative interactions may occur, and adopt measures to ensure that the viability of those VECs is maintained over the Project lifecycle.

The purpose and overall methodology of this CIA is therefore to:

- Identify existing, planned or reasonably foreseeable developments and land-use activities that may interact with the Project.
- Identify the environmental and social components that may be sensitive to cumulative change (Candidate VECs), and screen and select the VECs for which cumulative impacts may realistically arise.
- Assess how the Project, in combination with other influencing activities and existing environmental pressures, may contribute to cumulative effects on the selected VECs.
- Recommend mitigation, management and monitoring measures to avoid, minimise or otherwise manage cumulative impacts of the Project on the VECs.

This assessment complements but does not duplicate the discipline-specific impact assessments presented in earlier chapters of this ESIA. While each topic chapter evaluates the Project's impacts relative to baseline conditions, the CIA provides an integrated, higher-level assessment of combined effects, especially where spatial or temporal overlaps between the Project and other developments may occur.

The findings of this CIA inform the Project's Environmental and Social Management System (ESMS), ensuring that cumulative risks are systematically managed throughout construction and operation. The overall objective is to ensure that the Project's contribution to cumulative change remains within acceptable levels consistent with national requirements, lender standards and GIIP.

20.2Other Existing and Planned Developments and Activities

The wider region contains several existing operational developments and land-use activities that may interact with the Project and therefore have the potential to contribute to cumulative environmental and social effects. The following key activities have been identified, with their locations in relation to the Project shown in the corresponding figures:

- Zhanatas (100MW) and Shokpar (100MW) Wind Farm (Figure 19-1)
- Kazphosphate phosphate mining and processing activities (Figure 19-1)
- Eurochem phosphate mine (Figure 19-2)
- OHTLs along the Jambyl OTHL route (Figure 19-2) and (Figure 19-3)
- OHTLs along the Kentau OTHL route (Figure 19-4)
- Sozak Mining area along Kentau OHTL (Figure 19-5).

No future planned major infrastructure projects were identified during consultations with the district Akimats.

In addition to the specific developments listed above, the wider region is also influenced by ongoing baseline activities such as livestock grazing, agricultural land use, seasonal herder movements, local road traffic, and routine community activities. While not "projects" in the formal sense, these background pressures can contribute to cumulative environmental and social effects where they coincide spatially with the Project and the other developments identified.

These developments and activities form the broader context within which potential cumulative effects may arise. The extent to which they interact with the Project is considered further in the identification and screening of VECs in the subsequent section.

Figure 19-1: Existing Zhanatas and Shokpar Wind Farms, and Eurochem phosphate mine in relation to the Project

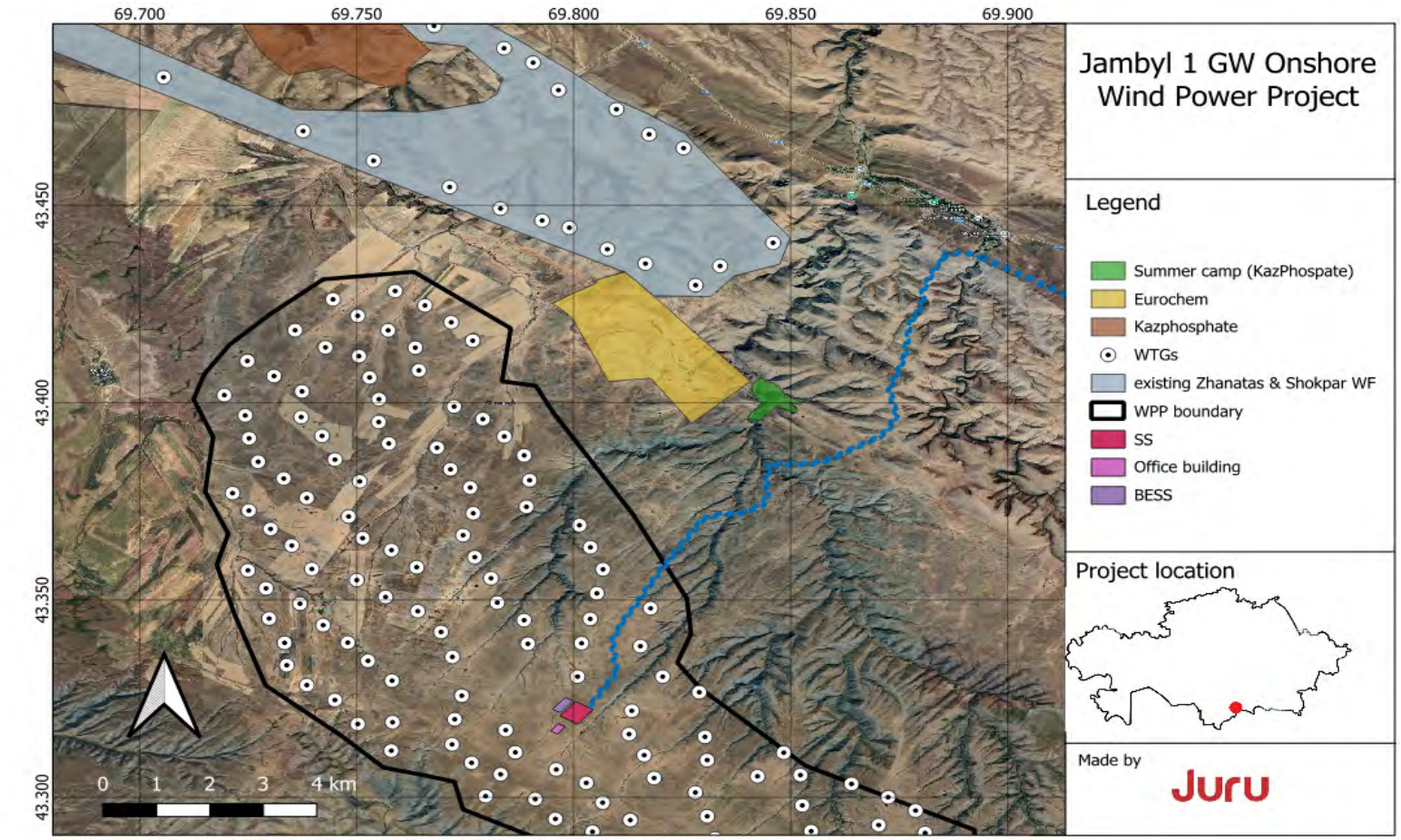


Figure 19-2: Jambyl OHTL Route and location of Existing OHTL

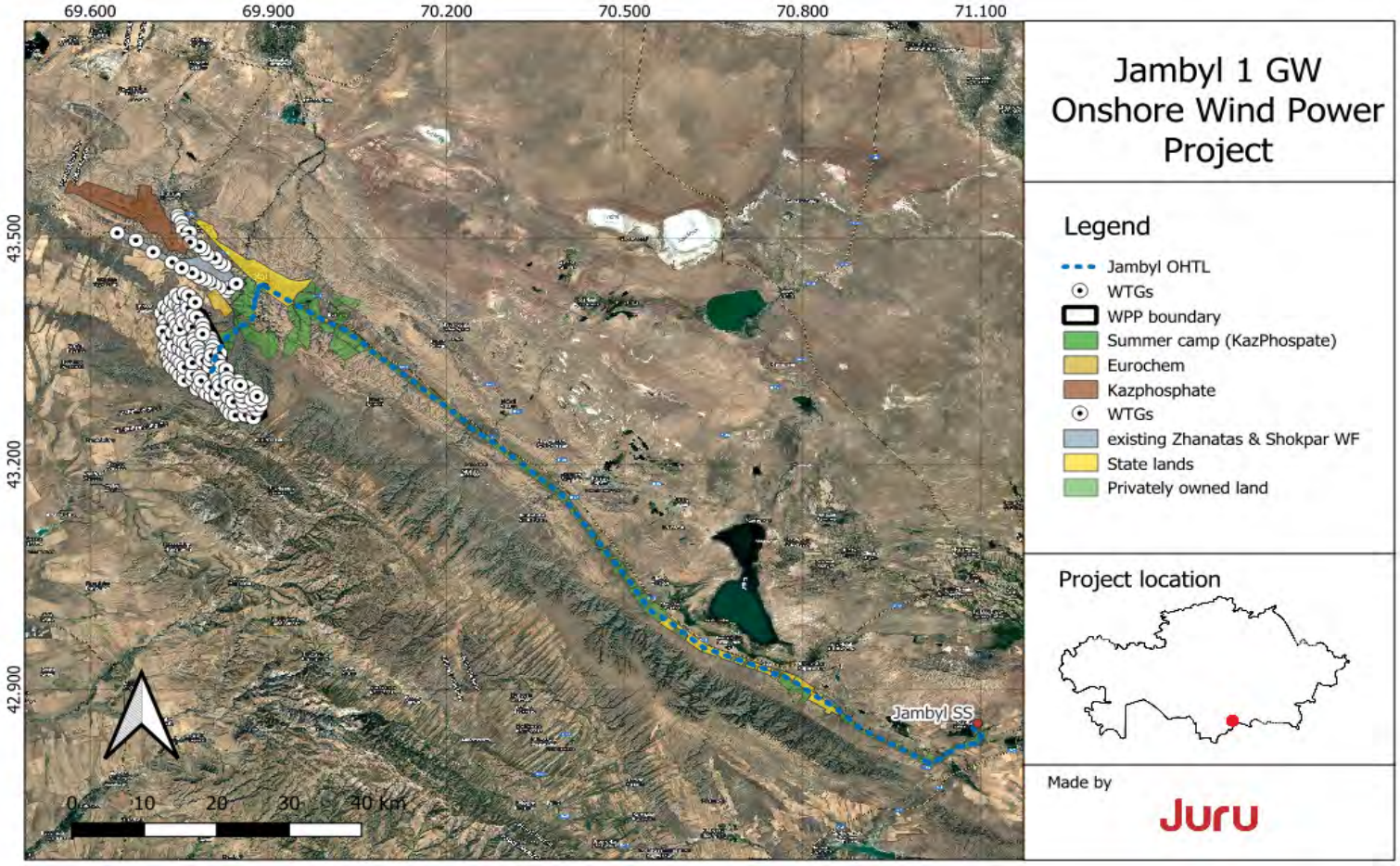


Figure 19-3: OHTL Route and location of Existing OHTLs in Vicinity of Jambyl Substation

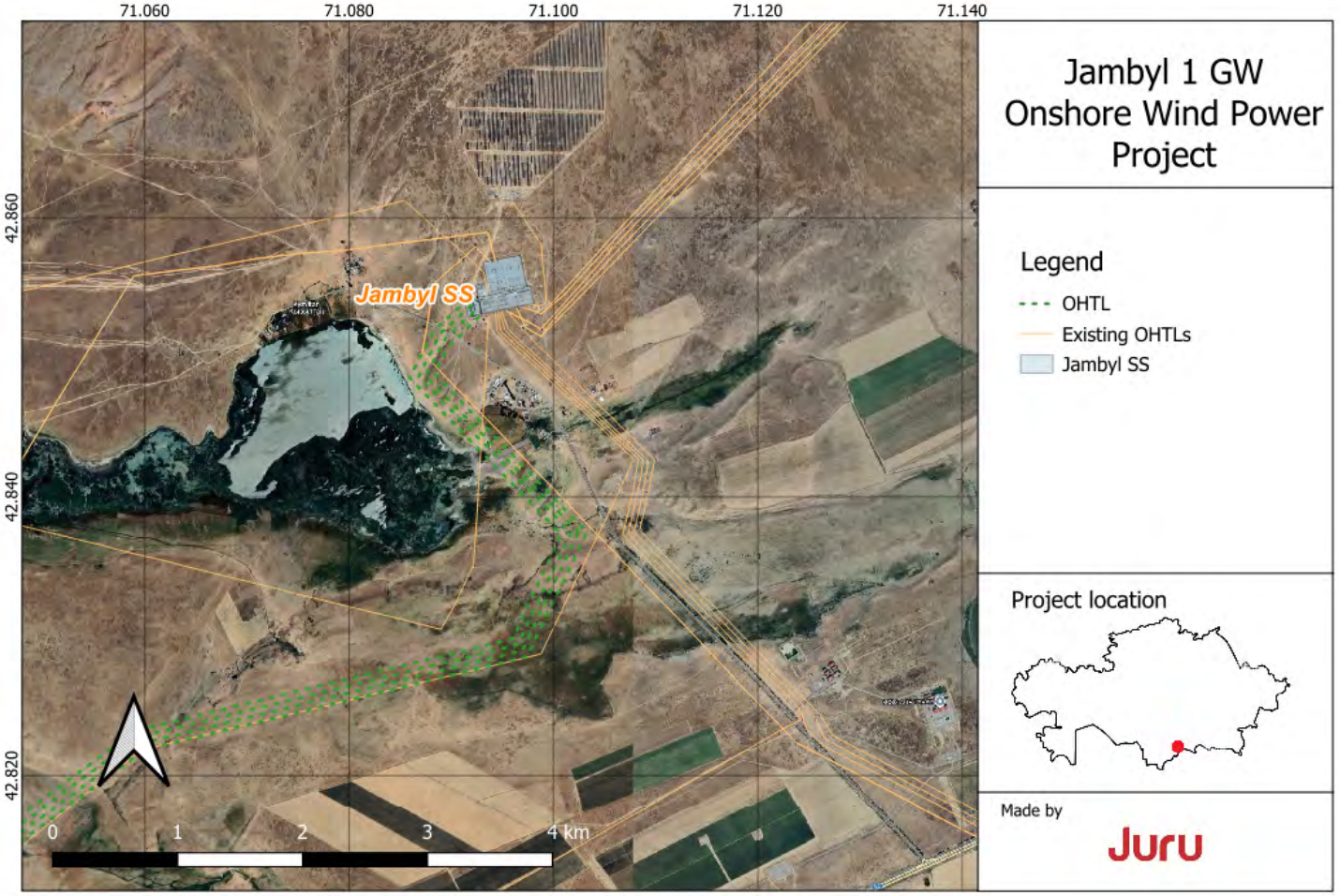


Figure 19-4: Kentau OHTL Route and location of Existing OHTL

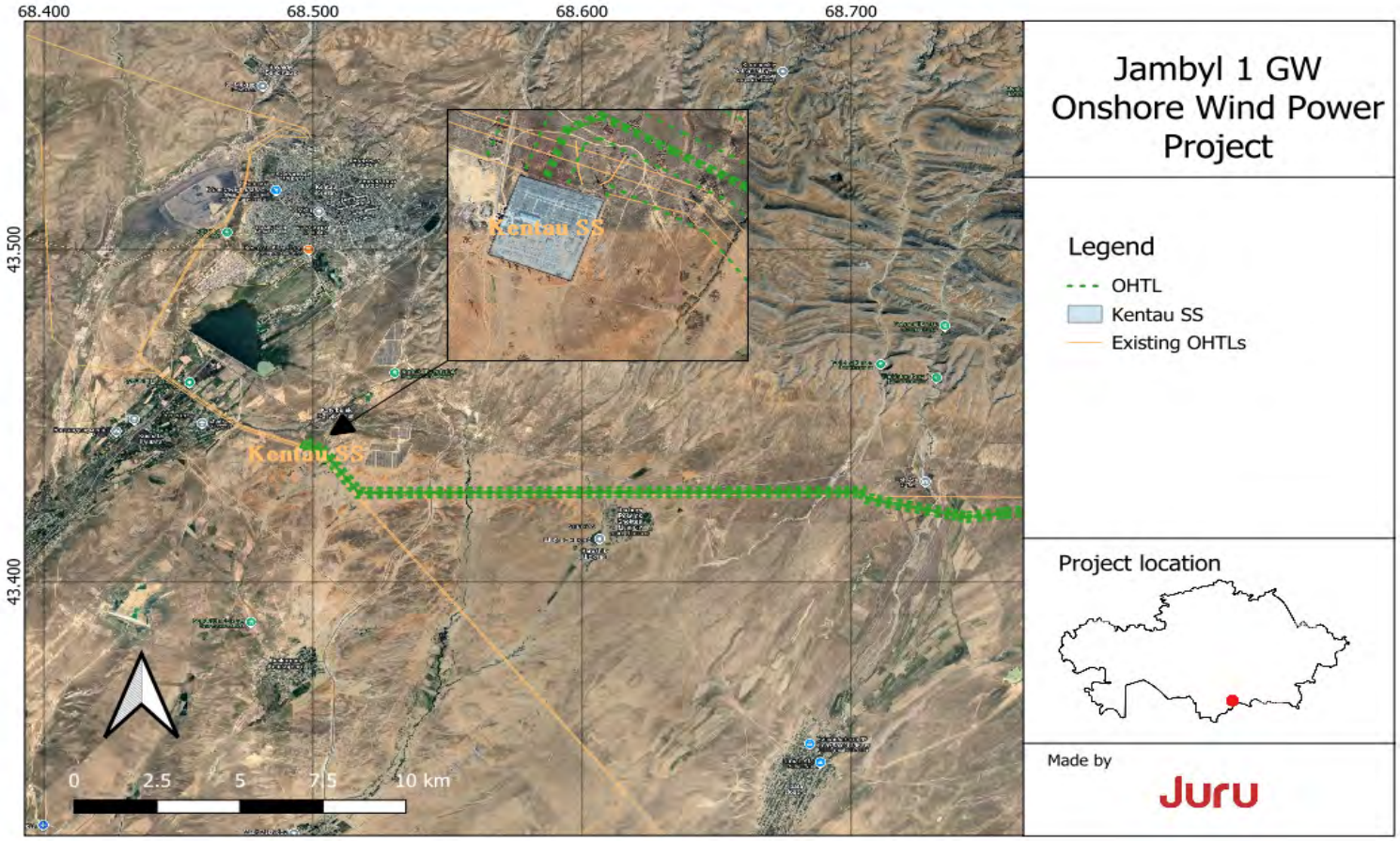
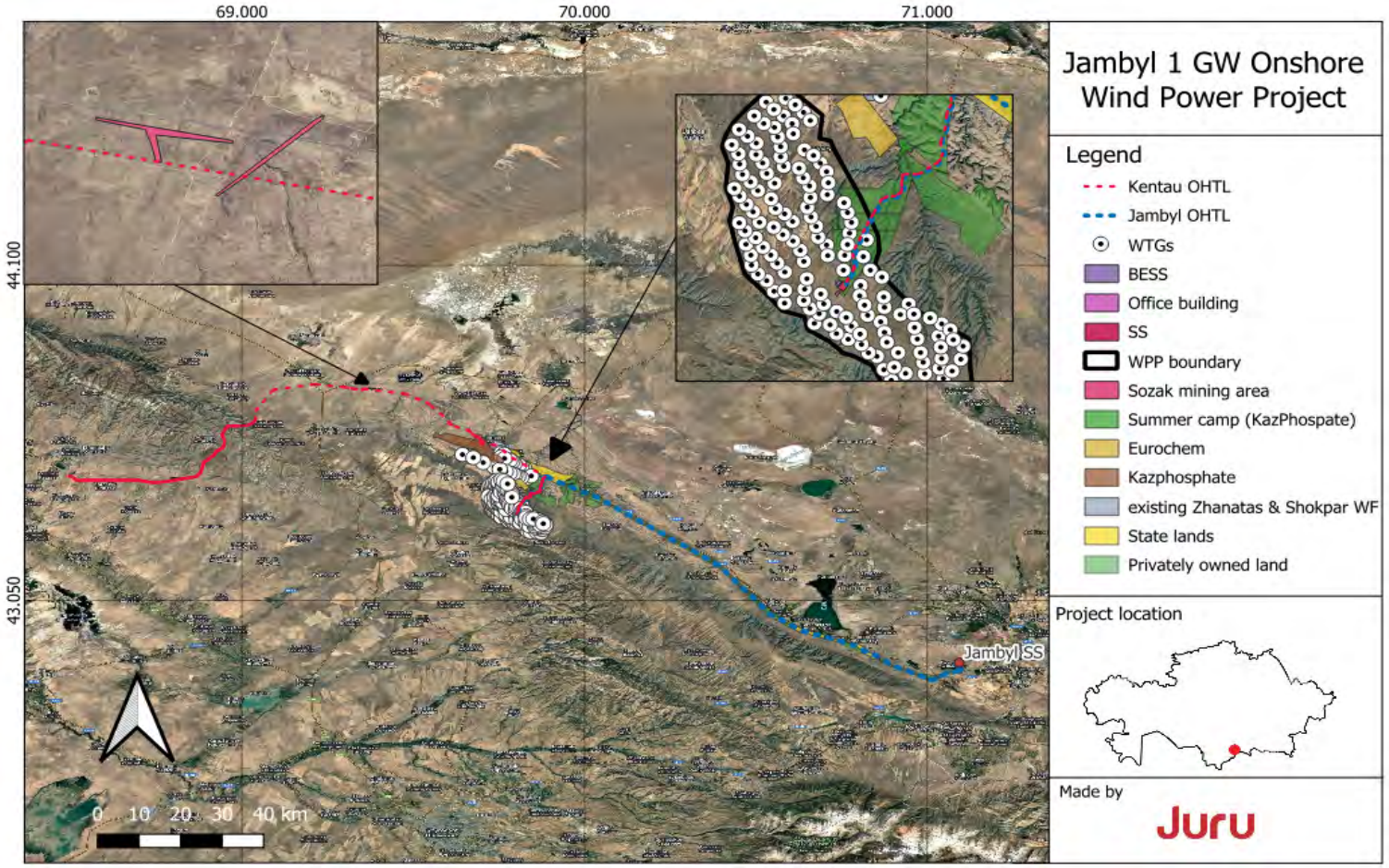


Figure 19-5: Sozak mining areas along Kentau OHTL



20.3Screening of Valued Environmental and Social Components (VECs)

The identification of VECs for cumulative assessment focuses on those environmental and social receptors that may reasonably experience combined effects from the Project and other existing, planned or reasonably foreseeable activities in the wider region.

This section therefore provides the screening of candidate VECs, assessing whether each receptor warrants further cumulative assessment based on:

- its inherent sensitivity or value;
- whether it is affected by the Project;
- whether it is also affected by other external activities;
- whether spatial or temporal overlap exists; and
- whether a credible cumulative pathway can be established.

Only VECs where cumulative interactions are likely or plausible are retained for detailed assessment in subsequent sections.

Table 19-1: Screening of VECs for Inclusion in the CIA

VECs	Relevance to the Project	Other Activities Affecting VEC	Credible Cumulative Pathway?	Include in CIA?	Justification
Migratory birds & raptors	WPP & OHTLs pose collision and displacement risks	Other wind farms; existing OHTLs	Yes	**Yes**	Wind farms and existing OHTLs overlap with major migratory flyways, creating a potential for cumulative collision and displacement risk.
Great bustard & key steppe avifauna	Sensitive species potentially affected by disturbance	Agricultural expansion; other wind farms	Yes	**Yes**	These species are of high conservation concern and are susceptible to landscape-scale disturbance and habitat fragmentation arising from multiple activities.
Karatau argali (ecological corridor)	WPP within alternate route; OHTLs span corridor edges	Grazing and agriculture; settlements	Yes	**Yes**	Argali movement occurs through narrow ecological corridors that may be increasingly constrained by combined disturbance and land-use pressures.
Steppe habitats & fragmentation	WPP access roads, platforms, OHTL towers	Grazing pressure; agricultural conversion	Yes	**Yes**	The Project contributes incremental habitat loss and fragmentation within an already pressured steppe landscape, resulting in a credible cumulative pathway.
Communities & settlements	Workforce presence; traffic; construction nuisance	Mining trucks; agricultural traffic	Limited	**No**	All other identified developments are operational and will not create overlapping construction workforces or disturbance. The Project workforce will be accommodated in dedicated facilities. Any community-related cumulative effects are limited to road traffic during Project construction, which is addressed under the Traffic & Transport Network VEC.
Cultural heritage sites	OHTL routing intersects CH-rich areas	Agricultural disturbance; natural erosion	Limited	**No**	All cultural heritage sites have been fully avoided by design and protected through statutory 120 m buffers. Other activities do not affect the same sites; therefore, no

VECs	Relevance to the Project	Other Activities Affecting VEC	Credible Cumulative Pathway?	Include in CIA?	Justification
					cumulative pathway exists.
Pastoralism & grazing livelihoods	Temporary disruption; access constraints	Land conversion; water pressures	Limited	**No**	The Project footprint is small relative to the grazing landscape, and cumulative effects remain low and manageable through standard access planning.
Ecosystem services (pasture productivity)	Minor local disturbance	Grazing; agricultural expansion	Limited	**No**	Any effects on pasture productivity are negligible and are already captured under other retained VECs (steppe habitats and fauna). No separate cumulative pathway exists.
Traffic & transport network	Heavy transport during construction	Mine haulage; agricultural transport	Yes	**Yes**	Project construction traffic may coincide with existing heavy-vehicle flows on key routes, creating a credible cumulative road-safety and congestion risk.
Surface watercourses & springs	Localised construction disturbance	Pastoral abstraction; mining; roads	Limited	**No**	Project-affected water features are confined to small upstream micro-catchments that do not interact with other developments. Furthermore, the Project will rely on tankered water rather than groundwater extraction. No cumulative hydrological pathway exists. However, impacts to springs or shallow aquifers may be incorrectly attributed to the Project and present a perceived impact to communities. Perceived impacts are to be addressed through ongoing engagement, as per the SEP.

VECs	Relevance to the Project	Other Activities Affecting VEC	Credible Cumulative Pathway?	Include in CIA?	Justification
Groundwater resources	Minor risk from construction only	Agricultural/well abstraction	Limited	**No**	The Project contribution is negligible and does not overlap spatially or temporally with other groundwater-related pressures; therefore, no cumulative interaction is anticipated.
Air quality (dust & particulates)	Construction dust sources	Mining operations; agriculture; road traffic	Localised	**No**	Project-related dust and emissions are short-term, highly localised and do not overlap significantly with other sources; cumulative air-quality effects are unlikely.
Ambient noise and vibration	Construction noise; turbine operational noise	Existing wind farms; Mining; road traffic	Limited	**No**	Sparse receptors and large separation distances mean no overlapping noise influence with other developments; no cumulative noise pathway exists. During construction blasting impacts from the Project is not likely to contribute to noise or vibration impacts on local communities due to distance (see Chapter 11), however Eurochem mine blast impacts may be misattributed to the Project and present a perceived impact to communities. Perceived impacts are to be addressed through ongoing engagement, as per the SEP.
Landscape & visual character	Turbines visible over long distances	Existing wind farms & OHTLs	Yes	**Yes**	The Project adds new tall structures in a region that already contains wind farms and transmission lines, contributing to cumulative landscape and visual change.

20.4Cumulative Impact Assessment for Retained VECs

This section presents the cumulative impact assessment for the VECs retained through the screening process. The assessment considers how the Project's residual impacts may combine with those arising from other existing or planned developments, as well as wider ongoing environmental and socio-economic pressures in the region. For each retained VEC, the analysis focuses on whether spatial or temporal overlap exists between the Project and other influencing activities, the magnitude and nature of the Project's contribution to cumulative change, and the significance of any resulting cumulative effects. Mitigation and monitoring measures are identified where required to ensure that cumulative impacts remain within acceptable levels and consistent with lender standards and GIIP.

20.4.1 Migratory Birds & Raptors

Existing Context and Cumulative Sensitivities

The Project is located within an area of high ornithological sensitivity, intersected by both the Central Asia–India and West Asia–Africa migratory flyways. Baseline studies indicate concentrated movement corridors for large soaring birds, including eagles, vultures, storks and other high-collision-risk species. The wider region already contains relevant linear infrastructure (multiple OHTLs) and the operational wind farm Zhanatas-Shokpar, contributing to cumulative collision and displacement pressure on migratory birds and raptors.

Project Contribution to Cumulative Change

The Project adds up to 140 WTGs and two long OHTL corridors, each with structures capable of collision or electrocution risk. Although mitigation measures (e.g., micrositing, turbine layout optimisation, marking of OHTLs) reduce direct impacts, the Project will still incrementally increase the density of aerial obstacles within a known flyway zone. This contribution is most significant during peak migration periods and along recognised raptor movement corridors influenced by topography.

Other Activities Affecting This VEC

Cumulative interactions may arise with:

- the Zhanatas and Shokpar wind farms, whose turbines are located within the same general migration region;
- existing OHTLs along both the Jambyl and Kentau alignments, which increase the concentration of collision-risk structures within the corridor; and
- regional grazing and agricultural activities which can influence prey availability, flight behaviour or local movement patterns.

Although these features are not directly connected, their combined presence increases the functional density of collision-risk elements across the flyway landscape.

It is noted that there is no publicly available post-construction monitoring or impact data for the operational Zhanatas and Shokpar wind farms. Consequently, it is not possible to draw conclusions regarding observed collision rates, displacement effects, or population-level responses associated with those projects. The cumulative assessment therefore relies on baseline survey data, spatial relationships between infrastructure and known movement corridors, and a precautionary interpretation of potential interaction pathways, consistent with GIIP.

The cumulative impact assessment is limited to consideration of the Project's own potential

contribution to cumulative risk, assessed in the context of surrounding infrastructure. The Project is not operationally linked to neighbouring wind farms, and cannot assume responsibility for the management, mitigation, or legacy impacts associated with other facilities. Mitigation and monitoring measures proposed for the Project are therefore strictly project-specific and are designed to address risks identified within the Project's AoI.

Cumulative Impact Assessment

When considered alongside existing turbines and transmission lines, the Project contributes to a wider pattern of aerial hazard density in a region already exposed to anthropogenic structures. The key cumulative concern relates to:

- increased probability of collision for large soaring birds, especially during concentrated migration events;
- incremental barrier effects, with multiple wind farms and OHTLs collectively influencing flight paths; and
- potential cumulative impacts on regionally significant raptor populations that may be sensitive to even small incremental losses.

Displacement effects may also accumulate where multiple projects reduce the extent of disturbance-free airspace or influence flight behaviour near cliffs, ridges, or upland steppe features.

Significance of Cumulative Impacts (Pre-Mitigation)

Given the ecological importance of the flyway and the presence of other existing structures, cumulative impacts on migratory birds and raptors are assessed as Moderate prior to mitigation, depending on species group and seasonal behaviour.

Mitigation and Enhancement Measures

To manage cumulative effects, the Project should consider implementing measures that extend beyond standard project-level controls, including:

- project-specific avian monitoring programmes aligned with regional datasets and relevant national guidance, and informed by publicly available information where applicable;
- minimization strategy including the application of shutdown on demand and a Vulture and Raptor Food Management Plan (VRFMP) to reduce Priority Bird collision risk and the presence of attractants which may contribute to bird and wind turbine collision risk;
- high-visibility OHTL marker installation along sensitive spans;
- participation in any regional or national research or conservation initiatives related to raptors and soaring birds.

Residual Cumulative Impact

With implementation of the above measures, cumulative impacts are expected to reduce to Minor. However, due to the strategic importance of the flyways and the presence of other existing infrastructure, some level of cumulative risk is unavoidable and must be managed through long-term monitoring and adaptive management, which will be managed through the Biodiversity Management Plan (BMP).

20.4.2 Great Bustard & Steppe Avifauna

Existing Context and Cumulative Sensitivities

The wider Project region supports a range of steppe-dependent bird species, including the Great Bustard, a species of high conservation concern known for its sensitivity to disturbance, habitat fragmentation, and collision risk. Baseline surveys indicate occasional use of the wider area by Great Bustard and regular presence of steppe passerines, larks, and other ground-nesting birds.

The steppe landscape is subject to long-term grazing pressure, localised agricultural expansion near settlements, and the presence of existing OHTLs and wind farms, all of which contribute to the progressive fragmentation of open habitat.

Project Contribution to Cumulative Change

The Project introduces temporary construction disturbance, permanent turbine platforms, access roads, and footprints associated with OHTL towers. These contribute small increments of habitat loss and localised disturbance to steppe birds that favour open, undisturbed areas. While the Project layout avoids key sensitivity zones where possible, the cumulative footprint still reduces undisturbed steppe extent.

Other Activities Affecting This VEC

Cumulative pressures on Great Bustard and steppe avifauna arise from:

- existing transmission lines, which fragment habitat and may influence flight behaviour;
- operational wind farms in the broader region, which contribute to displacement and collision risk for large steppe species;
- agricultural expansion and mechanised farming near local settlements; and
- grazing intensity, which alters vegetation structure and breeding habitat suitability.

These pressures combine to create a landscape that is gradually less favourable for steppe-specialist species.

As noted above, no publicly available post-construction monitoring data is available for the Zhanatas and Shokpar wind farms, including for Great Bustard or other steppe avifauna. The cumulative assessment therefore draws on baseline survey findings, habitat sensitivity, and the spatial distribution of infrastructure, applying a precautionary approach consistent with GIIP.

The assessment considers only the Project's incremental contribution to cumulative effects and does not assume responsibility for impacts arising from other projects. Mitigation measures proposed are project-specific and focused on risks identified within the Project area.

Cumulative Impact Assessment

When considered in combination with existing infrastructure in the surrounding steppe landscape, including a nearby wind power development, the Project contributes to cumulative impacts affecting Great Bustard and steppe avifauna through the spatial and functional overlap of multiple pressures.

Cumulative effects arise primarily from the co-occurrence of wind energy infrastructure and OHTLs within the same landscape units used by Great Bustard for breeding, foraging and movement. In combination, these developments result in:

- incremental loss and fragmentation of steppe habitat at the landscape scale;
- cumulative disturbance from construction and operational activities occurring within overlapping or adjacent areas;

- increased behavioural avoidance of areas with a higher density of vertical structures, reducing habitat availability and functionality; and
- for Great Bustard specifically, an incremental increase in collision risk and disturbance where movement and flight corridors intersect multiple infrastructure elements, including OHTLs.

While each individual project may result in limited direct effects when assessed in isolation, their spatial overlap leads to cumulative pressure on breeding habitats and associated functional areas used by Great Bustard. In this context, cumulative impacts are characterised by the additive and potentially synergistic effects of disturbance, habitat fragmentation and infrastructure-related barriers within the same steppe landscape.

Significance of Cumulative Impacts (Pre-Mitigation)

Given the Critical Habitat status of Great Bustard and the species' sensitivity to disturbance during the breeding period, cumulative impacts affecting breeding habitats and associated movement corridors are assessed as Moderate in the pre-mitigation context.

Mitigation and Enhancement Measures

To manage cumulative risks, the Project will implement:

- micro-siting of OHTL towers away from areas of higher steppe-bird activity where feasible;
- avoidance of construction during peak breeding periods in sensitive areas, where practicable;
- habitat restoration and soil stabilisation along temporary access routes post-construction;
- strategic placement of OHTL bird diverters to reduce collision risk for low-flying species; and
- pre-construction and construction surveys for steppe-bird species. Pre-construction data to be used as part of baseline data collection to inform the BMP. Construction phase information to be used to inform potential avoidance or minimization measures to avoid or reduce impacts associated with construction on the species. For example, the use of temporary setbacks to exclude construction activities from disturbing an active brood site.

Residual Cumulative Impact

With the above measures, residual cumulative effects are expected to reduce to Minor–Moderate, depending on species group and location. Some long-term cumulative pressure remains inevitable because of the already modified steppe ecosystem, but risks can be managed effectively through adaptive monitoring and mitigation through the BMP.

20.4.3 Karatau Argali (Ecological Corridor)

Existing Context and Cumulative Sensitivities

The Project lies close to the recognised Karatau ecological corridor, established to support the movement of the Karatau argali, a species of high conservation interest in Kazakhstan. Although baseline surveys indicate that the main concentration of argali movements occurs to the south and west of the WPP area, individuals and small groups may move through the wider steppe landscape, particularly along ridgelines and areas with suitable forage.

Cumulative pressures on argali include grazing competition, human activity along access tracks, disturbance from mining and agricultural activities, and fragmentation of movement routes by infrastructure.

Project Contribution to Cumulative Change

The Project introduces turbines, access roads, and two OHTL routes, all of which have the potential to cause localised disturbance, particularly during construction. While the Project design avoids the core ecological corridor and uses buffers to reduce interaction with known movement areas, the Project still introduces new sources of noise, human presence, and physical structures within the wider landscape. These features may incrementally affect argali movement or habitat use, even if the core corridor remains unaffected.

Other Activities Affecting This VEC

Cumulative risks to argali may arise in combination with:

- existing road networks, which increase disturbance and human presence;
- livestock grazing, which can limit forage availability in certain seasons;
- agricultural land conversion near settlements; and
- existing OHTLs, which contribute to linear features in the landscape and may influence movement behaviour in some contexts.

Although none of these activities directly block movement routes, they collectively contribute to incremental pressure on an already constrained ecological landscape.

Cumulative Impact Assessment

Considering the presence of other land uses and infrastructure, the Project's additional disturbance could contribute to:

- short-term displacement of argali from construction areas;
- incremental fragmentation where Project features coincide with existing disturbance footprints; and
- reduced habitat connectivity if several small disturbances accumulate in proximity to peripheral movement areas.

While the Project avoids the central ecological corridor and therefore does not pose a major fragmentation risk, it still adds to the cumulative disturbance footprint in the wider argali landscape.

Significance of Cumulative Impacts (Pre-Mitigation)

Before mitigation, cumulative impacts on argali movement and habitat use are assessed as Moderate because of the species' sensitivity, limited distribution, and the existing pressures on the corridor environment.

Mitigation and Enhancement Measures

Mitigation measures to manage cumulative effects will include:

- scheduling construction to avoid working in areas where peak seasonal movement periods may occur, where relevant;
- enforcing strict speed limits and traffic-management measures on access routes;
- restricting night-time construction activity in peripheral argali-use areas where possible;
- maintaining or restoring vegetation cover and forage quality along disturbed areas; and
- integrating argali observations into the broader biodiversity monitoring programme, enabling adaptive mitigation if movement disruption is detected.

In addition, ongoing liaison with environmental authorities will support alignment with national efforts

to maintain the functionality of the Karatau ecological corridor.

Residual Cumulative Impact

With effective implementation of the above measures, residual cumulative impacts are expected to reduce to Minor–Moderate. Some long-term residual influence is possible due to the species' sensitivity and the presence of other regional land uses, but the Project is not expected to materially affect the functionality of the core ecological corridor.

20.4.4 Steppe Habitats & Fragmentation

Existing Context and Cumulative Sensitivities

Steppe habitats dominate the Project area and wider region, supporting a characteristic assemblage of flora and fauna adapted to open, low-disturbance environments. These habitats are already subject to ongoing grazing pressure, localised agricultural expansion, soil disturbance near settlements, and the presence of linear infrastructure such as access tracks and transmission lines. Although the landscape remains largely intact at a regional scale, these various pressures contribute to gradual fragmentation of undisturbed steppe areas and reduced habitat quality in proximity to infrastructure or settlements.

Project Contribution to Cumulative Change

The Project introduces new physical footprints—turbine foundations, crane pads, access tracks, temporary construction areas, and OHTL tower locations. While these are dispersed across a large area and individually small, their cumulative footprint represents a localised but permanent loss of steppe habitat. The Project also increases human activity and construction disturbance during the build-out phase, contributing to temporary displacement of sensitive fauna.

Although the Project layout has avoided key ecological features and uses existing track corridors where possible, its overall land-take still incrementally reduces the availability and continuity of undisturbed steppe.

Other Activities Affecting This VEC

Other regional activities that exert cumulative pressure on steppe habitats include:

- long-term livestock grazing, which affects vegetation structure, soil stability and species composition;
- agricultural conversion near settlements, resulting in permanent habitat loss;
- mining and associated haulage routes, which degrade natural soil and vegetation in certain areas; and
- existing OHTLs and wind farms, which introduce additional linear elements and disturbance footprints into the steppe environment.

These activities do not individually result in significant fragmentation at a regional scale but collectively contribute to a progressive reduction in habitat integrity.

Cumulative Impact Assessment

When considered alongside existing land uses and infrastructure, the Project contributes to:

- a small but permanent increase in habitat fragmentation due to scattered turbine and tower footprints;

- incremental reduction of high-quality steppe habitat, particularly where multiple disturbance sources overlap;
- potential disruption to wildlife movement patterns across the steppe, especially for species sensitive to vertical structures or repeated disturbance; and
- temporary but widespread construction-phase disturbance, adding to the baseline of ongoing grazing and land-use pressures.

The Project does not, however, create major barriers to movement or extensive conversion of steppe habitat, and cumulative effects remain diffuse and landscape-wide rather than concentrated.

Significance of Cumulative Impacts (Pre-Mitigation)

Given the ecological value of steppe habitats, the largely intact regional context, and the diffuse and incremental nature of existing and project-related pressures, cumulative impacts on steppe habitats prior to mitigation are assessed as Minor.

Mitigation and Enhancement Measures

To manage cumulative impacts on steppe habitats, the Project will implement:

- use of existing tracks and corridors wherever possible to minimise new fragmentation;
- restoration of temporary construction areas, including soil stabilisation and revegetation;
- careful micro-siting of turbines and OHTL towers to avoid sensitive patches;
- strict erosion and runoff management to protect vegetation structure; and
- Habitat Condition Scoring Assessment to establish baseline habitat quality for future monitoring and restoration benchmarking.

Residual Cumulative Impact

With mitigation and restoration measures in place, residual cumulative impacts are expected to reduce to Minor. Although some residual habitat fragmentation is unavoidable given the nature of a large wind-energy development, the Project's contribution is not expected to materially alter regional habitat continuity or ecological function when considered alongside existing land uses.

20.4.5 Landscape & Visual Character

Existing Context and Cumulative Sensitivities

The Project is located within an expansive steppe landscape characterised by open views, long sightlines and a generally low density of built structures. However, the wider region already contains several prominent vertical elements, including the Zhanatas and Shokpar wind farms and multiple overhead transmission lines, which introduce industrial features into an otherwise natural landscape.

Although the landscape can absorb a degree of large-scale infrastructure without significant loss of character, its openness and visual simplicity also mean that tall structures tend to be widely visible and can contribute collectively to a perceptible shift in landscape character.

Project Contribution to Cumulative Change

The Project will introduce up to 140 wind turbines and two 220 kV OHTL corridors, both of which are large, highly visible elements. Turbines will be visible from considerable distances, and the OHTLs will add new linear features within the regional viewshed.

While the design has sought to limit visual complexity by adopting a coherent turbine layout and

optimising the OHTL alignment, the Project nonetheless represents a substantial addition to the visual environment.

Other Activities Affecting This VEC

Cumulative landscape and visual effects may arise in combination with:

- the existing Zhanatas and Shokpar wind farms, which already form part of the skyline;
- existing OHTLs, including those parallel to both proposed OHTL routes;
- mining and industrial activities, which introduce visible infrastructure and lighting; and
- agricultural expansion, which locally modifies land cover and vegetation patterns.

While these activities are dispersed, their combined visibility contributes to a regional trend of increasing infrastructure presence in the steppe landscape.

Cumulative Impact Assessment

When viewed in this landscape context, the Project contributes to:

- an increased density of tall energy-related structures, particularly when multiple wind farms or OHTL routes are visible within the same panoramic view;
- greater visual connectivity between existing and new infrastructure, potentially extending the perceived extent of developed land;
- incremental reduction in perceived remoteness and naturalness in certain view corridors; and
- localised increases in visual complexity, especially where turbines are seen in combination with OHTLs.

Notwithstanding the above, there are relatively few locations from which both the Project and the operational Zhanatas and Shokpar wind farms are clearly visible at the same time. Where such combined visibility does occur, receptors are generally already exposed to large-scale wind energy infrastructure, and the Project does not materially increase the magnitude of visual effects experienced at those locations. In these instances, the Project tends to reinforce an existing wind energy landscape rather than introduce a new or distinct visual influence.

Although the turbines will be visible from some viewpoints within the wider landscape, cumulative effects will be perceptible primarily where existing wind farms or OHTLs are already present within the viewshed; the overall landscape character will nevertheless remain predominantly open steppe.

Significance of Cumulative Impacts (Pre-Mitigation)

Prior to mitigation, cumulative landscape and visual effects are assessed as Minor - Moderate, reflecting the addition of a large wind farm and new transmission infrastructure into a region that already contains prominent energy-related structures.

Mitigation and Enhancement Measures

Mitigation of cumulative visual effects is limited by the scale and visibility of wind turbines; however, the following measures help reduce landscape integration issues:

- maintaining a coherent turbine layout with consistent spacing and height to minimise visual clutter;
- optimising OHTL alignment to make use of existing corridors where practicable and reduce additional fragmentation of the landscape;

- careful design of substations and ancillary facilities to reduce contrast with the surrounding landform;
- restoration of temporary construction areas to reduce long-term ground-level visual impacts; and
- ensuring lighting minimisation in accordance with aviation and safety requirements to limit night-time visual intrusion.

Residual Cumulative Impact

Following implementation of mitigation measures, residual cumulative effects remain Minor - Moderate due to the unavoidable visibility of large turbines. However, adverse effects are not expected to fundamentally alter regional landscape character, and cumulative change is consistent with regional energy-development trends.

20.4.6 Traffic & Transport Network

Existing Context and Cumulative Sensitivities

The regional road network serving the Project consists primarily of paved national highways and a series of secondary and local rural roads connecting settlements, mine facilities and agricultural areas. Existing traffic levels include heavy-vehicle movements associated with mining operations, agricultural transport, and routine community use.

Although traffic volumes are generally moderate, certain routes already experience periodic peaks, and road conditions in some sections may limit capacity for large numbers of heavy or oversized vehicles. Community exposure occurs mainly where haulage routes pass near settlements or across shared access points.

Project Contribution to Cumulative Change

During construction, the Project will generate substantial Heavy Goods Vehicles (HGVs) and oversized load movements, particularly during turbine delivery, foundation works and construction of the OHTL routes. These movements will be concentrated along specific haulage corridors identified in the route survey and will temporarily increase traffic volumes, journey times and safety risks for other road users.

While traffic will reduce markedly during operation, the construction period represents the key cumulative interaction window.

Other Activities Affecting This VEC

Potential cumulative pressures arise from:

- mining-related haulage, including regular movement of heavy trucks on regional roads;
- agricultural transport, particularly seasonal peaks during harvest periods; and
- other local road users, including small settlements and herder movements.

These activities use some of the same road corridors as the Project, particularly near Zhanatas and along sections of the access routes.

Cumulative Impact Assessment

The Project’s construction traffic, when combined with existing heavy-vehicle movements, may result in:

- increased road safety risks, particularly at junctions, village access points and sections of road with limited width or visibility;
- temporary congestion or slower movement on shared road corridors;
- greater disturbance to local communities, especially where routes pass near residential areas or herder camps;
- increased wear on road surfaces, contributing incrementally to maintenance pressures for local authorities.

These effects are concentrated during the construction phase and are not expected to be significant during operation.

Significance of Cumulative Impacts (Pre-Mitigation)

Before mitigation, cumulative traffic and transport impacts are assessed as Moderate during construction, reflecting the temporary but noticeable increase in heavy-vehicle movements in combination with existing road users.

Mitigation and Enhancement Measures

To manage cumulative effects, the Project will implement a set of measures focused on safety, scheduling and communications, including:

- development of a Construction Traffic and Transportation Management Plan (TTMP) to coordinate deliveries, manage timing of oversized loads, and minimise interactions with community traffic;
- route planning to avoid sensitive areas where feasible and to use existing high-capacity roads wherever possible;
- community notifications in advance of major deliveries or temporary road closures;
- installation of temporary signage, speed controls and spotters at high-risk points;
- coordination with local authorities, mining operators and agricultural users to stagger heavy-vehicle movements where practicable; and
- monitoring of traffic volumes and safety incidents to support adaptive management.

Residual Cumulative Impact

With mitigation in place, residual cumulative impacts are expected to be Minor–Moderate, limited to short-term construction periods. No long-term cumulative impacts on regional traffic conditions are anticipated.

20.4.7 Summary of Cumulative Impacts

Overall, the assessment indicates that the Project will contribute incrementally to several existing environmental and social pressures in the region. With the application of embedded mitigation and monitoring measures, cumulative impacts are generally manageable and remain within acceptable levels. The residual cumulative impacts for each retained VEC are summarised in Table 19-2 below. Note that all biodiversity related impacts will be manged through the development and implementation of a comprehensive Biodiversity Management Plan (BMP) that will be in place prior to construction activities commence.

Table 19-2: Summary of Residual Cumulative Impacts for Retained VECs

VEC	Residual Cumulative Impact
Migratory Birds & Raptors	Minor
Great Bustard & Steppe Avifauna	Minor–Moderate
Karatau argali (ecological corridor)	Minor–Moderate
Steppe habitats & fragmentation	Minor
Landscape & visual character	Minor–Moderate
Traffic & transport network	Minor–Moderate

21 Mitigation Through Design

21.1 Introduction and Overview of Methodology

Mitigation through design is a core principle of the Project's environmental and social risk-management approach. From the earliest stages of planning, the Project has applied an iterative design process aimed at reducing potential impacts through strategic siting, layout refinement, and technical optimisation. This approach ensures that the most effective form of mitigation—avoidance—is embedded directly into the Project's physical design before reliance is placed on management-stage controls.

The layout of the WTGs, the routing of the two 220 kV OHTLs, and the positioning of supporting infrastructure have been shaped by a systematic evaluation of constraints identified during the scoping phase of the Project. These constraints were informed by desk-based review, applicable legal and regulatory requirements, specialist surveys, stakeholder engagement, and preliminary baseline information being collected to support the ESIA. The layout presented and assessed within this ESIA therefore reflects the application of mitigation through design based on scoping-stage risk identification and emerging baseline data and has therefore not yet been fully informed by the findings or conclusions of the ESIA itself.

This approach has enabled the Project to eliminate or substantially reduce interactions with sensitive receptors such as residential areas, cultural heritage sites, springs and waterbodies, and areas of high biodiversity value, including zones associated with elevated collision risk for priority bird and bat species, by on information at the time.

In line with GIIP and Lender standards, the Project has applied the mitigation hierarchy as follows:

- Avoidance: Prioritising siting and routing decisions that prevent impacts from occurring in the first place, including macro-site selection, meso-scale exclusion of sensitive areas, and micro-siting of individual WTGs.

- Minimisation: Applying design refinements where avoidance is not feasible, such as optimising turbine spacing, adjusting OHTL alignments, reducing construction footprints, and incorporating technical solutions to reduce collision and electrocution risk.
- Restoration and Offset (where relevant): Measures beyond the design stage, to be addressed through the Biodiversity Management Plan (BMP) and other specialist frameworks, where residual impacts may require restoration or compensation.

By integrating environmental and social considerations directly into the design process from the outset and iteratively refining them through later stages,, the Project has reduced reliance on later-stage operational controls and ensured that key risks and sensitivities are addressed at the earliest practicable point in the Project lifecycle. The sections that follow describe the principal constraints identified and illustrate how these informed the optimisation of the WPP layout and OHTL routing assessed in this ESIA.

21.2 Initial Development Context and Preliminary WPP Layout

As described in Section 3.5.3 (Wind Farm Site Alternatives and Layout), Masdar were initially allocated another development area (covering approximately 288 km^2) in southern Kazakhstan, approximately 53 km west of the town of Taraz, in the Zhualy and Talas districts of the Jambyl region. Review of this initial option, supported by a high-level biodiversity screening, identified proximity to sensitive biodiversity features and an elevated environmental risk profile. On this basis, the initial development area was rejected and an alternative site with a lower biodiversity risk profile was identified. This process demonstrates that environmental and social considerations were a primary driver of site selection from the outset of Project development.

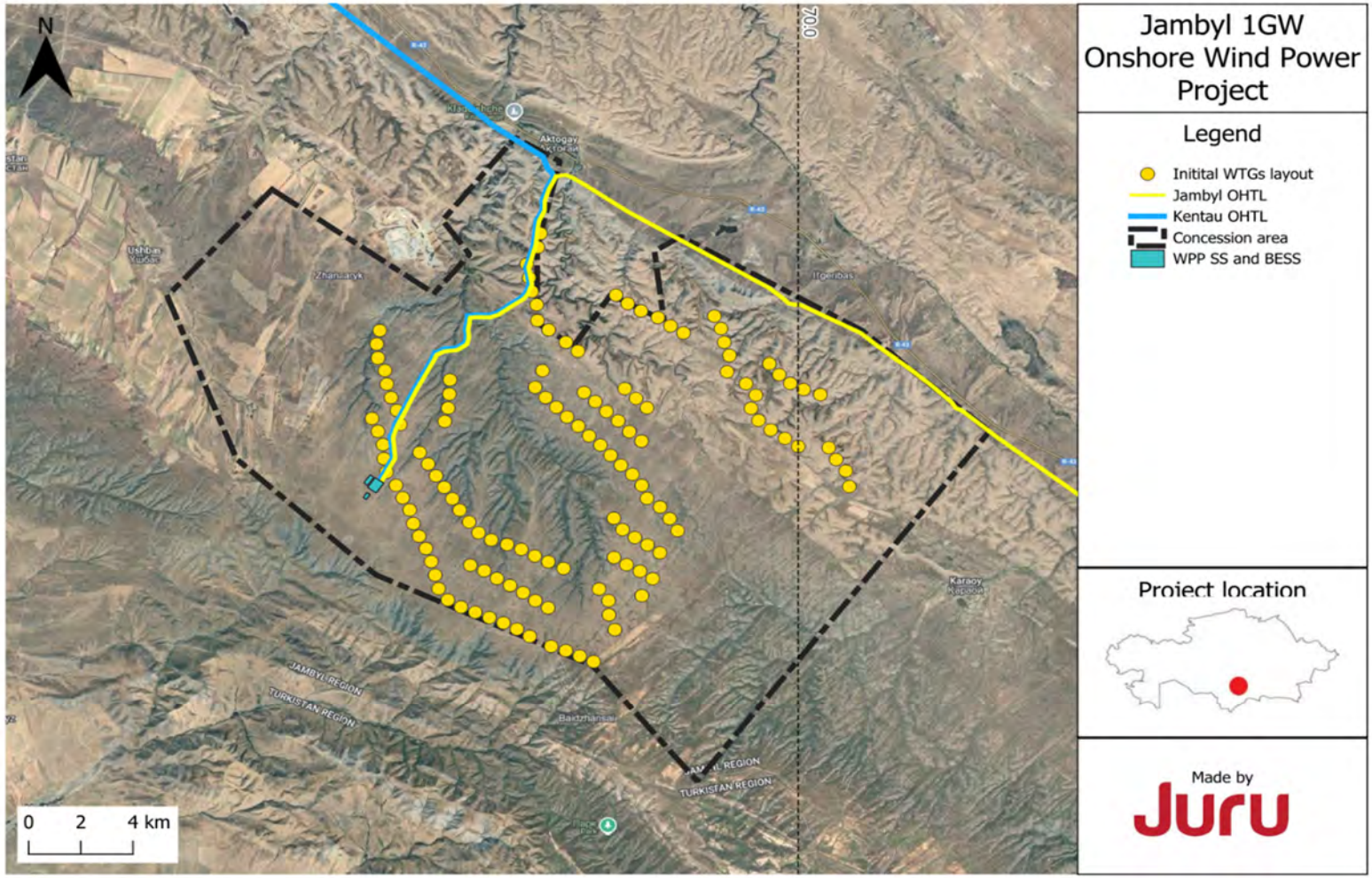
Following this early screening process, Masdar identified and defined an alternative broad development area for the WPP covering approximately 41,200 hectares. This development boundary represents the spatial envelope within which subsequent layout development and optimisation were undertaken. The location and extent of the overall Project development boundary, together with the initial WTG layout prepared for this site, are shown in Figure 20-1.

Within this development area, a preliminary WTG layout was prepared at an early stage of Project planning to support initial feasibility, yield, and engineering assessments. While the layout was informed by technical considerations such as wind yield, turbine spacing and wake effects, and electrical collection efficiency, it was already influenced by environmental and social information available at that time. Note the layout as considered at the Scoping stage had already been informed and updated based on environmental and social information available at that stage, including initial site visit findings, early stakeholder engagement, and preliminary baseline data collected during the scoping phase.

The WPP layout assessed in this ESIA reflects a further refinement of this initial design, informed by more systematic constraint mapping and emerging baseline data collected during the ESIA process. The layout has not yet been fully informed by the findings or conclusions of the ESIA itself but reflects design optimisation undertaken at the scoping and pre-ESIA stages of Project planning.

The environmental and social constraints identified during the scoping and ESIA baseline phases were mapped and overlaid on this initial WTG layout and development boundary, and used to inform subsequent layout refinement, as described in the sections below and illustrated in associated Figures.

Figure 20-1: Initial WTG Layout and Development Boundary



21.3Key Environmental and Social Constraints

A range of environmental and social constraints were identified during the scoping and ESIA baseline phases and used to inform subsequent layout refinement. These constraints were identified through desk-based review, specialist surveys, site visits, stakeholder engagement, and review of applicable national legislation and international lender requirements.

All identified constraints were compiled within a geographic information system (GIS) and mapped across the Project development area. The constraint mapping was used to identify areas where development should be avoided or where additional caution was required, and to inform iterative refinement of the WTG layout and associated infrastructure. This approach enabled potential interactions with sensitive receptors to be identified at an early stage and addressed through design, in line with the mitigation hierarchy.

The principal constraints considered during this process are presented below, covering social, biodiversity, physical and environmental factors. The figures presented alongside these sections illustrate the spatial relationship between the identified constraints and the current WPP layout and OHTL routing used as the basis for this ESIA.

21.3.1 Social Constraints

Social constraints were identified to minimise potential impacts on communities, avoid physical displacement, minimise economic displacement, protect cultural and spiritual values, and ensure compliance with applicable land-use, sanitary, and safety requirements. Constraints were identified through desk-based review, site visits, stakeholder engagement undertaken during the scoping phase, consultations with relevant authorities, and specialist surveys, including archaeological investigations. The spatial distribution of the identified social constraints and the associated setback distances is discussed and presented in the Sections 20.4 and 20.5.

The principal social constraints considered during the design process include the following:

- Residential buildings, settlements, and other occupied structures
- Cultural heritage and archaeological features, including sacred sites
- Anthrax burial sites and associated sanitary protection zones
- Community land use, grazing areas, and access routes

Residential Buildings and Settlements

Permanent and seasonal residential buildings, farmsteads, and other occupied structures (temporary and permanent) within and surrounding the Project development area were identified as key social receptors. These were mapped using high-resolution satellite imagery, field verification during site visits, and information obtained through stakeholder engagement.

Setback distances from residential buildings were applied during layout development to avoid physical displacement, reduce potential community health and safety risks, and minimise nuisance effects such as noise and shadow flicker. These separation distances are consistent with applicable national sanitary requirements and GIIP, and were treated as fixed spatial constraints during the design process.

Land Use

Areas used by local communities for grazing, seasonal activities, and access were identified through site visits and stakeholder engagement undertaken during the scoping phase. While these areas are not

subject to formal statutory exclusion zones, they were considered during layout development to minimise disruption to existing land-use patterns and community movement routes.

Where practicable, the WTG layout and associated infrastructure were adjusted to avoid fragmentation of grazing areas and to maintain existing access routes used by local communities.

Cultural Heritage and Archaeological Features

Cultural heritage constraints include registered and newly identified archaeological and cultural heritage features such as burial mounds (kurgans), burial sites (mogilniki), sacred sites, and locations of historical or spiritual significance. These features were identified through desk-based review of official heritage registers and through multiple archaeological surveys undertaken within the WPP area and along the OHTL corridors; refer to Section 9 (Archaeology & Cultural Heritage) for details.

In accordance with national heritage protection legislation, mandatory protection buffers were applied around identified heritage features. A precautionary buffer of up to 120 m was applied where required, reflecting the statutory protection zones applicable to archaeological and cultural heritage sites. These buffers were incorporated into the Project GIS and treated as exclusion zones during layout development.

Anthrax Burial Sites

Anthrax burial sites are locations where animals infected with anthrax had been buried. Confirmed anthrax burial sites were identified through consultation with relevant authorities and review of available sanitary and epidemiological records. In line with national sanitary and epidemiological regulations, a minimum safety buffer of 1 km was applied around confirmed burial sites.

These buffers were treated as absolute exclusion zones during WPP layout development, and no WTGs, access tracks, OHTLs or other infrastructure were permitted within these areas.

21.3.2 Biodiversity Constraints

Biodiversity constraints were identified to avoid or minimise potential impacts on habitats and species of conservation importance and to ensure compliance with national legislation and international lender requirements. The identification of biodiversity constraints was informed by desk-based review, multi-season field surveys, specialist ecological assessments, and review of available regional and international biodiversity datasets. These constraints reflect and refine the sensitive biodiversity receptors initially identified during the scoping process.

All biodiversity constraints were compiled within the Project GIS and mapped across the WPP development area and along the proposed OHTL routes. The mapped constraints were overlaid on the preliminary WTG layout and routing options to identify areas requiring avoidance or further design refinement. The spatial distribution of the identified biodiversity constraints and their relationship with the WPP layout and OHTL routing are discussed and illustrated in Sections 20.4 and 20.5 below.

The principal biodiversity constraints considered during the design process include the following:

- Proximity to legally protected or internationally recognised biodiversity areas
- Areas of elevated activity for priority bird species and collision-risk zones
- Great bustard habitat areas
- Bat roosts and other bat-sensitive features
- Terrestrial habitats supporting protected or notable species

- Wetlands, springs, rivers, and other water-dependent habitats.

Legally Protected and Internationally Recognised Areas

The presence and proximity of legally protected areas, Important Bird Areas (IBAs), Key Biodiversity Areas (KBAs), and ecological corridors were reviewed using national datasets and international screening tools. While no such areas are located within the Project footprint, their proximity informed macro-scale site selection and design decisions to avoid indirect impacts and cumulative effects.

Priority Bird Species and Collision-Risk Areas

Areas associated with increased activity of priority bird species, including migratory corridors, local flight paths influenced by topography, and zones of elevated raptor and vulture activity, were identified through avifauna surveys and specialist analysis. These areas were treated as key biodiversity constraints during layout development due to the potential risk of collision with WTGs and OHTLs.

Constraint mapping focused on avoiding turbine placement within areas of consistently high bird activity and informed subsequent micro-siting of WTGs and refinement of OHTL alignments to reduce collision risk.

Great Bustard Habitat

Areas identified as suitable or potentially suitable for Great Bustard breeding, foraging, and overwintering were identified through targeted surveys and review of available baseline information. Given the conservation status of the species and its sensitivity to disturbance and collision risk, these areas were treated as key biodiversity constraints during the development of the OHTL route.

During the OHTL routing process, precautionary avoidance of identified Great Bustard habitat was applied, with routing alternatives assessed and refined to minimise interaction with areas of higher suitability for the species. Identified habitats were incorporated into the constraint mapping used to inform OHTL alignment selection and route optimisation.

Bat-Sensitive Features

Bat-sensitive features, including confirmed roosting locations such as caves, as well as associated foraging and commuting habitats, were identified through targeted bat surveys and site reconnaissance. These features were incorporated into the constraint mapping used during the development of the OHTL route, with routing options assessed and refined to minimise proximity to identified roosting and activity areas.

Setback distances around confirmed roosting features were applied and integrated into the GIS constraint layers used to guide OHTL alignment selection and route optimisation. The WPP layout was also reviewed against identified bat-sensitive features, with turbine locations already positioned at a substantial distance from known roosting sites, thereby avoiding the need for additional layout modifications.

Terrestrial Habitats and Protected Species

Terrestrial habitats supporting protected or notable species, including areas used by Karatau argali, were identified through habitat surveys and specialist ecological assessments. These areas were mapped and considered during layout development to avoid fragmentation of key habitats and maintain ecological connectivity.

Wetlands, Springs, and Water-Dependent Habitats

Wetlands, springs, rivers, and associated riparian habitats were identified as biodiversity constraints due to their ecological importance and role in supporting a range of species, including birds and other fauna. These features were mapped and treated as avoidance areas for WTGs and associated infrastructure, and informed routing decisions for the OHTLs.

Trees and Woody Vegetation

Areas supporting trees and woody vegetation, including riparian tree stands along rivers and vegetation associated with wetlands or water bodies, were identified during field surveys and desk-based review. These features were mapped and treated as environmental constraints during infrastructure planning, with routing adjustments applied where necessary to avoid tree removal and minimise disturbance to woody vegetation, particularly in riparian and water-dependent habitats.

21.3.3 Physical and Environmental Constraints

Physical and environmental constraints were identified to ensure compliance with applicable regulatory requirements, protect water resources, and avoid areas where natural conditions could present elevated environmental risk or construction constraints. These constraints were identified through desk-based review of baseline data, specialist studies, site reconnaissance, and review of national legislative and regulatory requirements undertaken during the scoping and ESIA baseline phases.

All identified physical and environmental constraints were compiled within the Project GIS and mapped across the WPP development area and along the proposed OHTL routes. The mapped constraints were overlaid on the preliminary WTG layout and routing options to inform design refinement and avoidance at the layout stage. The spatial distribution of the identified physical and environmental constraints in relation to the WPP layout and OHTL routing are discussed and illustrated in Sections 20.4 and 20.5 below.

The principal physical and environmental constraints considered during the design process include the following:

- Surface water features and associated Water Protection Zones
- Flood-prone areas and natural drainage pathways
- Sanitary and protection zones applicable to infrastructure and water sources
- Topographic and geomorphological features influencing construction feasibility.

Surface Water Features and Water Protection Zones

Rivers, streams, drainage channels, springs, wetlands, and other surface-water features were identified through baseline surveys, desk-based mapping, and site visits. In accordance with the Water Code of the Republic of Kazakhstan, statutory Water Protection Zones (WPZs) and Water Protection Strips (WPSs) associated with these features were delineated and treated as spatial constraints during layout development.

These zones were incorporated into the Project GIS and used to guide turbine micro-siting, access track alignment, and OHTL routing to avoid direct encroachment into protected areas wherever practicable.

Floodplains and Natural Drainage Pathways

Areas subject to seasonal flooding and natural drainage pathways were identified based on baseline hydrological information and site reconnaissance. These features were treated as constraints to reduce

flood risk, avoid obstruction of natural surface-water flows, and minimise the potential for erosion and sediment mobilisation during construction.

Sanitary and Protection Zones

Sanitary protection zones associated with water supply sources, infrastructure, and linear facilities were identified based on applicable sanitary and epidemiological regulations. These zones were mapped and applied as exclusion or buffer areas during layout development to protect water quality and human health.

For the OHTL, the applicable sanitary protection zone associated with 220 kV transmission lines was incorporated into routing decisions to ensure compliance with national requirements.

Topography and Geomorphological Features

Topographic and geomorphological features, including steep slopes, escarpments, gullies, and areas of complex terrain, were identified through review of topographic data and site observations. These features were treated as physical constraints during the technical layout development due to increased construction risk, and access limitations.

Avoidance of these areas informed the placement of WTGs, access routes, and associated infrastructure.

21.4WPP Constraints and Sensitive Receptors

Key social constraints in the WPP area include anthrax burial sites, identified archaeological features such as kurgans and cemeteries, and one privately owned structure. These sensitive areas were carefully considered during the WTG layout planning to ensure avoidance and compliance with health, safety, and cultural heritage protection requirements.

Anthrax burial sites

In total, 8 anthrax burial sites have been identified within the broader WPP area. All such sites have been mapped along with their associated buffer zones, based on the Safety Protection Zone of 1,000m as required by Kazakh legislation; although one site has a reduced buffer of 250 meters as this site is not an officially registered anthrax site. All WTGs are located outside these buffer zones (see Figure 20-2 below).

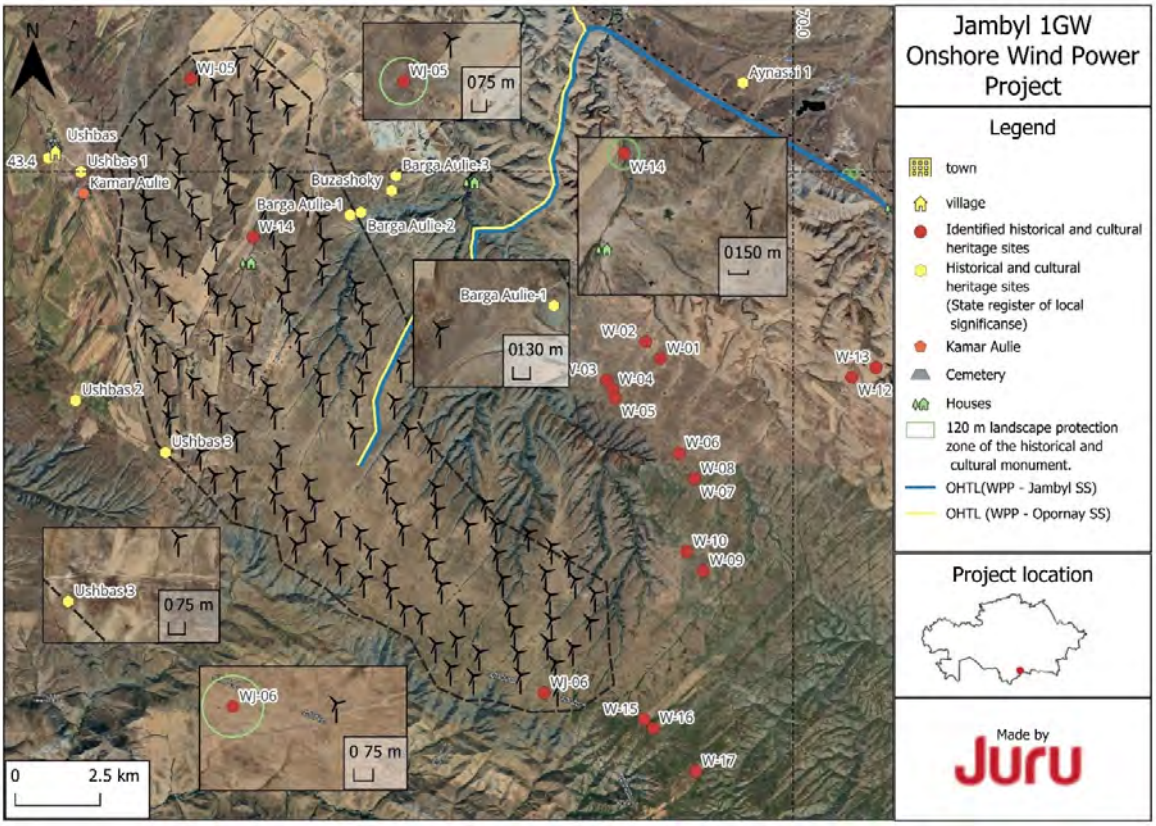
Figure 20-2: Anthrax burial site locations with WPP

Burial sites and kurgans

The Jambyl and Turkestan Region is known for its numerous medieval cities, settlements, ancient burial sites, and cultural landscapes.

On the territory of the WPP area, 4 burial sites and 6 single kurgans were identified. These sensitive sites and their buffer zones were therefore considered during the layout design of the WTGs (Figure 20-3). Only one such site sits within the development area where WTGs are proposed and the Project will avoid any direct impact on this site by applying the 120 m buffer as a minimum requirement.

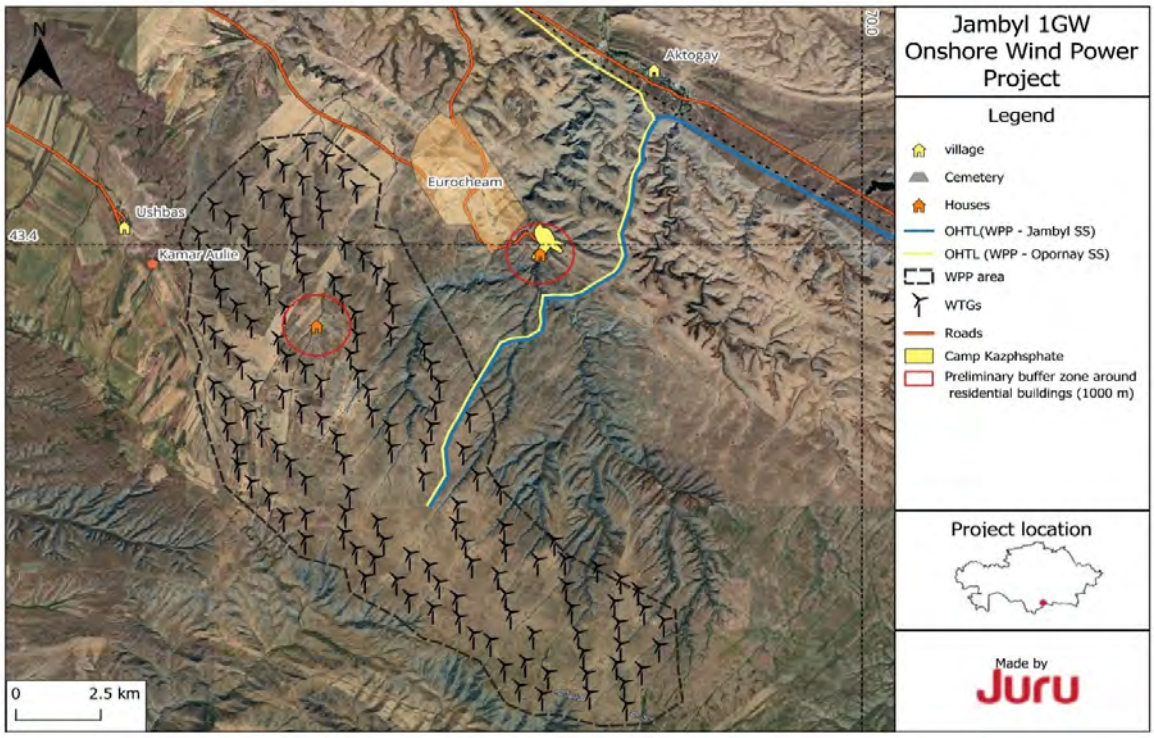
Figure 20-3: Archaeological sites on WPP area



Fixed Buildings/Structures

Only 2 buildings were identified within the initial wider WPP boundary area, of which only one sits within the proposed (refined) WTG development area. This single structure is not a residential dwelling but is used occasionally by the owner for shelter during the grazing season; further discussions with the owner will be undertaken as part of the LRP process in order to agree any compensation requirements. IFCs minimum setback distance for wind turbines of 375 m (1.5 times the turbine height) is required as a minimum for any structures within the WTG development area. However, in this particular case a 1 km buffer distance from the nearest WTG was applied around this structure to further reduce potential noise disturbance. The location of the structure, and associated 1 km buffer area, in relation to the WTG layout is provided in Figure 20-4 below.

Figure 20-4: Structures within and close to WPP area.



Biodiversity Considerations

Biodiversity considerations were also a major influence on the optimised WTG layout. Firstly, WTGs were not placed within the boundaries of the Zhuali-Karashat Sanctuary or within the central forest fund area, both of which occupied parts of the initially identified WPP boundary area and were considered environmentally sensitive. In addition, no project infrastructure was sited within the designated forest fund areas located in the central and northern parts of the Project area.

The initial turbine layout included a cluster in the north-eastern section of the WPP, located along the northern orographic folds of the Karatau range. However, results from vantage point (VP) surveys and published data indicated that these areas represent important sources of thermal uplift. Such conditions are frequently used by migrating soaring birds during the autumn migration period to gain altitude for ridge crossing. In order to reduce collision risk, this section of the WPP area was excluded from WTG development. Furthermore, the updated WTG layout avoids placing turbines within the northern orographic uplift zone entirely.

Additionally, as part of further layout refinement, care was taken to avoid the southern edge of the Karatau gorge system, where orographic lift also forms during spring migration. A buffer zone of 250 m was established from the southern gorge boundary, within which no WTGs were placed. This setback aims to preserve safe flight corridors for spring migrants.

Figure 20-5: Turbine layout options and biodiversity constrain zones.

The final layout also took into account the findings of the 2024 and 2025 raptor nest surveys. A 1 km buffer was applied around all active nests, and no turbines were placed within these zones to minimise disturbance and potential impacts on breeding raptors.

In addition, two areas within the mountainous part of the Project area were identified as zones of elevated nesting density of non-threatened bird species and as areas frequently used by large raptors for foraging activity. Although these areas do not support priority or threatened species, they represent zones of increased avian activity. These areas were treated as biodiversity sensitivity zones during layout optimisation, and turbine placement within these zones was avoided to reduce collision risk.

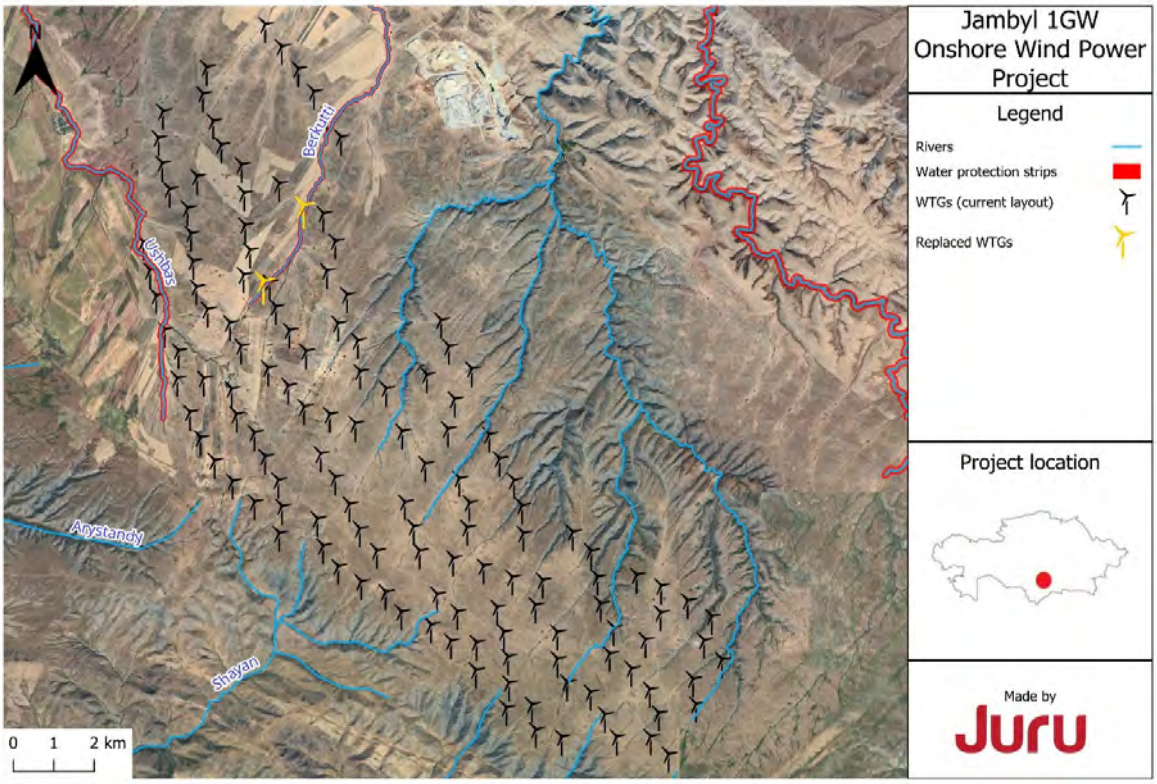
Water Protection Zones

As stated in Section 4.3.6, the Shabakty, Ushbas, and Berkutti rivers are located within the wind farm area. In addition, erosion networks that develop into the Shayan and Arystandy rivers begin at the southwestern boundaries of the site.

According to the Water Code of the Republic of Kazakhstan, rivers are subject to protection zones and buffer strips with activity restrictions. The strictest restrictions, including a broad list of prohibited activities, apply within water protection buffer strips. According to Resolution No. 318 of the Akimat of Zhambyl Region, the rivers Shabakty, Ushbas, and Berkutti have water protection buffer strips of 100 m, 50 m, and 35 m from the riverbank, respectively. Other watercourses at the WPP do not have protection zones officially designated.

During layout development, consultations were held with the relevant water resource authority – the Shu Talas Basin Inspection. As a result, two turbines were identified as being located within the water protection buffer strip of the Berkutti River. The layout was updated by relocating these WTGs outside the water protection zones (see Figure 20-6).

Figure 20-6: Turbine layout options and rivers.



The current project layout ensures that all wind turbines are located at a minimum distance of 110 meters from the rivers. An additional benefit of maintaining this minimum distance from watercourses is the reduction of potential water erosion risks to the Project infrastructure.

In addition to the water protection areas described above, Masdar also took into consideration the findings of IDOMs Hydrology and hydraulics Report (August 2025) ensuring the WTGs are located outside of the identified natural drainage channels and flood prone areas.

21.5OHTL Routing Constraints and Sensitive Receptors

21.5.1 Jambyl OHTL

In general, the Jambyl OHTL corridor crosses a territory that contains numerous burial mounds dating back to the Saka period. In ancient times, this region was part of the Great Silk Road. One of the sites is the Berikkara Burial Mound Complex, which is a Cultural Heritage Site of National Significance. The main concentration of burial mounds is located opposite the Berikkara gorge, perpendicular to and across the R-43 road, near Maitobe village and Lake Bilikol. In 1938, a total of 457 burial mounds and circular stone structures were recorded and described at this site. The burial ground consists of numerous chains arranged parallel to each other and extending from south to north, with a slight deviation to the east.

As part of an archaeological survey, the specialist team recommended to divert the OHTL route to avoid an area with high historical and cultural significance, including the Berikkara burial site. As a result, the OHTL route was shifted further to the northeast (see Figure 20-6).

This area continues to be of archaeological interest and is subject to ongoing research, thus avoidance

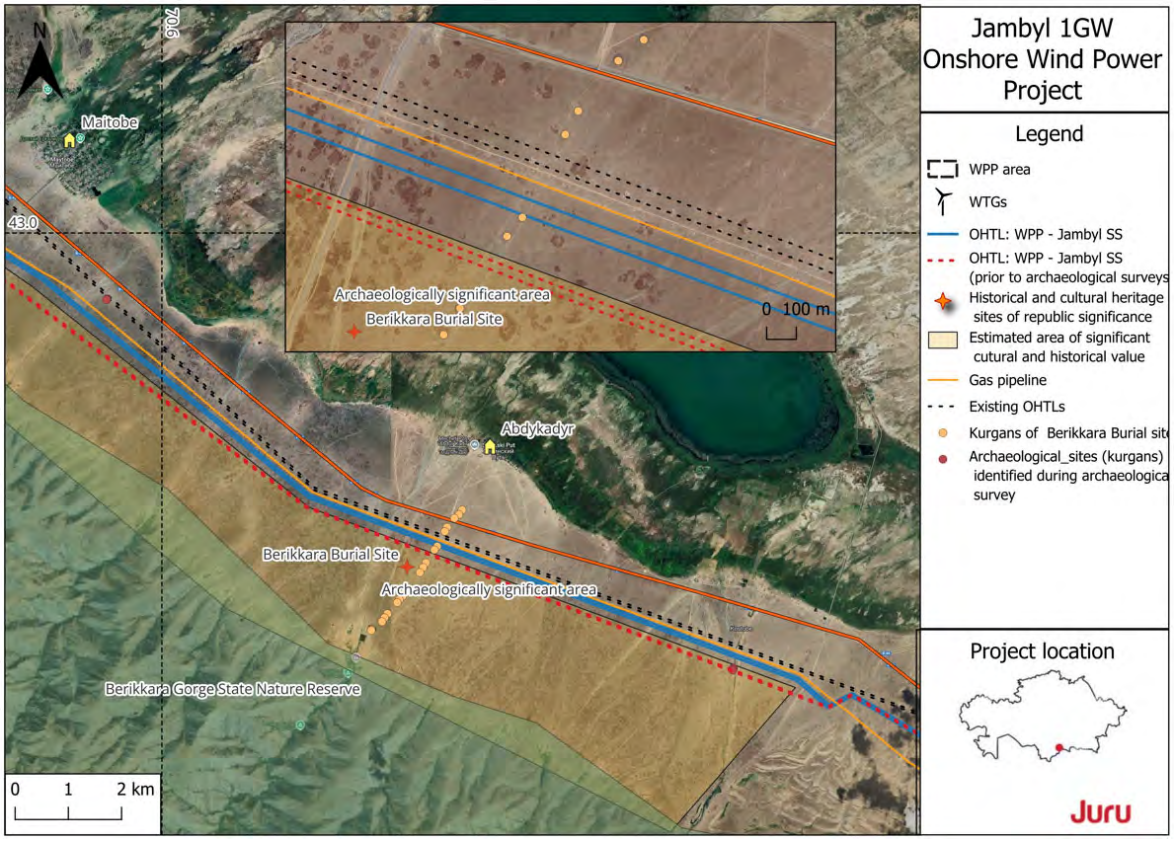
remains the priority for the project, with mitigation and management measures to be applied by the Project at all phases.

Lastly, three additional burial sites and one kurgan were identified along the Jambyl OHTL route; the OHTL was rerouted to avoid these assets. All other kurgans and burial sites identified during the surveys were located outside the OHTL buffer zone.

To ensure the protection of the burial sites, the placement of OHTL tower foundations in the vicinity of burial mounds is permitted only subject to maintaining a minimum distance of not less than 40 m between the edge of the burial mound and the base of the OHTL tower.

Prior to the commencement of construction works, a pre-construction (pre-design) site inspection will be carried out with the participation of the Cultural Heritage Protection Inspector of the Jambyl Region Akimat, experts from Kazarchaeology LLP (subcontractor), and the Project representatives. The inspection will determine the legally acceptable locations for OHTL tower foundations and confirm compliance with the required protection distances.

Figure 20-7: Social constraints (kurgans) identified on Jambyl OHTL

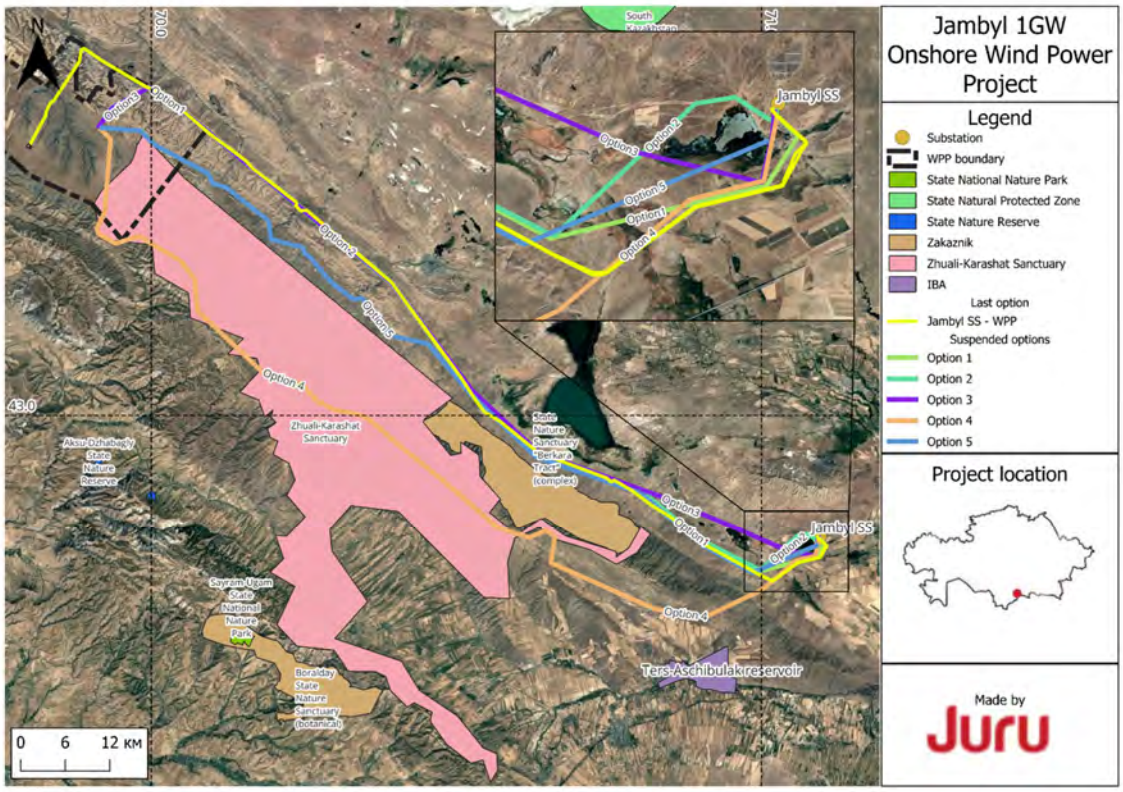


Route selection was guided by the principle of locating new infrastructure close to existing linear anthropogenic features such as roads and existing OHTLs.

A two-stage biodiversity assessment played a key role in the OHTL route refinement. The first stage (a high-level assessment) focused on avoiding legally protected areas and large patches of natural habitats (Figure 20-8). As a result, of the five route options initially considered, one (referred to as Option 4 in the Project Description section of this ESIA) was rejected because it would intersect the Zhuali-Karashat Sanctuary and traverse extensive undisturbed natural terrain. Similarly, Option 5 was discarded due to its alignment through relatively intact plateau habitats in the central part of the Maly Karatau range.

Option 3 was excluded for social reasons, as it crossed a military base located north of Lake Taskol, near Jambyl SS.

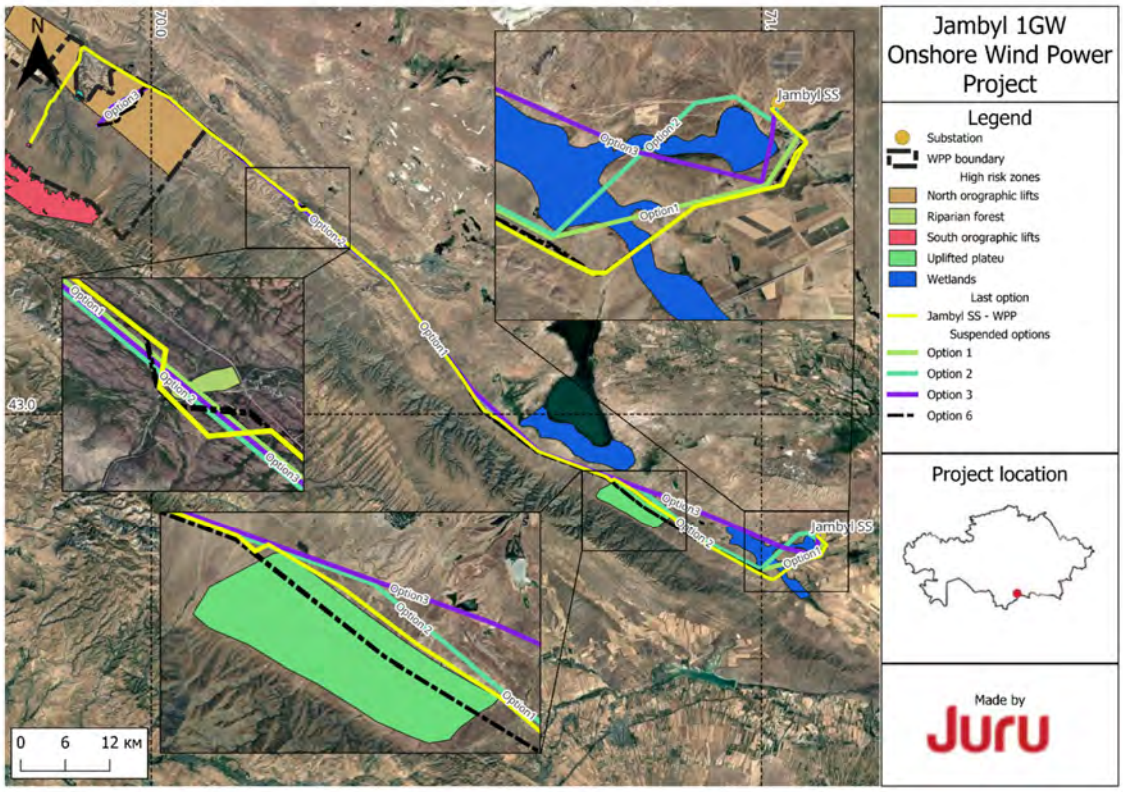
Figure 20-8: High-level biodiversity assessment of Jambyl OHTL route options.



Based on this analysis, Options 1 and 2 were selected for more detailed investigation.

The second stage of the biodiversity assessment incorporated findings from site visits and thematic field surveys (Figure 20-9). It revealed that Lake Taskol and adjacent wetland areas near the Jambyl SS are actively used by large numbers of waterbirds as a stopover site. To reduce potential disturbance and collision risk, the alignment was shifted further away from the lake and surrounding wetlands.

Figure 20-9: Identified high-risk zones on the Jambyl OHTL



At a later stage, Option 6 was proposed to bypass a gas pipeline corridor. However, this alignment crossed an uplifted plateau identified as a key autumn soaring site for migratory birds gaining altitude before crossing the Karatau ridge. Due to the elevated risk of bird collisions in this area, Option 6 was dismissed.

Additionally, to avoid disturbance to a riparian forest patch along the Koktal River (also referred to as Koshkarata in some sources), the OHTL was realigned to bypass this habitat. Throughout the route refinement process, a consistent effort was made to co-locate the OHTL as close as technically feasible to the existing OHTL to reduce landscape fragmentation and overall ecological footprint.

21.5.2 Kentau OHTL

As discussed in the Cultural Heritage Section (Chapter 9) a historical and cultural survey was undertaken along the Kentau OHTL, during which 4 separate cultural heritage areas were identified. These comprised of 3 single kurgans and one burial site (Sholakkorgan) consisting of 7 kurgans (see Table 20-2).

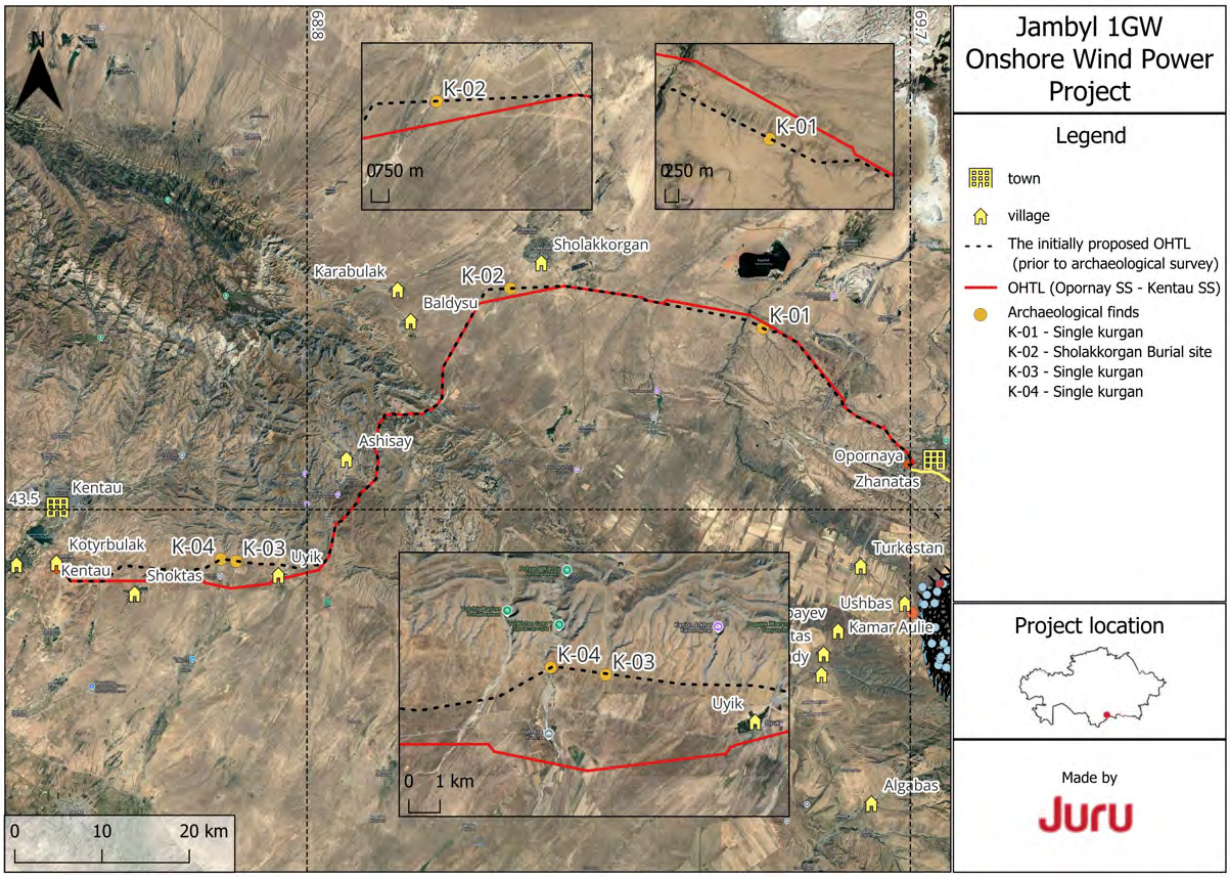
Table 20-1: Cultural Heritage Assets Identified Along Kentau OHTL)

N	Type/Name	Description
K-01	Single kurgan	The kurgan is constructed of stone. The diameter of the mound is 7.7 metres, and its height is 0.8 metres. It is dated to the 7th–3rd centuries

N	Type/Name	Description
		BCE.
K-02	**Sholakkorgan** **Burial site**	It consists of seven kurgans arranged in a single row. The outermost kurgan falls within the project development area. The kurgan is formed of an earthen mound, with a diameter of 27 metres and a height of 1.3 metres. It is dated to the 7th–3rd centuries BCE.
K-03	Single kurgan	The kurgan is composed of fractured stones, with a diameter of 17 metres and a height of 0.7 metres.
K-04	Single kurgan	The kurgan is composed of fractured stones, with a diameter of 11 metres and a height of 0.5 metres.

Following identification of these sites, the OHTL route was realigned to avoid these assets, and no direct physical impacts on the burial mounds are anticipated. The revised alignment, reflecting the results of the field archaeological investigations, is shown in Figure 20-10. K01 to K04 will be included in the cultural heritage management plan to ensure appropriate avoidance of the areas throughout the construction period for all construction related activities.

Figure 20-10: Identified social constraints (archaeological sites)



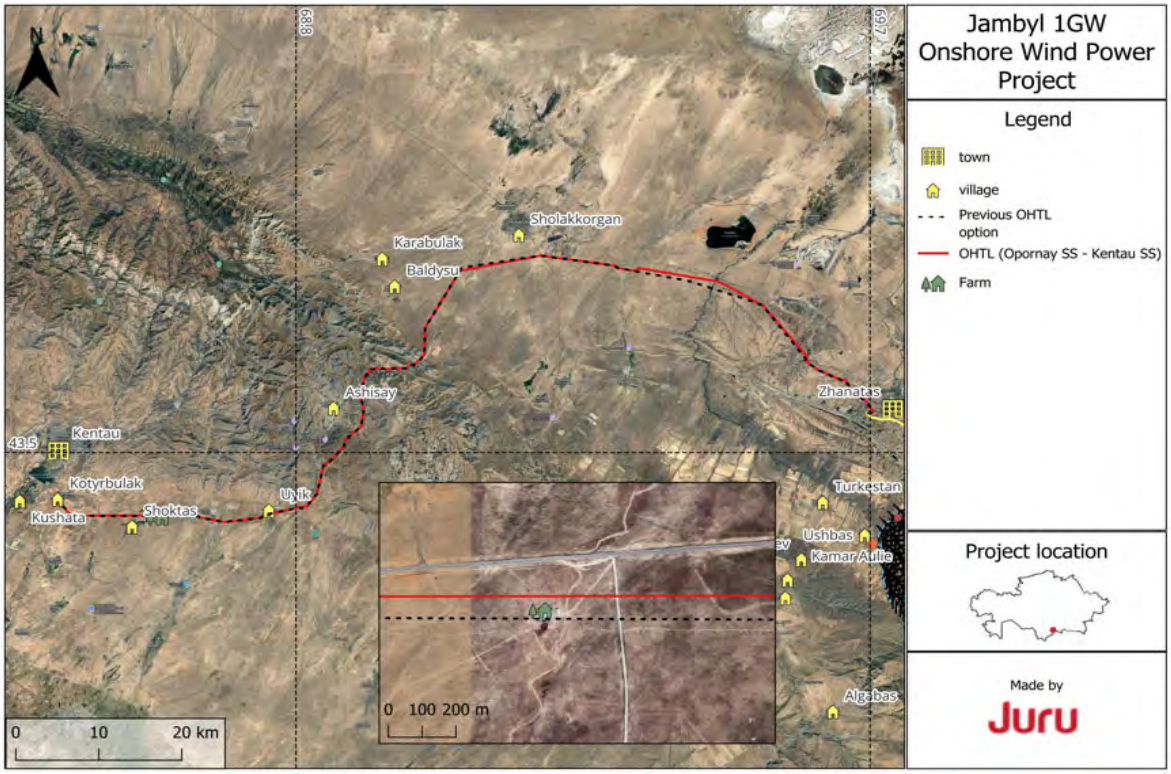
As indicated in the Project Description, initial OHTL routing was based on achieving at least 50m buffer/exclusion zone from the centreline of the OHTL to avoid impacts on sensitive receptors, such as residential buildings, cemeteries, etc.

During the site visit along the OHTL Opornay–Kentau route, a farm was identified as a social receptor, and the route was further adjusted to avoid this constraint (see Figure 20-11).

Figure 20-11: Farm located along the previous OHTL alignment



Figure 20-12: Identified social constraints (farm)



Biodiversity constraints were also considered in the initial route alignment of the OHTL between the

WPP and Kentau SS. The original route Option 1 was developed as the shortest and most direct path. However, initial desktop analysis indicated the presence of a potentially important habitat for wintering and breeding Great Bustards (*Otis tarda*) along the central part of the alignment. This assumption was supported by the proximity of the Arystandy IBA and was later confirmed through targeted ornithological field surveys.

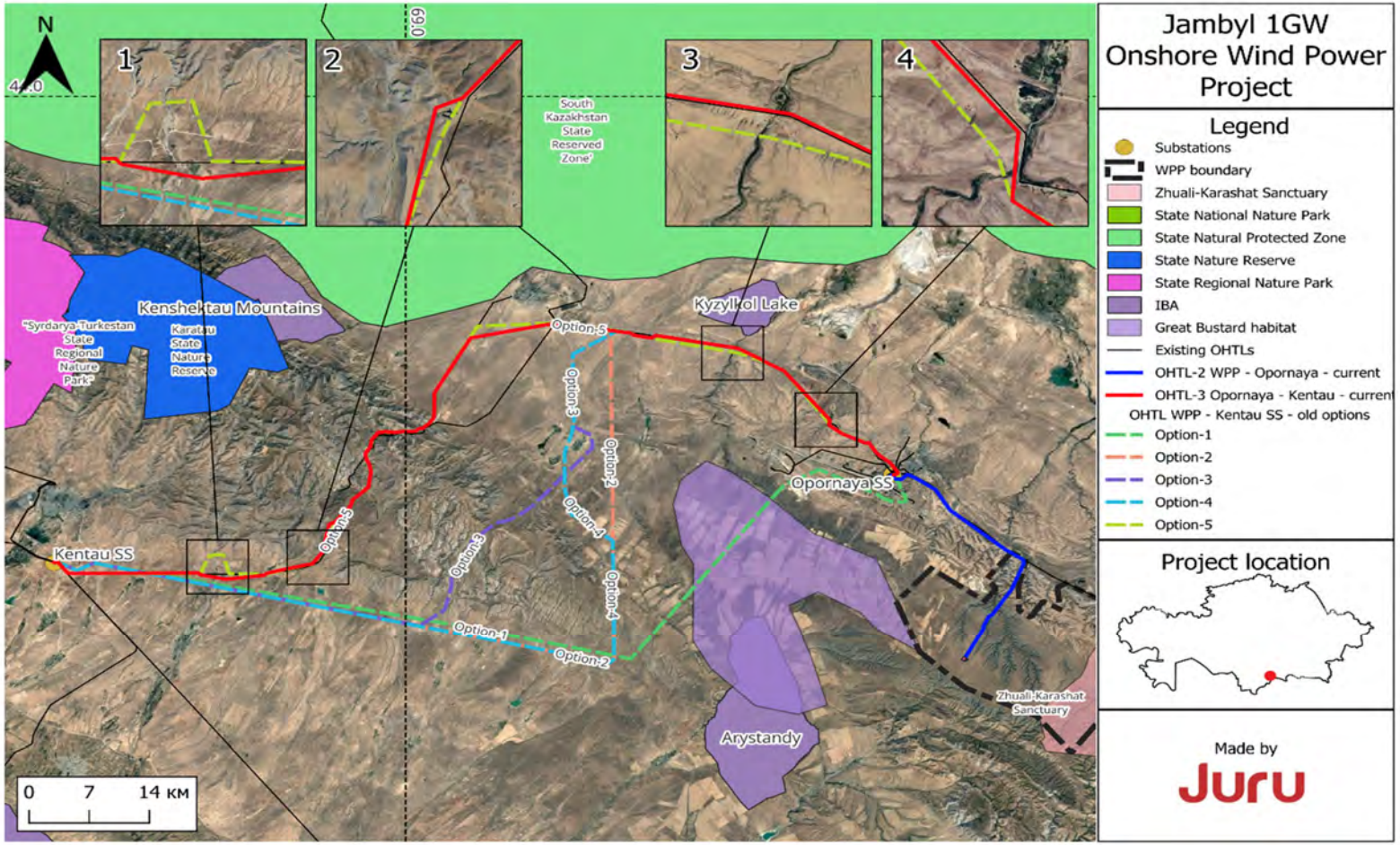
Options 2, 3, and 4 were developed in an effort to bypass the identified Great Bustard habitat. However, upon further evaluation, these alternatives were also considered high-risk due to their cumulative potential impacts on largely undisturbed natural landscapes. Moreover, despite the rerouting, these alignments remained in close proximity to the sensitive zone occupied by Great Bustards.

Consequently, Option 5 was developed as the most environmentally responsible alternative. This alignment follows, for most of its length, the existing OHTL corridor and avoids the narrow Karatau pass between the Greater and Lesser Karatau ranges, as this area is recognized as an important bottleneck for migratory birds and supports both wintering and breeding Bustard populations. By aligning with existing infrastructure, Option 5 reduces additional landscape fragmentation and avoids key ecological features.

Minor refinements to Option 5 were made to reduce environmental impacts and improve technical feasibility. These adjustments are illustrated on the four inset maps in Figure 20-13, each showing a specific realignment aimed at minimizing disturbance to natural habitats and avoiding ecologically sensitive areas, and are summarised below:

- Segment 1: The initial alignment crossed the Ushbas River north of the highway and a nearby settlement. However, this route would have passed through more intact habitats and brought the line closer to suitable nesting areas for raptors, increasing the collision risk. A southern route was therefore selected, which runs through a more disturbed landscape.
- Segment 2: The river crossing was repositioned to a narrower section to reduce the span of conductor suspended over water, minimizing both technical challenges and environmental risks.
- Segment 3: In the central part of the Ushbas Valley, the alignment was originally placed south of the existing corridor to avoid multiple crossings of infrastructure (e.g. an OHTL, railway, and dirt road). However, this southern route intersected natural habitats and passed near several active raptor nests. The final alignment instead follows the existing infrastructure corridor, concentrating impacts within an already modified area.
- Segment 4: To avoid routing the line across hilltops and to further reduce habitat fragmentation, the alignment was brought closer to the existing OHTL, taking advantage of previously disturbed terrain.

Figure 20-13: Route options for Kentau OHTL



4.7.3 - Conclusion

The adjustments made to the layout of the WPP and the OHTL routings demonstrate a responsible and responsive approach to minimising environmental and social impacts through design. By considering the sensitive receptors that were identified in the course of developing this Scoping Report and from initial outcomes from field survey observations — such as cultural heritage sites, social infrastructure, and sensitive biodiversity features — the project has sought to avoid direct impacts on such receptors thereby significantly reducing the overall impact of the Project and associated facilities.

Key benefits of these changes include:

- **Preservation of cultural heritage:** The revised routing avoids historically and archaeologically significant sites, such as burial mounds (kurgans) and cemeteries (burial sites), ensuring compliance with national heritage protection regulations and supporting the continued archaeological value of the region.
- **Minimized social disruption:** The identification and avoidance of residential buildings and local land use areas helped prevent potential resettlement, preserved community assets, and maintained the livelihoods of local populations.
- **Public health protection:** Known anthrax burial sites were identified and excluded from all project infrastructure zones, with appropriate buffer distances (1 km) in line with veterinary-sanitary regulations, ensuring the safety of both construction personnel and nearby communities.
- **Reduced Impact on Sensitive Biodiversity Features*:*** The updated WTG layout and OHTL routes have avoided protected areas, important natural habitats, and key bird flight paths, where possible. Adjustments were made to reduce collision risk with soaring and migratory birds and minimise disturbance to bustard breeding and overwintering areas. These refinements reflect a strong emphasis on avoidance in line with international biodiversity standards.
- **Alignment with best practices:**, These changes represent an important step in integrating technical, environmental, cultural, and community considerations into the project's design process, and reflects Good International Industry Practice (GIIP), enhancing the project's overall sustainability and social acceptance.

22 Environmental and Social Management and Monitoring

22.1 Introduction

This section provides an overview of the Environmental and Social Management and Monitoring program that will guide the implementation of the Project during construction and operation. Its purpose is to outline the overall management approach, governance structure, and key monitoring principles that will ensure the Project's compliance with national legislation, Masdar's corporate requirements, and the environmental and social standards of international lenders.

This chapter describes the structure and intent of the Project's Health, Safety, Social and Environmental

Management System (HSSE[315] MS) the responsibilities of the various implementing parties, and the principles that will govern monitoring and reporting throughout the Project lifecycle.

All detailed procedures, mitigation measures, contractor requirements, and topic-specific management plans are not included here.

These are part of Masdar's established Construction HSSE Management System (cHSSE MS). The cHSSE MS objective is to identify the overall structure and outline of the HSSE MS implemented during the construction phase by all involved counterparts, including the Developer, the Company, contractors, subcontractors, and others. The cHSSE MS sets out the structure of key HSSE plans and procedures to manage risks and impacts, and the institutional framework to ensure effective implementation, including roles and responsibilities, meetings, inspections, monitoring, and reporting requirements.

The cHSSE MS is applicable for the construction phase of the Project and will be adapted to form the Project-specific Construction HSSE MS, which the EPC Contractor will be required to implement under the oversight of the Project Company and the Project Management Consultant.

The cHSSE MS, including the HSSE MS Manual and its associated plans, will be revised for the operational phase, finalized prior to commissioning, and will serve as the primary framework for ongoing HSSE management (oHSSE MS) during operations. This section does not restate or reproduce the detailed mitigation measures already presented in the environmental and social discipline chapters of the ESIA. Instead, it provides a consolidated description of how those commitments will be implemented, governed, and monitored during the Project's construction and operation.

The Project-specific cHSSE MS will be finalised prior to the commencement of construction and will operationalise the commitments set out in this ESIA.

Any actions required by lenders through the Environmental and Social Action Plan (ESAP) will be integrated into the Project HSSE MS and will be tracked using the same monitoring and reporting procedures described below.

22.2Health, Safety, Social and Environmental Management System (HSSE MS)

The Project will be implemented under an HSSE MS that establishes the overarching framework, responsibilities, and procedures through which environmental and social risks and impacts will be managed throughout construction and operation. The HSSE MS provides the structure for ensuring that the commitments made in this ESIA, and any additional requirements established through national permitting and lender review, are effectively operationalised.

The Project HSSE MS will be based on Masdar's corporate cHSSE MS, which defines the minimum requirements, procedures, management plans, training expectations, documentation protocols, and monitoring processes applicable to all Masdar-led construction projects. This corporate system will be adapted to form the Project-specific Construction HSSE MS, to be implemented by the EPC Contractor

[315] Masdar's management system uses the term and abbreviation Health, Safety, Social and Environmental (HSSE) in a manner similar to the commonly used Environmental and Social (E&S) terminology in international practice. The adoption of HSSE emphasizes the importance of health and safety aspects, which are formally included under E&S but are often overlooked or insufficiently addressed in practice.

under the oversight of the Project Company and the Project Management Consultant (PMC).

The HSSE MS includes the core elements typically expected under GIIP and lender standards, including:

- The HSSE policy and guiding principles
- Identification of applicable national legal requirements and international lender standards
- Roles, responsibilities, and competency requirements for all implementing parties
- Procedures for identifying, managing, and monitoring environmental and social risks
- Emergency preparedness and response arrangements
- Training and competency management
- Incident notification and investigation
- Internal and external communication and reporting procedures
- Worker and community grievance mechanisms
- Document control and record-keeping systems
- Inspection, audit, and management-review processes
- Reporting requirements for Contractor → Project Company → Lenders
- Requirements for the development and approval of the Project HSSE MS including the HSSE MS Manual and its associated sub-plans.

These elements will provide the specific procedures, sub-plans and monitoring requirements to be implemented by the EPC Contractor and all subcontractors during construction.

During the operational phase, the Project Company will establish an Operational HSSE MS aligned with the same principles. The Operational HSSE MS will outline the arrangements needed to manage and monitor HSSE performance during the life of the Project, including operations and maintenance-related environmental controls, operational monitoring (e.g., noise, biodiversity), emergency response, and ongoing engagement with stakeholders. The Operational HSSE MS will be finalised prior to commissioning and in any case before the Commercial Operation Date (COD).

Together, the Construction HSSE MS and Operational HSSE MS will ensure that the Project's environmental and social performance remains fully aligned with national requirements, lender expectations, Masdar's corporate E&S standards, and Good International Industry Practice throughout the Project lifecycle.

The HSSE MS is the primary mechanism through which the mitigation and management measures identified in this ESIA will be operationalised during construction and operation of the Project by:

- Translating the ESIA's commitments into practical, implementable requirements;
- Providing the EPC Contractor and subcontractors with a structured management framework;
- Defining the systems and procedures required to ensure compliance with national legislation, lender standards and Masdar's corporate requirements; and
- Establishing the monitoring, reporting, training and governance arrangements necessary for effective environmental and social performance.

The HSSE MS applies to all components of the Project, including the Wind Power Plant (WPP), Battery Energy Storage System (BESS), overhead transmission lines (OHTLs), access roads, temporary construction

camps, laydown areas and supporting infrastructure.

The EPC Contractor will be required to align its internal environmental and social management systems, procedures and work instructions with Masdar's corporate cHSSE MS. This ensures that all contractor-led activities are implemented in accordance with the Project's governance framework and lender requirements.

The Project cHSSE MS will be finalised prior to the commencement of construction, in alignment with national permitting and lender requirements.

22.3Health, Safety, Social and Environmental Management Plans

The Project HSSE MS will outline the Project's E&S management approach based on a defined suite of construction-phase and operation-phase topic specific management plans aligned with lender expectations for Category A wind and transmission-line projects.

These suite of HSSE management plans will be developed to support the implementation of the Project during construction and operation and will form an integral part of the HSSE MS and collectively provide the procedures, controls, and performance requirements necessary to implement the mitigation measures identified in this ESIA and any additional obligations arising from national permitting and lender requirements.

The HSSE management plans will be prepared in accordance with Masdar's corporate HSSE MS and will be structured to ensure consistency with the corporate standards, templates, and expectations defined in Masdar's HSSE MS Manual. Each plan will define its purpose, scope, responsibilities, implementation arrangements and monitoring requirements, and together they will provide the EPC Contractor and O&M Contractor with the framework needed to manage environmental and social risks effectively.

For the purpose of this ESIA, only the list of required plans is provided, with high-level descriptions and responsibilities outlined in the tables below.

The plans are grouped into:

- Construction-phase management plans, to be implemented by the Company and EPC Contractor during site preparation, civil works, installation and commissioning; and
- Operation-phase management plans, to be implemented by the Company and O&M Contractor and overseen once the wind farm and associated transmission infrastructure are operational.

The following tables set out the required plans for each phase, together with a short narrative description of their purpose and the party responsible for implementing them.

22.3.1 Construction Phase Environmental and Social Management Plans

Table 21-1: Construction Environmental and Social Management Plans

Reference in HSSE MS	Name	Overall Description/Objective	Lead Implementation[316]
MP 00	Site Mobilization Plan	Drives compliance with E&S obligations during the initial site mobilization phase (site clearance, construction of temporary site facilities, etc.). The plan describes the E&S procedures and plans to be implemented by the EPC Contractor during the site mobilization phase to ensure all risks and impacts are properly managed and handled during this initial stage.	EPC Contractor
MP 01	HSSE MS Manual	Drives compliance with E&S obligations for the construction phase through identifying: 1. the overall structure and outline for the HSSE MS implemented for the construction phase by all involved counterparts to include the Developer, company, contractors and other; 2. E&S policies and commitment requirements; 3. Structure of the key E&S procedures and plans to be implemented to ensure all risks and impacts are properly managed; and, 4. the institutional framework and responsibilities to ensure that such procedures and plans are implemented effectively and efficiently.	Company/EPC Contractor
MP 02	Subcontractor and Supplier Management Plan	Ensures that employed subcontractors and suppliers comply with the project E&S requirements.	EPC Contractor
MP 03	E&S Training Management Plan	Identifies environmental, social, health and safety training needs and provides training requirements and schedule/matrix for all categories of personnel during the construction phase.	EPC Contractor
MP 04	Stakeholder Engagement Plan	Provides a structured approach to ensure that all actions required by the Project for stakeholder engagement are timely, consistent, comprehensive, coordinated, and culturally appropriate. The SEP outlines specific requirements for stakeholder identification and mapping, engagement activities, information disclosure, consultation meetings, and public participation. The SEP is a living document that will be updated as necessary throughout the Project's construction phase.	Company
MP 05	External Grievance Mechanism	Formal process established to receive, document, and address stakeholder concerns and grievances, ensuring resolution through a defined procedure.	Company
MP 06	Livelihood Restoration Plan	Plan for the restoration of livelihoods of formal or informal land users adversely affected by the Project to mitigate and fully compensate for economical displacement impacts.	Company
MP 07	Community Development	Identifies the overall development needs, management and implementation of development initiatives for local	Company

[316] This column identifies the lead responsible entity. Compliance is ultimately under the responsibility of the Company. The EPC and its contractors and suppliers shall provide the relevant input for the documents and plans implemented by the Company. All parties shall comply with all relevant HSSE MS requirements.

Reference in HSSE MS	Name	Overall Description/Objective	Lead Implementation[316]
	Plan	communities.	
MP 08	Labour and Working Conditions Management Plan	Defines the key labour requirements during the construction phase, establishing appropriate management measures to address labour-related issues and ensure compliance with Project obligations and the HSSE MS. Incorporates the Worker Grievance Mechanism.	EPC Contractor
MP 09	Worker Accommodation Management Plan	Specifies the standards and requirements for construction workforce accommodation, including provisions for the design, operation, and management of worker accommodation.	EPC Contractor
MP 10	Occupational Health and Safety (OHS) Management Plan	Establishes applicable guidelines and procedures for conducting construction activities in a manner that ensures the safety of employees and the protection of personnel and property during both routine and non-routine operations. Includes blasting management plan/procedure to be developed by the specialist blasting contractor and implemented under the EPC contract e.g. blast design, vibration monitoring, exclusion zones, notifications, pre-blast ecological checks, misfire protocols.	EPC Contractor
MP 11	Emergency Preparedness and Response Plan	Establishes organizational and operational measures to be implemented in the event of an emergency, ensuring that responses are adapted to the specific circumstances of each situation.	EPC Contractor
MP 12	Traffic and Transportation Management Plan	Management of traffic and transport-related risks to ensure the safety of both Project workers and surrounding communities during the construction phase.	EPC Contractor
MP 13	Security and Human Rights Management Plan	Defines the security measures to be implemented to mitigate security-related risks and ensure a responsible approach to security management. Aims to safeguard stakeholders from potential human rights violations while ensuring full compliance with international standards and recognized best practices.	EPC Contractor
MP 14	Hazardous Material and Waste Management Plan	Identifies the types and quantities of hazardous materials procured, natural resources utilized, and waste, including wastewater, generated during the construction phase. Establishes detailed procedures and assigns responsibilities for the safe management, transport, storage, and disposal of these materials, substances, and waste products in compliance with applicable regulations and best practices.	EPC Contractor
MP 15	Water Management Plan	Identifies water supply sources, estimation of required quantities, and procedures the sustainable use and management of water resources used throughout the construction phase of the Project.	EPC Contractor
MP 16	Biodiversity Management Plan	Ensures the protection of biodiversity resources including habitat, fauna, flora, and avifauna during the construction phase of the Project.	EPC Contractor
MP 17	Emissions Management Plan	Provides procedures to avoid, minimize, and mitigate environmental emissions during construction, applying the mitigation hierarchy and addressing aspects not fully covered by other plans. The plan includes measures for air quality, dust, noise, odour, and visual impacts, as well as resource use efficiency (water, energy, fuel, soil), stormwater and erosion control, batching plant operations, and pest management.	EPC Contractor

Reference in HSSE MS	Name	Overall Description/Objective	Lead Implementation[316]
MP 18	Chance Find Procedure	Defines the steps to be followed during construction if previously unknown archaeological, paleontological, cultural, or historical resources are encountered. Ensures that all chance finds are protected, recorded, and managed in compliance with applicable laws, lender requirements, and international standards.	EPC Contractor
MP 19	Gender Management Plan	Integrates gender considerations into project planning and construction activities. Promotes gender equality across recruitment, training, facilities, and grievance mechanisms, and embeds these requirements within the HSSE MS.	EPC Contractor

22.3.2 Operation Phase Environmental and Social Management Plans

Table 21-2: Operation Environmental and Social Management Plans

Reference in OHSSE MS	Name	Overall Description/Objective	Lead Implementation[317]
MP 01	Operations HSSE MS Manual	Provides the framework for managing health, safety, social, and environmental aspects during the operation phase. Drives compliance with HSSE obligations for the operation phase through identifying: 1. the overall structure and outline for the OHSSE MS implemented for the operation phase, by all involved counterparts to include the Developer, company, contractors and other; 2. E&S policies and commitment requirements; 3. Structure of the key E&S procedures and plans to be implemented to ensure all risks and impacts are properly managed; and, 4. the institutional framework and responsibilities to ensure that such procedures and plans are implemented effectively and efficiently.	Company
MP 02	Stakeholder Engagement Plan	Provides a structured approach to ensure that all actions required by the Project for stakeholder engagement are timely, consistent, comprehensive, coordinated, and culturally appropriate. The SEP outlines specific requirements for stakeholder identification and mapping, engagement activities, information disclosure, consultation meetings, and public participation. The SEP is a live document to be updated throughout the Project operation phase as required.	Company
MP 03	External Grievance Mechanism	Formal process established to receive, document, and address stakeholder concerns and grievances, ensuring resolution through a defined procedure.	Company
MP 04	E&S Training Management	Identifies the training needs in terms of environmental, social, health and safety topics relevant to the project and	O&M Contractor

[317] This column identifies the lead responsible entity. Compliance is ultimately under the responsibility of the Company. The O&M contractor, subcontractors, and service providers shall provide the relevant input for the documents and plans implemented by the Company. All parties shall comply with all relevant HSSE MS requirements.

Reference in OHSSE MS	Name	Overall Description/Objective	Lead Implementation[317]
	Plan	provides training requirements and schedule/matrix of training for the range of employees involved in the project during the operation phase	
MP 05	Hazardous Material and Waste Management Plan	Identifies the types and quantities of hazardous materials and natural resources used, aa well as the waste and wastewater generated at the project site during operation phase. Defines the procedures and responsibilities for the management, transport, storage and disposal of these materials, substances, and waste products.	O&M Contractor
MP 06	Emissions Management Plan	Site-specific plan developed to ensure that appropriate environmental management practices are followed during the operations to control and minimize associated environmental impacts and emissions. Outlines how the operation of the project will avoid, minimize, and mitigate its environmental impact and ensures that environmental aspects not covered by other plans (soil, hydrology, dust, noise, etc.) are managed in compliance with the Project's E&S obligations. It also identifies sources of water supply for the Project, estimation of required quantities, and procedures the sustainable use and management of water resources used throughout the operation phase of the Project.	O&M Contractor
MP 07	Biodiversity Management Plan	Ensures the protection of biodiversity resources during the operation phase of the Project.	O&M Contractor
MP 08	Traffic and Transportation Management Plan	Addresses traffic and transport related risks for both the project workers and the communities during operation, promotes safe driving awareness among the project staff, and establishes best practices on vehicle management.	O&M Contractor
MP 09	Emergency Preparedness and Response Plan	Establishes organizational and operational measures to be implemented in the event of an emergency, ensuring that responses are adapted to the specific circumstances of each situation.	O&M Contractor
MP 10	Occupational Health and Safety (OHS) Management Plan	Establishes applicable guidelines and procedures for conducting construction activities in a manner that ensures the safety of employees and the protection of personnel and property during both routine and non-routine operations.	O&M Contractor
MP 11	Labor and Working Conditions Management Plan	Defines the labor requirements during the operations phase, establishes appropriate management measures to address labor-related issues and ensure compliance with Project obligations and the HSSE MS. Incorporates the Worker Grievance Mechanism.	O&M Contractor
MP 12	Worker Accommodation Management Plan	Provides specifications for Worker Accommodation when employed on the Project during the operation phase. It includes specifications for the management of worker accommodation to which contractors (and any sub-contractors) shall comply when housing their workforce.	O&M Contractor
MP 13	Subcontractor and Supplier Management Plan	Establishes requirements and procedures to ensure that subcontractors and suppliers engaged by the O&M Contractor during the operation phase comply with the Project’s environmental and social standards, as well as applicable health, safety, security, and environmental (HSSE) management system requirements.	O&M Contractor

Reference in OHSSE MS	Name	Overall Description/Objective	Lead Implementation[317]
MP 14	Security Management Plan	Defines security measures to be implemented onsite to mitigate security-related risks, safeguard personnel and assets, and ensure that security practices respect human rights and follow international best practices.	O&M Contractor

22.4Roles and Responsibilities

Effective implementation of the Environmental and Social Management and Monitoring commitments requires clear allocation of roles and responsibilities across all parties involved in the Project. The Project Company, EPC Contractor, O&M Contractor, subcontractors and specialist consultants each have defined obligations to ensure that the commitments made in the ESIA are delivered in accordance with national legislation, lender standards and Masdar's corporate requirements.

The summary below provides an overview of the principal roles during construction and operation.

22.4.1 Project Company (Qazaq Wind Power LLP)

The Project Company has overall accountability for the Project's environmental and social performance. Its responsibilities include:

- Ensuring that the Project complies with national regulatory requirements, lender standards and Masdar's corporate E&S requirements;
- Overseeing the implementation of the HSSE MS through regular monitoring, inspections and audits;
- Managing stakeholder engagement activities and the community grievance mechanism;
- Coordinating with the Project Management Consultant (PMC) and external specialists, where required;
- Preparing operational-phase E&S management plans and establishing the Operational ESMS prior to commissioning;
- Reporting E&S performance to lenders in accordance with the Environmental and Social Action Plan (ESAP) and loan obligations;
- Ensuring that corrective actions for non-compliance or incidents are closed out effectively.

The Project Company will appoint dedicated Community Liaison Officers (CLOs) to support implementation of the Stakeholder Engagement Plan, grievance mechanism and LRP and to manage day-to-day interface with local communities. Three CLOs are planned, one for each of the Project's main components: the Wind Power Plant (WPP), the Jambyl OHTL, and the Kentau OHTL.

The CLOs will act as the primary point of contact between the Project and local communities and land users within their respective areas of influence. Their responsibilities will include facilitating ongoing communication, supporting the management of grievances, and ensuring that community concerns and feedback are communicated to the Project Company, EPC Contractor and Project Management Consultant, and are considered within the Project's environmental and social management and monitoring processes.

22.4.2 EPC Contractor

The EPC Contractor is responsible for day-to-day implementation of all construction-phase environmental and social requirements. This includes:

- Implementing the Construction HSSE Management Plans;
- Ensuring all subcontractors comply with the cHSSE MS and associated management plans, site rules and relevant HSSE requirements;
- Maintaining qualified HSSE personnel and ensuring adequate supervision during all construction activities;
- Conducting inductions, toolbox talks and competency-based training for the workforce;

- Identifying, managing and monitoring environmental and social risks in line with approved procedures;
- Implementing mitigation measures and monitoring programmes required by the ESIA;
- Maintaining records of inspections, incidents, non-compliances, grievances and monitoring results;
- Reporting regularly to the Project Company and PMC, including immediate notification of any significant incidents;
- Implementing corrective actions in a timely manner.

22.4.3 O&M Contractor

The O&M Contractor will assume responsibility for HSSE management during the operational life of the Project. Key responsibilities include:

- Implementing the Operational HSSE MS and associated operational management plans;
- Ensuring compliance with operational HSSE requirements, including noise, shadow flicker, biodiversity and waste management commitments;
- Conducting inspections, preventive maintenance and monitoring activities as required under the Operational HSSE MS;
- Managing worker health and safety during operation and maintaining relevant incident and performance records;
- Supporting the Project Company in community engagement and grievance handling during operation;
- Reporting operational HSSE performance to the Project Company and facilitating lender monitoring as required.

22.4.4 Subcontractors

Subcontractors engaged by the EPC Contractor or O&M Contractor must comply with all relevant HSSE requirements. Their responsibilities include:

- Implementing applicable elements of the HSSE MS and associated sub-plans;
- Ensuring their workforce receives appropriate induction and training;
- Following site rules, Codes of Conduct and emergency procedures;
- Reporting incidents, hazards and near-misses to the Contractor;
- Cooperating with inspections, audits and corrective actions.

22.4.5 Project Management Consultant (PMC)

Where appointed, the PMC provides oversight and technical support to ensure effective implementation of HSSE requirements. Responsibilities typically include:

- Reviewing and endorsing the EPC Contractor's management plans, method statements and risk assessments;
- Participating in monitoring, inspections and incident investigations;
- Providing specialist guidance to the Project Company and EPC Contractor;
- Advising on corrective actions and verifying their implementation.

22.4.6 External Specialists

Specialist consultants (e.g. ecology, hydrology, heritage, social) may be engaged to support the implementation of specific mitigation or monitoring requirements. This includes:

- Conducting pre-construction surveys and operational monitoring;
- Providing technical assessments and recommendations;
- Supporting compliance reporting and adaptive management where required.

22.4.7 Government Authorities

Relevant national and regional authorities have a statutory supervisory role. Their responsibilities may include:

- Issuing permits and approvals required for construction and operation;
- Conducting inspections in line with national environmental and social regulations;
- Reviewing monitoring data and incident reports as required;

Providing direction on compliance with applicable laws and standards.

22.5Environmental and Social Monitoring and Reporting

Environmental and social monitoring is essential to verify that the commitments made in the ESIA are effectively implemented and that the Project's performance remains aligned with national regulatory requirements, lender standards and Masdar's corporate expectations. Monitoring also provides the basis for adaptive management, enabling the Project Company and Contractors to identify issues early, implement corrective actions and maintain continual improvement throughout construction and operation.

This section provides a high-level overview of the monitoring and reporting arrangements for the Project. Detailed monitoring parameters, frequencies, methods and responsibilities will be defined in the individual construction and operational management plans.

22.5.1 Objectives of Monitoring

The monitoring programme is designed to:

- Confirm that mitigation measures set out in the ESIA are being implemented effectively;
- Demonstrate compliance with the Environmental Code of Kazakhstan, lender requirements and Masdar's cHSSE MS;
- Identify non-compliances, unexpected impacts or emerging risks so that timely corrective actions can be taken;
- Verify the effectiveness of management measures and enable refinement of practices through adaptive management;
- Provide transparent and accountable reporting to stakeholders and lenders.

22.5.2 Overview of Construction-Phase Monitoring

During construction, the EPC Contractor will undertake routine monitoring across key environmental and social parameters, including (as relevant):

- Air quality and dust control
- Noise and vibration, including any blasting activities
- Soil erosion, sediment control and stormwater management
- Surface-water protection and spill prevention
- Waste and hazardous-material management
- Biodiversity protection measures and compliance with no-go areas
- Cultural-heritage chance-find management

- Community health and safety, including traffic safety
- Worker health and safety performance
- Workforce welfare and accommodation conditions.

The EPC Contractor will document all monitoring outcomes and report regularly to the Project Company and PMC. The Project Company will undertake periodic verification and oversight audits, supplemented where required by independent third-party monitoring commissioned by lenders.

22.5.3 Overview of Operational-Phase Monitoring

During operation, the O&M Contractor will implement monitoring in accordance with the Operational HSSE MS. Key monitoring topics will typically include:

- Turbine operational noise verification
- Shadow-flicker monitoring (as required)
- Bird and bat fatality searches and activity monitoring
- Waste and hazardous waste management
- Water use and wastewater management
- Worker health and safety performance and training
- Community health and safety, including grievance trends
- OHTL corridor inspections (e.g., vegetation clearance, structure integrity).

The Project Company will retain overall responsibility for reporting and for ensuring that monitoring results are evaluated and corrective or adaptive actions taken where required.

22.5.4 Reporting Requirements

The Project will apply a tiered reporting hierarchy whereby the EPC Contractor reports to the Project Company and the Project Management Consultant, the Project Company consolidates and verifies these reports, and lenders receive quarterly and annual E&S performance updates.

EPC Contractor to Project Company/PMC

The EPC Contractor will provide:

- Daily HSSE updates (incidents, near-misses, observations);
- Weekly inspection summaries and corrective action updates;
- Monthly HSSE monitoring reports, including KPIs, non-compliances, grievances, training records and environmental-monitoring results;
- Immediate notification of major incidents or non-compliances.

O&M Contractor to Project Company

During operation, the O&M Contractor will submit:

- Monthly operational monitoring reports;
- Quarterly summaries of noise, shadow flicker, biodiversity, waste and HSSE performance;
- Incident notifications as required by the Operational HSSE MS.

Project Company to Lenders

The Project Company will prepare and submit:

- Quarterly HSEE performance reports during construction covering activities, monitoring results, grievances, incidents and corrective actions;
- Initial six-monthly HSSE performance reports during operation for first two years of operation covering operational activities, monitoring results, grievances, incidents and corrective actions
- Annual environmental and social reports, as required by lender agreements;
- Immediate notifications of any significant HSSE incidents in accordance with lender protocols.

Regulatory Reporting.

Where required under Kazakh law (e.g., waste reporting, water protection requirements), the Project Company and Contractors will submit mandatory reports to the relevant authorities.

22.5.5 Adaptive Management and Corrective Actions

Adaptive management is built into the Masdar HSSE MS. ISO 9001 certification embeds a formal Plan–Do–Check–Act (PDCA) cycle within the management system, ensuring that quality objectives are systematically planned, implemented, monitored, and continuously improved across all operations. Through documented procedures, performance monitoring, internal audits, and management review, the PDCA approach is integrated into day-to-day decision-making rather than treated as a standalone process. This ensures that lessons learned and performance data are consistently used to identify corrective actions and ensure ongoing adaptation and continuous improvement within the company's management system.

Where monitoring identifies non-compliances or ineffective mitigation measures, the Project Company will apply an adaptive management approach, including:

- Identification of root causes;
- Development of corrective and preventive actions;
- Clear assignment of responsibilities and deadlines;
- Verification of corrective-action completion;
- Updating of procedures or management plans where necessary
- Maintain a corrective actions tracker system.

These processes will follow the incident-management and non-compliance procedures set out in Masdar's HSSE MS Manual.

Community and worker grievances will be monitored and reported in accordance with the procedures established in the Project's Grievance Mechanisms, as described in the Stakeholder Engagement Plan, and this will be managed by the Project CLOs. Trends or recurring issues identified through the grievance process will be incorporated into adaptive management and corrective-action processes as required.

23 Conclusions and Recommendations

23.1 Overall Conclusions

This Environmental and Social Impact Assessment (ESIA) has been undertaken for the Jambyl 1 GW Wind Power Project, including the Wind Power Plant (WPP), Battery Energy Storage System (BESS), overhead transmission lines (OHTL), access roads, and supporting infrastructure. The ESIA has assessed the potential environmental and social risks and impacts arising during the construction and operation phases of the Project, in accordance with the environmental impact assessment requirements of the Republic of

Kazakhstan and applicable international lender standards, including the IFC Performance Standards and relevant World Bank Group Environmental, Health and Safety Guidelines.

The assessment identifies that the principal environmental and social impacts associated with the Project are predominantly linked to construction activities and reflect the scale and geographical extent of the development. With the application of the mitigation hierarchy and the implementation of the mitigation and management measures defined in this ESIA, the majority of impacts are assessed as temporary, localised, and reversible. Operational-phase impacts are generally limited and characteristic of large-scale wind energy developments of this nature.

Following the implementation of the proposed mitigation and management measures, no residual impacts of Major significance are predicted. Overall residual impacts are assessed as minor to moderate and are considered acceptable and manageable within the framework of the Project's environmental and social management systems.

23.2Social

The social assessment has considered potential impacts on local communities, workers, and other stakeholders associated with the construction and operation of the Project. Key areas of assessment include community health, safety and security, land use and livelihoods, labour and working conditions, traffic and transport, and stakeholder engagement.

The assessment indicates that the Project is located in a predominantly rural and sparsely populated area, and that no physical displacement or resettlement of households is anticipated. Social impacts are therefore primarily associated with temporary construction-phase activities, including increased traffic, workforce presence, economic opportunities and potential disturbance to local communities and land users and the potential impacts to social cohesion that these activities may generate.

During the operational phase, social impacts are generally limited in extent and may include ongoing economic benefits. The principal potential residual social impact relates to noise exposure at night for a small number of non-residential receptors, including seasonal or temporary overnight accommodation used by livestock grazers. This has the potential to give rise to sleep disturbance in certain circumstances. Appropriate mitigation and management measures, including design-stage noise controls, operational noise management, and the application of agreed mitigation or compensation measures where required, are expected to adequately address such impacts.

Measures have been identified to avoid or minimise potential social risks and impacts, including traffic management, community health and safety controls, labour management procedures, local employment and procurement measures and the implementation of stakeholder engagement and grievance mechanisms for both workers and external stakeholders. These measures will be implemented through the Project's environmental and social management framework and contractor management arrangements.

Taking into account the proposed mitigation and management measures, residual social impacts are considered acceptable and manageable. The Project is therefore considered socially acceptable and consistent with applicable national legislation and international lender requirements, subject to the effective implementation of the social management and monitoring commitments identified in this ESIA.

23.3Biodiversity

The biodiversity assessment confirms that the Project is located within a landscape supporting a range of

habitats and species, including migratory birds, bats, and other fauna of conservation interest. Biodiversity considerations have been integrated into Project planning and design from an early stage, with emphasis placed on avoidance and minimisation of impacts through macro- and micro-siting of wind turbines and overhead transmission lines, route optimisation, and the application of ecological constraints.

Potential biodiversity impacts may arise during both the construction and operational phases of the Project. Construction-phase impacts are primarily associated with temporary habitat disturbance, displacement, and disturbance of fauna, and are generally localised and reversible in nature. Operational-phase impacts are principally related to collision risk for birds and bats and, for certain disturbance-sensitive terrestrial species, potential longer-term displacement effects.

A comprehensive set of mitigation and management measures has been defined and will be implemented through the Project's Biodiversity Management Plan (BMP). These measures include pre-construction surveys, construction-phase controls, operational mitigation measures, monitoring, and adaptive management, and are designed to ensure compliance with national legislation and international lender requirements, including IFC Performance Standard 6. Where required, measures to achieve No Net Loss of biodiversity have been incorporated.

Taking into account the proposed mitigation and management measures, residual biodiversity impacts are considered acceptable and consistent with applicable national requirements and international lender standards.

23.4Environmental

The Project will result in changes to the physical environment primarily during the construction phase, including land disturbance, traffic movements, and increased noise levels. These impacts have been assessed in the context of the baseline conditions of the Project area and the sensitivity of affected receptors. Construction-related physical environmental impacts are generally temporary, localised, and reversible in nature. Where construction-phase impacts cannot be fully avoided, appropriate mitigation and management measures have been identified and will be implemented through the Project's construction Environmental and Social Management System (cESMS).

During the operational phase, physical environmental impacts are limited in extent and are characteristic of large-scale onshore wind energy developments. The principal operational impacts relate to wind turbine noise, landscape and visual effects, and potential shadow flicker at nearby sensitive receptors. Such environmental impacts have been avoided or minimised where practicable through Project design, including layout optimisation of the wind turbines, route selection for overhead transmission lines, and the incorporation of environmental constraints. These impacts have been assessed against applicable national requirements and international good practice, and appropriate design and operational control measures have been identified where required. No other significant physical environmental impacts are anticipated during operation.

With the application of the proposed mitigation and management measures, residual physical environmental impacts are assessed as being of minor significance. The Project is therefore considered to be environmentally acceptable, subject to the effective implementation of the mitigation and monitoring measures identified in this ESIA.

23.5Recommendations

Based on the findings of this ESIA, the following key recommendations are made to support effective Project implementation and to ensure that environmental and social risks and impacts are appropriately

managed throughout the Project lifecycle:

- **Finalise the Wind Turbine Generator (WTG) layout** once the selected turbine model and final technical specifications are confirmed, taking into account the findings and recommendations of this ESIA. The final layout should be optimised, where practicable, to further reduce potential residual environmental and social impacts, including effects on biodiversity, visual receptors, noise-sensitive receptors, and land use.
- **Incorporate all mitigation and management measures** identified in the ESIA into the Project's Environmental and Social Management System (ESMS) and associated management plans, ensuring that these measures are contractually binding on EPC contractors and subcontractors and are fully integrated into construction and operational procedures.
- **Implement the Biodiversity Management Plan (BMP)**, including pre-construction surveys, construction-phase controls, operational mitigation measures, post-construction monitoring, and adaptive management, to ensure compliance with applicable national legislation and international lender requirements and to achieve stated biodiversity objectives, including No Net Loss where required.
- **Prepare and implement the Livelihood Restoration Plan (LRP)**, where applicable, to address any Project-related economic displacement or temporary impacts on land use and livelihoods, ensuring that affected persons are adequately compensated and supported in accordance with national requirements and international lender standards.
- **Maintain effective stakeholder engagement** throughout construction and operation, including ongoing information disclosure, consultation with affected communities, land users, potential partners and other stakeholders, and the implementation of a transparent and accessible grievance mechanism for both workers and external stakeholders.
- **Establish and implement a proportionate environmental and social monitoring and reporting programme**, aligned with the Project's risk profile, to verify the effectiveness of mitigation measures, identify any unforeseen impacts, and enable timely corrective action where necessary. Monitoring outcomes should inform adaptive management and be reported to the Project Company and lenders in accordance with agreed requirements.
- **Review and update environmental and social management measures** as the Project progresses from construction to operation, ensuring that management arrangements remain appropriate to Project activities, evolving site conditions, and applicable regulatory and lender requirements.

Annex A

Existing Historical and Cultural Heritage Sites

Cultural Heritage

Annex A: WPP Area Tangible Heritage

Table 1: Heritage sites identified within the WPP Study Area (2024-25)

N	Coordinates	Type/Name	Description	Photo
W-01	43°21'02.3"N 69°54'43.2"E	Single kurgan	The kurgan is located on the top of a small hill. The mound is constructed of slab stone. The diameter of the mound is 12 metres, and its height is 1 metre. At the top of the mound, a small stone structure has been placed.	Photo 1
W-02	43°21'18.6"N 69°54'23.8"E	Single kurgan	It is also located on the top of a small hill. The mound is constructed of slab stone and has a diameter of 13.5 metres and a height of 0.8 metres. An obo (stone pile) is placed on the top of the mound.	Photo 2
W-03	43°20'41.9"N 69°53'33.0"E	Single kurgan	The mound is constructed of slab stone and has a diameter of 15 metres and a height of 1 metre. Two obos (stone piles) are present on the top of the mound."	Photo 3
W-04	43°20'32.8"N 69°53'40.7"E	Single kurgan	It has a stone mound composed of slab stone, with a diameter of 15 metres and a height of 1.8 metres. A stone obo is placed on the top of the mound.	Photo 4
W-05	43°20'25.2"N 69°53'43.9"E	Single kurgan	The kurgan mound is constructed of stone, with an obo placed on its top. The mound has a diameter of 9 metres and a height of 0.5 metres.	Photo 5.
W-06	43°19'32.7"N 69°55'07.5"E	Single kurgan	It is located on a small rise. The kurgan mound, partially disturbed due to the construction of an obo, has a diameter of 7 metres and a height of 0.4 metres.	Photo 6
W-07	43°19'08.4"N 69°55'27.5"E	Burial site	It consists of three kurgans aligned along a north–south axis. The mounds are constructed of fractured stone and have the following dimensions: Kurgan 1 – diameter 13 m, height 0.8 m; Kurgan 2 – diameter 6.5 m, height 0.4 m; Kurgan 3 – diameter 4.4 m, height 0.2 m.	Photo 7 Photo 8.
W-08	43°19'08.4"N 69°55'27.5"E	Single kurgan	The kurgan has a stone mound preserved to a diameter of 7 metres and a height of 0.4 metres. A small stone pile (obo) is also present on the top of the mound.	Photo 9
W-09	43°17'40.8"N 69°55'38.9"E	Single kurgan	The kurgan mound is composed of large stones, with a diameter of 7 metres and a height of 0.5 metres.	Photo 10
W-10	43°17'59.3"N 69°55'17.4"E	Single kurgan	It is located on a small hill and has a stone mound. The diameter of the mound is 6 metres, and its height is 0.4 metres.	Photo 11

N	Coordinates	Type/Name	Description	Photo
W-11	43° 19.641'N 70° 0.035'E	Burial site of 4 Kurgans	Kurgan 1 The mound is composed of earth and stone, with a diameter of 21 metres and a height of 1.3 metres." Kurgan 2 The kurgan mound is constructed of large stones mixed with earth. The mound has a diameter of 32 metres and a height of 1.8 metres. Kurgan 3 The kurgan mound is composed of large stones and earth. The kurgan is damaged, and the mound has been levelled; it is preserved to a diameter of 9 metres and a height of 0.3 metres. Kurgan 4 The kurgan mound is composed of earth and stone, with a diameter of 19 metres and a height of 1.8 metres. The central part of the mound is destroyed.	Photo 12, Photo13.
W-12	43°20.750' N 69°58.883' E	Single kurgan	The kurgan mound is constructed of large, fractured stones. The mound has a diameter of 12 metres and a height of 1.2 metres.	Photo 14
W-13	43°20.902' N 069°59.409' E	Single kurgan	It is located on the top of a hill and is constructed of large stones. The mound has a diameter of 14.5 metres and a height of 1 metre.	Photo 15.
W-14	43°22.900' N 69°45.758' E	Single kurgan	The kurgan mound is heavily grassed over and is constructed of earth and stone. The mound has a diameter of 8 metres and a height of 0.8 metres.	Photo 16
W-15	43°15.325' N 069°54.365' E	Burial site of 3 Kurgans	It consists of a chain of three kurgans. Kurgan 1 The kurgan has an earthen mound with a diameter of 16 metres and a height of 1 metre." Kurgan 2 This is a large kurgan with an earthen mound measuring 30 metres in diameter and 2.7 metres in height. A layout of large quartz boulders is present on the top of the mound. Kurgan 3 The kurgan has an earthen mound with a diameter of 9 metres, preserved to a height of 0.6 metres.	18, 19, 20

N	Coordinates	Type/Name	Description	Photo
W-16	43°15.190' N 069°54.565' E	Burial site of 3 Kurgans	It consists of a chain of three kurgans aligned along an east–west axis. Kurgan 1 The kurgan has an earthen mound with a diameter of 12 metres and a height of 0.5 metres. Kurgan 2 The kurgan has an earthen mound with stone inclusions, measuring 10 metres in diameter and 0.4 metres in height." Kurgan 3 The mound is constructed of earth and stone. Large quartz boulders are in the centre of the mound. The mound has a diameter of 8 metres and a height of 0.8 metres.	21, 22, 23
W-17	43°14.505' N 69°55.481'E	Single kurgan	The kurgan is located on the top of a hill and has a stone-and-earth mound with a diameter of 18 metres and a height of 1.75 metres.	24
WJ-05	43°25'28"N 69°44'30"E	Burial Site Kurgan №5	The kurgan has an earthen mound with a diameter of 14 metres and a height of 0.45 metres.	25, 26, 27, 28
WJ-06	43°15'45"N 69°52'11"E	Burial Site Kurgan №6	The kurgan has a stone-and-earth mound with a diameter of 16 metres and a height of 1.4 metres. Five sacrificial structures (altars) are located next to the kurgan.	29, 30, 31, 32

Table 2: List of Historical and Cultural Heritage Monuments within the WPP study area, identified in the State Register

N	Coordinates	Type/Name	Description	Photo
Barga Aulie -1	43°23'19.59"N 69°44'56.91"E	Single kurgan	Located 8.7 km southeast of Ushbas village and 9.6 km southwest of Aktogay village Early Iron Age Archaeology The funerary structure is a stone-built burial mound (kurgan) with a diameter of 12 m and a height of approximately 0.7 m, constructed of stone slabs. The stone mound has been partially dismantled, presumably for the construction of stone cairns (turs).	Photo 33, Photo 34
Barga Aulie -2	43°23'20.98"N 69°04'11.91"E	burial site	Early Iron Age Located 9.0 km southeast of Ushbas village and 9.4 km southwest of Aktogay village The burial ground consists of two kurgans arranged along a southwest–northeast (SW–NE) axis,	Photo 35 Photo 36

			with a distance of approximately 60 m between them. The burial mounds have diameters of 12 m and 15 m and heights of approximately 0.2 m and 0.3 m, respectively. The above-ground funerary structures are constructed of stone slabs.	
Barga Aulie -3	43°23'56"N 69°04'57.72"E	single burial mound	Medieval period Located 7.4 km southeast of Aktogay village and 9.9 km west of Ushbas village	No Photo
Buzashoky	43°23'41.99"N 69°04'52.02"E	burial mound	Buzashoky Located 8.3 km southwest of Aktogay village and 9.9 km southeast of Ushbas village Medieval period	No Photo
Ushbas-1	43°23'59.64"N 69°42'6.48"E	burial mound	Ushbas 1 Burial Site – Early Iron Age	No Photo
Ushbas-2	43°20'22.73"N 69°41'59.28"E	burial mound	Ushbas 2 Burial Site – Multiperiod	No Photo
Ushbas-3	43°19'33.49"N 69°43'56.64"E	burial mound	Ushbas 3 Burial Site – Early Iron Age Located 9.3 km southeast of Ushbas village, at the headwaters of the Arystandy and Ushbas rivers. The burial ground comprises seven kurgans, irregularly (chaotically) distributed over a wide area, with distances between individual mounds reaching up to 430 m. The above-ground funerary structures have diameters ranging from 5 m to 35 m and heights from approximately 0.3 m to 1.8 m. The mounds are constructed of earth and stone and are poorly grass-covered.	Photo 37

Figure 1: Cultural heritage and Archaeological sites in the WPP Area and Jambyl OHTL route

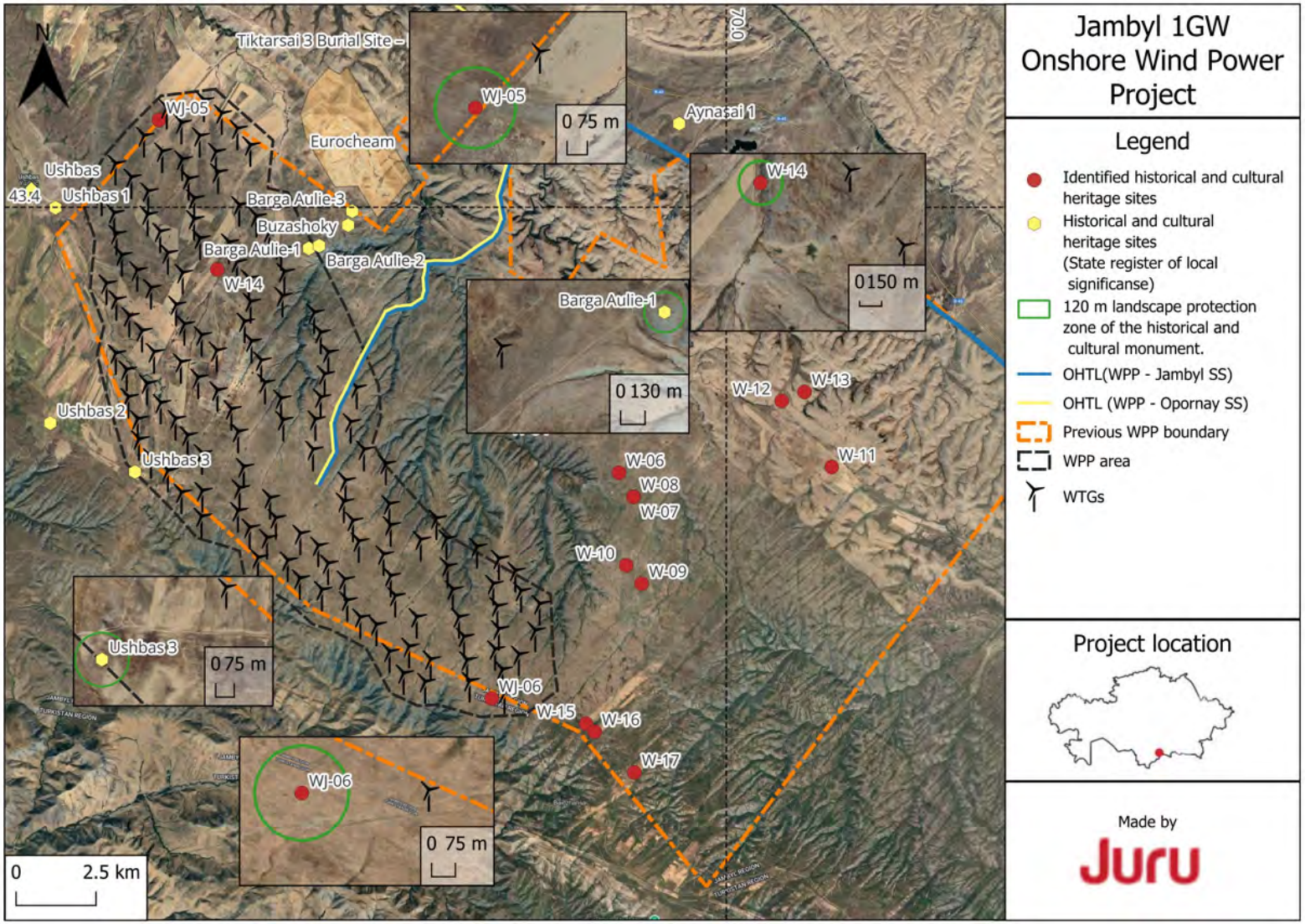




Photo 1. Single kurgan W-01



Photo 2 Single kurgan W-02



Photo 3. Single kurgan W-03



Photo 4. Single kurgan W-04



Photo 5. Single kurgan W-05



Photo 6. Single kurgan W-06



Photo 7. Burial site W-07



Photo 8. Burial site W-07



Photo 9. Single kurgan W-08



Photo 10. Single kurgan W-09



Photo 11. Single kurgan W-10



Photo 12. Burial site of 4 Kurgans W-11

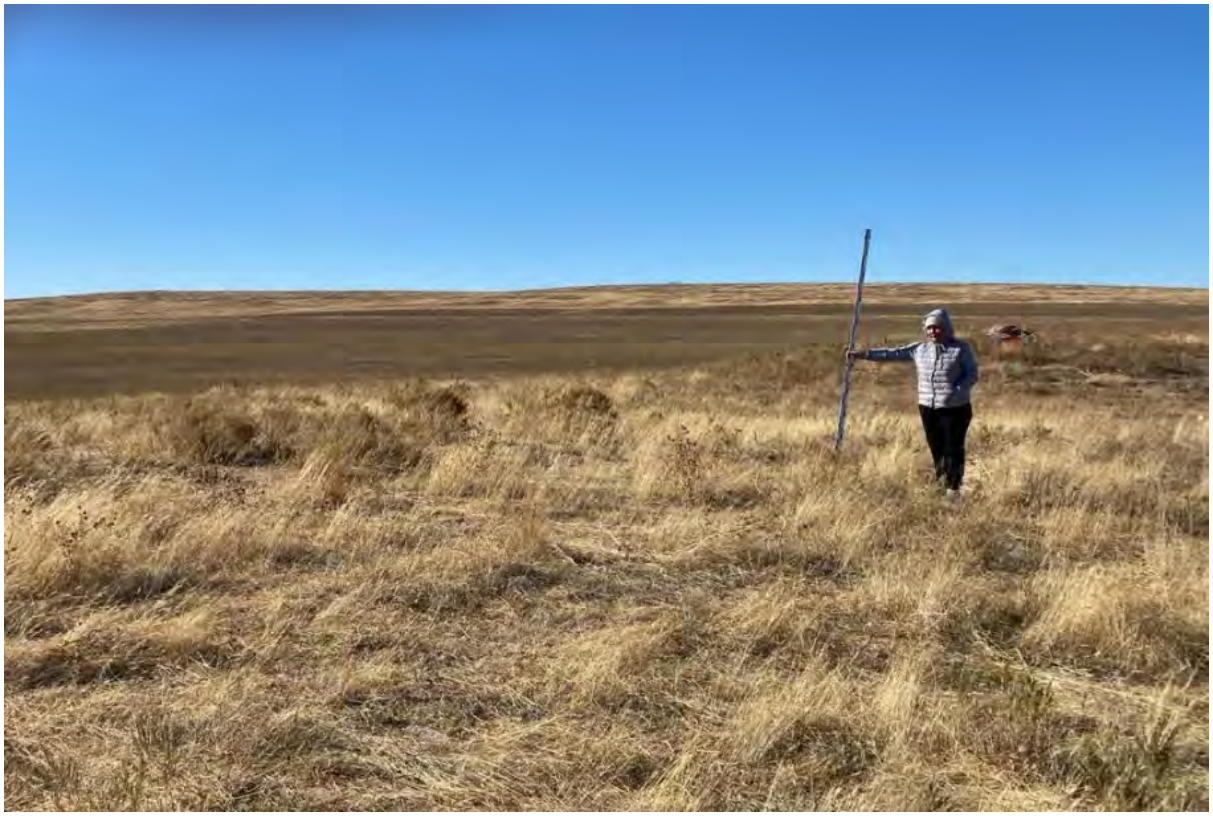


Photo 13. Burial site of 4 Kurgans W-11



Photo 14. Burial site of 4 Kurgans W-11



Photo 15. Single Kurgan W-12



Photo 16. Single Kurgan W-13



Photo 17. Single Kurgan 3 W-14



Могильник 2 курган 1

Photo 18. Burial site of 3 Kurgans W-15



Могильник 2 курган 2

Photo 19. Burial site of 3 Kurgans W-15



Могильник 2 курган 3

Photo 20. Burial site of 3 Kurgans W-15



Могильник 3, курган 1

Photo 21. Burial site of 3 Kurgans W-16



Могильник 3, курган 2

Photo 22. Burial site of 3 Kurgans W-16



Могильник 3, курган 3

Photo 23. Burial site of 3 Kurgans W-16



Одиночный курган

Photo 24. Burial site of 3 Kurgans W-17



Photo 25. Burial site. Kurgan 5 view from the east WJ-05



Photo 26. Burial site. Kurgan 5 view from the south WJ-05



Photo 27. Burial site. Kurgan 5 view from the west WJ-05



Photo 28. Burial site. Kurgan 5 view from the north WJ-05



Могильник 2. Курган 6. Вид с востока

Photo 29. Burial site. Kurgan 6 view from the east WJ-06



Могильник 2. Курган 6. Вид с юга

Photo 30. Burial site. Kurgan 6 view from the south WJ-06



Могильник 2. Курган 6. Вид с запада.

Photo 31. Burial site. Kurgan 6 view from the west WJ-06



Могильник 2. Курган 6.Вид с севера

Photo 32. Burial site. Kurgan 6 view from the north WJ-06



Photo 33. Barga Aulie -1 Single kurgan



Photo 34. Barga Aulie -1 Single kurgan



Photo 35. Barga Aulie -2 Burial site



Photo 36. Barga Aulie -2 Burial site



Photo 37. Ushbas-3 Burial site

Cultural Heritage

Annex B: Jambyl OHTL Tangible Heritage

Table 1: Heritage sites identified along the Jambyl OHTL

N	Coordinates	Type / Name	Description	Photo
J-01	43°16'31.8"N, 70°12'24.6"E	Single kurgan	The kurgan has a stone mound, with a stone ring structure located at the top of the mound. The diameter of the kurgan is 15 m, and the height of the mound is 1.5 m	Photo 1
J-02	43°10'06.5"N, 70°22'39.4"E	Burial site consisting of 3 kurgans	The mounds of the kurgans are constructed from fractured stone and have the following dimensions: Kurgan 1: mound diameter – 7 m; height – 0.5 m Kurgan 2: mound diameter – 3.5 m; height – 0.2 m Kurgan 3: mound diameter – 6 m; height – 0.4 m	2, 3
Maitobe Burial site:			Three kurgans fall within the OHTL development zone. The kurgan mounds are stone–earthen and have the following dimensions:	
J-3.1	42°59'20.0"N, 70°35'14.7"E	Kurgan 1 Maitobe Burial site	Mound diameter – 9 m; height – 0.4 m	4
J-3.2	42°59'20.0"N, 70°35'14.5"E	Kurgan 2 Maitobe Burial site	Mound diameter – 11 m; height – 0.3 m	5
J-3.3	42°59'19.6"N, 70°35'14.1"E	Kurgan 3 Maitobe Burial site	Mound diameter – 13 m; height – 0.4 m	6
Kurgan Burial Ground:			This burial ground is extensive, typically forming a chain that intersects the OHTL development corridor. Three kurgans also fall within the development zone. The kurgans have stone–earthen mounds with the following characteristics:	
J-4.1	42°55'36.2"N, 70°43'53.3"E	Kurgan 1	Mound diameter – 11 m; height – 0.5 m	7
J-4.2	42°55'35.6"N, 70°43'52.8"E	Kurgan 2	Mound diameter – 8 m; height – 0.2 m	8

N	Coordinates	Type / Name	Description	Photo
J-4.3	42°55'34.9"N, 70°43'52.7"E	Kurgan 3	Mound diameter – 11 m; height – 0.6 m	9
J-05	43°20'32"N, 70°05'23"E	Kurgan 1	The mound is composed of large, rounded stones. The diameter of the kurgan is 6 m, and the height is 0.25 m. A stone oba (ritual marker) is located in the center of the kurgan.	10, 11, 12, 13
J-06	43°21'17"N, 70°04'11"E	Kurgan 2	The mound is built from large stones. The diameter of the kurgan is 5 m, and the height is 0.3 m.	14, 15, 16, 17
J-07	43°22'59"N, 70°00'55"E	Kurgan 3	The kurgan is located on a hill crest. The mound consists of large stones. The diameter of the kurgan is 7 m, and the height is 0.5 m.	18, 19, 20, 21
J-08	43°23'03"N, 70°01'00"E	Kurgan 4	The kurgan is situated on the top of a ridge. The mound is composed of stones. The kurgan has a diameter of 9 m and a height of 0.8–1 m.	22, 23, 24, 25
Burial site:			Burial site consisting of 2 kurgans	
J-9.1	43°23'57"N, 69°58'56"E	Burial site Kurgan 1	Earthen mound. Diameter 14 m, height 1.2 m.	26, 27, 28
J-9.2	43°23'58"N, 69°58'57"E	Burial site Kurgan 2	Earthen mound, 10 m in diameter and 1 m high. The kurgan is damaged and in poor condition; approximately one-fifth of the mound is occupied by a modern OHTL.	29, 30, 31, 32
Burial Site:			Burial Site No. 2 (consisting of 6 kurgans)	
WJ-01	43°23'56"N, 69°58'45"E	Kurgan 1	Stone–earthen mound. Diameter 7 m, height 0.3 m.	33, 34, 35, 36
WJ-02	43°23'57"N, 69°58'46"E	Kurgan 2	Stone–earthen mound. Diameter 8 m, height 0.5 m.	37, 38, 39, 40
WJ-03	43°23'57"N, 69°58'46"E	Kurgan 3	Stone–earthen mound. Diameter 5 m, height 0.1 m.	41, 42, 43, 44
WJ-04	43°23'58"N, 69°58'47"E	Kurgan 4	Stone–earthen mound. Diameter 12 m, height 0.6 m.	45, 46, 47, 48
WJ-05	43°25'28"N, 69°44'30"E	Kurgan 5	Earthen mound. Diameter 14 m, height 0.45 m.	
WJ-06	43°15'45"N, 69°52'11"E	Kurgan 6	Stone–earthen mound. Diameter 16 m, height 1.4 m. Five sacrificial altars (zhertvenniki) are located adjacent to the kurgan.	

Table 2: List of Historical and Cultural Heritage Monuments along the Jambyl OHTL, identified in the State Register

Maitobe (see J-3.1, J-3.2 and J-3.3)	Located 1 km southeast of Maitobe village and 100 m north of the Taraz – Karatau road.	Burial site	Located 1 km southeast of Maitobe village and 100 m north of the Taraz – Karatau road. Discovered and surveyed in 1979. The burial site consists of 10 kurgans with earth mounds and stone embankments, where mound diameters range from 5 to 30 m, and heights from 0.3 to 2 m. The mounds are oriented from west to east. Spacing between individual kurgans varies from 70 to 150 m. Two of the largest kurgans have mound diameters of 20 m, with preserved heights of 1 m. Three kurgans fall within the OHTL development zone. The kurgan mounds are stone–earthen. List of Historical and Cultural Heritage Sites of Local Significance	See 4, 5, and 6
Berikkara	located near Lake Bilikol	Burial site	2nd century BCE – 4th century CE, located several kilometres south of the village of Karabastau. List of Historical and Cultural Heritage Sites of Republican Significance. The Berikkara burial complex is one of the largest and most archaeologically significant kurgan cemeteries in southern Kazakhstan, extending along both banks of the Berikkara River at the foothills of the Karatau Range. First recorded in 1938–1939 and investigated repeatedly over nearly a century, the site comprises at least 411 burial mounds, including a central concentration of monumental "royal" kurgans distinguished by their large size, complex stone-and-earth construction, enclosing stone rings, and the rare use of white quartz. The mounds reach heights of 15–18 meters and diameters of up to 120 meters. The site has experienced disturbances from looting and past infrastructure development; a main road (R-42), transmission line and gas pipeline run perpendicular through the site. Excavations have yielded rich assemblages of ceramics, metal ornaments, weapons, and horse-related fittings, supporting a chronology from the 2nd century BCE to the 4th century CE	49

			associated with Early Iron Age nomadic cultures. Owing to its scale, monumentality, distinctive construction features, and contribution to understanding nomadic societies of the Karatau foothills, the complex is considered a site of high archaeological value at both regional and national levels.	

Figure 1 Cultural heritage and archaeological sites on the Jambyl OHTL Route - overview

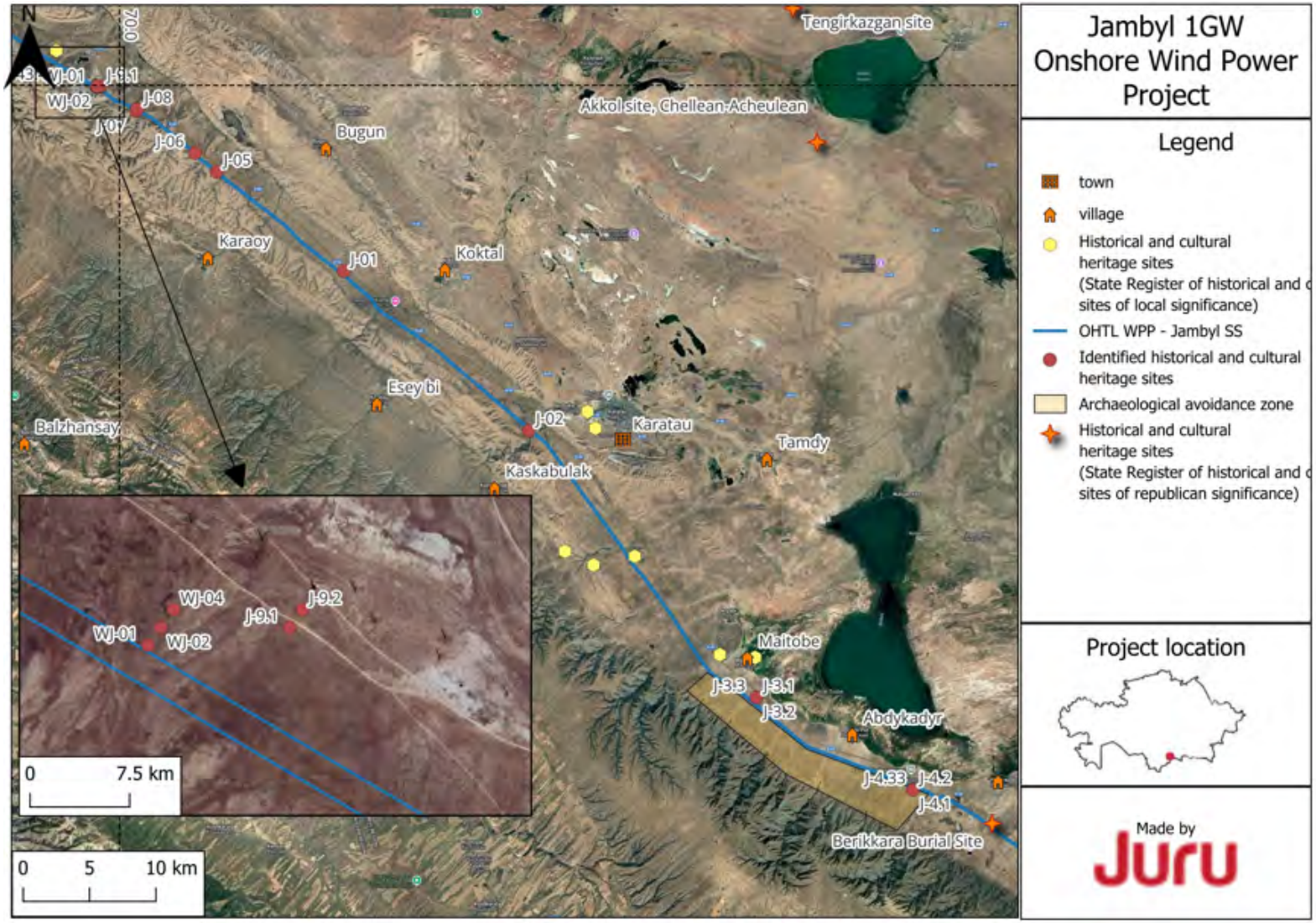


Figure 2 Cultural heritage and archaeological sites on the Jambyl OHTL Route – northwest section

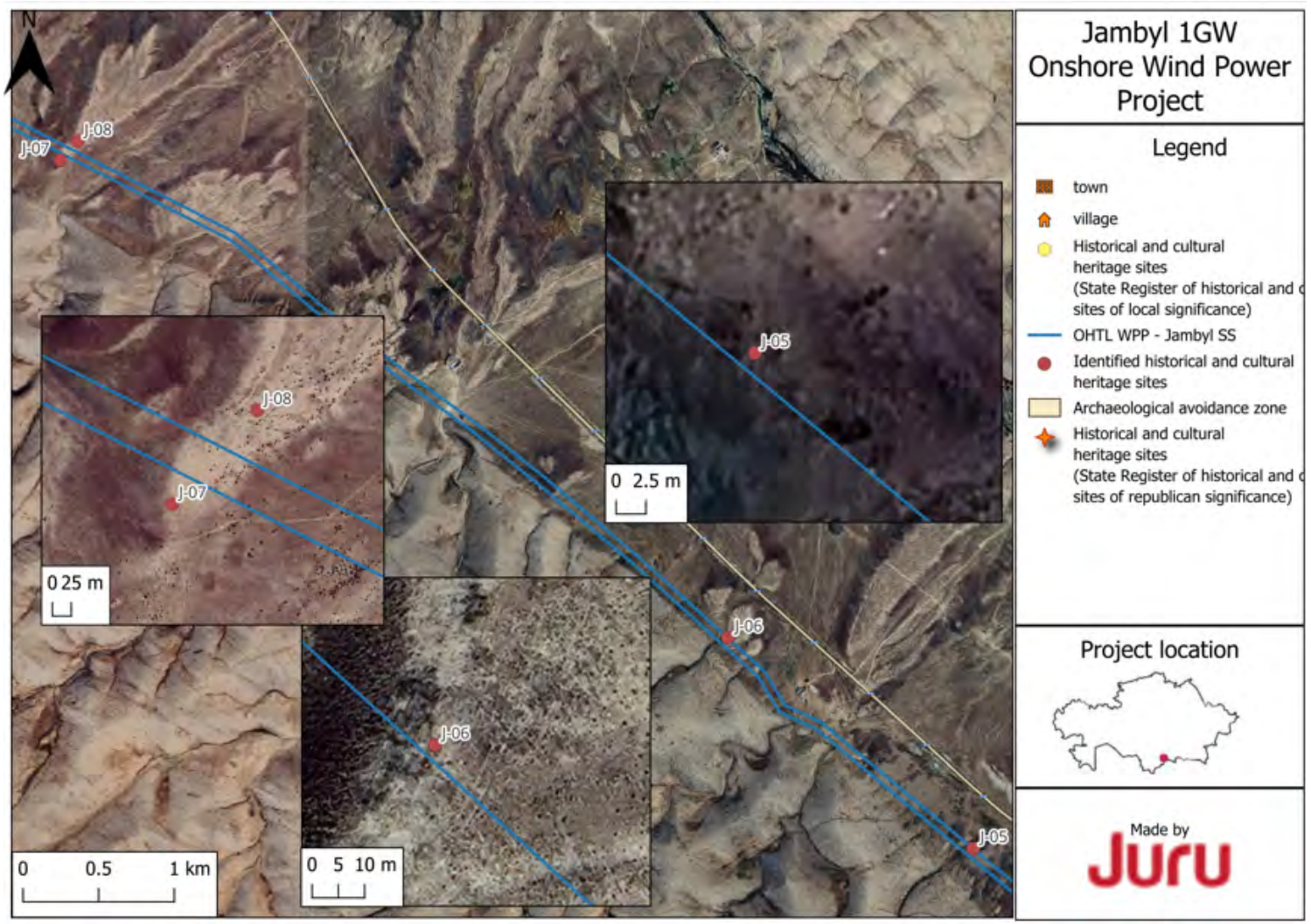


Figure 3 Cultural heritage and archaeological sites on the Jambyl OHTL Route – central section

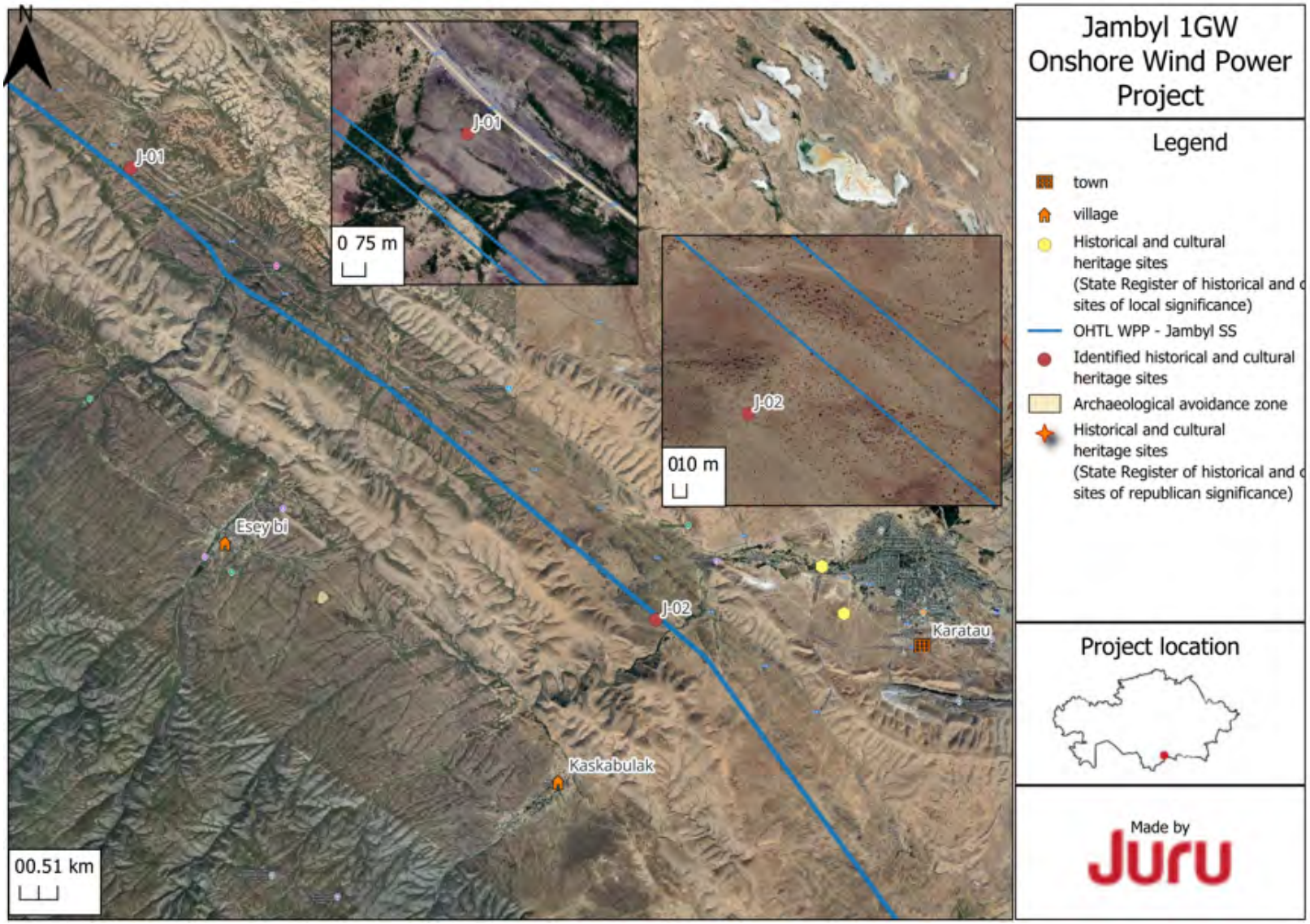


Figure 4 Cultural heritage and archaeological sites on the Jambyl OHTL Route – southeast section

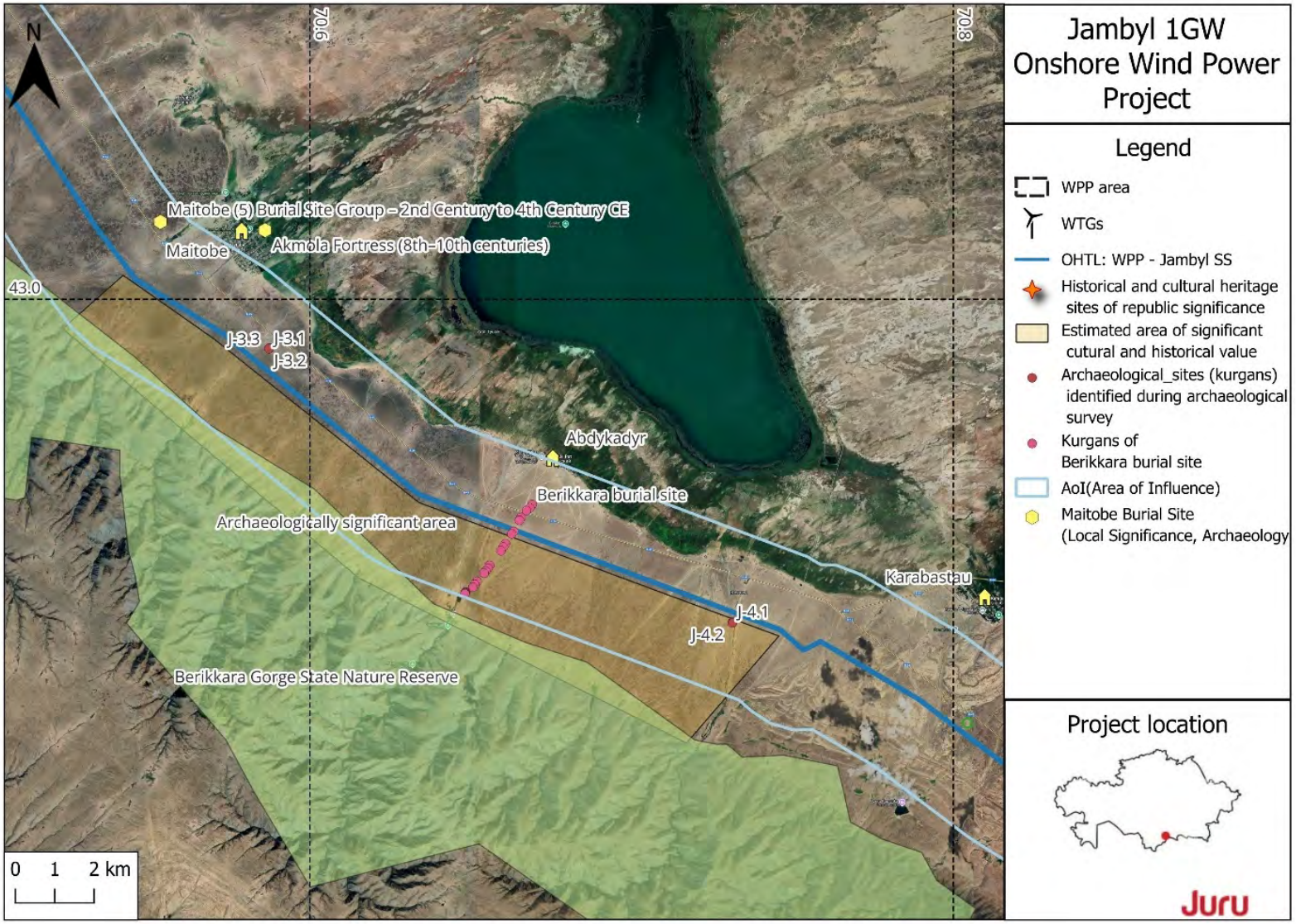


Figure 5 Cultural heritage and archaeological sites on the Jambyl OHTL Route – Berikkara area

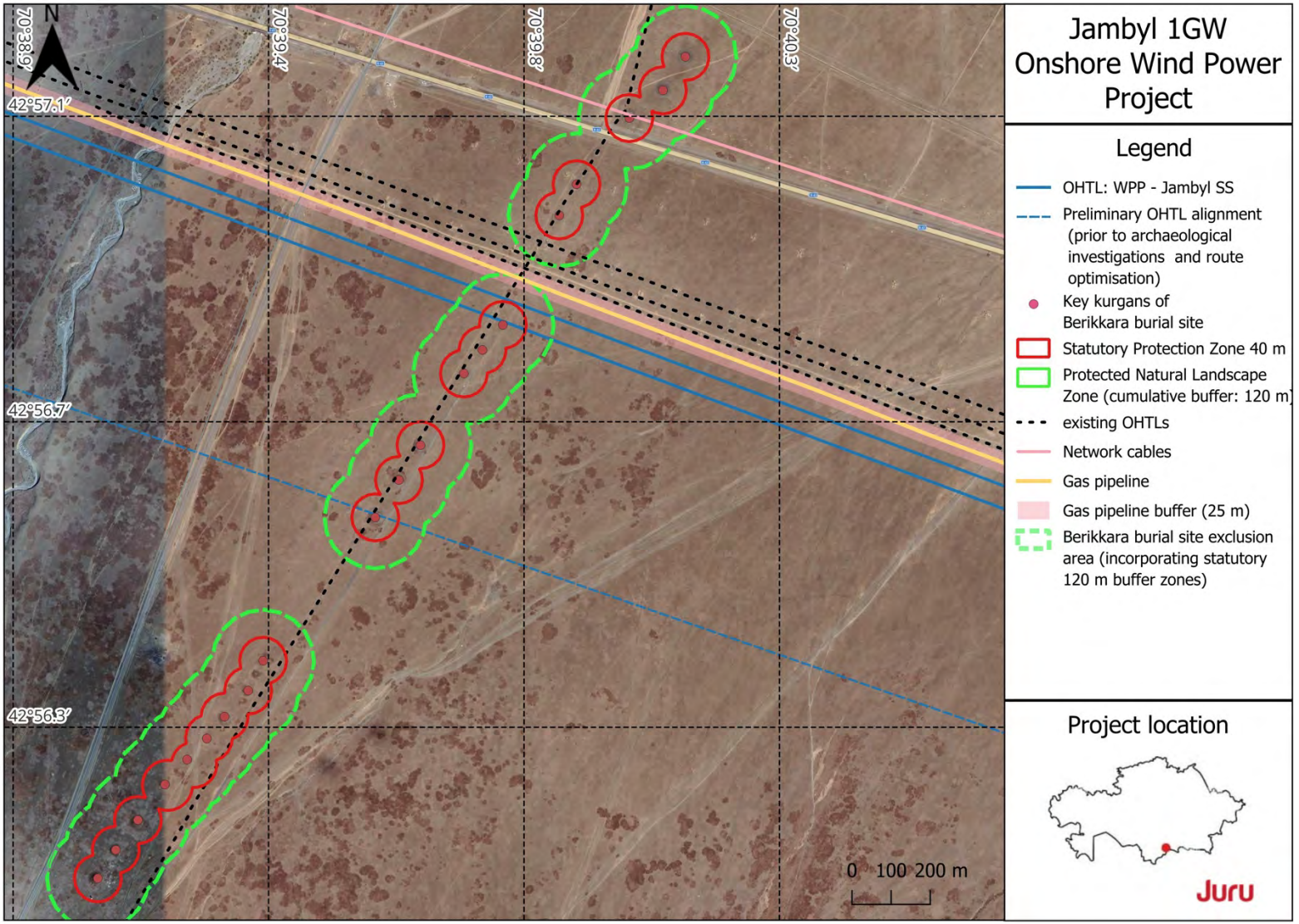




Рис 13. Зона ЛЭП. Курган 1.

Photo 1.. Jambyl OHTL area. Single kurgan J-01



Рис 14. Могильник из 3 – х курганов. Курган 2.

Photo 2.. Burial site consisting of 3 kurgans. Kurgan 2 - J-02



Рис 15. Могильник из 3 – х курганов. Курган 3.

Photo 3. Burial site consisting of 3 kurgans. Kurgan 2 – J-02



Рис 16. Могильник Майтобе. Курган 1.

Photo 4. Maitobe burial site. Kurgan 1 - J-3.1



Рис 17. Могильник Майтобе. Курган 2.

Photo 5. Maitobe burial site. Kurgan 2 J-3.2



Рис 18. Могильник Майтобе. Курган 3.

Photo 6. Maitobe burial site. Kurgan J-3.3



Рис 19. Курганный могильник. Курган 1.

Photo 7. Burial site. Kurgan 1 J-4.1



Рис 20. Курганный могильник. Курган 2.

Photo 8. 2Burial site. Kurgan 2 J-4.2



Рис 21. Курганный могильник. Курган 3.

Photo 9 Burial site. Kurgan 3 J-4.3



Photo 10. Kurgan J-05 View from the east



Photo 11. Kurgan J-05 View from the south



Photo 12. Kurgan J-05 View from the west



Курган 1. Вид с севера

Photo 13. Kurgan J-05 View from the north



Курган 2.Вид с востока

Photo 14. Kurgan J-06. View from the east



Курган 2. Вид с юга

Photo 15. Kurgan J-06. View from the south



Курган 2. Вид с запада.

Photo 16. Kurgan J-06 View from the west



Курган 2. Вид с севера

Photo 17. Kurgan J-06 View from the north



Курган 3.Вид с востока

Photo 18. Kurgan J-07 View from the east



Курган 3. Вид с юга

Photo 19. Kurgan J-07 View from the south



Курган 3. Вид с запада.

Photo 20. Kurgan J-07 View from the south



Photo 21. Kurgan J-07 View from the north



Курган 4.Вид с востока

Photo 22. Kurgan J-08 View from the east



Курган 4. Вид с юга

Photo 23. Kurgan J-08 View from the south



Курган 4. Вид с запада.

Photo 24. Kurgan J-08 View from the south



Курган 4. Вид с севера

Photo 25. Kurgan J-08 View from the north



Могильник 1. Курган 1. Вид с востока

Photo 25. Kurgan J-08 View from the north



Могильник 1. Курган 1. Вид с юга

Photo 26. Burial site. Kurgan 1. J – 9.1 View from the south



Могильник 1. Курган 1. Вид с запада.

Photo 27.Burial site. Kurgan 1. J – 9.1 View from the west



Могильник 1. Курган 1.Вид с севера

Photo 28. Burial site. Kurgan 1. J – 9.1 View from the north



Могильник 1. Курган 2. Вид с востока

Photo 29. Burial site. Kurgan 2. J – 9.2 View from the east



Могильник 1. Курган 2. Вид с юга

Photo 30.Burial site. Kurgan 2. J – 9.2 View from the south



Могильник 1. Курган 2. Вид с запада.

Photo 31. Burial site. Kurgan 2. J – 9.2 View from the west



Могильник 1. Курган 2.Вид с севера

Photo 32. Burial site. Kurgan 2. J – 9.2 View from the north



Могильник 2. Курган 1. Вид с востока

Photo 33. Burial site. Kurgan 2. WJ-01 View from the east



Могильник 2. Курган 1. Вид с юга

Photo 34. Burial site. Kurgan 2. WJ-01View from the south



Могильник 2. Курган 1. Вид с запада.

Photo 35. Burial site. Kurgan 2. WJ-01View from the west



Могильник 2. Курган 1.Вид с севера

Photo 36. Burial site. Kurgan 2. WJ-01View from the north



Могильник 2. Курган 2. Вид с востока

Photo 37. Burial site. Kurgan 2. WJ-01View from the east



Могильник 2. Курган 2. Вид с юга

Photo 38. Burial site. Kurgan 2. WJ-02 View from the south



Могильник 2. Курган 2. Вид с запада.

Photo 39. Burial site. Kurgan 2. WJ-02 View from the west



Могильник 2. Курган 2.Вид с севера

Photo 40. Burial site. Kurgan 2. WJ-02 View from the west



Могильник 2. Курган 3. Вид с востока

Photo 41. Burial site. Kurgan 3. WJ-03 View from the east



Могильник 2. Курган 3. Вид с юга

Photo 42. Burial site. Kurgan 3. WJ-03 View from the south



Могильник 2. Курган 3. Вид с запада.

Photo 43. Burial site. Kurgan 3. WJ-03 View from the west



Могильник 2. Курган 3.Вид с севера

Photo 44. Burial site. Kurgan 3. WJ-03 View from the north



Могильник 2. Курган 4. Вид с востока

Photo 45. Burial site. Kurgan 4. WJ-04 View from the east



Могильник 2. Курган 4. Вид с юга

Photo 46. Burial site. Kurgan 4. WJ-04 View from the south



Могильник 2. Курган 4. Вид с запада.

Photo 47. Burial site. Kurgan 4. WJ-04 View from the west



Могильник 2. Курган 4.Вид с севера

Photo 48. Burial site. Kurgan 4. WJ-04 View from the north



Photo 49: Berikkara burial site

Cultural Heritage

Annex C: Kentau OHTL Tangible Heritage

Table 1: Heritage sites identified along the Kentau OHTL (Opornaya SS – Kentau SS)

N	Coordinates	Type/Name	Description	Photo
K-1	43°41'05.9"N 69°29'32.3"E	Single kurgan	The kurgan is constructed of stone. The diameter of the mound is 7.7 metres, and its height is 0.8 metres. It is dated to the 7th–3rd centuries BCE.	Photo 1
K-2	43°43'30.9"N 69°08'12.7"E	Sholakkorgan Burial site	It consists of seven kurgans arranged in a single row. The outermost kurgan falls within the project development area. The kurgan is formed of an earthen mound, with a diameter of 27 metres and a height of 1.3 metres. It is dated to the 7th–3rd centuries BCE.	Photo 2
K-3	43°26'49.7"N 68°45'01.9"E	Single kurgan	The kurgan is composed of fractured stones, with a diameter of 17 metres and a height of 0.7 metres.	Photo 3
K-4	43°26'57.3"N 68°43'43.6"E	Single kurgan	The kurgan is composed of fractured stones, with a diameter of 11 metres and a height of 0.5 metres.	Photo 4

Figure 1 Cultural heritage and archaeological sites on the Kentau OHTL route

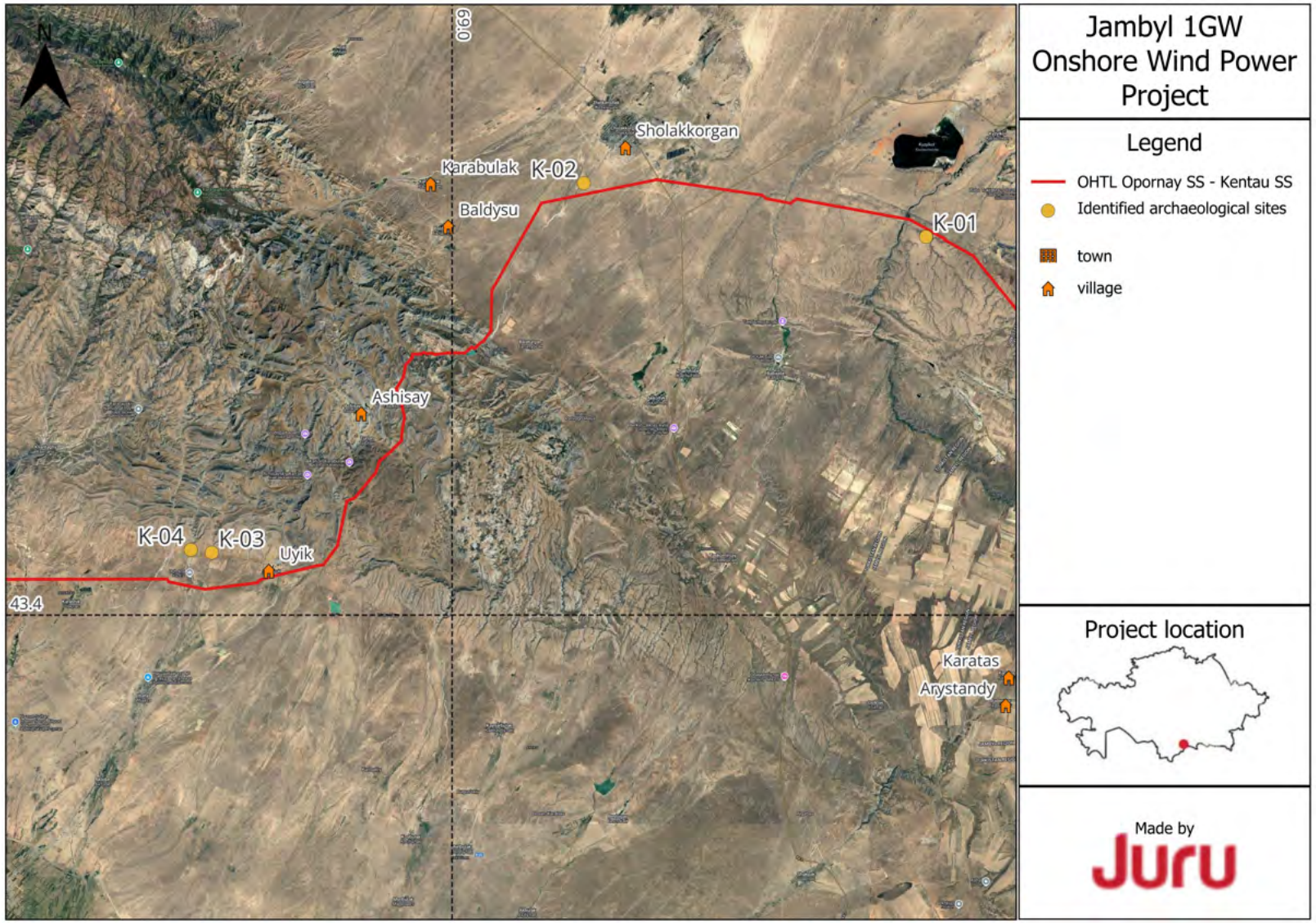




Photo 1. Single kurgan K- 01



Photo 2. Sholakkorgan Burial site K-02



Photo 3. Single kurgan K-03



Photo 3. Single kurgan K-04

Cultural Heritage

Annex D: Intangible Cultural Heritage

Table 1: Locations and photographs of intangible cultural heritage sites in WPP area

№	Description	Location	Photograph
1	Kamar Aulie cemetery and grove / pilgrimage site	1.2km south-east of Ushbas village	Cemetery - outside:  Cemetery – inside:  Grove (rest area and table located under the large tree): 

№	Description	Location	Photograph
2	Barga Aulie sacred site	8.7 km southeast of Ushbas village	

Figure 1: Locations of intangible cultural heritage resources in Project area

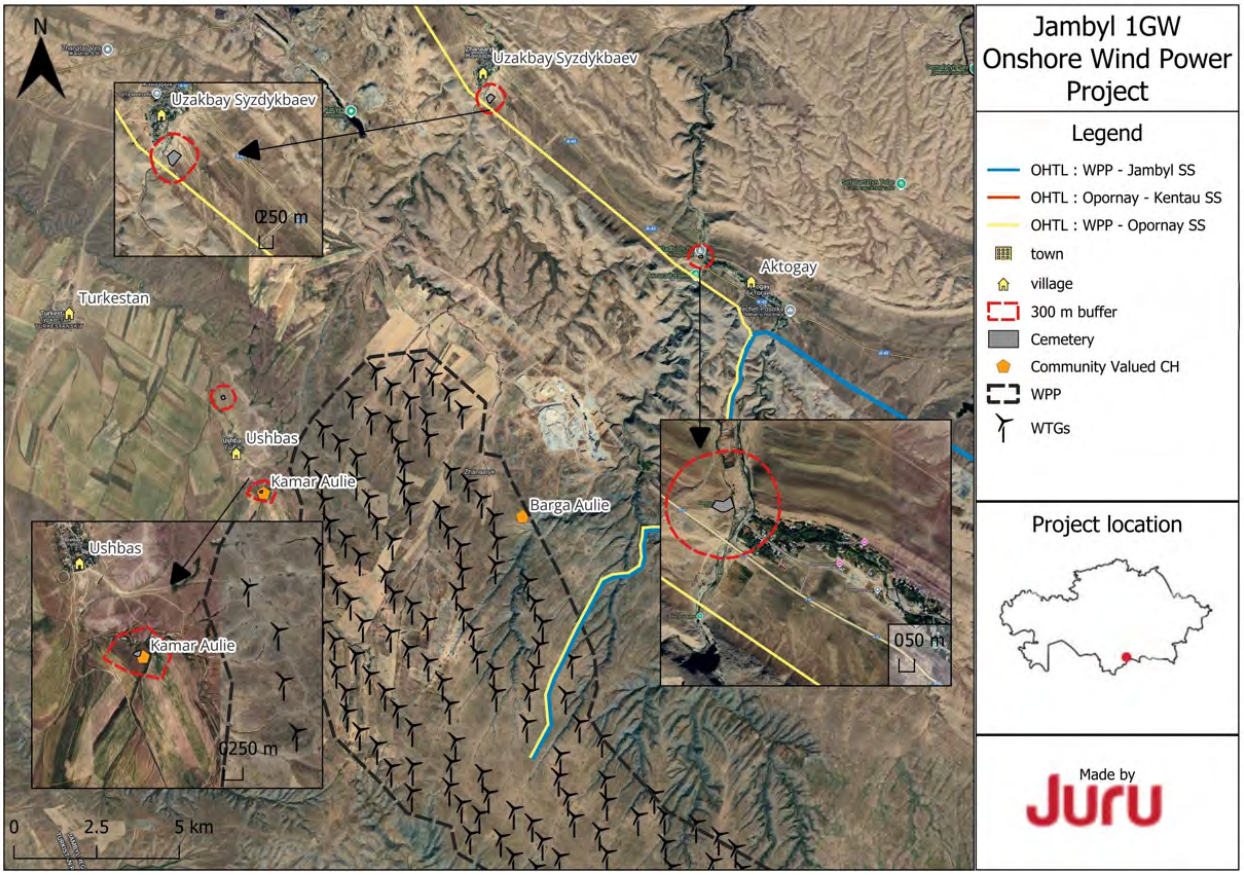


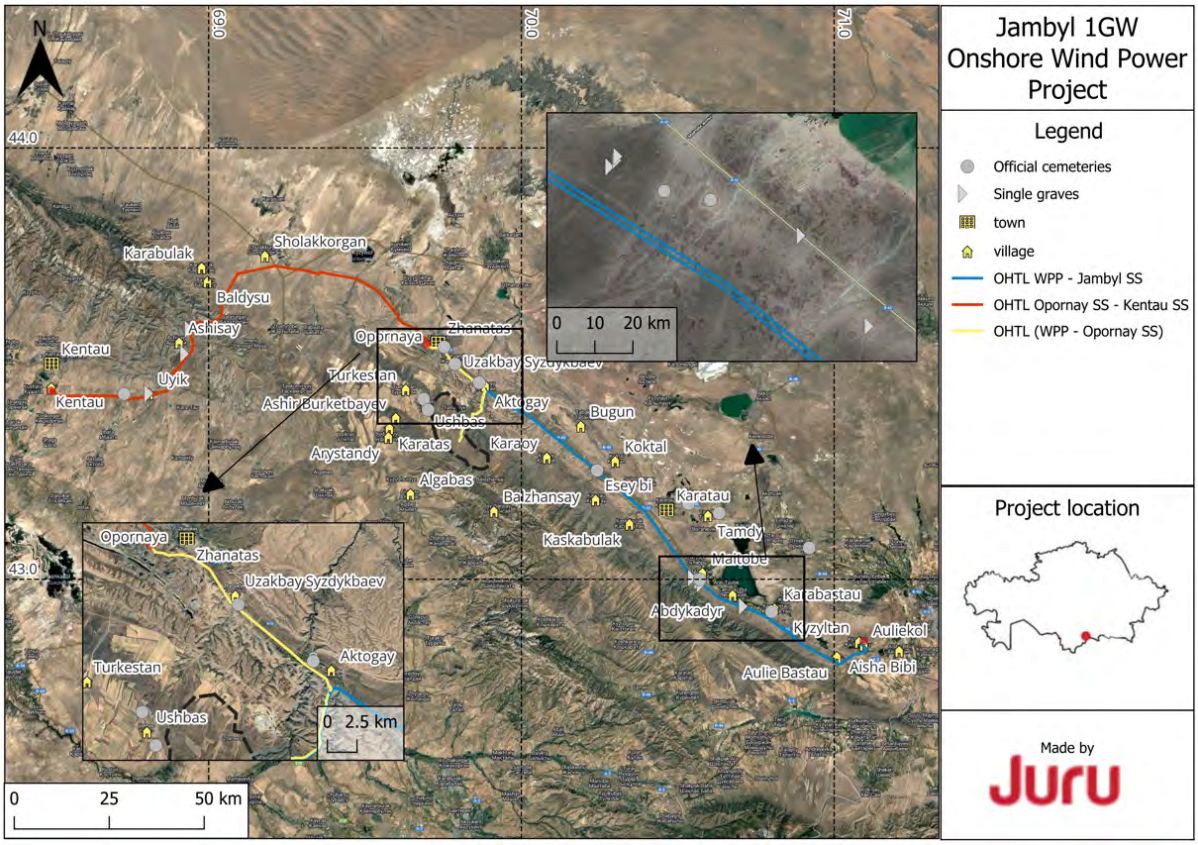
Table 2: Locations and photographs of contemporary cemeteries and single graves

№	Description	Coordinates	Photograph
1	Kuttyk Baba (shrine / memorial)	N: 42°56'10.06" E: 70°44'08.01"	
2	Single graves-1	N: 42°56'11.81" E: 70°43'25.15"	
3	Single graves-2	N: 42°59'20.53" E: 70°35'21.41"	
4	Single graves-3	N: 42°59'47.42" E: 70°34'53.75"	
5	Cemetery-1	N: 42°59'58.82" E: 70°34'20.44"	

№	Description	Coordinates	Photograph
6	Cemetery-2	N: 43°00'01.95" E: 70°33'57.50"	
7	Single graves-4	N: 43°00'07.88" E: 70°33'35.96"	

№	Description	Coordinates	Photograph
8	Single graves-5	N: 43°00'09.82" E: 70°33'38.86"	
9	Single graves-6	N: 43°00'11.01" E: 70°33'39.30"	
10	Cemetery-3	N: 43°15'12.21" E: 70°14'33.15"	

Figure 2 Locations of contemporary cemeteries and single graves in the Project area



Annex B

Species Sensitivity Analysis

Sensitivity analysis

Sensitivity reflects the intrinsic ecological value and vulnerability of the defined receptor, independent of the characteristics of the Project or the likelihood of interaction with specific infrastructure components.

Sensitivity is determined through consideration of:

- **Conservation value**, including global and national conservation status, legal protection, and Critical Habitat (CH) status under IFC PS6;
- **Ecological vulnerability**, including biological resilience, reproductive rate, recovery potential, and population structure;
- **Site dependence**, reflecting the importance of the AoI to the receptor's population or lifecycle (e.g. breeding, migration, wintering, corridor function).

Receptors triggering Critical Habitat under IFC PS6 are assigned High sensitivity and those that were not recorded in the surveys were screened out from the impact assessment. Criteria for each category are defined in the tables below.

Site Dependence			
	Category name	Definition	Typical evidence
0	No functional role	Species not recorded or no ecological function within AoI; habitat unsuitable or presence incidental with no functional relevance	Adequate survey effort with no records; no suitable habitat; no evidence of use
1	Occasional or incidental use	Irregular or opportunistic presence without evidence of breeding, aggregation, or sustained use	Sporadic flyovers; isolated records; opportunistic foraging; no repeated seasonal pattern
2	Regular non-critical use	Repeated seasonal or regular use of AoI but not essential to population persistence; alternative habitats or routes available	Consistent seasonal migration passage; regular foraging; broad-front migration corridor; habitat widely available regionally
3	Lifecycle-critical function	AoI supports breeding, lekking, nesting, maternity, staging, roosting, or a meaningful proportion of the population; functional dependence evident	Confirmed breeding or maternity sites; staging aggregations; territorial behaviour; documented corridor reliance
4	Irreplaceable or population-defining function	AoI supports a substantial proportion of national or flyway population or qualifies under Critical Habitat thresholds; habitat feature regionally unique or non-substitutable	CH trigger met; high aggregation density; unique habitat feature with no regional alternative

Ecological Value			
	Category name	Definition	Life history characteristics
0	Very high demographic resilience	Species with rapid population turnover and strong capacity to compensate for additional mortality.	Early maturity; short generation length; high fecundity; multiple offspring per year; high natural mortality but rapid replacement; low adult survival elasticity.
1	Moderate demographic resilience	Species with moderate recovery capacity but some sensitivity to sustained increases in mortality.	Intermediate generation length; moderate fecundity; several offspring per breeding attempt; partial dependence on adult survival; moderate turnover rate.
2	Low demographic resilience	Species with slow life history traits and limited ability to compensate for additional mortality.	Delayed maturity; low reproductive output; small clutch sizes; long generation length; strong adult survival dependence; slow population growth.
3	Very low resilience	Species with extremely low reproductive rates and very high sensitivity to small increases in adult mortality.	Very delayed maturity; typically one offspring per breeding attempt; very long generation length; extremely high adult survival elasticity; minimal compensatory capacity.

Conservation Tier			
	Category name	Definition	Typical criteria
0	Not of conservation concern	Species of Least Concern globally and not nationally Red Listed or legally protected.	IUCN LC; no national Red Book listing; no CMS/CITES Appendix I; not legally protected.
1	National or regional concern	Species nationally protected, or with regional conservation plans.	National Red Book listing; national protection status; regional conservation plans.
2	Globally/nationally Near Threatened or Vulnerable or Data Deficient	Species classified as Near Threatened (NT) or Vulnerable (VU) on the IUCN Red List or equivalent national listing.	IUCN NT or VU; CMS Appendix II; CITES Appendix II; recognised global conservation concern.
3	Globally/nationally Endangered or Critically Endangered	Species classified as Endangered (EN) or Critically Endangered (CR) on the IUCN Red List or equivalent national listing.	IUCN EN or CR; CMS Appendix I; CITES Appendix I; high international conservation priority.
4	Critical Habitat Trigger	Species meeting IFC PS6 Critical Habitat thresholds within the Area of Influence (e.g., significant proportion of global or regional population present).	Confirmed PS6 CH criteria met; ≥ threshold % of population supported; designated Key Biodiversity Area trigger.

Final Sensitivity			
Category	Definition	Typical Combination of Criteria	Interpretation in ESIA Context

High	Receptors of high ecological importance where the site plays a significant role in supporting populations or key ecological functions. Impacts may affect population viability at local, regional, or (in some cases) national scale.	• Threatened species (national/global) present in meaningful numbers • Site supports key lifecycle functions (e.g. breeding, roosting, migration corridor) • High relative abundance or regular use • Limited alternative habitat or specialised ecological requirements	Impacts likely to be moderate to major significance depending on magnitude. Requires strong mitigation, clear justification, and often adaptive management.
Medium	Receptors of moderate ecological importance where the site contributes to population support but is not critical for species persistence.	• Species of conservation interest but low/moderate abundance • Regular but non-critical use of site (e.g. foraging, transit) • Habitat of moderate quality or partially modified • Alternative habitats available in the wider landscape	Impacts typically minor to moderate. Mitigation required but generally achievable through standard good practice measures.
Low	Receptors of low ecological importance with limited conservation value and low dependency on the site.	• Common and widespread species • Low abundance or occasional presence • No key ecological functions supported • Highly modified or degraded habitat	Impacts generally minor and not significant. Standard mitigation measures sufficient.
Out of Scope	Receptors that are not relevant to the impact pathway or for which no plausible interaction with project activities is expected based on baseline evidence.	• No records within AoI or immediate surroundings • No suitable habitat or ecological function present • Impact pathway not applicable (e.g. no collision risk, no habitat interaction) • Presence highly unlikely or only theoretical	Receptor is excluded from detailed impact assessment. This should be clearly justified to avoid over-precautionary conclusions and ensure consistency with realistic impact pathways.

Receptor sensitivity

Taxonomic group	Population type	Latin name	Engilsh name	Conservation tire	Ecological Vulnerability	Site Dependence	CH Trigger	Final Sensitivity
Bird	combined	*Anser erythropus*	Lesser White-fronted Goose	2	1	0		Out of scope
Bird	combined	*Branta ruficollis*	Red-breasted Goose	2	1	0		Out of scope
Bird	combined	*Marmaronetta angustirostris*	Marbled Duck	3	1	0		Out of scope
Bird	combined	*Aythya ferina*	Common Pochard	2	1	0		Out of scope
Bird	combined	*Aythya nyroca*	Ferruginous Duck	3	1	0		Out of scope
Bird	non-breeding	*Oxyura leucocephala*	White-headed Duck	3	1	1		Medium
Bird	breeding	*Otis tarda*	Great Bustard	3	2	4	YES	High
Bird	non-breeding	*Otis tarda*	Great Bustard	3	2	4	YES	High
Bird	combined	*Chlamydotis macqueenii*	Asian Houbara	2	2	0		Out of scope
Bird	breeding	*Tetrax tetrax*	Little Bustard	2	2	3		High
Bird	non-breeding	*Tetrax tetrax*	Little Bustard	2	2	2		Medium
Bird	non-breeding	*Anthropoides virgo*	Demoiselle Crane	2	1	2		Medium
Bird	non-breeding	*Grus grus*	Common Crane	2	1	2		Medium
Bird	combined	*Vanellus gregarius*	Sociable Lapwing	3	1	0		Out of scope
Bird	non-breeding	*Ciconia ciconia*	White Stork	3	1	1		Medium
Bird	breeding	*Ciconia nigra*	Black Stork	2	1	3		High
Bird	non-breeding	*Ciconia nigra*	Black Stork	2	1	2		Medium
Bird	non-breeding	*Pelecanus onocrotalus*	Great White Pelican	3	2	2		Medium

Bird	non-breeding	*Pelecanus crispus*	Dalmatian Pelican	2	2	1		Medium
Bird	non-breeding	*Pandion haliaetus*	Osprey	3	2	1		Medium
Bird	non-breeding	*Gypaetus barbatus*	Bearded Vulture	2	3	1		Medium
Bird	breeding	*Neophron percnopterus*	Egyptian Vulture	3	3	3		High
Bird	non-breeding	*Neophron percnopterus*	Egyptian Vulture	3	3	2		High
Bird	breeding	*Aegypius monachus*	Cinereous Vulture	2	3	2		High
Bird	non-breeding	*Aegypius monachus*	Cinereous Vulture	2	3	2		High
Bird	combined	*Gyps himalayensis*	Himalayan Griffon	2	3	0		Out of scope
Bird	breeding	*Gyps fulvus*	Eurasian Griffon	1	3	2		High
Bird	non-breeding	*Gyps fulvus*	Eurasian Griffon	1	3	2		High
Bird	breeding	*Circaetus gallicus*	Short-toed Snake-Eagle	2	2	2		Medium
Bird	non-breeding	*Circaetus gallicus*	Short-toed Snake-Eagle	2	2	2		Medium
Bird	non-breeding	*Clanga clanga*	Greater Spotted Eagle	2	2	2		Medium
Bird	breeding	*Hieraaetus pennatus*	Booted Eagle	2	1	3		High
Bird	non-breeding	*Hieraaetus pennatus*	Booted Eagle	2	1	2		Medium
Bird	non-breeding	*Aquila nipalensis*	Steppe Eagle	3	2	3		High
Bird	non-breeding	*Aquila heliaca*	Imperial Eagle	2	2	2		Medium
Bird	breeding	*Aquila chrysaetos*	Golden Eagle	2	2	3		High
Bird	combined	*Haliaeetus leucoryphus*	Pallas's Fish-Eagle	3	2	0		Out of scope

Bird	non-breeding	*Haliaeetus albicilla*	White-tailed Eagle	2	2	1		Medium
Bird	breeding	*Bubo bubo*	Eurasian Eagle-Owl	1	1	3		Medium
Bird	non-breeding	*Falco vespertinus*	Red-footed Falcon	2	1	1		Low
Bird	non-breeding	*Falco cherrug*	Saker Falcon	3	1	1		Medium
Bird	non-breeding	*Falco peregrinus*	Peregrine Falcon	3	1	1		Medium
Bird	breeding	*Falco peregrinus pelegrinoides*	"Barbary" (Peregrine) Falcon	3	1	3		High
Bird	combined	*Cygnus olor*	Mute Swan	1	1	1		Low
Bird	combined	*Tadorna ferruginea*	Ruddy Shelduck	1	1	2		Low
Bird	combined	*Tadorna tadorna*	Common Shelduck	1	1	1		Low
Bird	combined	*Spatula querquedula*	Garganey	1	1	0		Out of scope
Bird	combined	*Mareca strepera*	Gadwall	1	1	0		Out of scope
Bird	combined	*Anas platyrhynchos*	Mallard	1	0	1		Low
Bird	combined	*Aythya fuligula*	Tufted Duck	1	1	0		Out of scope
Bird	combined	*Fulica atra*	Eurasian Coot	1	0	2		Low
Bird	breeding	*Vanellus vanellus*	Northern Lapwing	2	0	2		Medium
Bird	non-breeding	*Vanellus vanellus*	Northern Lapwing	2	0	1		Low
Bird	combined	*Tringa totanus*	Common Redshank	1	0	0		Out of scope
Bird	combined	*Chroicocephalus ridibundus*	Black-headed Gull	1	0	0		Out of scope
Bird	combined	*Larus cachinnans*	Caspian Gull	1	0	0		Out of scope
Bird	combined	*Larus fuscus*	Lesser Black-backed Gull	1	0	1		Low
Bird	combined	*Gelochelidon nilotica*	Gull-billed Tern	1	0	0		Out of scope

Bird	combined	*Hydroprogne caspia*	Caspian Tern	1	1	0		Out of scope
Bird	combined	*Sterna hirundo*	Common Tern	1	0	0		Out of scope
Bird	combined	*Podiceps cristatus*	Great Crested Grebe	1	1	0		Out of scope
Bird	combined	*Podiceps nigricollis*	Eared Grebe	1	1	0		Out of scope
Bird	combined	*Microcarbo pygmaeus*	Pygmy Cormorant	1	1	0		Out of scope
Bird	combined	*Phalacrocorax carbo*	Great Cormorant	1	1	2		Low
Bird	combined	*Platalea leucorodia*	Eurasian Spoonbill	2	1	1		Low
Bird	combined	*Ardea alba*	Great Egret	1	1	2		Low
Bird	combined	*Ardea cinerea*	Gray Heron	1	1	1		Low
Bird	non-breeding	*Pernis ptilorhynchus*	Oriental Honey-buzzard	1	1	1		Low
Bird	non-breeding	*Accipiter nisus*	Eurasian Sparrowhawk	1	1	2		Low
Bird	non-breeding	*Accipiter brevipes*	Levant Sparrowhawk	1	1	1		Low
Bird	non-breeding	*Accipiter badius*	Shikra	1	1	1		Low
Bird	non-breeding	*Accipiter gentilis*	Eurasian Goshawk	1	1	1		Low
Bird	breeding	*Circus aeruginosus*	Western Marsh-Harrier	1	1	2		Low
Bird	non-breeding	*Circus aeruginosus*	Western Marsh-Harrier	1	1	1		Low
Bird	combined	*Circus cyaneus*	Hen Harrier	1	1	1		Low
Bird	combined	*Circus macrourus*	Pallid Harrier	2	1	2		Medium
Bird	combined	*Circus pygargus*	Montagu's Harrier	1	1	1		Low
Bird	non-breeding	*Milvus migrans*	Black Kite	1	1	1		Low
Bird	combined	*Buteo lagopus*	Rough-legged Hawk	1	1	1		Low

Bird	non-breeding	*Buteo buteo*	Common Buzzard	1	1	1		Low
Bird	breeding	*Buteo rufinus*	Long-legged Buzzard	1	1	2		Low
Bird	non-breeding	*Buteo rufinus*	Long-legged Buzzard	1	1	1		Low
Bird	non-breeding	*Falco naumanni*	Lesser Kestrel	1	0	2		Low
Bird	breeding	*Falco tinnunculus*	Eurasian Kestrel	1	0	2		Low
Bird	combined	*Falco columbarius*	Merlin	1	0	1		Low
Bird	combined	*Falco subbuteo*	Eurasian Hobby	1	0	2		Low
Bat	combined	*Rhinolophus ferrumequinum*	Greater Horseshoe Bat	1	1	2		Low
Bat	combined	*Myotis blythii*	Lesser Mouse-eared Bat	1	1	2		Low
Bat	combined	*Myotis emarginatus*	Geoffroy's Bat	1	1	2		Low
Bat	combined	*Myotis sp.*	Mouse-eared Bat (Myotis species)	1	1	2		Low
Bat	combined	*Barbastella leucomelas*	Arabian Barbastelle	2	2	2		Medium
Bat	combined	*Plecotus strelkovi*	Strelkov's Long-eared Bat	1	1	2		Low
Bat	combined	*Nyctalus noctula*	Common Noctule	1	1	3		Medium
Bat	combined	*Eptesicus serotinus*	Serotine Bat	1	1	3		Medium
Bat	combined	*Eptesicus ognevi*	Ognev's Serotine	1	1	3		Medium
Bat	combined	*Eptesicus sp.*	Serotine Bat (Eptesicus species)	1	1	2		Low
Bat	combined	*Vespertilio murinus*	Parti-coloured Bat	1	1	2		Low
Bat	combined	*Pipistrellus pipistrellus*	Common Pipistrelle	1	1	2		Low
Bat	combined	*Hypsugo savii*	Savi's Pipistrelle	1	1	2		Low

Bat	combined	*Otonycteris hemprichii*	Hemprich's Long-eared Bat	2	1	0		Out of scope
Bat	combined	*Otonycteris leucophaea*	Turkestani long-eared bat	2	1	2		Medium
Bat	combined	*Tadarida teniotis*	European Free-tailed Bat	2	1	2		Medium
Non-flying Mammals		*Gazella subgutturosa*	Goitered Gazelle	2	1	0		Out of scope
Non-flying Mammals		*Vormela peregusna*	Marbled Polecat	2	1	0		Out of scope
Non-flying Mammals		*Ovis ammon nigrimontana*	Karatau Argali	3	2	4	YES	High
Reptiles		*Testudo horsfieldii*	Central Asian Tortoise	2	2	2		Medium
Aquatic species		*Triplophysa paradoxa*	Paradox Stone Loach	1	1	0		Out of scope
Aquatic species		*Triplophysa coniptera*	Coniptera Stone Loach	3	1	4	YES	High
Aquatic species		*Leuciscus lindbergi*	Lindberg's Dace	1	1	0		Out of scope
Plants		*Spiraeanthus schrenkianus*	Schrenk's Spiraeanthus	3	1	4	YES	High
Plants		*Iris orchioides*	Orchid Iris	1	1	3		Medium
Plants		*Tulipa orthopoda*	Orthopoda Tulip	3	1	4	YES	High
Habitat		Cereal steppe		1	1	3		Medium
Habitat		Shrub land on Piedmont Slopes		1	2	3		High
Habitat		Valleys of rivers, streams, ponds and springs (riparian valleys, ravines, gorges)		1	2	3		High