TA-6955 KGZ: Preparing the Issyk-Kul Ring Road Improvement Project

Environmental Impact Assessment (EIA) Report

October 2023

Document Control and Records of Revision

Version	Date	Remarks	Submitted By
1	11 August 2023	Draft EIA Report prepared by TA6955 EIA team	Donato dela Cruz, EIA Team Leader
2	04 September 2023	Draft EIA Report revised based on comments by MOTC	Donato dela Cruz, EIA Team Leader

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ABBREVIATIONS

$	United States Dollar
A/C	asbestos cement
AADT	average annual daily traffic
AAS	atomic absorption spectroscopy
ABEC	Almaty–Bishkek Economic Corridor
ACM	asbestos containing materials
ADB	Asian Development Bank
BOD	biochemical oxygen demand
BS	British Standard
BTIK	Biosphere Territory of Issyk-Kul
CAREC	Central Asia Regional Economic Cooperation
CBD	Convention on Biological Diversity
CO	carbon monoxide
CO_2	carbon dioxide
CO_{2e}	carbon dioxide equivalent
COD	chemical oxygen demand
CFU	colony forming unit
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CLRTAP	Convention on Long-range Transboundary Air Pollution
cm	centimeter
CMA	cold mix asphalt
CMS	Convention on the Conservation of Migratory Species of Wild Animals
CNG	Community Noise Guidelines
CSSM	crushed stone-sand mixture
dB	decibel
dBA	decibel A-weighted
DNP	defect notification period
DRF	Department of Road Facilities
EIA	environmental impact assessment
EMP	environmental management plan
ENG	Environmental Noise Guidelines
EN	endangered
GC	gas chromatography
GHG	greenhouse gas
GOST	Государственный Стандарт (Gosudarstvenny Standart), which means “state standard”
GPS	Global Positioning System
GRG	grievance redress group
GRM	grievance redress mechanism
GSM	gravel-sand mixture
H&S	health and safety

ha	hectare
HFC	hydrofluorocarbons
HLPC	high-pressure liquid chromatography
HRMS	high resolution mass spectrometry
Hz	hertz
IAQM	UK Institute of Air Quality Management
ICP	inductively coupled plasma
IFC	International Finance Corporation
ILO	International Labor Organization
IR	infrared
IRRIP	Issyk-Kul Ring Road Improvement Project
IUCN	International Union for Conservation of Nature
JOC	Japan Overseas Consultants
KBA	Key Biodiversity Area
KDTP	Kyrgyzdortransproekt
KGS	Kyrgyzstani Som
km	kilometer
km/h	kilometer per hour
KR	Kyrgyz Republic
kV	kilovolt
LARP	Land Acquisition and Resettlement Plan
LC	Least concern
LED	light emitting diode
m	meter
m^3	cubic meter
mg/l	milligram per liter
mm	millimeter
mm/s	millimeter per second
MNERTS	Ministry of Natural Resources, Ecology and Technical Supervision
MOTC	Ministry of Transport and Communication
MPC	maximum permissible concentration
Mw	moment magnitude
NDC	nationally determined contribution
NGO	non-governmental organization
NH_3	ammonia
NO	nitric oxide
NO_2	nitrogen dioxide
NO_2^-	nitrite-anion
NO_3^-	nitrate-anion
NO_x	oxides of nitrogen (NO + NO_2)
NOC	no objection certificate
O_2	oxygen
ODS	ozone depleting substances
OVOS	Russian acronym for “Assessment of Environmental Impacts”

pc/pcs	piece/pieced
PIU	Project Implementation Unit
$PM_{2.5}$	particulate matter with diameter equal to or less than 2.5 microns
PM_{10}	particulate matter with diameter equal to or less than 10 microns
POP	persistent organic pollutant
ppv	peak particle velocity
CSC	construction supervision consultant
RAMS	Road Asset Management System
ROD	Road Operations Department of MOTC
RMU	Road Maintenance Unit
ROW	right of way
R_w	weighted sound reduction index
SSEMP	site-specific environmental management plan
SER	State Environmental Review
SMA	stone-mastic asphalt
SNiP	Russian Construction Norms and Rules
SPL	sound pressure level
SPS	Safeguard Policy Statement
TRL	UK Transport Research Laboratory
TSS	total suspended solids
UK	United Kingdom
UNCCD	United Nations Convention to Combat Desertification
UNECE	United Nations Economic Commission for Europe
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
US	United States
VU	vulnerable
WB	World Bank
WHO	World Health Organization

Executive Summary

A. Background

1. This document presents the results of the environmental impact assessment (EIA) for the Issyk-Kul Ring Road Improvement Project that covers the rehabilitation of the existing 75.2 km of the ring road from Barskoon Village (km 140+600) to Karakol City (km 215+827)1 in Issyk-Kul Oblast in the Kyrgyz Republic (Figure E1). The proposed rehabilitation will widen the existing two-lane road to a four-lane road. It will also include the replacement or repair of existing bridges and culverts and the construction of a new bridge, culverts, rest areas, bus stops, and pedestrian walkways and installation of streetlights, safety islands and other elements to improve road safety.

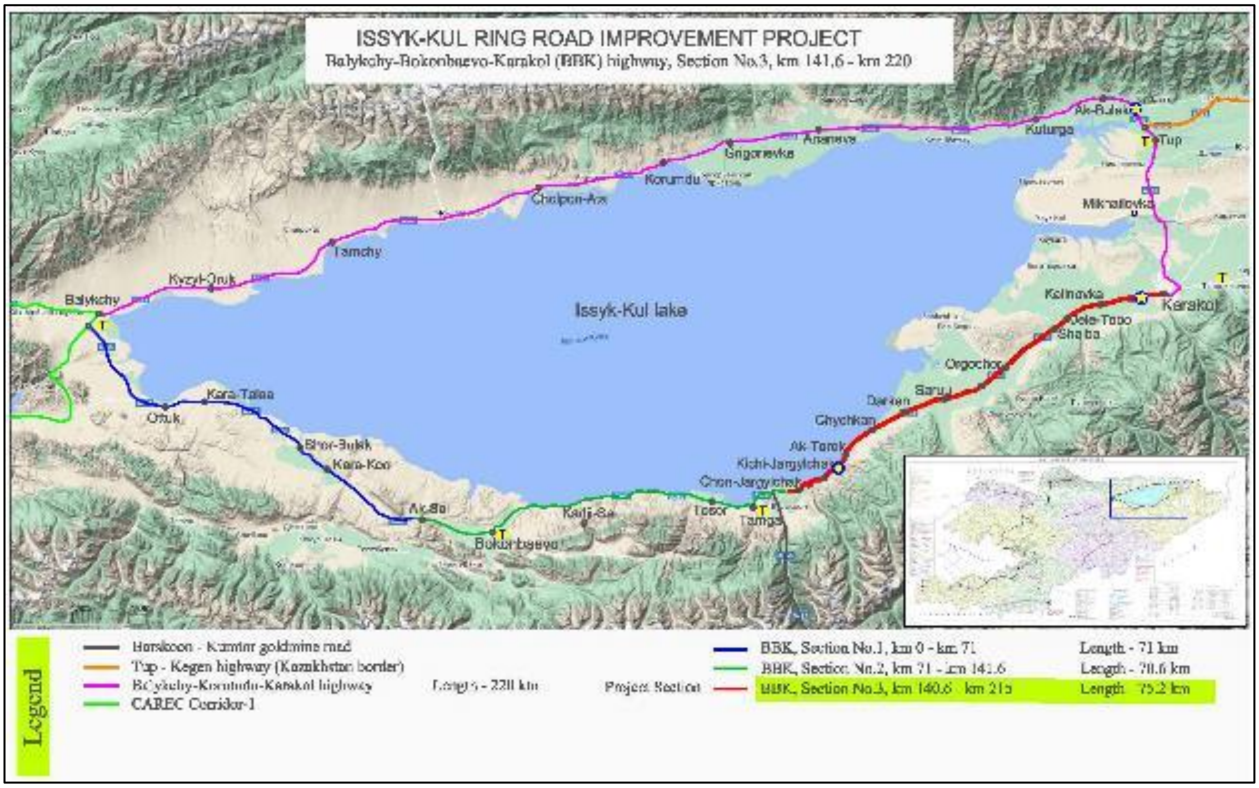

Figure E1: The Issyk-Kul Ring Road Project

2. The Central Asia Regional Economic Cooperation (CAREC) road corridors 1 and 3 provide regional connectivity with other Central Asian neighboring countries including Kazakhstan and the People's Republic China. The Bishkek–Torugart road (part of CAREC Corridor 1) and the Bishkek–Osh road (part of CAREC Corridor 3) also enable a north–south connectivity within the country. In addition, the Almaty–Bishkek Economic Corridor is spurring economic growth and creating jobs through greater private investments, trade, and agglomeration of economic activities.[2] The development of the Issyk-Kul Lake area, the country's most popular tourist

[1] UTM Coordinates: Route start at Barskoon (4674802.974 N; 714973.077 E) and end at Karakol (4710761.766 N, 776779.256 E)

[2] ADB. 2014. Operationalizing Economic Corridors in Central Asia: A Case Study of the Almaty-Bishkek Corridor. Manila.

destination, is an integral part of the Almaty–Bishkek Economic Corridor. The Issyk-Kul Ring Road also represents strategic importance for the livelihoods of local communities, including women and the vulnerable group, by improving their access to job opportunities and markets for their crops and livestock. The Issyk-Kul Ring Road Improvement Project will contribute to these initiatives by eliminating the domestic connectivity bottleneck between the Issyk-Kul Ring Road and the CAREC Corridor 1.

3. The entire Issyk-Kul Ring Road has severely deteriorated. It has poor riding quality and a traffic capacity that does not meet the requirements of high volume of vehicles during tourist and harvest seasons, posing a safety risk. There is a lack of roadside public services such as visitor centers, public toilets, and streetlights lowering satisfaction for tourists. The government has been reconstructing the ring road using its own funds and with assistance from other development partners such as the Arab Coordination Group and the European Bank for Reconstruction and Development. The project will reconstruct the remaining road section and supplement the implementation of the action plan that was jointly developed by the Ministry of Transport and Communications (MOTC) and the Ministry of Culture, Information, Sports, and Youth Policy for the development of tourism infrastructure in the Issyk-Kul Lake area by providing selected facilities along the project road.

4. The project is aligned with the following impact: competitiveness of the Kyrgyz Republic increased.[3] The project outcome will be efficient movement of people and goods on Issyk-Kul Ring Road and CAREC Corridors 1 and 3 improved. The project outputs include: (i) climate-resilient[4] Barskoon–Karakol road reconstructed, (ii) road asset management system institutionalized, (iii) implementation of the national road safety action plan institutionalized, and (iv) decarbonization of the road sector supported.

5. The project is in line with the Asian Development Bank (ADB) Strategy 2030[5] and will support its operational priority 7 by expanding trade and investment opportunities in the Issyk-Kul Lake area (Pillar 2: global and regional trade and investment opportunities are expanded). The project also supports operational priorities 1, 2, 3, and 6.[4] The project is well aligned with (i) the CAREC 2030 Strategy, particularly cluster 2 (trade, tourism, and economic corridor development), and cluster 3 (economic infrastructure connectivity) by significantly improving road infrastructure along the Issyk-Kul Lake and removing the current transport bottleneck between the Issyk-Kul Lake and CAREC Corridors 1 and 3 and (ii) the ADB's Country Partnership Strategy for the Kyrgyz Republic, 2018–2022 which supports growth and economic diversification through improved transport connectivity.[6] The project is in line with the (i) National Development Strategy 2040,7 (ii) the updated NDC, and (iii) the Program for the Development of a Green Economy for 2019–2023,8 all of which support regional trade and tourism and making finance flows consistent with a pathway toward low greenhouse gas emissions and climate-resilient development.

6. The project is currently estimated to cost approximately $90 million. ADB is currently considering a concessional loan of $40 million from ADB's ordinary capital resources and a grant of $40 million from ADB's Special Funds resources (Asian Development Fund). The balance will be financed by the government of the Kyrgyz Republic.

[3] Government of Kyrgyz Republic. 2018. National Development Strategy of the Kyrgyz Republic for 2018–2040. Bishkek.
[4] Road is adaptable for natural hazards such as floods, landslides, and melting road surfaces.
[5] ADB. 2018. Strategy 2030: Achieving a Prosperous, Inclusive, Resilient, and Sustainable Asia and the Pacific. Manila.
[6] ADB. 2018. Country Partnership Strategy: Kyrgyz Republic, 2018-2022—Supporting Sustainable Growth, Inclusion, and Regional Cooperation. Manila.

7. The project has the following envisaged benefits.

(i) **Improving road condition**. The project road will have good riding quality over a 20-year period and provide tourist- and environment-friendly transport services.

(ii) **Improving road safety**. The project will enhance the road safety management in MOTC and enable safer passenger and goods services that support safe travel of women on the project road.

(iii) **Reducing carbon**. The project will support decarbonization of the road sector and support green travel.

(iv) **Economic benefit**. By completing the southern ring road upgrade, the project will divert some traffic from the northern ring road, thereby slightly reducing seasonal congestion around Cholpon-Ata. Transport demand around the lake is driven by tourism. The project both complements and will benefit from active summer and winter tourism around Karakol. Direct project road user benefits include vehicle operating cost savings, travel time savings, reduced vehicle emissions and improved road safety.

(v) **Supporting regional connectivity**. The project will improve connectivity with Kazakhstan and Uzbekistan via the recently re-opened Karkyra border crossing point and the Tyup–Karkyra road upgrade, due to be completed in 2025. It will also complement connectivity with the People's Republic of China via the CAREC Corridor 1 through the Torugart border crossing point.

8. **Impact and Outcome.** The project will be aligned with the following impact: competitiveness of the Kyrgyz Republic increased. The expected project outcome is efficient movement of people and goods improved.

9. The project will have the following outputs:

- **Output 1**. Climate-resilient Barskoon-Karakol road reconstructed. This output will (i) widen the two-lane carriageway to four lanes to meet the increase in traffic demands; (ii) provide with rest areas, bus stops, electrically powered vehicles infrastructure, streetlights, and walkways, and (iii) enable safer access to pedestrians including women.
- **Output 2.** Institutional capacity in road asset management, road safety, and decarbonization strengthened. This output will include the following three sub-outputs: (i) Road Asset Management System (RAMS) Phase III, (ii) Road Safety Improvement (RSI) Phase II, and (iii) Decarbonization of the road sector.

10. **Civil works.** Output 1 of the project will involve civil works: (i) widening of the existing two-lane carriageway to four lanes to meet the increase in traffic demands; (ii) construction of rest areas, bus stops, electrically powered vehicles infrastructure, streetlights, and walkways, and (iii) provision of safer access to pedestrians. The details are discussed in Chapter 2 of this EIA Report.

11. **RAMS Phase III.** The sub-output scope has been formulated in consideration of worldwide experience and lessons learned together with the assessment of current RAMS practices of MOTC and expected outcome of ongoing RAMS Phase II project. A lack of MOTC management level engagement has been identified as one of the major reasons in the limited sustainability of RAMS Phase I efforts. Thus, the project will develop Road Asset Management Policy and Action Plan with an objective to facilitate management level engagement and to establish a mechanism for systematic resource allocation for RAMS-related activities. The project will help MOTC in (i) preparing a multi-year maintenance rolling program annually, (ii) increasing maintenance allocation through optimizing tax collection mechanism of road users, and (iii) preparing cadre, including women, in managing road asset by providing continuous support to the technical university.

12. **RSI Phase II.** The sub-output scope is being finalized with due consideration of the progress made under RSI Phase I and expected outcome. The current scope is as follows (i) mainstream a safety auditing of MOTC, (ii) carry out safety assessment on the state road network to identify low-cost safety countermeasures, (iii) improve the design standard in line with road safety requirements, (iv) prepare cadre including women in road safety engineering, and (v) piloting selected safety measures on the project road section.

13. **Decarbonization of the road sector.** The project will support MOTC to develop and finalize a road sector climate strategy and action plan for sustainable road transport and define key solutions towards greenhouse gas reduction and climate resilience. This will (i) ensure that future investments in the sector are aligned with the goals outlined in the Paris Agreement, (ii) guide the updating of the NDC related to the transport sector, and (iii) contribute to the transition towards a green economy.

B. Purpose and Scope of the EIA

14. This EIA focuses exclusively on the road widening and installation of roadside facilities, as the most environmentally sensitive component of the project given its construction and operation is likely to have significant adverse environmental impacts. These impacts will affect an area that is locally and internationally classified as ecologically important. It is within the Biosphere Territory of Issyk-Kul (BTIK), a special protected natural territory that is included in the World Network of Biosphere under UNESCO's Man and Biosphere Programme. The project site is approximately 1 km from one of the core zones of the Issyk-Kul State Nature Reserve, the Ala Too core zone, and within 10 km of another core zone, the Kokuy-Kol core zone. It is adjacent to Lake Issyk-Kul, which designated as a Ramsar site and as important wintering site for migratory waterbirds. It is also a few kilometers away from Important Bird and Biodiversity Area (IBA). Fourteen (14) sites of historical and cultural heritage are located within the 50-meter zone from the road. Thus, the project is classified as Category A for environment per ADB Safeguard Policy Statement (SPS).

15. The purpose of the EIA is to meet ADB SPS requirements for Category A projects. A separate OVOS (EIA) will be submitted by MOTC to the national environmental agency prior to the start of the project. The EIA submitted to ADB can be modified to comply with the OVOS requirements. However, if the requirements of the government is less stringent than ADB SPS, then EIA submitted to ADB will prevail.

16. The scope of this EIA covers the following: (i) description of road improvement, including construction and installation of related facilities (the project); (ii) identification and description of the elements of the environment, community and stakeholders likely to be affected by the project and/or likely to cause adverse impacts to the project, including both the natural and man-made environment; (iii) information on alternatives and options considered for the design, site location and layout of the project to avoid and minimize potential environmental impacts to environmentally sensitive areas, other sensitive uses and sensitive receptors, including reasons for selecting the preferred option(s); (iv) identification and assessment of significance of impacts on biodiversity, flora and fauna, air quality, water quality, waste management implication, road traffic, socio-cultural and livelihood, occupational health and safety and cultural and archaeological resources, particularly on sensitive receptors and potential affected uses; (v) mitigation measures to prevent or minimize pollution, environmental disturbance and nuisance during construction and operation of the project; (vi) identification, prediction and evaluation of residual (i.e., after practicable mitigation) environmental impacts and the cumulative effects expected to arise during the construction and operation phases of the project in relation to sensitive receptors and potential affected uses; (vii) identification, assessment and specification of methods, measures and standards, to be included in the detailed design, construction and operation of the project, which

are necessary to mitigate these environmental impacts and reducing them to acceptable levels; (viii) identification of constraints associated with the mitigation measures recommended in the EIA study and, where necessary, to identify the outstanding issues that need to be addressed in any further detailed EIA study; and (ix) design and specifications in the environmental monitoring and audit requirements to ensure the effective implementation of the recommended environmental protection and pollution control measures.

17. The impacts and risks have been analyzed in the context of the project's area of influence. This area of influence encompasses (i) the primary project site(s) and related facilities that the project will develop or control; (ii) associated facilities and (iii) areas and communities potentially affected by cumulative impacts from further planned development of the project, other sources of similar impacts in the geographical area, any existing project or condition, and other project-related developments; and (iv) areas and communities potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location. The impact assessment includes (i) collection and use of field data gathered during the period from January 2023 to July 2023, (ii) consultations with stakeholders, (iii) modelling, and (iv) professional judgment and experience of the EIA team members. In addition, satellite and aerial photos have been used to study the geography and environmental changes at the project site.

C. Project Description

18. **Project Rationale and Objectives**. The entire Issyk-Kul Ring Road is severely deteriorated (Figure E2). It has poor riding quality and a traffic capacity that does not meet the requirements of high volume of vehicles during tourist and harvest seasons, posing a safety risk. On the average, 15 people per 100,000 population die annually in road crashes due to narrow carriageway, inadequate signalization, limited streetlighting, unsafe crossings for pedestrian and vulnerable road users, including women, speeding, inadequate winter maintenance, and poor drivers' behavior. There is also a lack of roadside public services such as visitor centers, public toilets, and streetlights lowering satisfaction for tourists.

Figure E2: Existing road condition

19. The Government of the Kyrgyz Republic has been reconstructing the ring road using its own funds and with assistance from other development partners such as the Islamic Development Bank and European Bank for Reconstruction and Development.

20. The proposed project, which will reconstruct the remaining ring road section from Barskoon to Karakol City, will: (1) upgrade the road and provide convenient facilities to road users; (2) improve regional and domestic connectivity of the region; and (3) improve road safety, that will result to efficient movement of people and goods in the region. The project derives synergies with earlier ADB assistance and adopts a cross-sectoral approach to integrated development in the Issyk-Kul Lake area, with an integration of gender perspective.

21. Being a landlocked country, the Kyrgyz Republic depends heavily on road transport. About 95% of passengers and more than half of freight traffic are carried by road. The Ministry of Transport and Communication (MOTC) is responsible for developing and maintaining the road network with a total length of 18,000 kilometers, of which, only about 43% have a hard surface. Although there have been improvements in the road network performance, the quality of the roads continues to lag as the country ranked 113 out of 141 countries by the World Economic Forum's Global Competitiveness Index.[7]

22. Development of the Issyk-Kul Lake area, the country's most popular tourist destination, is an integral part of the Almaty–Bishkek Economic Corridor (ABEC). ABEC is spurring economic growth and creating jobs through greater private investments, trade, and agglomeration of

[7] World Economic Forum. 2019. The Global Competitiveness Report. Geneva.

economic activities.[8] The Issyk-Kul Ring Road also represents strategic importance for livelihoods of local communities, including women and the vulnerable group, by improving their access to job opportunities and markets for their crops and livestock. The project will contribute to these initiatives by eliminating the domestic connectivity bottleneck between the Issyk-Kul Ring Road and the CAREC Corridor 1[9].

23. The project is aligned with (i) the CAREC 2030 strategy, particularly cluster 2 [trade, tourism, and economic corridor development], and cluster 3 [economic infrastructure connectivity] by significantly improving road infrastructure along the Issyk-Kul Lake and removing the current transport bottleneck between the Issyk-Lake and CAREC Corridor 1 and (ii) the ADB's Country Partnership Strategy 2018–2022 which supports growth and economic diversification through improved transport connectivity. The project is in line with the (i) National Development Strategy 2040, (ii) the updated NDC, (iii) the Green Economy Strategy, and (iv) the National Strategy for Gender Inclusiveness, all of which support regional trade and tourism, making finance flows consistent with a pathway toward low greenhouse gas emissions and climate-resilient development, and gender mainstreaming in road sector development.

24. **Project Components**. The proposed improvements of the existing road, which is a classified as Category II road, include[10]:

(i) Construction of pavement using CMA (cold mix asphalt) with an axle load of 11.5 tons;

(ii) Increasing the number of road lanes from 2 lanes to 4 lanes with a dividing strip fence of the "double-sided metal barrier" type;

(iii) Improvement of road junctions and ramps; arrangement of channelized intersections and junctions with of speed change lanes for the left turn;

(iv) Widening or replacement of bridges, and construction of new bridges and water drainage structures (pipes and culverts);

(v) Installation of a fence on the dividing strip of a double-sided metal barrier and side reinforced concrete parapet fences of "Sapozhok" type;

(vi) Arrangement of bus stops with traffic lay-by and speed change lanes;

(vii) Improvement of infrastructure within settlements through the construction of sidewalks, footpaths, water drainage canals, street lighting in residential areas and pedestrian crossings and livestock crossings;

(viii) Arrangement of equipped parking areas for vehicles at roadside service facilities (separated from the carriageway) with change speed lanes;

(ix) Performing other necessary auxiliary work on the installation of road safety elements, such as the installation of reusable signal poles made of polyethylene, road signs, road markings, noise strips, bollards on safety islands, reflective elements and other road works.

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[8] ADB. 2014. Operationalizing Economic Corridors in Central Asia: A Case Study of the Almaty-Bishkek Corridor. Manila.

[9] The Central Asia Regional Economic Cooperation (CAREC) road corridors 1 and 3 provide regional connectivity with other Central Asian neighbors. The Bishkek–Torugart road (part of CAREC Corridor 1) and the Bishkek–Osh road (part of CAREC Corridor 3) also enable a north–south connectivity within the country.

[10] Project Design Document, Chapter 1 – Explanatory Note (03/22-32 – EN).

25. The road will be widened to four (4) lanes, from two (2) lanes with each lane having a width of 3.5 m (total width of 14 m). The total width of the road that will be asphalted is 17.6 meters, including a 2.6 m median and 0.5 m buffer on both sides (Table E1, Figure E3 and Figure E4). The road is designed for maximum speed of 120km/h to 100 km/h in flat terrain and 60 km/h in mountainous and in settlement areas.

Table E1: Road design parameters and dimensions.

No.	Parameter/Indicator	Value
1	Road Category (GOST R-52398-2005)	II
2	Design speed - Base / in Settlements (controlled)	120 (90) / 60 km/hour
3	Number of lanes	4
4	Width of the lane	3.5m
5	Width of the carriage way	14m (2 x 7.0)
6	Width of the median including barriers	2.6m
7	Width of the shoulder (soil type 2.5m and asphalt type 0.5m)	3m
8	Transverse slope of the pavement	20%
9	Transverse slope of the shoulder	40%
10	The steepest slope (rough terrain)	40% (50)
11	Type of pavement (asphalt), axle load/class	11.5T/ A2
Source: Design – Survey Institute “Kyrgyzdortransproekt”. Ministry of Transport and Communications, Kyrgyz Republic.		

26. The design of the road shoulder will vary depending on whether it is passing through a settlement area or not. In settlement area the road shoulder will have a width of 0.5m (Figure E3) while in non-settlement areas it will be 3.0m (Figure E4). Road sections in settlement areas will be provided with street lighting and sidewalks while in non-settlement areas there will be no sidewalks and street lighting will be provided at intersections and bridges only.

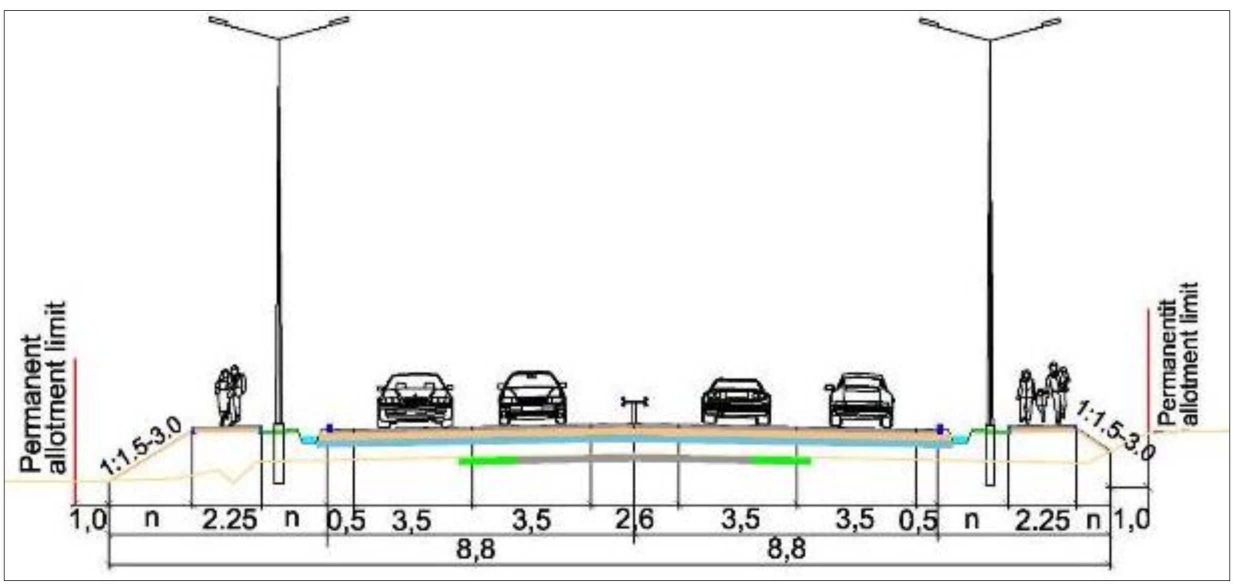

Figure E3: Road cross section in settlement areas

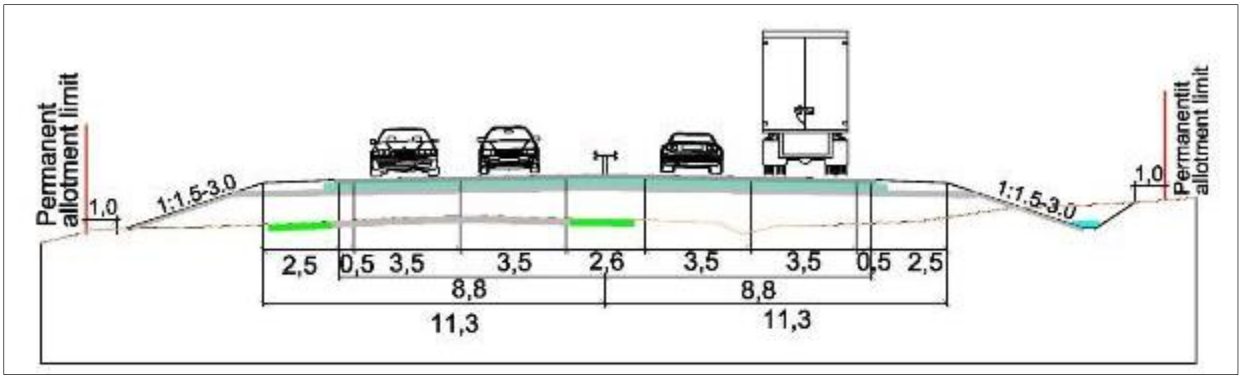

Figure E4: Road cross section in non-settlement areas

27. The road pavement will have a thickness of 60 cm, consisting of the four layers (**Figure E5**):

(i) Top layer (asphalt surface): stone-mastic asphalt (SMA-22) – 6cm;

(ii) Bottom layer (asphalt base): A32N type asphalt concrete mixture – 9cm;

(iii) Base layer: crushed stone-sand mixture (CSSM) – 20cm; and

(iv) Subgrade layer (underlaying layer): gravel-sand mixture (GSM) – 25cm.

28. The road shoulder will be filled up with gravel-sand mixture and strengthened with milled asphalt concrete mix (15 cm thick).

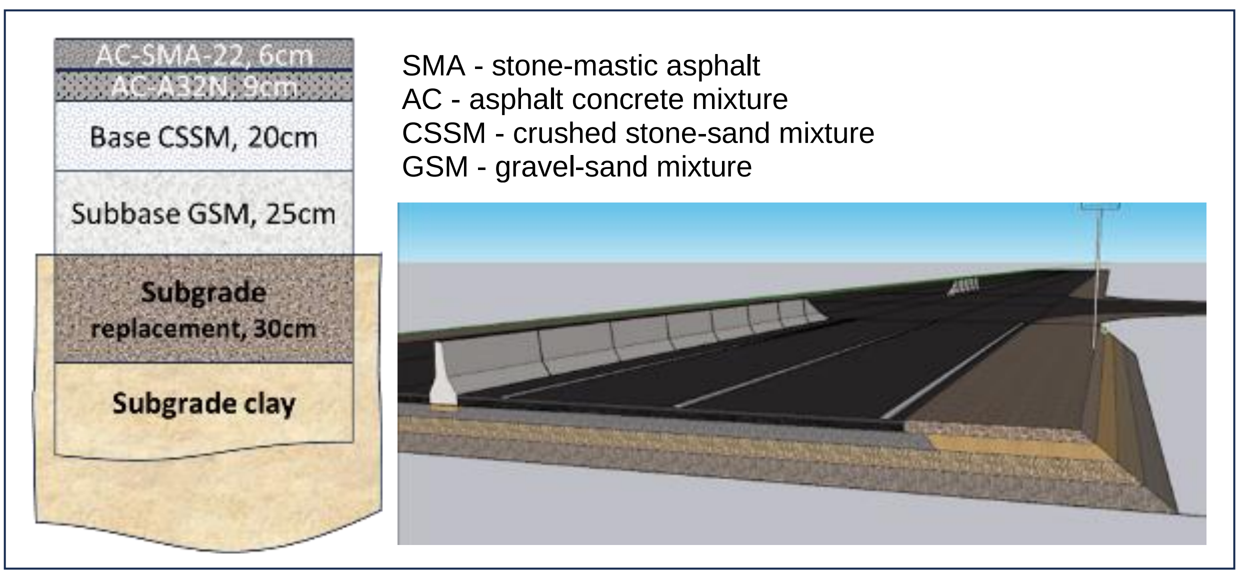

Figure E5: Road pavement layers.

29. Figure E6 shows the locations of the major components of the proposed project, which include the following:

(i) **Bridges**. Three (3) existing bridges will be replaced, one (1) existing bridge will be repaired and one new bridge will be constructed (KM 145+136.0, KM 181+961.5, KM 199+697.6, KM 209+534.5, KM 178+957.2);

(ii) **Irrigation aqueduct**. One (1) irrigation aqueduct that crosses the road will be replaced (at KM 149+326.0);

(iii) **Culverts**. The existing number of culverts will be increased from 148 to 175, to facilitate the normal flow of water (snowmelt and rainwater). An additional 26 culverts will be constructed as an adaptation measure to increase water flow due to climate change;

(iv) **Rest areas**. Two rest areas will be constructed on opposite sides of the road provided with parking for cars, trucks and buses, tables with benches and toilets (on the right hand side of the road at KM 157+546 and on the left hand side of the road at KM 160+113);

(v) **Underground pedestrian crossing**. Eight (8) pedestrian underpasses will be built in settlement areas along the road (at KM 149+760, KM 154+965, KM 161+141, KM 169+940, KM 173+935, KM 179+765, KM 180+685, KM 181+500);

(vi) **Road Signs**. A total of 3,112 pcs of road signs mounted on 1,756 metal posts will be installed along the road route. (Note: multiple road signs can be mounted on a single metal post). The signs will include warning, prohibition, regulatory, service and information signs that organize the safety traffic);

(vii) **Road markings**. Horizontal and vertical road markings will be provided that will include lines on the surface (white and yellow), markings at intersections and junctions, pedestrian crossings, road barriers, etc. Thermoplastic marking to divide the road along the axis of the road and on both edges of the road will be installed. Noise strips (rumble strips) will be installed in places in pedestrian crossings on the road near educational institutions and other places;

(viii) **Road safety fences and barriers**. Parapet reinforced concrete barriers of “Sapozhok” type will be installed on high embankments and approaches to bridges. The barriers will have light reflecting signal columns. Metal railing will be installed for the safety of bikers and pedestrians in crowded places and high embankments. Double-sided galvanized metal barrier fence on metal posts with light reflecting elements will be installed along the axis of the dividing strip of the road;

(ix) **LED traffic lights** will be installed in places of high intensity of pedestrians and educational institutions;

(x) **Street lighting** will be installed in sections of the road in residential/built-up areas; and

(xi) **Bollard** (traffic delineator post) and road buffer will also be installed as necessary.

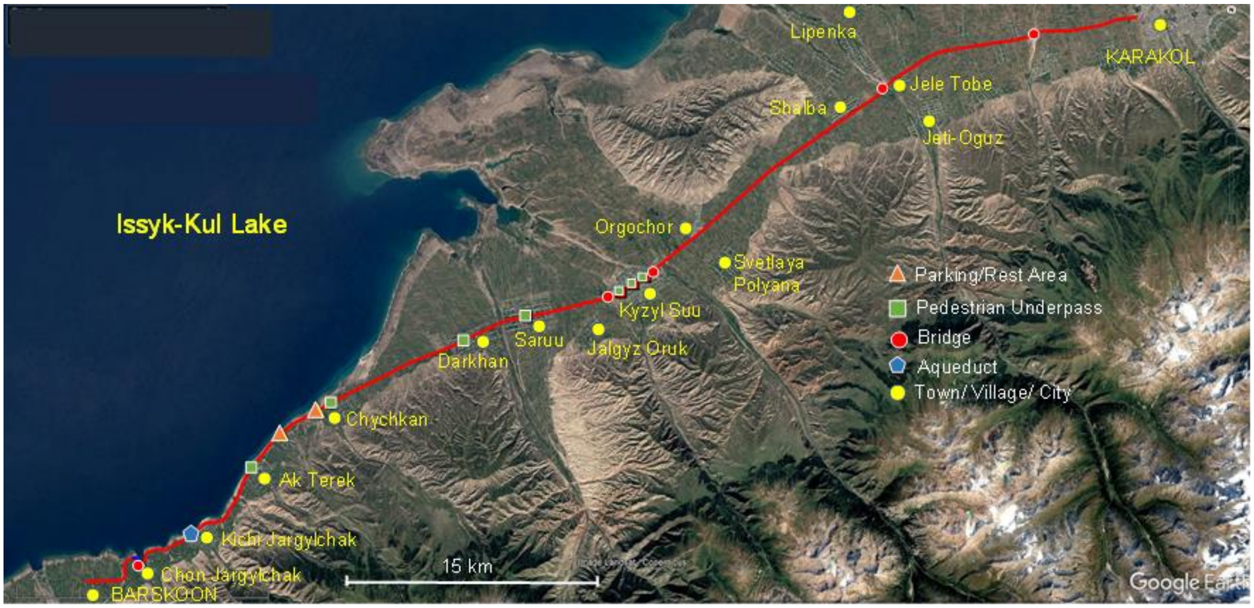

Figure E6: Location of the major components of the road project

30. Part of the pre-construction phase will include the bidding process to identify and appoint the contractor who will carry out the civil works for the project . It will also involve obtaining the necessary consents, permits, clearances, no objection certificate (NOC), etc. from various government agencies and the ADB. The preparation of the OVOS for submission to the MNERTS and subsequently obtaining the environmental permit is part of this phase.

31. The rehabilitation of the road will follow standard construction work methodology, the details of which will be determined once the contract for the project is awarded to the winning bidder. In general, it will include the following: preparation works, earthworks and construction of the road pavement, culverts, bridges and other structures.

32. Site preparation works will include clearing (demolition, dismantling and disassembly) of structures, cutting of trees to make way for the widening of the road, and removal of existing asphalt pavement of the road. Old engineering structures suitable for reuse (reinforced concrete rings, bridge structures, etc.) will be transferred to the Road Maintenance Unit (RMU) of the MOTC. Unsuitable material will be taken to dumps. The old asphalt will be reused in the construction of roadsides or used to level rural roads.

33. 82.3% (58,629 m^3) of the asphalt pavement that will be removed from the existing road will be milled and reused onsite to strengthen road shoulders. The remaining 17.7% (12,603.6 m^3) will be trucked to nearby dump sites.

34. More than 5,000 trees (poplar, elm, apricot, willow, birch, juniper, and spruce) planted on the roadside will be cut due to the road expansion. These trees will be replaced with new trees upon completion of road construction, two new trees will be planted for every tree that is cut. In addition, trees that die after planting will be replaced.

Figure E7: Existing trees (poplar, elm, apricot, willow, birch, etc.) along the road that will be cut for the road widening

35. The construction of the road subgrade will involve a thorough layer-by-layer compaction of soil. Backfilling the next layer will be allowed only after leveling and compacting the underlying layer with rollers to the required density. After the road's subgrade has been built, smoothed, and levelled off to the necessary height, the road pavement will be constructed layer by layer (Figure 1.5).

36. Bridge and culvert construction and installation works will be carried out in accordance with the requirements of SNiP 3.06.04-91. Excavation of the pit for the bridge foundations will be carried out using an excavator and manually (i.e., using shovels). The pit will be backfilled after the completion of the concrete foundations. Excess soil will be loaded into dump trucks and transported to a dump site.

37. A significant volume of materials will be obtained from quarries and used for the construction of road embankments and bridge access points. The opening of new quarries in the territory of the Biosphere Territory of Issyk-Kul is prohibited and it is recommended to use the existing old quarries located in the rehabilitation zone that are located in the vicinities of the road project.

38. If the contractor will use materials from existing or developed quarries, he must obtain all necessary permits from local authorities and the Ministry of Natural Resources and Technical Supervision. In addition, the contractor shall take appropriate operational and management measures to minimize environmental impacts. Additionally, when deciding on the development of quarries in the Biosphere Territory of Issyk-Kul, consultations shall be held with the Directorate of the Biosphere Territory of Issyk-Kul to obtain an expert opinion. The prospective contractor may offer his own sources of materials, but the materials must be approved by the civil engineer (Construction Supervision Consultant) before use. The contractor will have to obtain all necessary permits for the allocation of sites for quarries, which should be at least 500 meters away from Lake Issyk-Kul. In the case of using private quarries, all permits (licenses, approvals from local authorities, the Ministry of Natural Resources, etc.) are the responsibility of the quarry owners, which shall be specified in the contracts between the contractor and the owner of the quarry.

39. In 2023, based on traffic counts conducted in May 2023, the average annual daily traffic (AADT) in the Issyk-Kul Ring Road from Barskoon to Kyzyl Suu was 3,624 vehicles while that from Kyzyl Suu to Karakol was 5,235. These numbers are projected to increase to 13,029 in 2046

for the road segment Kyzyl Suu to Karakol, while for the segment from Barskoon to Kyzyl Suu, it is projected to increase to 9,267. The widened and rehabilitated road will be able to accommodate this increase.

D. Legal Framework

40. **Biodiversity and Nature Reserve**. The proposed project is located in an area which is locally and internationally classified as an important ecological area. The project area is within the Biosphere Territory of Issyk-Kul (BTIK), a special protected natural territory declared by Decree No. 623 of 25 September 1988 of the Government of the Kyrgyz Republic and the Approved Government Resolution of the Kyrgyz Republic of 24 January 2000 No. 40[11]. The Territory is included in the World Network of Biosphere under UNESCO's Man and Biosphere Programme since 2001[12]. The project site is approximately 1 km from one of the core zones of the Issyk-Kul State Nature Reserve, the Ala Too core zone, and within 10 km of another core zone, the Kokuy-Kol core zone (Figure E8). The proposed project is adjacent to Lake Issyk-Kul, which designated as a Ramsar site in 1976 (No. 1231) and added to the Montreux Record[13] on 4th July 1990. The lake is of primary importance as a wintering site for migratory waterbirds. An area in Lake Issyk-Kul Lake, near the proposed project site is also listed as an Important Bird and Biodiversity Area (IBA) by Birdlife International[14].

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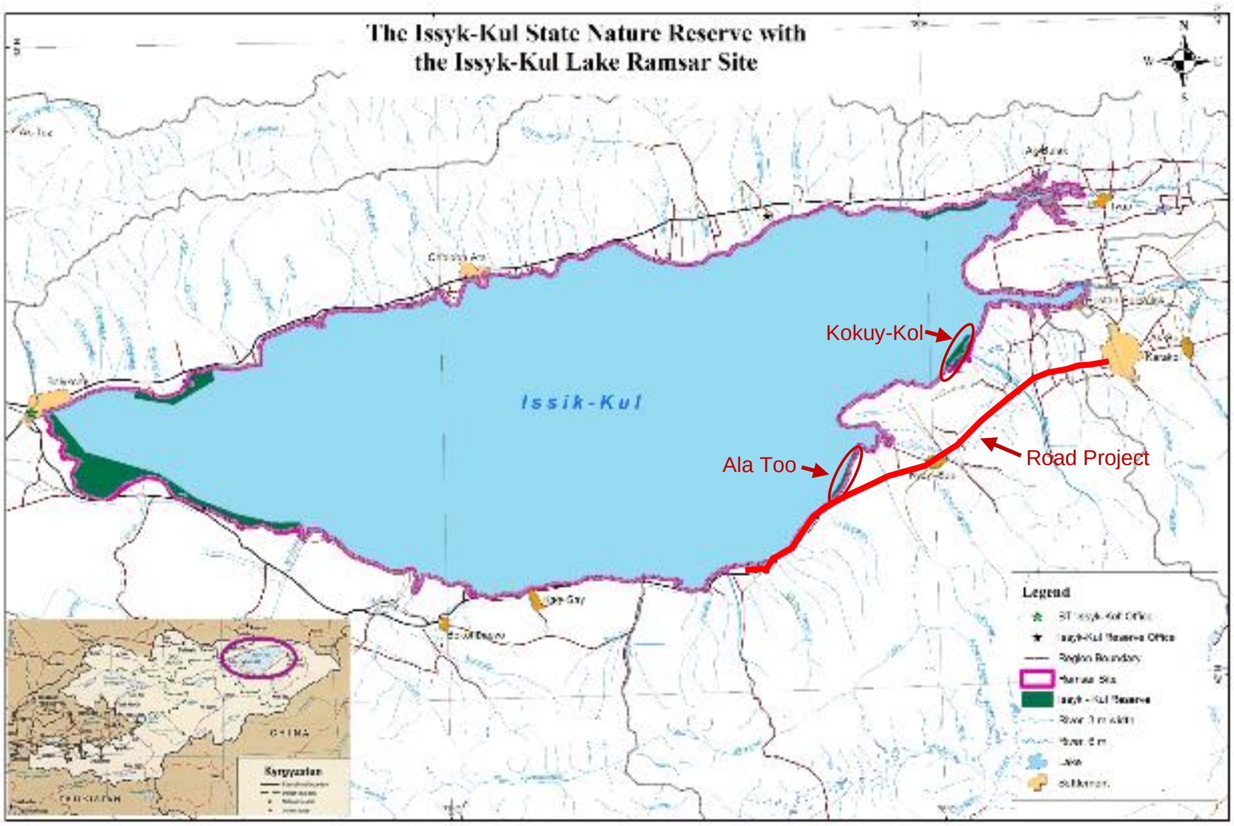
[11] As amended by the resolutions of the Government of the Kyrgyz Republic November 5, 2002, June 28, 2005 No. 263, September 19, 2006 No682, March 13, 2013 No 131.

[12] UNESCO Man and Biosphere Programme. Issyk-Kul Biosphere Reserve, Kyrgyzstan. https://www.unesco.org/en/man-and-biosphere/issyk-kul-biosphere-reserve-kyrgyzstan last accessed on 30 January 2023.

[13] The Montreux Record identifies Ramsar sites that need priority conservation attention at national or international level, and is maintained as part of the Ramsar database.

[14] Birdlife International. Bird Data Zone. Eastern Issyk-Kul Lake. http://datazone.birdlife.org/site/factsheet/eastern-issyk-kul-lake-iba-kyrgyzstan



Source: Ramsar https://rsis.ramsar.org/RISapp/files/33282621/pictures/KG1231map2013.pdf

Figure E8: The Issyk-Kul Nature Reserve with the Issyk-Kul Lake Ramsar Site

41. **Environmental Assessment Requirement**. Regulations of the Kyrgyz Republic[15] requires the preparation of an OVOS (the Russian acronym for "Assessment of Environmental Impacts") for the project. The construction of road and railway is included in the list of activities requiring an OVOS (No. 17 in the inclusion list of the Regulation on OVOS). The proposed project will require environmental clearance in the form of a positive conclusion (approval) from the State Expert Commission for SER on the submitted OVOS and other required documents. This is separate from any approvals issued by ADB for the project.

42. Preparation and finalization of OVOS report and implementation of OVOS process, including consultation is the responsibility of the project proponent. It must be done by a certified organization ("OVOS contractor"), which is usually sub-contracted or arranged by the design institute responsible for designing the "technical" aspects of the project. For this project, the PIU will arrange for adaptation of this EIA Report to conform to Kyrgyz national requirements. The OVOS report will be submitted to the State Expert Commission for the State Environmental Review (SER) together with the Statement of Environmental Impacts and other relevant documents by the PIU. The duration of the review depends on the complexity of the project, but should not exceed 3 months after submission of all OVOS documents and associated payment

[15] Law on Environmental Protection (Law No. 53 of 1999) which prohibits financing or implementation of projects related to the use of natural resources without obtaining approval from the State Environmental Expertise. Regulations on the procedure for conducting an environmental impact assessment in the Kyrgyz Republic (Decree No. 60 of 2015) establish the procedure for assessing the environmental impact assessment (EIA or OVOS) of a project or an activity.

to the SER agency by the project proponent. The decision of the Commission, may be positive or negative. Positive conclusions may be conditional. Negative conclusions either require amendments to the submitted plans and designs or may be outright rejections of the proposal.

E. Safeguard Requirements of Lenders and International Best Practices.

43. Financing for the project is being sought from the ADB in the form of loan and grant with additional costs to be borne by the government of the Kyrgyz Republic. Project financing from the ADB requires adherence to international best practices and safeguard requirements of the lenders.

44. **ADB SPS**. The ADB SPS governs environmental and social safeguards of ADB's operations. It applies to all ADB-financed and/or ADB-administered projects and their components, regardless of the source of financing, including investment projects funded by a loan, and/or a grant, and/or other means, such as equity and/or guarantees. This project has been classified as Category A thus requiring an EIA. The project will comply with the ADB SPS requirements on stakeholders engagement, information disclosure, consultation and participation, grievance redressal mechanism, and monitoring and reporting.

45. Applicable environmental, health and safety (EHS) guidelines. During the design, construction, and operation of the project, pollution prevention and control technologies and practices consistent with international good practice, as reflected in internationally recognized standards such as, among others, the World Bank Group's EHS Guidelines will be applied. These standards contain performance levels and measures that are normally acceptable and applicable to projects. When Government of Kyrgyz Republic regulations differ from these levels and measures, the project will achieve whichever is more stringent. If less stringent levels or measures are appropriate in view of the project circumstances, full and detailed justification will be provided for any proposed alternatives that are consistent with the requirements presented in ADB SPS.

F. Description of the Environment

46. Table E2 summarizes the baseline environmental conditions at project site based on the studies that were conducted as part of the EIA. The methodologies utilized in establishing the baseline conditions are discussed in details in the EIA Report (Chapter 4).

Table E2: Baseline Environmental Condition at the proposed project site

Environmental Aspect		Baseline Environmental Conditions
Physical Environment	Landscape and topography	The project site has an elevation of more than 1,600m. It traverses meadow and meadow steppe.
	Geology and seismicity	The project area consists of Upper Quaternary deposits: pebbles, crushed stones, sands, clays, loams. There are no nearby major faults to the project site. However, as is the whole of Kyrgyz Republic, the seismic hazard at the project site is considered as high and is within an 8 point Seismic Zone.
	Natural hazards	▪ In general, the proposed road project is not susceptible to flooding except for a short section near the settlement of Orgochor. ▪ Being on flat plains and far from mountain areas, the project site is not susceptible to rock fall and landslide.
	Climate	▪ Monthly mean temperature in the Issyk-Kul Region, varies from -16.17 ^{o}C in January to + 12.84^{o}C in July. During the months of October to April, the mean temperatures are normally below 0^{o}C.

Environmental Aspect		Baseline Environmental Conditions
		▪ The maximum mean monthly precipitation occurs during the month of July at 55.51mm while the minimum happens in the month of January at 5.53mm.
	Air Quality	The airshed of the project site is “degraded” with regards to PM_{10} and $PM_{2.5}$. There are potential exceedances of the WHO guideline and national standard for annual mean concentrations across the region due to high background levels. The airshed is “not degraded” with regards to NO_2, CO, and SO_2. No exceedances of any relevant standards are predicted for NO_2, CO, and SO_2 concentrations The main sources of pollutants are vehicles and resuspended road dust.
	Noise	At many of the settlement areas, existing road traffic noise levels at houses alongside the road, already exceed the noise levels set out in the IFC Guidelines for the day and night time periods.
	Vibration	Baseline vibration levels at houses alongside the road were below 1mm/s, which is consistent with normal levels of vibration expected from road traffic at the distances of 10-30m from a main road. It is also consistent with the guidance given in the UK Design Manual for Roads and Bridges[16] which states that peak particle velocities in the structure of buildings close to heavily trafficked roads rarely exceed 2 mm/s and typically are below 1 mm/s. No evidence was found of abnormal ground conditions likely to give rise to higher levels of vibration than might otherwise be expected.
	Hydrology	The project site is within the Issyk-Kul – Tarim basin, which includes Lake Issyk-Kul. The headwaters of the rivers crossing the proposed road project site are located in glaciers in the mountains or are formed when snow melts. River water is intensively used for irrigation of agricultural crops, where in most cases more than 2/3 of the total river water flow are used for irrigation. In some cases, 100% of the river water is used for irrigation and the river has no flow at the crossing point with the road. Out of the eight major rivers in the project area, four have no flow at the point of crossing the project area during spring and summer, when these rivers were visited.
	Water Quality	**Rivers**. In general, river water quality is considered good as most of the water quality parameters analyzed were within the Kyrgyz National standards. Exceedances in suspended solids and iron was due to soil and sediment resulting from rain runoff as samples were taken in mid-April during the rainy season and snowmelt in the mountains. The slight exceedance of iron concentration in one of the rivers is most likely due to iron in soil and therefore is natural in origin. As there is no flow in the lake, most of soil and sediment in river water settles very near the mouth of the river. **Lake Issyk-Kul**. The water quality of Lake Issyk-Kul is considered good as most of the analyzed water quality parameters were within the Kyrgyz National standards. The exceedances in suspended solids were most likely due to soil in the river water flowing into the Lake. The high concentrations of sulfates and chlorides are from natural conditions of the lake.
Biological Resources	Biodiversity	The proposed project is located in an area which is locally and internationally classified as an important ecological area. It is within

[16] Design Manual for Roads and Bridges (DMRB). https://nationalhighways.co.uk/suppliers/design-standards-and-specifications/design-manual-for-roads-and-bridges-dmrb/

Environmental Aspect		Baseline Environmental Conditions
		the Biosphere Territory of Issyk-Kul (BTIK), a special protected natural territory, which is also included in the World Network of Biosphere under UNESCO's Man and Biosphere Programme. The project site is approximately 1 km from one of the core zones of the Issyk-Kul State Nature Reserve, the Ala Too core zone, and within 10 km of another core zone, the Kokuy-Kol core zone. It is adjacent to Lake Issyk-Kul, which is designated as a Ramsar site and an important wintering site for migratory waterbirds. It is near an Important Bird and Biodiversity Area (IBA). The road is within the transition zone where economic activities are permitted, but are regulated so as to ensure sustainable use of ecosystems. Allowed activities include agricultural, industrial, recreational, transportation, communications, defense, and community building.
Economic Resources	Land Use	In its entire length, the road project crosses settlements (58.4% of the total length) and farmlands (41.6% of the total length).
	Agriculture	The main economic activity in the project site is agriculture. The main agricultural crops cultivated include potatoes, wheat, barley, vegetables, fruits and berries.
	Industry	There are no major manufacturing plants in the project area. The main industries include: milk factory, tailoring and brick making.
	Commercial Center	Commercial establishments (small stores, bank, market, etc.) are mainly based in the Kyzyl Suu, the capital of Jeti-Oguz and in Karakol City, the capital of Issyk-Kul Oblast.
	Tourism	There are no available data on the number of tourist arrivals in Jeti-Oguz. However, based on observations during the site visits of the project site, it was observed that foreign tourists who visit the attractions (Jeti-Oguz Rocks and Lake Issyk-Kul) in Jeti-Oguz are normally part of group tours of Central Asia. There are very few accommodation facilities that cater to foreign travellers that are mostly backpackers and tour groups.
Socio-cultural Resources	Population and demographics	Jeti-Oguz and Ak-Suu rayons are considered rural areas, with population densities of only 6 and 7 persons/km^2, respectively. The female to male ratio of the population is one. 92% are Kyrgyz with the rest nationalities of other Central Asian countries. The populations at settlements along the road project in Jeti-Oguz Rayon is relatively small. The population at all settlements was less than 10,000, except in Kyzyl Suu the capital of Jeti-Oguz Rayon, with 15,464. Karakol City, the capital of the Issyk-Kul Oblast, has a population 82,952.
	Cultural and archaeological resources	The project site is part of the silk road (Sites of the southern Issyk-Kul)[17]. Fourteen (14) sites of historical and cultural heritage are located within the 50-meter zone from the road: (i) Five (5) burial grounds of the early Iron Age and/or the Middle Ages, which include 15 burial mounds; (ii) Seven (7) modern Muslim cemeteries and sculptural monuments; and (iii) Two (2) ethnographical Muslim cemeteries.

[17] UNESCO. Tentative Lists. Silk Roads Sites in Kyrgyzstan.

G. Analysis of Alternatives

47. ADB SPS requires projects with potential significant adverse environmental impacts to undertake analysis of alternatives. This step will ensure all reasonable alternatives or options are taken into account, including the effect of a no project option scenario, and that these are examined towards preventing or minimizing impacts to the environment and allowing decision-makers to choose the best alternatives to protect and enhance environmental quality. The EIA has undertaken various alternatives analysis for the project (i) Road alignment and route alternatives and (ii) Design/Operational aspects, including technology options and operational parameters and conditions.

48. **The 'no project' alternative** considers the scenario where the project will not be implemented. Under this scenario, the existing 2-lane road from Barskoon to Karakol will continue to be used without any improvement. Most sections of the is degraded with most of the asphalt already washed out. Without rehabilitation, the road condition will likely further deteriorate. This road condition results in unpleasant and tiring travel for people who live and need to go to the settlements along the road. A road in bad condition is bad for the environment as it will result in: (i) vehicles running less efficiently; (ii) higher wear and tear of tires; (iii) higher noise level; and (iv) higher safety risk. Tourists who would like to enjoy Lake Issyk-Kul avoid going to the southern shores because of the bad road conditions depriving the local economy of potential income from tourists. Some of the existing culverts and water channels crossing the existing road are not sufficient to handle the quantities of water during snowmelt and rain events resulting in flooding.

49. **Road alignment and route**. The project only considered the upgrade of the existing road and did not explore other alternatives in terms of new route/alignment as this option provides a number of environmental and socio-economic advantages, compared to moving the road to a new route. The advantages include the following: (i) minimal additional land take; (ii) avoidance of destruction of fertile agricultural lands. Rerouting the road means that the new road will need to traverse productive farms that are planted with various crops including wheat, potato, barley and orchards planted with fruit trees such as apricot. (iii) Lower costs to acquire lands, as the total area for the road project will be much lesser.

50. **Design Alternatives**. Due diligence of the project design was carried out including evaluation of different design options. The design options that were selected considered environmental, safety, socio-economic and cost aspects. These include the following:

(i) **Pavement**. Pavement cost represents about 38% of the total cost of the road rehabilitation project and as such it is important to assess all available alternatives to optimize the design. Three options were evaluated, which included the following: (a) original design; (b) option 1 – change the thickness of all road layers; and (c option 2 – change the thickness of base course layers only (base course thickness reduced by 5 cm and the subbase course by 5 cm). The original design was chosen as it's better in addressing frost heaving, although it costs more. Frost heaving of pavement is a phenomenon where the ground freezes and thaws, causing the upward movement or displacement of pavement or road surfaces. It occurs in cold regions where the ground experiences freezing temperatures. Frost heaving of pavement can result in uneven surfaces, cracks, potholes, and damage to the road infrastructure.

(ii) **Median barriers**. Two options were considered in the design of median road barriers. The original design is a metal barrier while the option is reinforced concrete barrier. Comparison of the two options using a number of relevant parameters – energy absorption, source, cost and bending width was carried out. The reinforced concrete barrier is more advantageous based on the parameters considered. It is estimated that the reinforced barrier, being locally sourced at a lower cost will result in savings of US$1.6 million.

(iii) **Refuge (Safety) Island**. Safety islands accommodate pedestrians at pedestrian crossings across multi-lane roads and serve refuge islands for pedestrians crossing the road. Safety island will be installed at appropriate locations.

(iv) **Rest areas**. Two rest areas will be built as part of the project. The number has been reduced from initially seven (7) rest areas, or almost one every ten kilometers. Environmentally, the reduction of the number of rest areas will be more favorable to the environment, as this reduces the number of areas where there will be environmental risk, e.g., improper disposal of wastes, risk of soil and groundwater pollution from improper discharge of wastes.

(v). **Number of Culverts**. The number of culverts crossing the road will be increased to facilitate the normal flow of water (snowmelt and rainwater). The number of culverts were increased from 148 to 175, with corresponding increase in cross sectional area from 203 m^2 to 371 m^2 (83% increase). To account for potential increase in quantities of rainfall and snowmelt due to climate change an additional 26 culverts will be constructed with an additional flow area of 154 m^2 (41% increase).

(vi). **Recycling of asphalt**. Approximately 58,629 m^3 (82.31%) of existing asphalt on the road pavement will be recycled and reused onsite to strengthen road shoulder.

(vii). **Vibration.** The Contractor shall carry out a vibration risk assessment based on the vibration modeling report and other EIA requirements. Based on the risk assessment, the contractor shall take into account all risks associated with construction work and develop a construction method that must be approved by CSC/PIU. The contractor must assess the condition of buildings and structures located along the project site before starting construction works. The Contractor shall bear the full responsibility for any possible impacts resulting from the construction work performed.

51. The final choice of what mitigation option should be implemented to mitigate vibration and the consequent impacts will however be left to the winning bidder, as the choice will have cost implications and the contractor is in the best position to assess which measure is optimal. The contractor shall ensure that potential vibration damage to structures and houses located close to the road alignment is avoided and/or minimized through the implementation of control and mitigation measures that may include the use of “no vibration” roller for compaction or any other means. The contractor shall ensure that any complaint on vibration damage on structure or house is properly investigated and that recommendation of the investigation implemented, including indemnification. The contractor shall be liable for any proven damage to structure or house after proper investigation.

H. Anticipated Environmental Impacts and Mitigation Measures

52. **Construction Phase Impacts and Mitigation Measures**. Table E3 presents the summary of construction phase impact assessment and proposed mitigation measures. The detailed impact assessment, including the methodologies used, and the complete mitigation measures are discussed in Chapter 5 of the EIA Report (Anticipated Environmental Impacts and Mitigation Measures).

Table E3: Summary of construction phase impact assessment and mitigation measures

Aspect	Impact Assessment	Recommended Mitigation Measures	Compensatory or Offset Measures
Air Quality	High Risk in terms impacts on dust soiling, human health and ecology (Lake Issyk-Kul and rivers) from dust generation from earthworks, construction and track out. The significance of impacts without mitigation is classified as “Major Adverse” due to the high sensitivity of receptors and the high potential for dust emissions.	The contactor will be required to develop and implement a Dust Management Plan (DMP), that shall include: ▪ Dust suppression measures, particularly watering of exposed soil/areas, especially during the dry season and windy conditions ▪ Setting and implementing speed limit in construction areas and unpaved road at < 20 kph ▪ Regular housekeeping (sweeping)	The Contractor will engage an accredited laboratory to conduct air quality monitoring. The monitoring results must be submitted to the CSC for assessment and development of recommendations and corrective actions.
Noise	The results of noise assessment indicated that there will be major daytime noise impacts at dwellings and community facilities alongside the road. There is no practicable means of mitigating these noise impacts and this is considered to be an unavoidable consequence of construction of the scheme. The effects are however transient.	The contractor will be required to set out and adopt working practices designed to ensure that best practicable means are used to control noise from construction operations. This will include measures such as: use acoustic covers and silencers in equipment, no idling policy, scheduling of noise activities during normal working hours, installation of temporary hoardings in areas where there are sensitive receptors (e.g., hospital)	None
Vibration	Along the road corridor, 105 dwellings and 30 non-residential buildings of adobe construction are at risk of cosmetic damage during vibratory compaction of the road. Residents of these buildings and an additional 390 brick-built houses/ buildings would likely experience moderate vibration impact whilst compaction is carried out adjacent to the dwelling and buildings.	▪ The contactor will be required to develop and implement a Vibration Management Plan. Before the start of construction works, the contractor with the presence of CSC Vibration Expert and PIU will carry out baseline condition/structural survey of all buildings within 25 meters of the road alignment that in the opinion of the contractor might be affected by vibration resulting from the construction activities. The surveys shall be conducted in the presence of and with the permission of the property owners. The findings of the building condition surveys shall be recorded in the report that shall contain the following information: (i) Building address and location; (ii) A description of the building condition and any existing cosmetic and/or structural damage; (iii) Sketches and photographs	The contractor will be required to pay compensation for damages on houses/ buildings.

Aspect	Impact Assessment	Recommended Mitigation Measures	Compensatory or Offset Measures
		showing the location and extent of any damage; and (iv) High resolution video recordings of the surveyed buildings. ▪ The CSC Vibration Expert shall review the baseline condition survey and structural assessment report of the Contractor submit to ADB for approval. The Vibration Expert shall approve the construction methodology based on the assessment of vibration impacts (to be conducted by the contractor). He will also inform the Social Safeguards team if structural damage is expected and to identify if there is a need to relocate the residents temporarily/permanently.	
Hydrology	During works on water channels (bridges and culverts), water flow will be temporarily diverted	Water pipes will also be provided for the passage of water across the road. The temporary bypasses and water pipes will be dismantled after the completion of construction.	The contractor will be required to restore all altered water channels, including removal of sediments that accumulated due to construction activities.
Water	**Rivers**. Earthworks and construction work in rivers and other water channels can potentially result in significant adverse impact due to soil-laden runoff entering the rivers during periods of heavy rains or snowmelt. Impacts from accidental spillage of chemicals and fuels and sewage from labor camps and construction sites are considered low adverse. **Lake Issyk-Kul**. In areas adjacent to the Lake Issyk-Kul (0 to 500m from the lake at km 143 to km 160) construction activities can potentially result in significant adverse impact due soil-laden runoff entering/ reaching the	The contractor will be required to carry out construction activities on water channels and near the lake during the drier months. The contractor will be required to develop and implement (1) Wastewater, Water and Drainage Management Plan; and (2) Spill Prevention and Response Plan. Other control measures: ▪ Use of sediment trap and/or other measures to settle out soil/ sediments in runoff and prevent them entering the river or the lake; ▪ Minimizing the time on construction works on water channels; ▪ Proper storage of chemicals and fuels; ▪ Locating labor camps at least 500 m away from rivers and the lake; etc.	The contractor will be required to restore all altered water channels, including removal of sediments that accumulated due to construction activities.

Aspect	Impact Assessment	Recommended Mitigation Measures	Compensatory or Offset Measures
	Lake during periods of heavy rains or snowmelt. Impacts from accidental spillage of chemicals and fuels and sewage from labor camps and construction site are considered low adverse.		
Biodiversity	Field surveys estimated that 5,217 trees alongside the project road will be cut for road widening. None of these trees are red book species. Removal of vegetation will result in loss of nesting, and feeding sites for wildlife.	Cut trees will be replaced by replanting new tree seedlings (two new trees for every tree that is cut). It is recommended to plant local varieties of trees and shrubs that do not require high maintenance and watering (e.g., wild apricot, wild cherry, narrow-leaved elk, elm tree, fruits and flowers of these trees are food for birds).	The contractor will be required to replace every tree that is cut (one is to one ratio).
Cultural and archaeological resources – identified	The following objects of historical and cultural heritage located within the 50-meter zone from the road maybe directly affected: Five (5) burial grounds of the early Iron Age and/or the Middle Ages, which include 15 burial mounds; and Two (2) ethnographical Muslim cemeteries. The seven (7) modern Muslim	▪ 14 burial mounds at 5 locations and 1 recent burial, found within 50-meter from the road will be excavated before the start of the construction work on the nearby road section. The result of the excavation shall be coordinated with the Ministry of Culture, Information, Sports and Youth Politics of the Kyrgyz Republic by the MOTC. ▪ Coordinate the with local authorities and other agencies the preparation of protection zone for two Ethnographical Muslim cemeteries found within 50-meter from the road before the start of construction work on the nearby road section. The PIU will assist in coordinating work between the Ministry of Culture, Information, Sports and Youth Politics of the Kyrgyz Republic and local authorities. The local authorities are responsible for developing the “project protection zones”.	The contractor will be required to carry out and shoulder the expenses for the excavation, including documentation and any actions required by the Ministry of Culture to ensure proper preservation of cultural and archaeological artefacts. The PIU, as the project proponent, shall coordinate with local authorities and other agencies to ensure the establishment of the protection zone.
Cultural and archaeological resources – chance find	There is a good chance that there will be chance find of cultural and archaeological artefacts as the project site is believed to be once part of the Silk Road.	▪ Prepare a detailed chance find procedure following ADB’s SPS (2009). ▪ When. any physical cultural resource is found during construction the contractor will be required to stop work at the specific site and the Ministry of Culture,	“The contractor will be required to carry out and shoulder the expenses for the excavation, including documentation

Aspect	Impact Assessment	Recommended Mitigation Measures	Compensatory or Offset Measures
		Information, Sports and Youth Policy of the Kyrgyz Republic will be informed through the MOTC.	and any actions required by the Ministry of Culture to ensure proper preservation of cultural and archaeological artefacts. The PIU will assist in coordinating work with local authorities, which are responsible for developing the “project protection zones”.
Wastes	Construction wastes including materials from demolition, dismantling and disassembly of existing structures (e.g., fences, road signs, pipes, etc.) will be trucked/ transported to the Road Maintenance Unit (MRU) of MOTC for recycling or reuse or to nearby dump sites. A small quantity of existing asbestos-cement (A/C) water pipes will be removed (15.21 linear meter = 625.13 kg = 0.4 m^3). Domestic wastes generated at worker’s camps and site offices consisting mainly of packaging wastes, plastic and glass bottles, food wastes (left overs), papers and other domestic wastes.	▪ Old engineering structures suitable for reuse (reinforced concrete rings, bridge structures, etc.) will be transferred to the Road Maintenance Unit (RMU) of the MOTC. Unsuitable material will be taken to dumps. Most of the asphalt pavement that will be removed from the existing road (82.3% or 58,629 m^3) will be milled and reused onsite to strengthen road shoulders, with the remaining 17.7% (12,603.6 m^3) to be trucked to nearby dump sites (within 30 kms of the project). The location of the dump site will be identified during the construction phase. ▪ The contractor will be required to develop and implement a site-specific Asbestos Containing Materials (ACM) Management Plan in line with the ADB Good Practice Guidance for the Management and Control of Asbestos.[18] ▪ The constructor will be required to develop a Waste Management Plan that will include segregated waste storage, recycling and reuse and disposal to government-authorized landfills.	

[18] ADB. Good Practice Guidance for the Management and Control of Asbestos, Protecting Workplaces and Communities from Asbestos Exposure Risks. March 2022.

Aspect	Impact Assessment	Recommended Mitigation Measures	Compensatory or Offset Measures
Occupational Health and Safety	Workers and personnel will be exposed to various occupational health and safety, including exposure to dust, falling from height, vehicular accident, etc.	The contractor will be required to develop a Health and Safety (H&S) Plan that would address occupational and safety risks. The plan shall include the following: ▪ Conduct of H&S risk assessment; ▪ Regular and continuous training and awareness campaign (H&S induction, tool box meeting, etc.); ▪ Development of specific work procedures that include H&S risk management; and ▪ Daily H&S site inspections, etc.	The contractor will be required to cover the cost for hospitalization and treatment of injured workers, including compensation for disabilities. In case of fatality, the contractor will be required to indemnify the family of the deceased worker and repatriation of the remain.
Community Health and Safety	Residents living near the road maybe affected by dust, noise and vibration during construction works.	The contractor will be required to implement all measures to prevent or minimize impacts from dust, noise and vibration as listed above.	The contractor will be required to indemnify or compensate residents who, based on thorough investigation have been adversely affected by the project.
Resources	The key materials, i.e., gravel, sand and stone that will be used for the subgrade, subbase and base layers of the road will be sourced from existing quarries and borrow pits near the project site (from a few hundred meters to a few kilometers from the road). The final sources will be determined by the contractor prior to construction.	The contractor will be required to carry out an environmental impact study and develop impact management plan that will be approved by the PIU prior to quarrying. In areas along rivers or streams, extraction of the construction materials will be carried out during the low water period. Materials will be extracted above the water level. A quarry permit from relevant government agencies shall be obtained prior to quarrying.	The contractor will be required to pay necessary fees as part of the permit obtained from the government for quarrying.
Labor camp	The location and number of labor camp has not been identified. The main impact from establishment of labor camp includes generation of wastes and sewage that may lead to soil and water pollution. In addition, potential	▪ Labor camps shall be located at least 500 m away from river and Lake Issyk-Kul; ▪ Latrine and toilet facilities with septic tank will be provided at labor camp; ▪ Segregated waste bins will be provided at the labor camp. Wastes will be regularly collected for	The contractor will be required to restore the labor camp location to its original conditions.

Aspect	Impact Assessment	Recommended Mitigation Measures	Compensatory or Offset Measures
	disturbance of biodiversity from hunting and fishing may occur.	disposal in government-authorized landfill.	

53. **Operational Phase Impacts and Mitigation Measures**. Table E4 presents the summary of operational phase impact assessment and proposed mitigation measures. The detailed impact assessment, including the methodologies used, and the complete mitigation measures are discussed in Chapter 5 of the EIA Report (Anticipated Environmental Impacts and Mitigation Measures).

Table E4: Summary of operational phase impact assessment and mitigation measures

Aspect	Impact Assessment	Recommended Mitigation Measures	Compensatory or Offset Measures
Air Quality	▪ Based on dispersion modelling results (using ADMS-Roads), the concentrations PM_{10} along the rehabilitated road may potentially be slightly above the significance criterion of 5% of the WHO air quality guideline for annual mean, and 24-hour mean PM_{10} at a small number of receptors within 20m of the kerb in Kyzyl Suu and within 10m of the kerb in other settlements. ▪ Impacts for all other pollutants are below the significance criteria used in the assessment, so are classified as "acceptable". ▪ Impacts on air quality at the Issyk-Kul Biosphere Reserve or at the Issyk-Kul Biosphere Reserve Core Zone are classified as acceptable."	It is recommended that a program of air quality monitoring be implemented in the vicinity of the new road. This will identify if mitigation is required during the operational phase. If needed, the following options may be considered: (a) road sweeping; (b) planting of vegetation barriers along roadside in settlements; (c) implementation of lower speed limits in settlements.	The Ministry of Natural Resources, Ecology and Technical Supervision, through in-house staff or outsourced specialized laboratories, will be responsible for air quality monitoring.
Noise	The increase in road traffic flows in the period following opening of the project, combined with the effect (minimal) of the road	It is not recommended that mitigation be provided in these circumstances as the increases are a result of intensification rather than the project itself and there are likely to be	None

Aspect	Impact Assessment	Recommended Mitigation Measures	Compensatory or Offset Measures
	widening, is likely to give rise to increases in road traffic noise of c.2.9dB at the majority of receptors alongside the road during both day and night time periods, which is considered to be a negligible noise impact. At a small number of locations increases in road traffic noise of c.3.0dB have been calculated which would be a minor noise impact.	changes between the forecast and actual road traffic flows and vehicle types between the year of opening and 2047. A reasonable course of action would be to carry out a review of the working assumptions underpinning the noise calculations (road traffic flows, vehicle type, road condition etc) at a future date (e.g., 10 years after scheme opening) and assess the requirement for mitigation at that time.	
Vibration	Vibration arising from future operation of the road would be unlikely to give rise to cosmetic or structural damage, or adverse human response.	None required	None
Hydrology	The improved drainage system (culverts and canals along the road) is expected to mitigate flooding.	Regular inspection and maintenance, including regular de-clogging to remove debris and sediment that accumulate on the culvert.	None
Water quality	Runoff from the road may contain particulates (dust, tire wear) and very low amount of oil and grease and enter rivers and Lake Issyk-Kul and as such impact is considered as low and not significant.	Continue the regular water quality monitoring of rivers and Lake Issyk-Kul being carried out by MNERTS and use the results of these monitoring to assess the actual impacts of road operation on the water quality of the rivers and Lake Issyk-Kul.	None
Biodiversity	The operation of the road will increase the risk of damage to the biodiversity of the project site with the expected influx of tourists after the completion of the rehabilitation of the road.	Biodiversity conservation during the operation phase will focus on maintenance of trees along the road, the development and implementation of a biodiversity conservation and management plan, training and awareness, and partnership and capacity building.	Development and implementation of a biodiversity conservation and management plan, training and awareness, and partnership and capacity building.
Cultural and heritage sites	The operation of the road will not directly affect archaeological sites. However, there will be risk of damage to archaeological sites with the expected influx of tourists after the	Establishment of protection zones of physical cultural and heritage sites and regular monitoring of the condition of these sites by local authorities or relevant government agencies.	Environmental fees can be charged for entering and visiting cultural and heritage sites.

Aspect	Impact Assessment	Recommended Mitigation Measures	Compensatory or Offset Measures
	completion of the rehabilitation of the road.		

54. **Cumulative Impacts Assessment**. At the project site, there are currently no on-going projects that can contribute to cumulative impacts. The additional impacts or environmental stresses from the implementation of the proposed project to the environment have been considered in the impact assessment during construction and operational phase, including climate change.

55. **Induced Impacts**. The main potential induced impact of the project is the increase in tourist visits with the corresponding increase in vehicular traffic. This will result to the development and expansion of support activities and facilities to accommodate the increase. Economically, this will have a positive impact on the livelihood and income of the local population. On the other hand, the increase in tourists visits will result to higher air pollution from vehicles. It may also increase the risk of degradation and damage to biodiversity in the area, without a biodiversity management plan in place.

I. Environmental Management Plan

56. The Environmental Management Plan (EMP) presents measures that shall be undertaken during the different phases of the road project implementation. The EMP's key objective is to prevent and where prevention is not possible, to minimize, mitigate and/or offset adverse environmental impacts of the project. This EMP includes mitigation and management measures identified in the EIA that need to be implemented, including cost estimates, institutional arrangement (i.e., organizational setup), monitoring program and reporting, and timeframe for implementation of the plan. The EMP, will be included in the bidding and contract documents, so by accepting the contract, the Contractor will be legally obliged to implement all specified mitigation measures, including the allocation of budget to implement all mitigation measures and monitoring activities required in the EMP, and provisional sum that will ensure funding for any budget shortfall or for addressing any unanticipated impacts during the construction phase and DNP of the project.

57. The Contractor shall prepare a site-specific EMP (SSEMP) based on the EMP and the project's EIA Report to make it relevant to the particular condition and setting during the project's construction and DNP phases. The Contractor shall prepare the SSEMP describing specific design features that will ensure environmental protection and set out the work methods, management, and mitigation measures and monitoring that will be put in place, for each of the various activities, during the implementation of the project. The scope of the SSEMP shall address all of the issues itemized in the EMP in this EIA Report. The SSEMP shall have the same level or stricter set of measures than those included in the EMP of this EIA Report. The SSEMP shall consider relevant ISO standards (e.g., ISO 14001) when detailing the project's environmental management system. The Contractor shall submit the draft SSEMP to CSC/PIU for review, the PIU on behalf of the MOTC shall approve the final SSEMP. If there will be significant changes in the final detailed design of the project compared to the preliminary design used in the EIA, the CSC, together with the PIU shall accordingly update the EIA Report and the EMP, including budget that will cover implementation of any additional mitigation measures and monitoring activities. The PIU shall submit the EIA Report and other relevant documents to ADB for final review and disclosure.

58. The Contractor is required to (i) establish an operational system for managing environmental impacts; (ii) implement mitigation measures and monitoring requirements set forth

in the EIA Report, EMP and SSEMP; (iii) implement any corrective or preventive actions set out in safeguards monitoring reports that PIU will prepare from time to time to monitor implementation of the project's EIA and EMP; and (iv) allocate budget for compliance with these EMP requirements, monitoring activities and actions, including provisional sum where to draw budget for any shortfall in the initial budget estimates and for addressing any unanticipated impacts during construction and DNP phase of the project.

J. Information Disclosure, Consultation and Participation

59. Consultations and meetings were carried out by the EIA Team and the MOTC with various organizations, including the State Administration of Issyk-Kul Oblast, the Rayons of Jeti-Oguz and Ak-Suu and Karakol City, central and regional offices of national government agencies and departments, non-governmental organizations (NGOs), and the Directorate of the Biosphere Territory of Issyk-Kul. During the meetings/consultations, the EIA Team discussed the proposed project and the objectives of the meeting/consultation in connection with the preparation of the EIA for the project. The team also solicited comments and concerns regarding the project and also asked the support of the organization for data and information that are necessary in the preparation of the EIA of the project.

60. A public consultation was conducted on 7th July 2023, at the Kyzyl-Suu House of Culture, Jeti-Oguz, Issyk-Kul Oblast that discussed the proposed project, its design and engineering solutions, resettlement and social aspects as well as findings of the EIA. The Jeti-Oguz district administration supported the organization of this meeting, which was attended by 68 participants that included representatives of the Jeti-Oguz District administration, local people from villages along the road from Barskoon to Karakol City[19] with representatives of the ADB also in attendance. This public consultation served as an opportunity to engage stakeholders, inform them about the proposed project, and gather their feedback and concerns, including on the environmental impacts of the proposed project. The active participation of government officials and the local community in these consultations demonstrates a commitment to transparency and inclusive decision-making processes in the project preparation. Environmental issues raised during the public consultation are addressed during the consultation and in the EIA. During the meeting, no objections were made against the project.

61. The following agencies and organizations were consulted as part of the EIA: (i) Directorate of the Biosphere Territory of Issyk-Kul; (ii) Ministry of Culture, Information, Sports and Youth Politics; (iii) Road Operations Company (ROC), Ministry of Transportation and Communications (MOTC); (iv) Ministry of Emergency Situations, Jety-Oguz Rayon; (v) "Kyrgyz Autozhol" Enterprise, Ministry of Transportation and Communications, Issyk-Kul Oblast; (vi)Ministry of Natural Resources, Ecology and Technical Supervision, Issyk-Kul Oblast; (vii) Hydrometeorology Center in Issyk-Kul Oblast; (viii) Ak-Suu Forest Experimental Station (named after V.P. Fatunov) and the Research and Production Center for Forest Research of the Institute of Biology, National Academy of Sciences; (ix) Karakol City Forestry Service, Issyk-Kul Oblast, Ministry of Agriculture; (x) Youth Volunteer Organization "Leadership"; (xi) Ministry of Mineral Resources, Ecology and Technical Supervision, Issyk-Kul Regional Department in Cholpon-Ata; (xii) Deputy Akim (Head), Jeti-Oguz Rayon Administration; (xiii) Jeti-Oguz District Forestry Service, Issyk-Kul Oblast, Ministry of Agriculture; (xiv) Baitoo Public Foundation, Saruu Village; (xv) Mr. Bapaev Chyngyz

[19] There were 68 (60 men and 8 women) participants at the stakeholders' meeting, including 6 from Barskoon village, 14 from Kyzyl Suu Village, 3 from Saruu Village, 3 from Tilekmat Village, 2 from Ak-Terek Village, 4 from Jeti-Oguz village, 4 from Jele Tobe Village, 3 from Alkym Village, 1 from Kokuy-Kol Village, 1 from Zhalgyz Oruk, 2 from Lesnoe Village, 1 from Svetlaya Polyana Village, 1 from - Ananyevo Village, 5 from Karakol City, 1 from Balykchy, 1 from Chyrak, 1 from Isanov Village and 10 from Bishkek City.

Arstanovich, First Vice Mayor, Karakol City; (xvi) Public Foundation “El-Too”; and (xvii) Ms. Zhyldyz Asanakunova, Environmental NGO in Issyk-Ku Lake.

K. Grievance Redress Mechanism

62. The project’s GRM was approved by the Minister of MOTC through the issuance of MOTC Order No.127 (on Grievance Redress Group) dated 26 April 2023. This order aims to ensure transparency and objectivity of decisions made and interaction of the MOTC with local authorities and civil society in the process of implementing the project.

63. The mechanism consists of grievance resolution at two levels: the local and central government levels. At each level, grievance redress groups (GRGs) are established. The role and responsibility of the GRGs is to accept claims and complaints, assess its validity, determine the scope of eventual impacts, and timely resolve the issue, including the claims regarding the compensation and maintain GRM as flexible and efficient to address and resolve the claims during project implementation.

L. Implementation Arrangements

64. The executing agency is the Ministry of Transport and Communications (MOTC) of the Kyrgyz Republic. The project steering committee chaired by the Minister, through the MOTC, will provide overall guidance and strategic directions to the project. The MOTC will establish the Project Implementation Unit (PIU) composed of officials and staff from the MOTC. The PIU will be continuously strengthened with external experts, as may be required, throughout the implementation of the project. The PIU will be supported by a Construction Supervision Consultant (CSC), a professional engineering and management consulting firm. The CSC will assist in the delivery of the different project components, which include the construction and NDP, including capacity building of MOTC and PIU in monitoring road construction and operations. The CSC will act as MOTC’s representative during the construction and NDP. The CSC will have national and international environmental safeguards specialist / consultant responsible for overseeing implementation of environmental safeguards on behalf of MOTC and PIU. The Contractor will be responsible for the implementation of the project, and other responsibilities as indicated in the contract documents. In compliance with the requirement of ADB SPS, the project, as a Category A undertaking with significant impacts and risks, shall retain external environmental monitoring expert consultants who will verify monitoring information.

M. Monitoring and Reporting

65. EMP compliance monitoring will be undertaken by the PIU. The Contractor will submit monthly reports to PMU. The PMU will prepare and submit reports to ADB on a quarterly basis during construction phase and semi-annually during the DNP until ADB issues a project completion report for the project. Similarly, the PIU will be responsible for the preparation of required environmental monitoring reports and submission to various government agencies. Any major accidents having serious environmental consequences will be reported immediately by the Contractor to the PIU.

66. In compliance with ADB SPS, external environment expert consultants will be retained under the project who will conduct independent monitoring and review of EMP implementation. The expert will work closely with PIU and Contractor, but will report directly to ADB or occasionally through the PIU. Additional compliance reports to the MOTC required as part of environmental clearance process shall be prepared and based on the required monitoring and reporting format.

N. Findings (Conclusion) and Recommendations

67. The EIA for the proposed project was carried out using best practices and following the ADB Environmental Safeguard requirements. It included screening, scoping, description of the baseline environmental conditions, impact identification and assessment, identification of mitigation measures, and development of environmental management plan including monitoring. The EIA considered all phases of the project. The overall findings of the project are:

(ii) During construction, the project will have significant adverse impacts on nearby receptors, including the people in settlements, on cultural and archaeological sites, and on biodiversity and ecological receptors, particularly in Lake Issyk Kul. Impact will be from dust (airborne and in runoff), noise and vibration. Most of these impacts, which are intermittent and short-term, can be mitigated with the control measures listed in the EMP.

(iii) During operation, the operation of the improved road will have no significant adverse impacts on receptors.

(iv) Socio-economically, the project can also potentially increase tourist visits in the project area with the consequent increase in economic incomes of the local people. The better connectivity as a result of the improved road can also potentially help in increasing the local economy and the economy of the Kyrgyz Republic in general.

68. Based on the results of the EIA, specific recommendations have been provided and these are discussed and listed in the Chapter V (Anticipated Environmental Impacts and Mitigation Measures) and reiterated in Chapter IX (Environmental Management Plan). Most of the recommendations are typical of this type of project (e.g., dust control using watering, proper siting, etc.) In general, to prevent or minimize project impact and to protect the environment, the contractor shall develop and implement an SSEMP that include the mitigation and control measures identified in the EIA report and the EMP and for any unforeseen impacts of the project and for any significant impact resulting from the change in project design. Corollary to this is for the contractor to implement the environmental monitoring plan presented in the EIA Report.

69. Major recommendations that are specific to this particular project are reiterated below:

(i) Engage external environment expert(s) for verification of environmental monitoring reports and EMP implementation. External expert(s) shall not be involved in day-to-day project implementation or supervision;

(ii) Excavate heritage and archaeological sites near the road corridor as identified in the survey conducted as part of the EIA and report to and follow the resolution of the Ministry of Culture, Information, Sports and Youth Politics of the Kyrgyz Republic with regard to handling chance archaeological finds during the construction phase. The PIU will assist in coordinating work with local authorities, which are responsible for developing the “project protection zones”..

(iii) The Contractor shall carry out a vibration risk assessment based on the vibration modeling report and other EIA requirements. Based on the risk assessment, the Contractor shall take into account all risks associated with construction work and develop a construction method that must be approved by CSC/PIU. The contractor must assess the condition of buildings and structures located along the project site before starting construction works. The Contractor shall bear the full responsibility for any possible impacts resulting from the construction work performed.

(iv) Carry out air quality monitoring, post construction, to identify any additional control measures that need to be implemented to minimize impacts from air pollution during the operation of the project.

(v) Replace all trees that will be cut at the ratio of one (1) tree planted for every tree that is cut. Replacement trees shall be native species that are suitable to local conditions.

(vi) Utilize existing quarries or borrow pits as source of gravel and stones for the road. Coordinate with local authorities and obtain permit from relevant agency prior to quarrying. Borrow areas and quarries comply with environmental requirements to control impacts.

(vii) Develop and implement an Asbestos Containing Materials (ACM) Management Plan in line with the ADB Good Practice Guidance for the Management and Control of Asbestos. Although limited volume of asbestos cement (A/C) pipe will be dismantled, improper handling and disposal can result to health impacts to nearby workers and population if not properly done.

I. Introduction

A. Background

70. This document presents the results of the environmental impact assessment (EIA) carried out for the 75.2 kilometer (km) section of the southern part of the Issyk-Kul Ring Road between Barskoon and Karakol (the project).

71. The Central Asia Regional Economic Cooperation (CAREC) Road Corridors 1 and 3 provide regional connectivity with other Central Asian neighboring countries including Kazakhstan and the People's Republic China. The Bishkek–Torugart road (part of CAREC Corridor 1) and the Bishkek–Osh road (part of CAREC Corridor 3) also enable a north–south connectivity within the country. In addition, the Almaty–Bishkek Economic Corridor is spurring economic growth and creating jobs through greater private investments, trade, and agglomeration of economic activities.[20] The development of the Issyk-Kul Lake area, the country's most popular tourist destination, is an integral part of the Almaty–Bishkek Economic Corridor. The Issyk-Kul Ring Road also represents strategic importance for the livelihoods of local communities, including women and the vulnerable group, by improving their access to job opportunities and markets for their crops and livestock. The Issyk-Kul Ring Road Improvement Project will contribute to these initiatives by eliminating the domestic connectivity bottleneck between the Issyk-Kul Ring Road and the CAREC Corridor 1.

72. The entire Issyk-Kul Ring Road has severely deteriorated. It has poor riding quality and a traffic capacity that does not meet the requirements of high volume of vehicles during tourist and harvest seasons, posing a safety risk. There is a lack of roadside public services such as visitor centers, public toilets, and streetlights lowering satisfaction for tourists. The government has been reconstructing the ring road using its own funds and with assistance from other development partners such as the Arab Coordination Group and the European Bank for Reconstruction and Development. The project will reconstruct the remaining road section and supplement the implementation of the action plan that was jointly developed by the Ministry of Transport and Communications (MOTC) and the Ministry of Culture, Information, Sports, and Youth Policy for the development of tourism infrastructure in the Issyk-Kul Lake area by providing selected facilities along the project road.

73. The project is aligned with the following impact: competitiveness of the Kyrgyz Republic increased.[21] The project outcome will be efficient movement of people and goods on Issyk-Kul Ring Road and CAREC Corridors 1 and 3 improved. The project outputs include: (i) climate-resilient[22] Barskoon–Karakol road reconstructed, (ii) road asset management system institutionalized, (iii) implementation of the national road safety action plan institutionalized, and (iv) decarbonization of the road sector supported.

74. The project is in line with the Asian Development Bank (ADB) Strategy 2030[23] and will support its operational priority 7 by expanding trade and investment opportunities in the Issyk-Kul Lake area (Pillar 2: global and regional trade and investment opportunities are expanded). The project also supports operational priorities 1, 2, 3, and 6.[4] The project is well aligned with (i) the CAREC 2030 Strategy, particularly cluster 2 (trade, tourism, and economic corridor development),

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[20] ADB. 2014. Operationalizing Economic Corridors in Central Asia: A Case Study of the Almaty-Bishkek Corridor. Manila.

[21] Government of Kyrgyz Republic. 2018. National Development Strategy of the Kyrgyz Republic for 2018–2040. Bishkek.

[22] Road is adaptable for natural hazards such as floods, landslides, and melting road surfaces.

[23] ADB. 2018. Strategy 2030: Achieving a Prosperous, Inclusive, Resilient, and Sustainable Asia and the Pacific. Manila.

and cluster 3 (economic infrastructure connectivity) by significantly improving road infrastructure along the Issyk-Kul Lake and removing the current transport bottleneck between the Issyk-Kul Lake and CAREC Corridors 1 and 3 and (ii) the ADB's Country Partnership Strategy for the Kyrgyz Republic, 2018–2022 which supports growth and economic diversification through improved transport connectivity.[24] The project is in line with the (i) National Development Strategy 2040, (ii) the updated NDC, and (iii) the Program for the Development of a Green Economy for 2019–2023, all of which support regional trade and tourism and making finance flows consistent with a pathway toward low greenhouse gas emissions and climate-resilient development.

75. The project is currently estimated to cost approximately $90 million. ADB is currently considering a concessional loan of $40 million from ADB's ordinary capital resources and a grant of $40 million from ADB's Special Funds resources (Asian Development Fund). The balance will be financed by the government of the Kyrgyz Republic.

76. The project has the following envisaged benefits:

(i) **Improving road condition**. The project road will have good riding quality over a 20-year period and provide tourist- and environment-friendly transport services.

(ii) **Improving road safety**. The project will enhance the road safety management in MOTC and enable safer passenger and goods services that support safe travel of women on the project road.

(iii) **Reducing carbon**. The project will support decarbonization of the road sector and support green travel.

(iv) **Economic benefit**. By completing the southern ring road upgrade, the project will divert some traffic from the northern ring road, thereby slightly reducing seasonal congestion around Cholpon-Ata. Transport demand around the lake is driven by tourism. The project both complements and will benefit from active summer and winter tourism around Karakol. Direct project road user benefits include vehicle operating cost savings, travel time savings, reduced vehicle emissions and improved road safety.

(v) **Supporting regional connectivity**. The project will improve connectivity with Kazakhstan and Uzbekistan via the recently re-opened Karkyra border crossing point and the Tyup–Karkyra road upgrade, due to be completed in 2025. It will also complement connectivity with the People's Republic of China via the CAREC Corridor 1 through the Torugart border crossing point.

77. **Impact and Outcome.** The project will be aligned with the following impact: competitiveness of the Kyrgyz Republic increased. The expected project outcome is efficient movement of people and goods improved.

78. The project will have the following outputs:

- **Output 1**. Climate-resilient Barskoon-Karakol road reconstructed. This output will (i) widen the two-lane carriageway to four lanes to meet the increase in traffic demands; (ii) provide with rest areas, bus stops, electrically powered vehicles infrastructure, streetlights, and walkways, and (iii) enable safer access to pedestrians including women.
- **Output 2.** Institutional capacity in road asset management, road safety, and decarbonization strengthened. This output will include the following three sub-outputs: (i)

[24] ADB. 2018. Country Partnership Strategy: Kyrgyz Republic, 2018-2022—Supporting Sustainable Growth, Inclusion, and Regional Cooperation. Manila.

Road Asset Management System (RAMS) Phase III, (ii) Road Safety Improvement (RSI) Phase II, and (iii) Decarbonization of the road sector.

79. **Civil works.** Output 1 of the project will involve civil works: (i) widening of the existing two-lane carriageway to four lanes to meet the increase in traffic demands; (ii) construction of rest areas, bus stops, electrically powered vehicles infrastructure, streetlights, and walkways, and (iii) provision of safer access to pedestrians. The details are discussed in Chapter 2 of this EIA Report.

80. **RAMS Phase III.** The sub-output scope has been formulated in consideration of worldwide experience and lessons learned together with the assessment of current RAMS practices of MOTC and expected outcome of ongoing RAMS Phase II project. A lack of MOTC management level engagement has been identified as one of the major reasons in the limited sustainability of RAMS Phase I efforts. Thus, the project will develop Road Asset Management Policy and Action Plan with an objective to facilitate management level engagement and to establish a mechanism for systematic resource allocation for RAMS-related activities. The project will help MOTC in (i) preparing a multi-year maintenance rolling program annually, (ii) increasing maintenance allocation through optimizing tax collection mechanism of road users, and (iii) preparing cadre, including women, in managing road asset by providing continuous support to the technical university.

81. **RSI Phase II.** The sub-output scope is being finalized with due consideration of the progress made under RSI Phase I and expected outcome. The current scope is as follows (i) mainstream a safety auditing of MOTC, (ii) carry out safety assessment on the state road network to identify low-cost safety countermeasures, (iii) improve the design standard in line with road safety requirements, (iv) prepare cadre including women in road safety engineering, and (v) piloting selected safety measures on the project road section.

82. **Decarbonization of the road sector.** The project will support MOTC to develop and finalize a road sector climate strategy and action plan for sustainable road transport and define key solutions towards greenhouse gas reduction and climate resilience. This will (i) ensure that future investments in the sector are aligned with the goals outlined in the Paris Agreement, (ii) guide the updating of the NDC related to the transport sector, and (iii) contribute to the transition towards a green economy.

B. Purpose and Scope of the EIA

83. This EIA focuses exclusively on the road widening and installation of roadside facilities, as the most environmentally sensitive component of the project given its construction and operation is likely to have significant adverse environmental impacts. These impacts will affect an area that is locally and internationally classified as ecologically important. It is within the Biosphere Territory of Issyk-Kul (BTIK), a special protected natural territory that is included in the World Network of Biosphere under UNESCO's Man and Biosphere Programme. The project site is approximately 1 km from one of the core zones of the Issyk-Kul State Nature Reserve, the Ala Too core zone, and within 10 km of another core zone, the Kokuy-Kol core zone. It is adjacent to Lake Issyk-Kul, which designated as a Ramsar site and as important wintering site for migratory waterbirds. It is also a few kilometers away from Important Bird and Biodiversity Area (IBA). Thus, the project is classified as Category A for environment per ADB Safeguard Policy Statement (SPS). The ADB Rapid Environmental Assessment Checklist used for screening and categorization is attached as Annex 1.

84. The purpose of the EIA is to meet ADB SPS requirements for Category A projects. A separate OVOS (EIA) will be submitted by MOTC prior to the start of the project. This EIA Report

can be modified to comply with the OVOS requirements. However, if the requirements of the government are less stringent than ADB SPS, then this EIA will prevail.

85. The scope of this EIA covers the following: (i) description of road improvement, including construction and installation of related facilities (the project); (ii) identification and description of the elements of the environment, community and stakeholders likely to be affected by the project and/or likely to cause adverse impacts to the project, including both the natural and man-made environment; (iii) information on alternatives and options considered for the design, site location and layout of the project to avoid and minimize potential environmental impacts to environmentally sensitive areas, other sensitive uses and sensitive receptors, including reasons for selecting the preferred option(s); (iv) identification and assessment of significance of impacts on biodiversity, flora and fauna, air quality, water quality, waste management implication, road traffic, socio-cultural and livelihood, occupational health and safety and cultural and archaeological resources, particularly on sensitive receptors and potential affected uses; (v) mitigation measures to prevent or minimize pollution, environmental disturbance and nuisance during construction and operation of the project; (vi) identification, prediction and evaluation of residual (i.e., after practicable mitigation) environmental impacts and the cumulative effects expected to arise during the construction and operation phases of the project in relation to sensitive receptors and potential affected uses; (vii) identification, assessment and specification of methods, measures and standards, to be included in the detailed design, construction and operation of the project, which are necessary to mitigate these environmental impacts and reducing them to acceptable levels; (viii) identification of constraints associated with the mitigation measures recommended in the EIA study and, where necessary, to identify the outstanding issues that need to be addressed in any further detailed EIA study; and (ix) design and specifications in the environmental monitoring and audit requirements to ensure the effective implementation of the recommended environmental protection and pollution control measures.

86. The impact assessment includes (i) collection and use of field data gathered during the period from January 2023 to July 2023, (ii) consultations with stakeholders, (iii) modelling, and (iv) professional judgment and experience of the EIA team members. In addition, satellite and aerial photos have been used to study the geography and environmental changes at the project site. Moreover, similar project reports have been reviewed and referenced in completing this report. The complete list of reference materials is included as Chapter XI.

C. Stage of the project preparation

87. The project will be implemented through a large civil works contract, under which the contractor will be responsible to build the road and other facilities according to the detailed engineering design completed in 2023 and as specified in the bidding and contract documents' Technical Specification.

88. Project implementation will commence with the mobilization of the contractor in July 2024. The construction period will be 3 years and defects notification period (DNP) is 5 years. Rehabilitation and reinstatement of disturbed areas, access roads and public areas are expected to be completed during the DNP.

D. EIA Preparation

89. The EIA report has been prepared by the Project Implementation Unit (PIU) with the support of the following consultants:

- Asylbek Abdygulov, PIU Environmental Specialist, MOTC;
- Donato S. dela Cruz, EIA Team Leader and Environmental Specialist;
- Mark Attree, EIA Deputy Team Leader and Air Quality Specialist;
- Chinara Sadykova, Biodiversity Specialist;
- Seitkazy Sagymbaev, Ornithologist (Bird Specialist);
- Emil Niyazov, Ichthyologist (Fish Specialist);
- Venera Zhunusbaeva, Water Quality Specialist;
- Kunbolot Akmatov, Archaeologist;
- Alec Glendinning, Noise and Vibration Specialist;
- Sultan Barikov, ADB Consultant; and
- Lizandro Racoma, ADB Consultant.

E. EIA Methodology

90. **General Approach**. The EIA for the proposed project was carried out using best practices and following the ADB Environmental Safeguard requirements. It included screening, scoping, description of the baseline environmental conditions, impact identification and assessment, identification of mitigation measures, and development of environmental management plan including monitoring. The EIA considered all phases of the project.

91. **Scoping**. A review of project documents and an initial site visit was carried out in January 2023 to understand the nature and setting of the project. Information gathered were used to narrow down the most critical issues for the project that will require more detailed and in-depth analysis during the assessment. The most critical aspects identified that need attention are the impact on biodiversity, cultural and archaeological resources and nearby communities from noise, vibration, air emission, water discharge. All environmental issues were categorized into physical, ecological and socio-economic aspects.

92. **Description of baseline environmental conditions**. An extensive literature review was carried out to gather relevant environmental data. This was complemented by visits to relevant government offices at the national, regional and district levels to obtain additional environmental monitoring data. Field surveys and monitoring were carried out to obtain site-specific data on various aspects of the environment including: biodiversity, noise, water, air, vibration and archaeology. All collected data were analyzed to provide an assessment of the baseline environmental conditions, which was used as basis in the assessment of the impacts of the activities of the road project on the environment.

93. **Impact assessment and mitigation measures**. The impacts of the project were assessed qualitatively and quantitatively. Where there are no available data, particularly as the project is still at the initial stage of design, qualitative assessment was carried out using international best practices and expert judgment. In cases where sufficient data were available, quantitative assessment was carried out, e.g., for air quality assessment, noise and vibration. The assessment took into consideration the existing baseline environmental conditions and assessed the impacts

due to the incremental contribution from project activities both during construction and operational phases. Mitigation measures were identified based on the result of the impact assessment. These included recommendations in modifying the design to prevent or minimize the impacts and specific control measures that included technologies and management measures.

94. **Information Disclosure, Consultation and Participation**. Consultations and meetings were carried out by the EIA Team and the MOTC with various organizations, including the State Administration of Issyk-Kul Oblast, the Rayons of Jeti-Oguz and Ak-Suu and Karakol City, central and regional offices of national government agencies and departments, non-governmental organizations (NGOs), and the Directorate of the Biosphere Territory of Issyk-Kul. During the meetings/consultations, the EIA Team discussed the proposed project and the objectives of the meeting/consultation in connection with the preparation of the EIA for the project. The team also solicited comments and concerns regarding the project and also asked the support of the organization for data and information that are necessary in the preparation of the EIA of the project.

95. **Environmental management plan**. The environmental management plan focused on the implementation of the identified mitigation and control measures, including organizational requirements, monitoring, capacity building (training and awareness), reporting and cost.

II. Project Description

A. Project Scope and Location

96. The Issyk-Kul Ring Road Improvement Project (IRRIP) covers the rehabilitation of the existing 75.2 km of the Issyk-Kul Ring Road from Barskoon Village (km 140+600) to Karakol City (km 215+827)[25] (Figure 1) in Issyk-Kul Oblast of the Kyrgyz Republic. The rehabilitation will widen the existing two-lane road to a four-lane road. It will also include the construction of associated infrastructures such as bridges, rest areas, bus stops, streetlights, pedestrian walkways, etc.

97. The Issyk-Kul Ring Road connects towns and villages in the southern coastal areas of Lake Issyk-Kul to Karakol City, the capital of Issyk-Kul Oblast (Region). It connects these settlements to Balykchy on the western shore of the Lake. Through Balykchy, the Issyk-Kul Region is connected to Bishkek, the capital of Kyrgyz Republic and to other cities in Central Asia and Europe via the CAREC (Central Asia Regional Economic Cooperation) Corridor 1[26,27] (Figure 2).

98. As shown in Figure 3 for most of its length, the existing segment of the ring road from Barskoon to Karakol City crosses farmlands (Figure 4) planted with vegetables, cereals and fodder grasses and settlements. These settlements (Figure 5) include the villages of Chon Zhargylchak, Kichi Zhargylchak, Ak Terek, Chychkan/Jenish, Darkhan, Saruu, Kyzyl Suu, Orgochor, Shalba, Chirak, Jele Tobe, Kytai, Kyzyl Dyikan, Kalinovka and Karakol City (Figure 3).

99. The road passes through plains and crosses a few rivers.

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[25] UTM Coordinates: Route start at Barskoon (4674802.974 N; 714973.077 E) and end at Karakol (4710761.766 N, 776779.256 E)

[26] Ministry of Transport and Roads of the Kyrgyz Republic. Investment Projects Implementation Group. CAREC Transport Corridor. CAREC Corridor 1. http://piumotc.kg/uploads/documents/CAREC-Corridor-1-map.pdf

[27] CAREC Corridors. https://www.carecprogram.org/?page_id=20

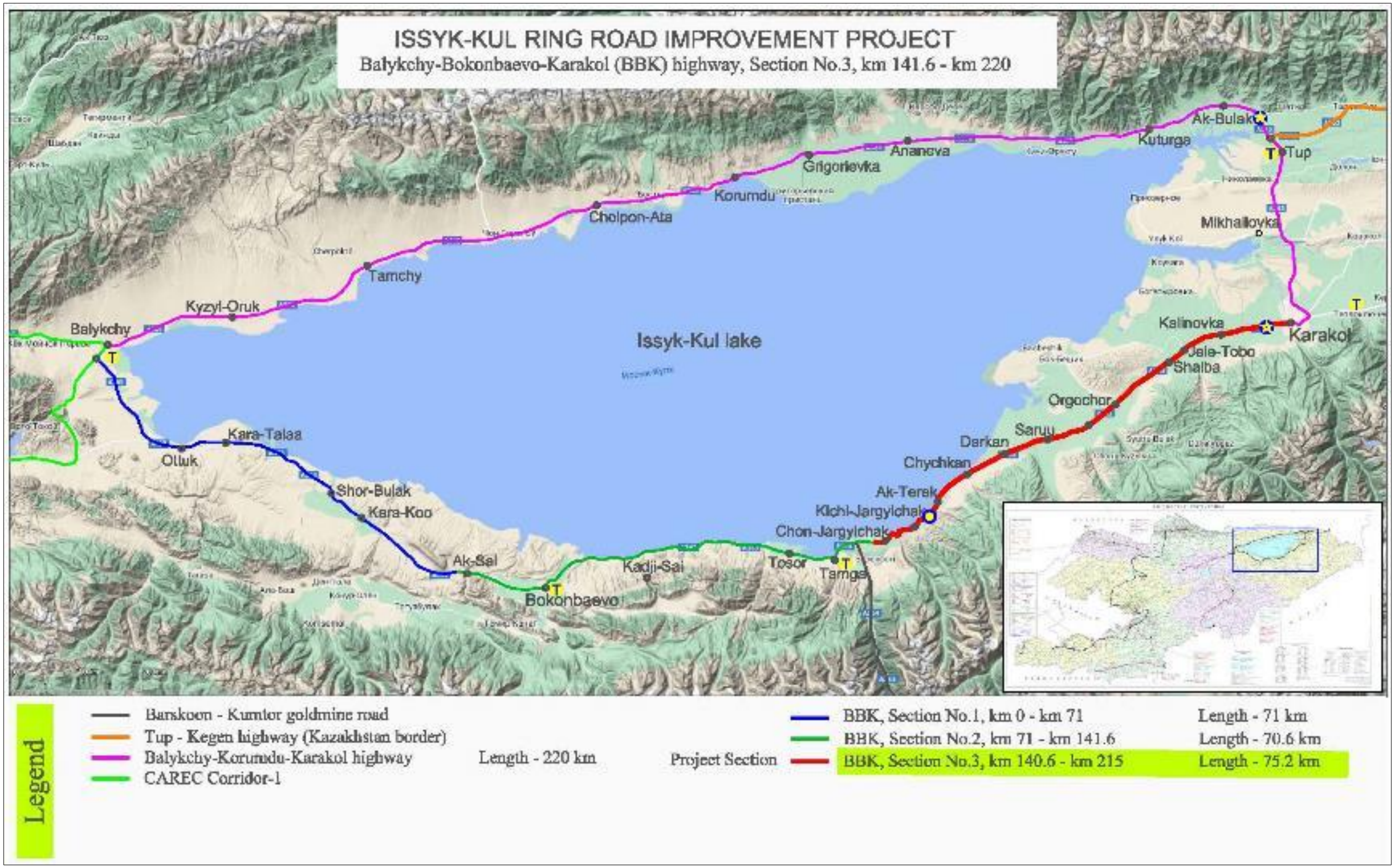
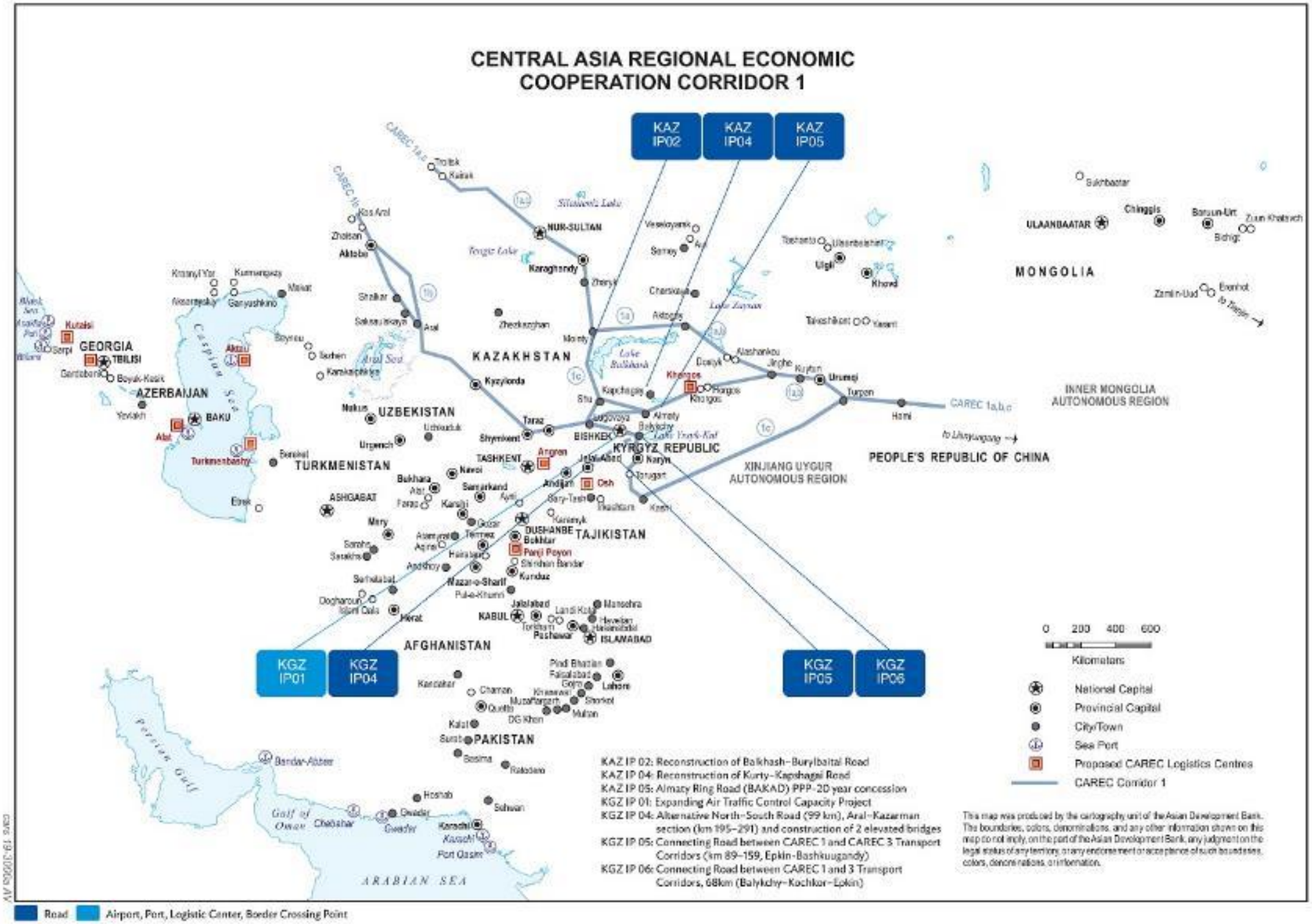
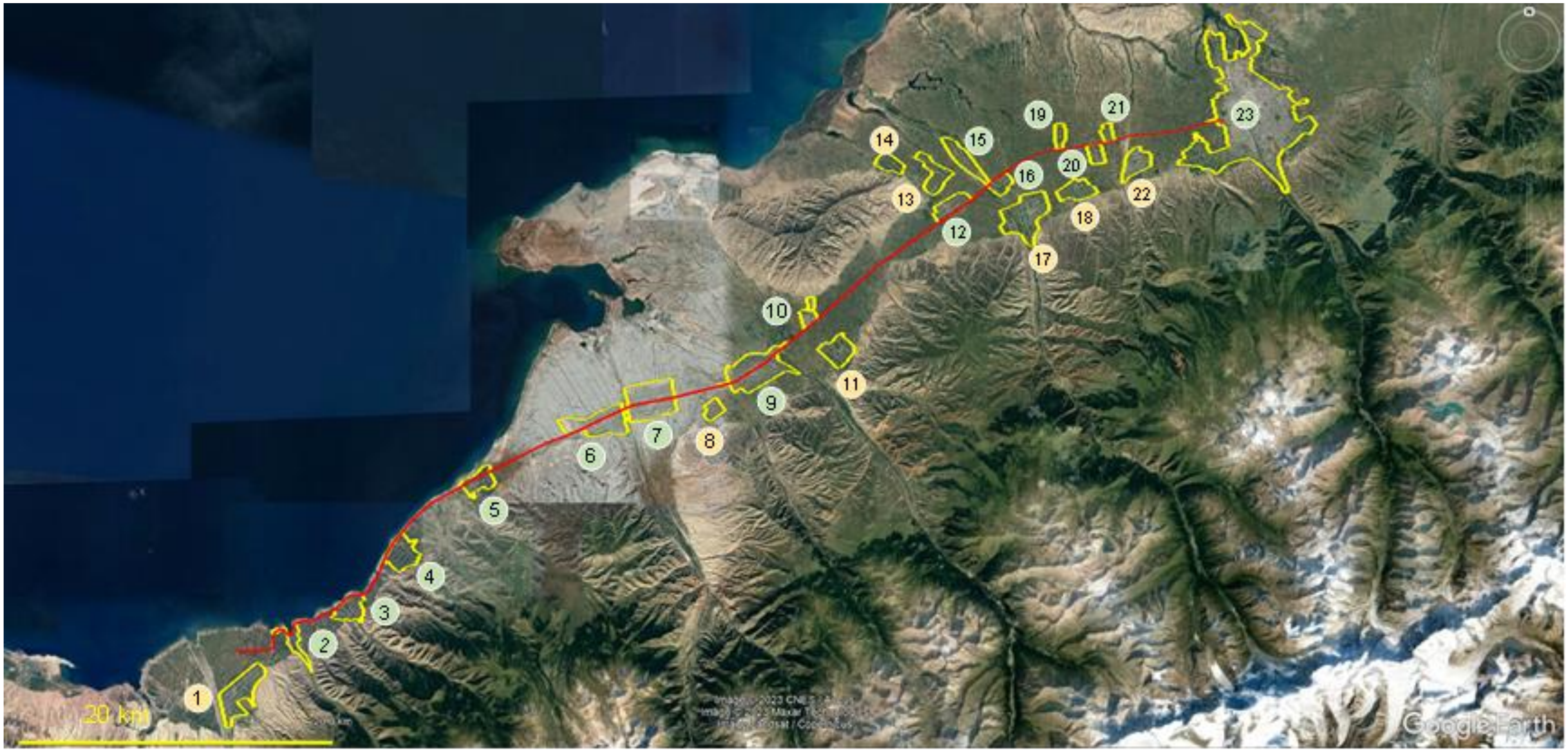


Figure 1: Project location.



Source: ADB. July 2022. Concept Paper, Proposed Loan and Technical Assistance Grant Kyrgyz Republic: Issyk-Kul Ring Road Improvement Project.

Figure 2: Central Asia Regional Economic Cooperation (CAREC) Corridor 1.



Legend

SN	Settlement	SN	Settlement	SN	Settlement	SN	Settlement
1	Barskoon	7	Saruu	13	Ak Dobo	19	Kytai
2	Chon Jargylchak	8	Jalgyz Oruk	14	Munduz/ Ak Usten	20	Kyzyl Dykan/ Baltabai
3	Kichi Jargylchak	9	Kyzyl Suu	15	Chirak	21	Kalinovka/ Konkina
4	Ak Terek	10	Orgochor	16	Jele Tobe	22	Yrdyk
5	Jenish/ Chychkan	11	Svetlaya Polyana	17	Jeti-Oguz	23	Karakol
6	Darkhan	12	Shalba/ Tilekmat	18	Kyzyl Zuu		

Figure 3: Settlements along (green color) and within 2 kilometers (orange color) of the Barskoon-Karakol Segment of the Issyk-Kul Ring Road.

Figure 4: Farmlands on both sides of the Issyk-Kul Ring Road near Jele Tobe Village

Figure 5: Road section of Issyk-Kul Ring Road in Kyzyl Suu, the capital of Jeti-Oguz Rayon

B. Project Rationale

100. The entire Issyk-Kul Ring Road is severely deteriorated (Figure 6). It has poor riding quality and a traffic capacity that does not meet the requirements of high volume of vehicles during tourist and harvest seasons, posing a safety risk. On the average, 15 people per 100,000 population die annually in road crashes due to narrow carriageway, inadequate signalization, limited street lighting, unsafe crossings for pedestrian and vulnerable road users including women, speeding, inadequate winter maintenance, and poor drivers' behavior. There is also a lack of roadside public services such as visitor centers, public toilets, and streetlights lowering satisfaction for tourists.

Figure 6: Deteriorated road section near Barskoon

101. The government has been reconstructing the ring road using its own funds and with assistance from other development partners such as the Islamic Development Bank and European Bank for Reconstruction and Development. The project will reconstruct the remaining road section and supplement the implementation of the action plan that was jointly developed by MOTC and the Ministry of Culture for the development of tourism infrastructure in the Issyk-Kul Lake area by providing selected facilities along the project road.

102. The Issyk-Kul Ring Road Improvement Project will: (1) upgrade the road and provide convenient facilities to road users; (2) improve regional and domestic connectivity of the region; and (3) improve road safety that will result in efficient movement of people and goods in the region. The project derives synergies with earlier ADB assistance and adopts a cross-sectoral approach to integrated development in the Issyk-Kul Lake area, with an integration of gender perspective.

103. Being a landlocked country, the Kyrgyz Republic depends heavily on road transport. About 95% of passengers and more than half of freight traffic are carried by road. The Ministry of Transport and Communication (MOTC) is responsible for developing and maintaining the road network with a total length of 18,000 kilometers, of which, only about 43% have a hard surface. Although there have been improvements in the road network performance, the quality of the roads continues to lag as the country ranked 113 out of 141 countries by the World Economic Forum's Global Competitiveness Index.[28]

104. Development of the Issyk-Kul Lake area, the country's most popular tourist destination, is an integral part of the Almaty–Bishkek Economic Corridor (ABEC). ABEC is spurring economic growth and creating jobs through greater private investments, trade, and agglomeration of economic activities.[29] The Issyk-Kul Ring Road also represents strategic importance for livelihoods of local communities, including women and the vulnerable group, by improving their access to job opportunities and markets for their crops and livestock. The project will contribute

[28] World Economic Forum. 2019. The Global Competitiveness Report. Geneva.
[29] ADB. 2014. Operationalizing Economic Corridors in Central Asia: A Case Study of the Almaty-Bishkek Corridor. Manila.

to these initiatives by eliminating the domestic connectivity bottleneck between the Issyk-Kul Ring Road and the CAREC Corridor 1[30].

105. The project is aligned with (i) the CAREC 2030 strategy, particularly cluster 2 [trade, tourism, and economic corridor development], and cluster 3 [economic infrastructure connectivity] by significantly improving road infrastructure along the Issyk-Kul Lake and removing the current transport bottleneck between the Issyk-Lake and CAREC Corridor 1 and (ii) the ADB's Country Partnership Strategy 2018–2022 which supports growth and economic diversification through improved transport connectivity. The project is in line with the (i) National Development Strategy 2040, (ii) the updated NDC, (iii) the Green Economy Strategy, and (iv) the National Strategy for Gender Inclusiveness, all of which support regional trade and tourism, making finance flows consistent with a pathway toward low greenhouse gas emissions and climate-resilient development, and gender mainstreaming in road sector development.

C. Project Components

106. The design of the road rehabilitation was prepared by the Design – Survey Institute "Kyrgyzdortransproekt" of the Ministry of Transport and Communications (MOTC) of the Kyrgyz Republic. The road design was in accordance with the requirements of the standards and regulations:

(i) SNiP – Construction Norms and Rules (Mandatory);

(ii) GOST[31] – State Standard (Mandatory);

(iii) SN KR – Construction Norms of Kyrgyz Republic (Mandatory);

(iv) SP – Set of Rules (Mandatory);

(v) Recommendation - Construction Norms (not mandatory); and

(vi) ODN - Industrial Road Norms (mandatory).

107. As the road is classified as technical Category II, it was designed in accordance with the requirements of SNiP KR 32-01:2004[32]. For Category II road, the width of the roadside lane for public roads on sections passing outside settlements is set for each side of the right of way at 40 meters each.

108. The proposed improvements of the existing road, which is a classified as Category II road, include[33]:

(i) Construction of pavement using CMA (cold mix asphalt) with an axle load of 11.5 tons;

(ii) Increasing the number of road lanes from 2 lanes to 4 lanes with a dividing strip fence of the "double-sided metal barrier" type;

(iii) Improvement of road junctions and ramps; arrangement of channelized intersections and junctions with of speed change lanes for the left turn;

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[30] The Central Asia Regional Economic Cooperation (CAREC) Road Corridors 1 and 3 provide regional connectivity with other Central Asian neighbors. The Bishkek–Torugart road (part of CAREC Corridor 1) and the Bishkek–Osh road (part of CAREC Corridor 3) also enable a north–south connectivity within the country.

[31] GOST Государственный Стандарт (Gosudarstvenny Standart), which means "state standard" refers to a set of international technical standards maintained by the Euro-Asian Council for Standardization, Metrology and Certification (EASC).

[32] Design of automobile roads.

[33] Project Design Document, Chapter 1 – Explanatory Note (03/22-32 – EN).

(iv) Widening or replacement of bridges, and construction of new bridges and water drainage structures (pipes and culverts);

(v) Installation of a fence on the dividing strip of a double-sided metal barrier and side reinforced concrete parapet fences of “Sapozhok” type;

(vi) Arrangement of bus stops with traffic lay-by and speed change lanes;

(vii) Improvement of infrastructure within settlements through the construction of sidewalks, footpaths, water drainage canals, street lighting in residential areas and pedestrian crossings and livestock crossings;

(viii) Arrangement of equipped parking areas for vehicles at roadside service facilities (separated from the carriageway) with change speed lanes;

(ix) Performing other necessary auxiliary work on the installation of road safety elements, such as the installation of reusable signal poles made of polyethylene, road signs, road markings, noise strips, bollards on safety islands, reflective elements and other road works.

109. Information discussed in this Chapter of the EIA are mainly cited from the following design documents developed by the “Kyrgyzdortransproekt”:

(i) Section 1. Explanatory note;

(ii) Section 2. Right of way (ROW) design;

(iii) Section 3. Structural design solutions: 3.1 Structural design solutions for roads; 3.2 Structural design solutions for bridges; and 3.3 Structural design solutions for culverts;

(iv) Section 5. Design of engineering networks and utilities: 5.1. Relocation of existing overhead lines - 10/0.4 Right of way; 5.2. Relocation of existing communication lines; 5.3. Outdoor Lighting; 5.4. External water supply (relocation of the water supply network); and 5.5. Installation of traffic lights;

(v) Section 9 Other Documentation; 9.1. Technical justification based on the results of engineering-geological surveys; and 9.2. Technical justification based on the results of engineering geodetic surveys; 9.3. Brief hydrological note; 9.4. AGZ (Architectural and Urban Planning Conclusion); 9.5. Calculation of the design of pavement; and 9.6. Calculation of the design of bridges for loads and impacts.

Figure 7: Map showing segment of the Issyk-Kul Ring Road from Barskoon to Karakol City and the locations of facilities and major project components.

1. Road Widening

a) Road width

110. The road will be widened to four (4) lanes, from two (2) lanes with each lane having a width of 3.5 m (total width of 14 m). The total width of the road that will be asphalted is 17.6 meters, including a 2.6 m median and 0.5 m buffer on both sides (Table 1, Figure 8 and Figure 9).

111. The design of the road shoulder will vary depending on whether it is passing through residential/settlement areas or not. In settlement/residential areas, three different designs will be followed depending on the existing conditions as shown in Figure 8. Sidewalks and drainage canals will be provided in residential areas, which can be on one side or two sides of the road depending on whether there is settlement on one or both sides of the road. Trees will also be planted on the road side(s).

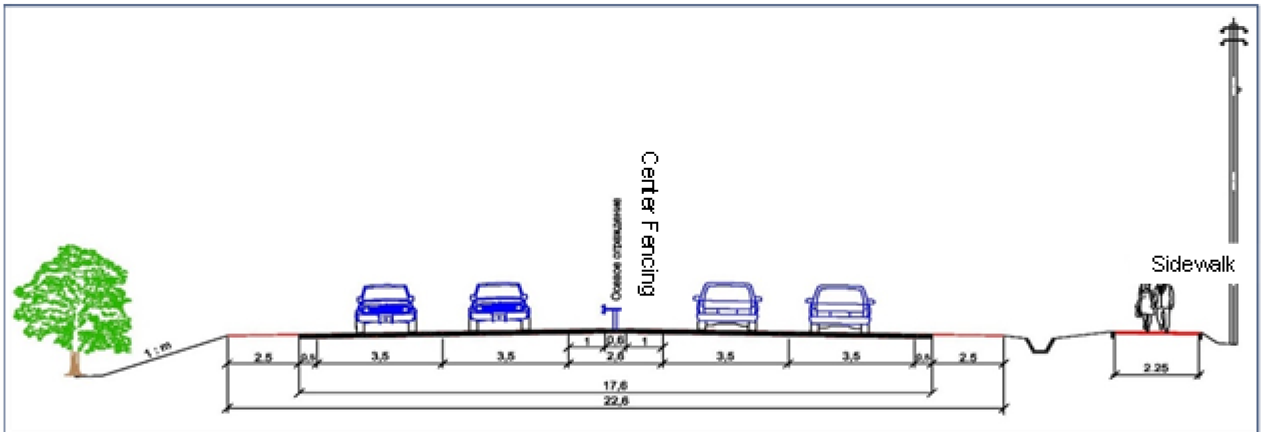
112. As shown in Figure 9, the road design for locations outside settlement areas will include 2.5-meter shoulders on both sides of the road, with trees to be planted on both sides of the road one meter from the edge of the shoulder. Drainage will not be included, with the water runoff allowed to percolate into the soil.

113. The road is designed for maximum speed of 120 km/h to 100 km/h in flat terrain and 60 m/h in mountainous and in settlement areas.

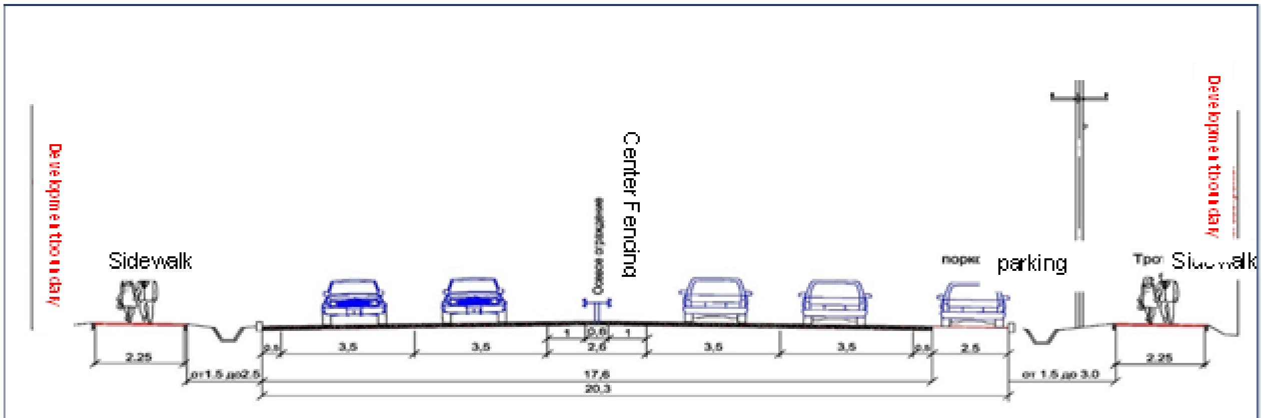
Table 1: Road design parameters and dimensions.

No.	Parameter/Indicator	Value
1	Road Category (GOST R-52398-2005)	II
2	Design speed - Base / in Settlements (controlled)	120 (90) / 60km/h
3	Number of lanes	4
4	Width of the lane	3.5m
5	Width of the carriage way	14m (2 x 7.0)
6	Width of the median including barriers	2.6m
7	Width of the shoulder (soil type 2.5m and asphalt type 0.5m)	3m
8	Transverse slope of the pavement	20%
9	Transverse slope of the shoulder	40%
10	The steepest slope (rough terrain)	40% (50)
11	Type of pavement (asphalt), axle load/class	11.5T/ A2
12	Quantity of bridges	5
13	Quantity of Underpasses	8

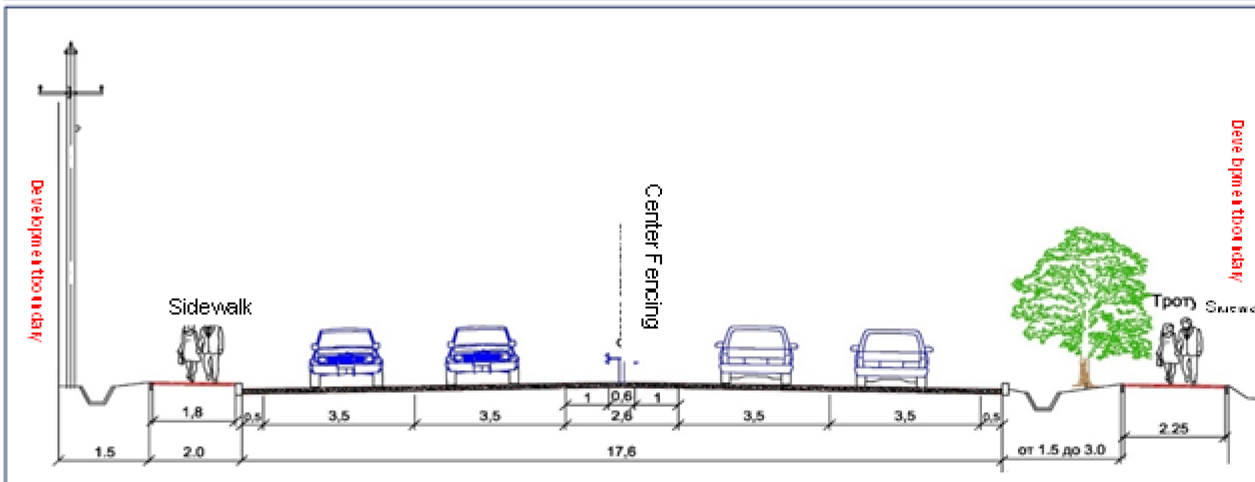
Source: Design – Survey Institute “Kyrgyzdortransproekt”. Ministry of Transport and Communications, Kyrgyz Republic.



Source: Ministry of Transport and Communications, Kyrgyz Republic



Source: Ministry of Transport and Communications, Kyrgyz Republic



Source: Ministry of Transport and Communications, Kyrgyz Republic

Figure 8: Typical cross-section of the road in built-up areas.

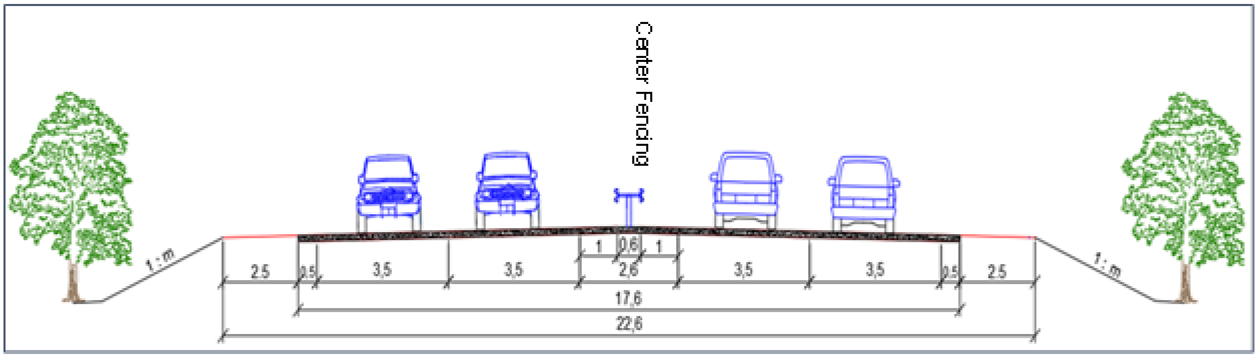


Figure 9: Typical cross-section of the road in locations outside of residential and built up areas.

b) Road Pavement

114. The road pavement will have a thickness of 60 cm, consisting of the following four layers (Figure 10 and Figure 11):

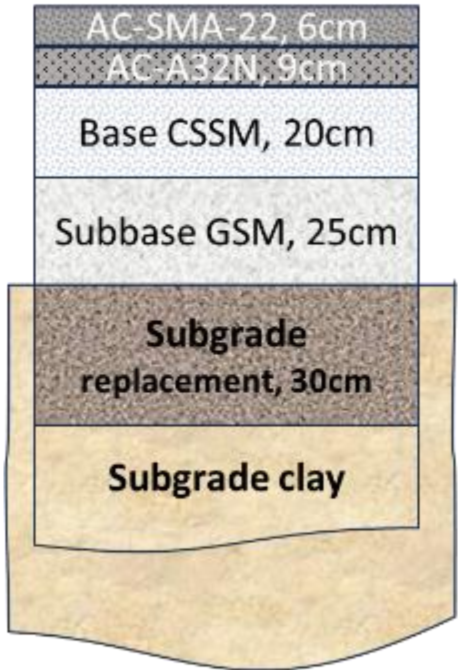
(i) Underlying layer of gravel-sand mixture;

(ii) Base course from crushed stone-sand mixture;

(iii) Bottom layer of the asphalt concrete mix; and

(iv) Surface layer of stone-mastic asphalt mix.

115. The road shoulder will be filled up with gravel-sand mixture and strengthened milled asphalt concrete mix (15 cm thick).



No.	Layer	Thickness (cm)
1	Top layer (asphalt surface): stone-mastic asphalt (SMA-22)	6
2	Bottom layer (asphalt base): A32N type asphalt concrete mixture	9
3	Base layer: crushed stone-sand mixture (CSSM)	20
4	Subgrade layer (underlaying layer): gravel-sand mixture (GSM)	25
Source: Ministry of Transport and Communications, Kyrgyz Republic		

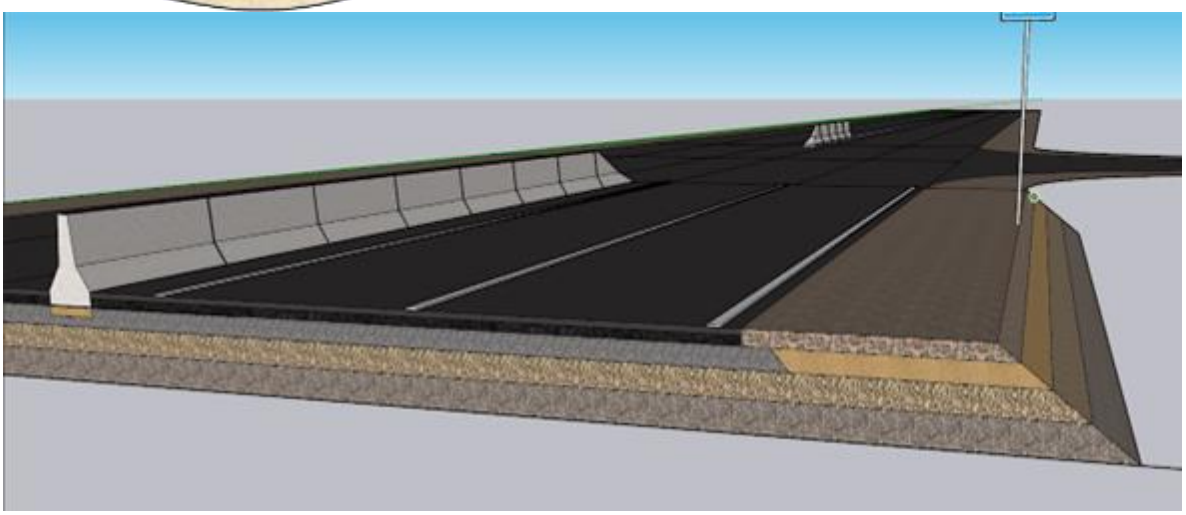


Figure 10: Road pavement layers.

Construction of pavement
Конструкция дорожной одежды

Type I/Тип I

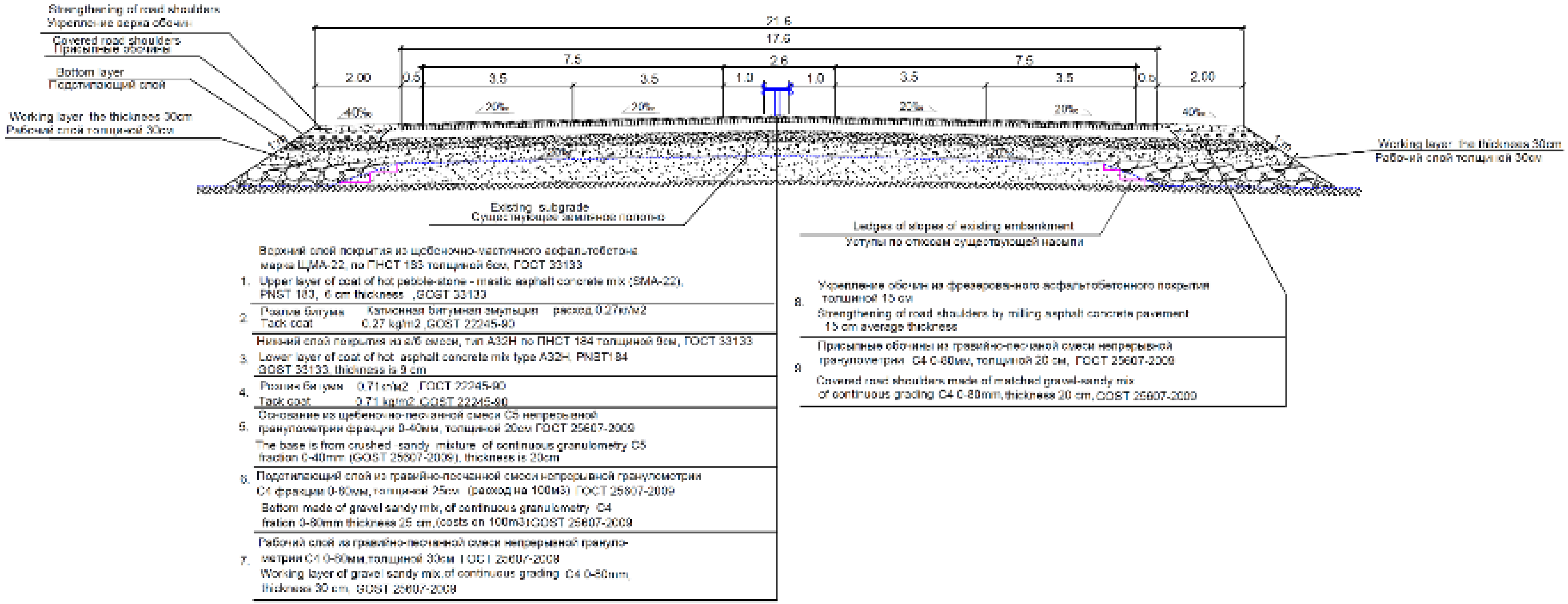


Figure 11: Road pavement design.

2. Bridges, Aqueduct and Underpasses

a) Construction of New Bridges and Repair of Existing Bridges and an Aqueduct

116. Table 2 shows the locations of the bridges and the aqueduct while Figure 12 shows the bridge design. Three (3) existing bridges will be replaced (Figure 13), one (1) new bridge constructed while the deck of one (1) bridge will be replaced. An existing aqueduct will also be replaced (Figure 14).

117. The bridges were designed in accordance with the following building codes and specifications:

(i) SNiP 2.05.03-84* (Bridges and culverts - revised edition);

(ii) SNiP 3.06.04-91 (Work execution and acceptance rules - Bridges and culverts);

(iii) SNiP KR 32-01:2004 (Motor roads);

(iv) SNiP KR 2.03-01:84 (Concrete and reinforced concrete structures);

(v) SNiP KR 20-02:2018 (Earthquake resistant construction);

(vi) SNiP 1.04.03-85* (Construction continuity standards);

(vii) GOST 33390-2015 (Public roads – Bridges); and

(viii) GOST 32960-2014 (Public roads - Normative loads, design schemes of loading).

Table 2: Location of bridges and aqueduct (new and to be replaced)

No.	Location			Intervention	Configuration
1	Chon-Jargylchak River	KM 145+136.0	42°11'18.00"N; 77°38'34.73"E	Replacement	Single 15.0m span
2	Unnamed River	KM 181+961.5	42°20'45.83"N; 78° 0'46.22"E	Replacement	Single 18.0m span
3	Jeti-Oguz River	KM 199+697.6	42°26'42.21"N; 78°10'52.94"E	Replacement	Single 18.0m span
4	Irdyk River	KM 209+534.5	42°28'26.60"N; 78°17'27.45"E	New	Single 18.0m span
5	Kichin-Kyzyl-Suu River.	KM 178+957.2	42°19'57.57"N; 77°58'52.27"E	Repair, new deck	Single 15.0m span
6	Aqueduct	KM 149+326.0	42°12'19.65"N 77°40'54.75"E	Replacement	Single 27.0m span
Source: Ministry of Transport and Communications, Kyrgyz Republic					

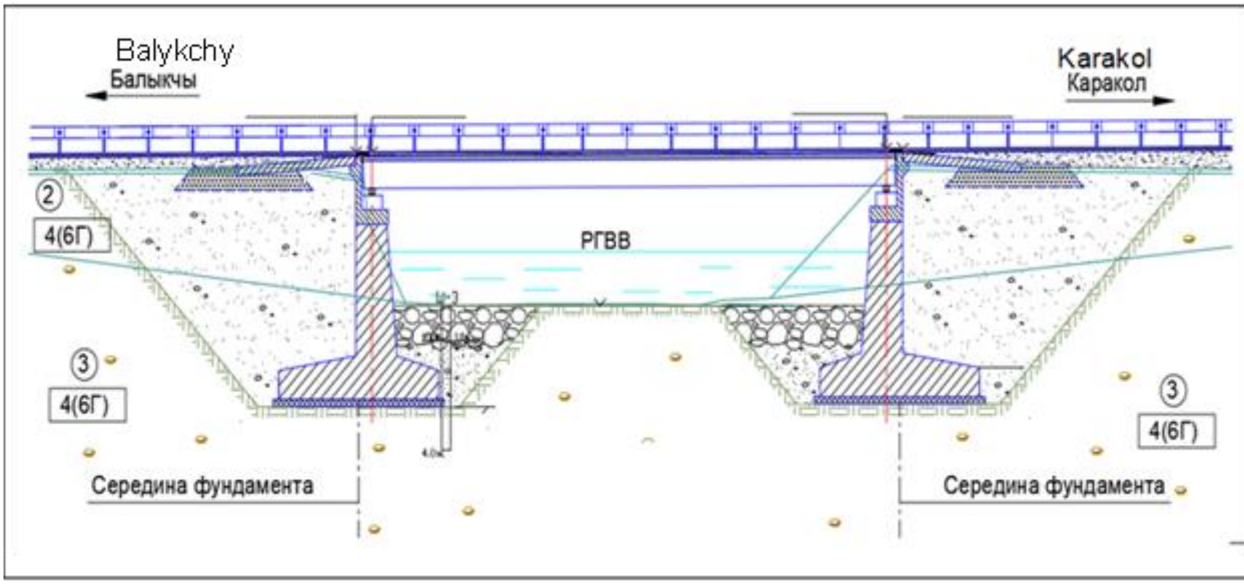


Figure 12:Typical bridge cross-section

Figure 13: Existing bridge that will be replaced (KM 181+941)

Figure 14: Existing aqueduct that will be replaced (KM 149+326.0).

b) Pedestrian Underpasses

118. Eight (8) pedestrian underpasses will be built in settlement areas along the road (Table 3 and Figure 15) mostly near schools (Figure 16). The tunnel part of the underpasses will consist of 2.5m x 3.0m pre-cast concrete box sections.

Table 3: Location of proposed pedestrian underpasses.

Location (KM)	UTM Coordinates	Village Name
149+760	42°12'30.22"N; 77°41'7.01"E	Chon-Zhargylchak
154+965	42°14'30.09"N; 77°43'23.68"E	Ak-Terek
161+141	42°16'33.09"N; 77°46'51.04"E	Jenish
169+940	42°18'35.40"N; 77°52'37.24"E	Darkhan
173+935	42°19'20.16"N; 77°55'19.53"E	Saruu
179+765	42°20'7.54"N; 77°59'25.18"E	Kyzyl-Suu
180+685	42°20'26.43"N; 78° 0'5.54"E	Kyzyl-Suu
181+500	42°20'37.28"N; 78° 0'29.20"E	Kyzyl-Suu

Source: Ministry of Transport and Communications, Kyrgyz Republic

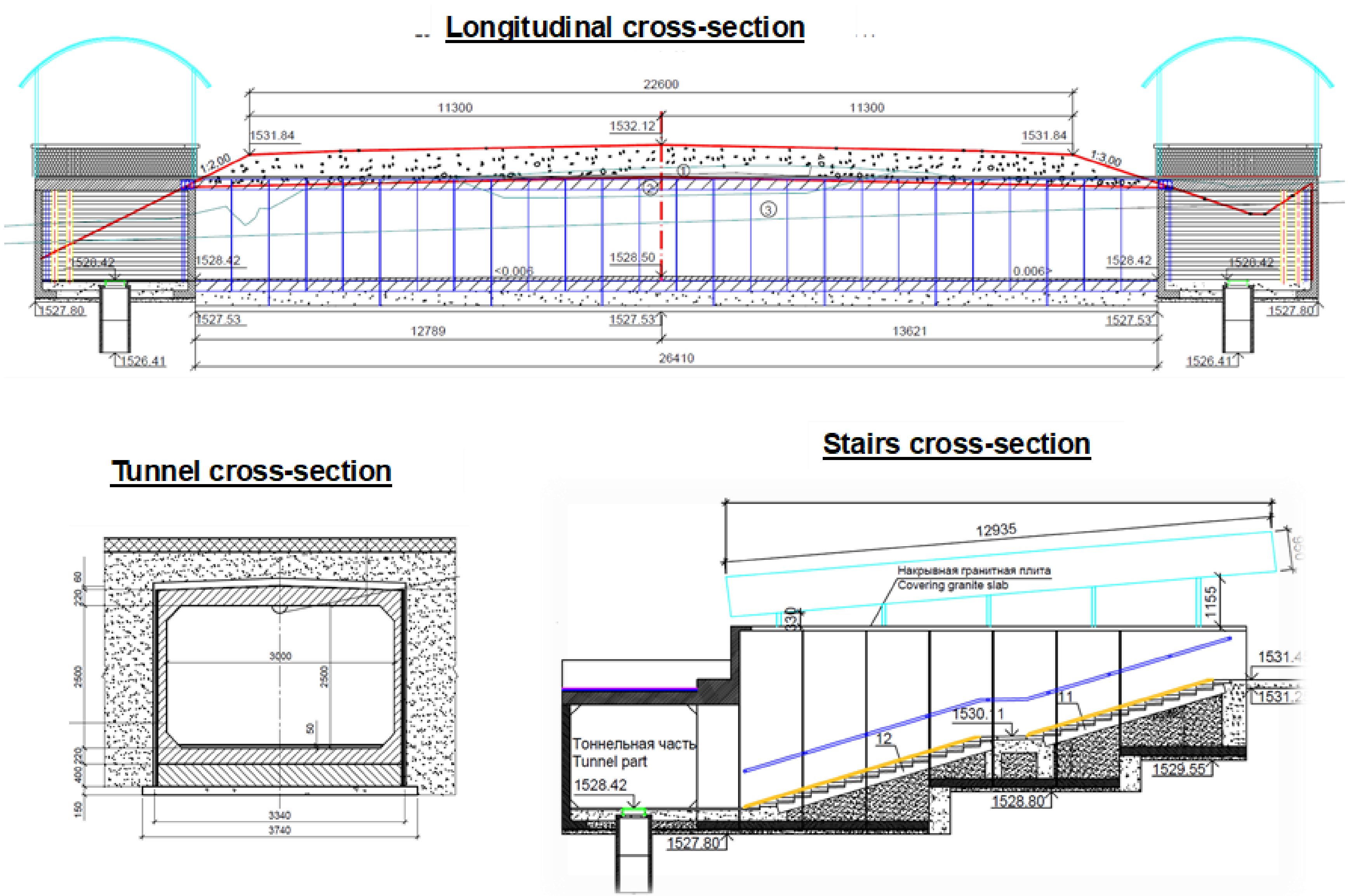


Figure 15: Typical cross-sectional drawing of pedestrian underpass.

Figure 16: Location of pedestrian underpass near a school in Kyzyl Suu Village (KM 179+765).

3. Culverts

119. Installation of new culverts, as well as replacement of existing worn-out culverts, will be carried out as part of the project (Figure 17). Existing reinforced concrete pipe culverts (d=1.0 m) will be replaced with larger diameter culverts as required in SNiP 2.05.03-84, to account for the increase in the width of the road subgrade provided for by the increase in the category of the road.

120. The existing number of culverts will be increased from 148 to 175, with corresponding increase in cross sectional area from 203 m^2 to 371 m^2 (83% increase) to facilitate the normal flow of water (snowmelt and rainwater) (Table 4). To account for potential increase in quantities of rainfall and snowmelt due to climate change an additional 26 culverts will be constructed with an additional flow area of 154 m^2 (41% increase).

121. Culverts of varying type (reinforced concrete, box concrete, reinforced box concrete) and sizes (diameters) will be provided. At specific locations along the road ramps, as necessary, 206 pipes with a total length 1, 243 meters will be provided. In addition, 241 pipe culverts will be constructed adjacent to the sidewalks at various locations (mainly in settlement areas) with a total length of 5,062 m.

122. The culverts are designed in accordance with the standard design series 3.501.1-144 (Inv. No. 1313/5 and No. 1313/2) “Reinforced concrete pipe culverts for railways and highways”, OST35-27.0-85 and OST35-27.1-85, standard project series 3.501.1-177.93 “Culverts, box reinforced concrete prefabricated for railways and roads”, SNiP KR 32-01.2004 and SNiP 2.05.03-84. The culverts are designed on the basis of non-pressure water passage with normal inlet and outlet heads, on a monolithic foundation.

Figure 17: Existing culvert in Darkhan Village (KM 170+160).

Table 4: Number of culverts.

Items	Existing road	Upgraded Road
Number of culverts	148	175
Cross sectional area	203m^2	371m^2
Percentage increase	-	82%
Number of new culverts for climate change	-	26
Cross sectional area of new drainage for climate change	-	154m^2
Percentage of new drainage for climate change	-	41%

4. Road Improvement

123. In addition to the road design, other elements are taken into account to improve the road, including: road markings, road signs, barriers, parking areas, stopping areas, enclosed bus stops, sidewalks in settlements, and toilets. Street lighting will be provided in settlements, and road intersections. Road improvement is based on the requirements of CU TR 14/2011 (Road Safety) and according to the technical requirement of GOST R 52289-2004.

a) Rest Areas with Parking

124. Provisions for Two (2) rest areas that will be constructed in the future (not as a part of this project) along the road with parking for trucks and buses, tables with benches and toilets. Figure 18 shows the layout of the proposed parking areas. The location for one of the rest areas (located at KM157+546) is an existing parking area, which has no facility except for a ramp for vehicle repair (Figure 19) while the other rest area (KM160+113) is in a new site (Figure 20).

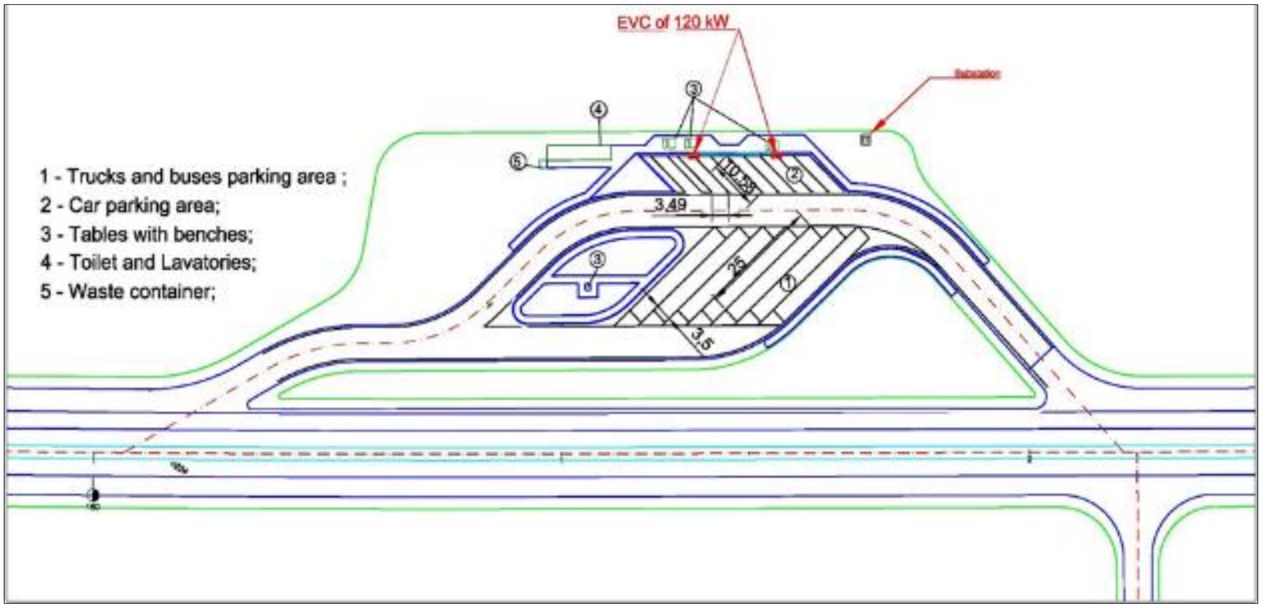


Figure 18: Parking/Rest area layout.

Figure 19: Existing parking/rest area where a new parking/rest area will be constructed between the villages of Ak Tarek and Zhenish (KM 157+438).

Figure 20: Location of proposed parking/rest area at KM160+113.

b) Road Signs

125. Road signs establish procedures for traffic, warns road users about threats to road safety or helps to navigate traffic. They include warning, prohibition, regulatory, service and information signs that organize the safety traffic. The road signs are adopted in accordance with GOST 52289-2004 and GOST 32945-2014. A total of 3,112 pcs of road signs will be mounted on 1,756 metal posts (Note: multiple road signs can be mounted on a single metal post) will be installed along the road route).

c) Road Markings

126. Road markings are markings on the road surface that serve to communicate certain information to road users. The markings can be used alone or combined with road signs or traffic lights. Horizontal and vertical road markings will be provided, which will include lines on the surface (white and yellow), markings at intersections and junctions, pedestrian crossings, road barriers, etc., as required in GOST-R 51256-2018, GOST 52289-2004, GOST 32953-2014, GOST 31151-2014. These also include thermoplastic marking based on GOST R 52289-2014 and GOST 32945-2014 to divide the road along the axis of the road and on both edges of the road.

127. Noise strips (rumble strips) will be installed in places in pedestrian crossings on the road near educational institutions and other places. Noise strips are road safety elements on the paved road surface directly in the coating layer of the road structural elements, causing vibration of the vehicle suspension elements and creating strong noise, forcing drivers to slow down. The noise strips are also installed to ensure safety at the start and at the end of settlements along the road route. It will be used in accordance with the following regulatory requirements: GOST 33025-2014 as well as the technical requirements of the road facilities are adopted in accordance with GOST 33151-2014.

d) Road Safety Fences and Barriers

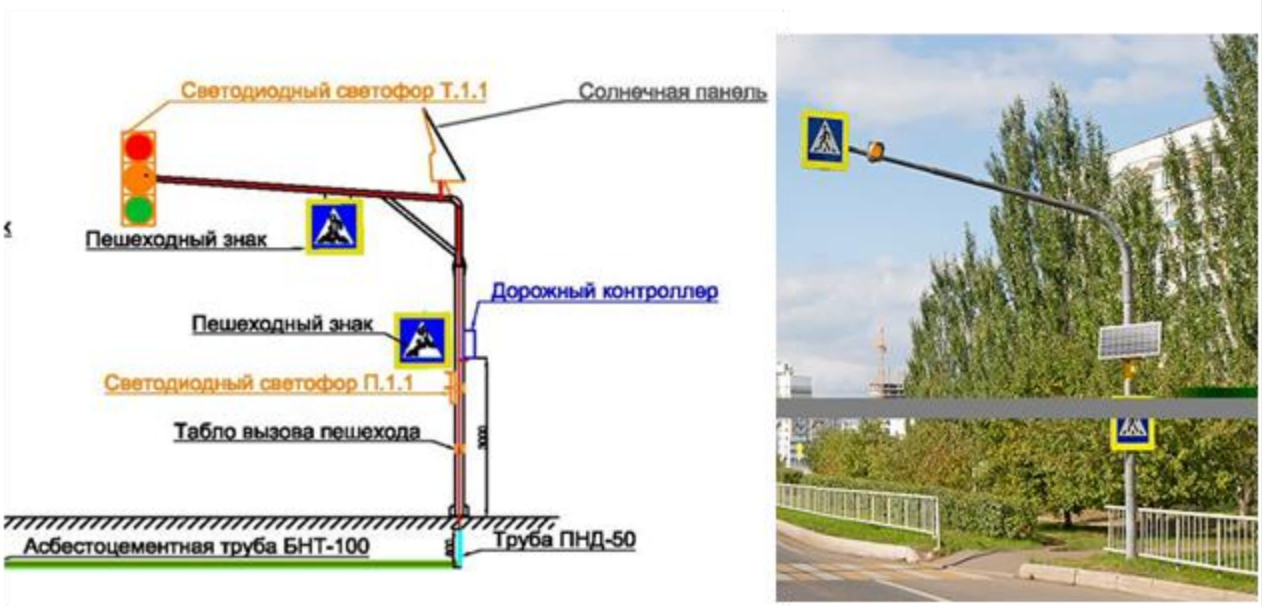
128. Parapet reinforced concrete barriers of “Sapozhok” type will be installed on high embankments and approaches to bridges (Figure 21(a)). The barriers will have light reflecting signal columns. Metal railing will be installed for the safety of bikers and pedestrians in crowded places and high embankments (more than 2.5 meters). Double-sided galvanized metal barrier fence on metal posts with light reflecting elements will be installed along the axis of the dividing strip of the road (Figure 21(b)).

129. LED traffic lights will be installed in places of high intensity of pedestrians and educational institutions. Street lighting will be installed in sections of the road in residential/built-up areas (Figure 21). Bollard (traffic delineator post) and road buffer will also be installed as necessary (Figure 21(c) and(d)).

(1) Reinforced concrete fencing | (2) Rail metal barrier fencing | (3) Bollard (traffic delineator post) | (4) Road buffer

Source: Ministry of Transport and Communications, Kyrgyz Republic

Figure 21: Road safety fences and barriers.



Source: Ministry of Transport and Communications, Kyrgyz Republic

Figure 22: Traffic signal.

e) Bus Stops

130. As part of the project, 106 bus stops will be built in settlement areas at existing and at new locations. The distance between stops will be from 400 to 600 m, depending on the situation. There will be two (2) enclosed waiting areas per bus stop.

5. Landscaping (Tree Cutting and Planting)

131. More than 5,000 trees (poplar, elm, apricot, willow, birch, juniper, and spruce) planted on the roadside will be cut (Table 5 and Figure 23) due to the road expansion. However, these trees will be replaced with new trees upon completion of road construction, two new trees for every tree that is cut. In addition, trees that die after planting will be replaced. .

Table 5: Number and sizes of trees that will be cut.

Size (Trunk Diameter, cm)	Number of Trees	
	Hardwoods*	Softwoods**
<16	1,954	740
16 - 24	148	525
24 - 32	35	510
>32	233	1,072
Total	2,370	2,847
Grand Total	5,217	
*Hardwoods (e.g., poplar, elm, apricot, willow, and birch) **Softwoods (e.g., juniper and spruce)		

Figure 23: Trees along the road route (poplar, elm, apricot, willow, birch, etc.).

132. The following general requirements and guidance for planting of trees along the road will be implemented:

(i) During construction, measures to preserve existing trees, large shrubs and other plant resources will be implemented.

(ii) Remedial/compensatory actions will be implemented such as relocating trees which are on the road's widening footprint or replacing these trees with new seedlings.

(iii) Planting of trees on the roadside must meet the following basic requirements: (a) Ensure that protective functions are achieved in accordance with requirements of project design; b) Do not reduce road safety; and (c) Plants that are planted are the most biologically stable and durable wood and shrub species.

(iv) The plants acquire protective properties within the time limits established by the project.

(v) Schemes for mixing and placing trees and shrubs should promote the full mechanization of tree planting and maintenance of the planted trees.

(vi) Environmentally and economically efficient/sustainable.

(vii) When choosing plants, it is necessary to consider the following: the adaptability of the plant to the specific conditions of the project site (physical, chemical and biological properties, microclimate, insolation (amount of sunshine), humidity, anthropogenic factors); the interaction of transplanted plants with each other, the possibility of further development of their root system, the longevity of growth in new conditions while maintaining the required qualities.

133. Tree planting will include the following specific activities:

(i) Preparation of the site where the trees will be planted;

(ii) Preparation of fertile soil layer;

(iii) Preparation of planting points (pits or trenches where the seedlings will be planted);

(iv) Preparation of planting material (seedlings);

(v) Digging out, transportation, storage of planting material;

(vi) Planting the trees and shrubs seedlings; and

(vii) Tree maintenance (watering) is the responsibility of the contractor until the end of the defect notification period.

D. Project Phases

1. Pre-Construction Phase

a) Land Allocation and Acquisition

134. Prior to the commencement of construction, additional lands (36.73 hectares) will be allocated for permanent use - for road widening, bus stops, rest areas, etc. In addition, 26 hectares of land for temporary construction offices (2 hectares at two sites) and laydown areas (24 hectares in 20 sites) will be allotted. Lands that will be temporarily used for the project will be rehabilitated after the completion of the road rehabilitation project (restored, recultivated and planted perennial grasses). The location of the temporary laydown areas and construction site offices will be determined before construction starts.

135. Land allocation will be in accordance with the following regulatory documents:

(i) SN 467-74 “Norms of land allocation for roads;

(ii) Resolution of the Government of August 18, 2017 No. 512 on approval of the procedure for the use of roads and road structures and their protection in the territory of the Kyrgyz Republic and the Procedure for the classification and numbering of public roads in the territory of the Kyrgyz Republic; and

(iii) Kyrgyz Republic Law “On automobile roads” dated June 2, 1998 No. 72.

136. Coordination and consultation with the land users or owners will be carried out with regard to the widening and alignment of the road, including right of way (ROW)) and the location of quarries, temporary laydown areas for materials and equipment to be used for construction and temporary construction sites for various purposes.

137. A detailed separate report on Land Acquisition and Resettlement is prepared discussing the extent of land acquisition and its impacts.

b) Other Activities

138. Other activities that will be implemented during the pre-construction phase include the following:

(i) Grievance Redress Mechanism (GRM): The PIU will issue public notices to inform the public within the project area of the GRM, contact information (GRM website address, PIU address and telephone number, PIU contact point email address) and local entry points (e.g., contractors);

(ii) Institutional set up and strengthening. Recruit and appoint (a) a qualified Environmental Officers within the PIU; and (b) prior to the start of construction deliver required training programs that will include relevant environmental, health and safety laws, regulations and policies; implementation of the EMP, environmental monitoring, and the GRM for both ADB and national requirements;

(iii) Update EMP (as required): Mitigation measures defined in this EMP and the EMoP will be updated based on final technical design. This will be the responsibility of the PIU's Environmental Officer. Submit to ADB for approval and disclose on project and ADB website;

(iv) Preparation and submission of Environmental Management Plans;

(v) Ensure (at a minimum) a summary of key EIA details is translated into a local language and is made accessible to local communities, affected peoples, and interested stakeholder; and

(vi) Conduct an assessment of quarries and borrow pits and ensure that risks and impacts are assessed and managed prior to works commencement (see P.145).

2. Construction Phase

a) Site Preparation Works

139. Before the commencement of the project construction activities, the following site preparation works will be carried out:

(i) Relocation of existing power transmission lines;

(ii) Relocation of communication lines;

(iii) Restoration and fixing of the route (setting-out);

(iv) Coordination on the start and schedule of construction work with traffic police, road administration, environmental administration, and other organizations;

(v) Preparation of the construction site office;

(vi) Preparation of laydown areas for equipment;

(vii) Preparation of specialized sites for storage of fuels and lubricants for use of construction equipment;

(vii) Dismantling of infrastructures (engineering structures) along the main road (Table 6);

(ix) Dismantling of road ramps;

(x) Dismantling of road signs and panels;

(xi) Dismantling of asphalt pavement;

(xii) Dismantling of reinforced concrete chutes;

(xiii) Dismantling of bus stops and bus waiting sheds;

(xiv) Dismantling of fences;

(xv) Dismantling or concrete curbstones on sidewalks;

(xvi) Dismantling of overpasses;

(xvii) Demolition of reinforced concrete parapet (Sapazhok);

(xviii) Disassembly of reinforced concrete signal posts; and

(xix) Felling/Cutting and clearing of trees - hardwoods (poplar, elm, apricot, willow, and birch) and softwoods (juniper and spruce) (Table 6);

140. As shown in Table 6, materials from demolition, dismantling and disassembly will be trucked/transported to either the ROD of MOTC or to dump sites. Materials that will be sent to ROD will be recycled/reprocessed for reuse (e.g., paving of village roads).

141. Of the asphalt pavement that will be removed from the existing road, 82.3% (58,629 m^3) will be milled and reused onsite to strengthen road shoulders, with the remaining 17.7% (12,603.6 m^3) to be trucked to nearby dump sites (within 30 kms of the project).

Table 6: Structures to be dismantled, demolished or disassembled.

Structures to be Dismantled		Quantity	Management Method/ Disposal
Engineering structures (infrastructures) along the main road – 148 pcs	Reinforced concrete blocks of pipes	1,800 pcs (797.4 m^3)	50% hauled by trucks to dump site and 50% hauled to Road Operations Department (ROD)
	Reinforced concrete floor slabs	291 pcs (135.16 m^3)	To be hauled to ROD
	Reinforced concrete wing walls	12 pcs (36.08 m^3)	To be hauled to ROD
	Asbestos-cement pipes	15.21 linear meter (625.13 kg)	To be hauled to dump site
	Metal pipes	59.5 m (2,400.9 kg)	To be hauled to ROD
	Metal barrier	56 linear meter (1,605.52 kg)	To be hauled to ROD
Dismantling of engineering structures on the ramps	Monolithic reinforced concrete pipe heads	3.2 m^3	To be hauled to dump site
	Reinforced concrete blocks of pipes	632 pcs (152.76 m^3)	To be hauled to ROD

Structures to be Dismantled		Quantity	Management Method/ Disposal
	Reinforced concrete chutes	18 linear meters (9 m^3)	To be hauled to dump site
	Metal pipes	30 linear meters (887.7 kg)	To be hauled to ROD
Dismantling of road signs, including panels	Warning signs	52 pcs (158 kg)	To be hauled to ROD
	Priority signs	48 pcs (163.2 kg)	
	Prohibitory signs	23 pcs (96.6 kg)	
	Information signs	14 pcs (490 kg)	
	Reinforce concrete km signs	46 pcs (4.14 m^3)	
Dismantling of bus stops and enclosed bus stops		25 pcs	To be hauled to ROD
Dismantling of reinforced concrete chutes		3,558 linear meters	To be hauled to Orgochor Village
Dismantling of existing asphalt pavement		58,629 m^3	Milling and reuse onsite to strengthening road shoulders
		12,603.6 m^3	To be disposed to dump site
Dismantling of fences	Metal fences	18.3 tons (6,569 linear meters)	To be hauled to ROD
	Picket fences	335 m^3 (22,326 linear meters)	To be hauled to ROD
	Brick fences	1,080 m^3 (2,217 linear meters)	To be hauled to ROD
	Fence foundations	978 m^3	To be hauled to ROD
Dismantling of concrete curb stones on sidewalks		224 m^3	To be hauled to ROD
Demolition of elevated roads (overpasses)		3 pcs (120 m^3)	To be hauled to ROD
Demolition of reinforced concrete parapet “Sapazhok”		385 linear meter (118.4 m^3)	To be hauled to ROD
Disassembly of reinforced concrete signal posts		106 pcs (2.47 m^3)	To be hauled to ROD

Source: Design Specifications, Chapter 1

b) Road Construction/Widening

(1) Sources of Key Construction Materials.

142. Potential sources of gravel (quarries), the key material for the road subgrade and underlying layers, have been identified by the MOTC. Most of these sources are located within a few hundred meters to a few kilometers of the road project (Table 7). Most of these areas are existing quarries.

Table 7: List of quarries and borrows as potential sources of gravel for road construction

No.	Station [km]	Location	Reserve	Haul Distance [km]	Estimated Vol. [m3]	Remarks
1	140+600	Right	Barskoon gravel	1.5	300,000	Barskoon River bank/bed (existing quarry)
2	140+700	Right	Barskoon stone	0.2	30,000	Barskoon River bank/bed (existing quarry)

No.	Station [km]	Location	Reserve	Haul Distance [km]	Estimated Vol. [m3]	Remarks
3	143+000	Right	Terrasovoye gravel	0.1	-	Sulo Kolot River bank/bed. Depleted.
4	154+840	Right	Gravel deposit	0.8	200,000	Hill/mountain area (existing quarry)
5	156+500	Right	Gravel deposit		576,000	Hill/ mountain area
6	171+320	Left	Gravel deposit	Lakeshore	125,000	Lakeshore area
7	173+000	Left	Jukuu Quarry	5.0	250,000	Lakeshore area
8	204+220	Right	Jeti-Oguz gravel	8.0	150,000	Hill/mountain area (existing quarry)
9	205+000	Left	Jeti-Oguz river bed gravel	1.0	200,000	Jeti-Oguz River bed.(existing quarry)
10	211+500	Right	Gravel deposit	6.0	150,000	Yrdyk River (existing quarry)
11	213+500	Right	Gravel deposit	1.5	300,000	Mountain/hill area
12	220+000	East	Ak Suu basic gravel	10.0	-	No data

143. It should be noted that the potential sources of gravels are river banks/bed or hills/mountains (Figure 24). In both cases, control measures shall be implemented to control environmental impacts of quarry/ burrow pit. Some areas are also near Lake Issyk-Kul.

144. In areas along rivers or streams, extraction of the construction materials will be carried out during the low water period using an excavator with loading into dump trucks. Materials will be extracted above the groundwater level so as not to affect river water.

145. The final sources of gravel will be identified prior to construction. As the final sources are yet to be determined, a framework on control measures will be provided in the EMP (Chapter 9 of the EIA Report).

146. It is recommended that before applying for a quarry permit, an environmental study be carried out to assess potential impacts and control measures to minimize environmental impacts of quarrying.

(2) Traffic During Construction

147. Traffic during the construction of the road will be along the existing road. Temporary bypass roads will be provided in areas where bridges and water drainage pipes are to be constructed.

(3) Drainage

148. To avoid waterlogging of the soil during construction, surface drainage will be provided for the period of road reconstruction. To do this, the surface is leveled and temporary ditches are cut by a motor grader with water drainage to low places.

(4) Compaction

149. During the construction of the subgrade, a thorough layer-by-layer compaction of soil will be ensured. Backfilling the next layer is allowed only after leveling and compacting the underlying layer with rollers to the required density.

Figure 24: Proposed quarries for gravel needed for the road construction

c) Bridge and Pipe Culvert Construction

150. Bridge construction and installation works will be carried out in accordance with the requirements of SNiP 3.06.04-91 (Bridges and Culverts).

151. During bridge construction, temporary bypasses will be provided for vehicles (Figure 25). Water pipes will also be provided for the passage of water across the road. The temporary bypasses and water pipes will be dismantled after the completion of construction.

152. Excavation of the pit for the bridge foundations will be carried out using an excavator and also manually (i.e., using shovels). The pit will be backfilled after the completion of the concrete foundations. Excess soil will be loaded into dump trucks and transported to a dump site.

153. Foundations, structural supports and retaining walls of the bridge will be constructed of monolithic concrete. The concrete mixtures will be poured in layers. Each layer will be evenly distributed over the entire cross section area of the structure (e.g., foundation). The next layer of concrete will be poured before the setting of the concrete in the previous layer.

154. The superstructure beams and slabs of the bridge will be mounted using a jib crane. Metal structures will be painted with moisture-resistant paint.

155. Similarly, digging of trenches for pipe culverts will be carried out using an excavator and manually. After installing the culverts, the trench will be backfilled. Excess soil will be loaded into dump trucks and transported to a dump site.

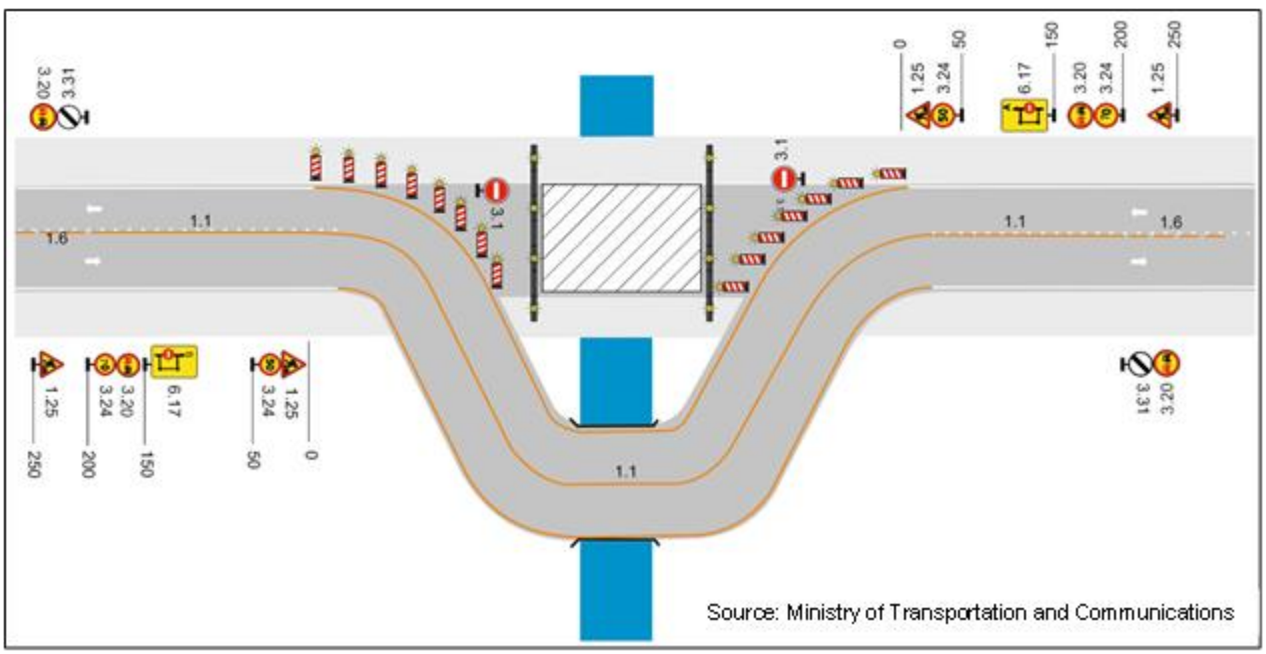


Figure 25: The working area for construction works on the bridge and large culverts.

3. Operation Phase

156. Traffic counts conducted by JOC in May 2023 (Figure 26) showed that the average annual daily traffic (AADT) in the Issyk-Kul Ring Road from Barskoon to Kyzyl Suu was 3,624 vehicles while that from Kyzyl Suu to Karakol was 5,235. These numbers are projected to increase to

13,029 in 2046 for the road segment Kyzyl Suu to Karakol while for the segment from Barskoon to Kyzyl Suu, it is projected to increase to 9,267.

Figure 26: Average Annual Daily Traffic (AADT) for the road section from Barskoon to Karakol

E. Project Schedule

157. The project's construction phase will commence in July 2024. The construction period will be 3 years and defects notification period (DNP) is 5 years. Rehabilitation and reinstatement of disturbed areas, access roads and public areas are expected to be completed during the DNP.

F. Project Cost

158. The project is currently estimated to cost approximately $90 million. ADB is currently considering a concessional loan of $40 million from ADB's ordinary capital resources and a grant of $40 million from ADB's Special Funds resources (Asian Development Fund). The balance will be financed by the government of the Kyrgyz Republic.

III. Policy, Legal and Administrative Framework

159. This chapter discusses Kyrgyz policies, laws and regulations and international treaties and conventions signed by the Kyrgyz Republic that are relevant to the project. The relevant specific provisions of the law are discussed and are also mentioned in more details in the relevant sections of the EIA Report (e.g., air quality standards in the air quality section).

160. ADB's 2009 SPS requires the application of either national or international environmental quality standards, whichever are the more stringent. Thus, the Kyrgyz National standards are compared with the International Finance Corporation/World Bank (IFC/WB) Environment, Health, and Safety General Guidelines ('EHS Guidelines', 2007), World Health Organization (WHO) Guidelines, and other relevant standards to determine, which specific standard should be applied for the project.

A. Policy and Institutional Framework

1. Constitution of the Kyrgyz Republic (adopted by referendum on 11 April 2021)

161. The Constitution of the Kyrgyz Republic, which was adopted by a referendum on 11 April 2021, is the supreme law in the Kyrgyz Republic. All laws must comply with this Constitution. Article 49 of the Constitution declares the right of the Kyrgyz people to an environment that is favorable to life and health and entitles them to compensation for damage to health or property from environmental negligence. This article of the Constitution declares that it is the duty of the Kyrgyz People to protect and care for the natural environment, flora and fauna.

2. National Environmental Action Plan

162. The National Environmental Action Plan, which was adopted in 1994, serves as a blueprint for environmental protection in the Kyrgyz Republic. This plan identifies a number of critical environmental concerns that need to be addressed. It also emphasizes the integration of environmental measures with economic and social development strategy.

3. National Development Strategy of the Kyrgyz Republic for 2018-2040, November 2018

163. The National Development Strategy of the Kyrgyz Republic for 2018-2040 sets the development policy of the Kyrgyz Republic up to 2040 in all spheres of society, including social and economic development and governance. The strategy puts emphasis on sustainable development.

164. Chapter 3.2 (Formation of sustainable environment for development) of the document, states the gradual shift to environment-friendly modes of transport (e.g., electric vehicles) as part of the national development strategy. For environment, it is envisioned to achieve environmentally sustainable economic growth through the minimization of the negative environmental impacts of economic activities, improving efficiency, provision of incentives for environmental protection and preservation of natural environment, and using reliable data to make environmentally sustainable decisions.

165. In Chapter VI (Priority steps of mid-term stage) of the strategy document, the following were specified with regard to transport:

(i) Task 7.14 (Expansion of transport and logistics opportunities). Transport infrastructure will be improved to facilitate free movement of the people and ending transport congestion of the country.

(ii) Task 7.25 (Infrastructure connectivity of the territories). High quality roads, not only of international and national importance, will be constructed to allow connectivity of the territories in the country, including the rehabilitation and modernization of Ring Road around the Issyk-Kul Lake.

166. The strategy document (Chapter 6.2) specifies that Issyk-Kul Region's focus should be its development as a tourist destination. Such will require continuous transport infrastructure development, primarily the Issyk-Kul Lake ring road and related service infrastructure. Considering the uniqueness of the Issyk-Kul Region as a biosphere territory, special efforts should be carried out to ensure its environmental preservation and safety.

4. Government Ministries and Agencies

a) Ministry of Transport and Communications (MOTC)

167. The Ministry of Transport and Communications (MOTC)[34] of the Kyrgyz Republic is responsible for the formulation and implementation of transport policy and management of road transport complex, rail and water transport. Figure 27 shows the various departments and state enterprises under the MOTC. The Department of Road Facilities and the State Enterprise "Kyrgyzavtozhol" are directly involved in the proposed road project.

168. The Department of Road Facilities (DRF) is a subordinate subdivision of the MOTC, responsible for the management of road facilities of the Kyrgyz Republic. DRF under the MOTC performs the functions of a state customer for the development and implementation of state, sectoral targeted programs in the field of road facilities, projects for the construction, reconstruction, capital, medium and current repairs of public roads, road structures financed from the Republican budget; ensuring technical supervision of road works; acceptance into operation of completed construction, reconstruction and repair of sections of public roads and artificial structures, and so on.

169. The State Enterprise "Kyrgyzavtozhol", which includes many state-owned enterprises and institutions is involved in the repair and maintenance of roads. In particular, the majority of road maintenance institutions were merged. The main task of the State Enterprise "Kyrgyzavtozhol" is to fulfill the state order for the current repair and maintenance of public roads and meet the needs of the state, legal entities and individuals in ensuring the uninterrupted and safe movement of vehicles on sections of a developed road network.

[34] http://mtd.gov.kg/polozhenie-2/

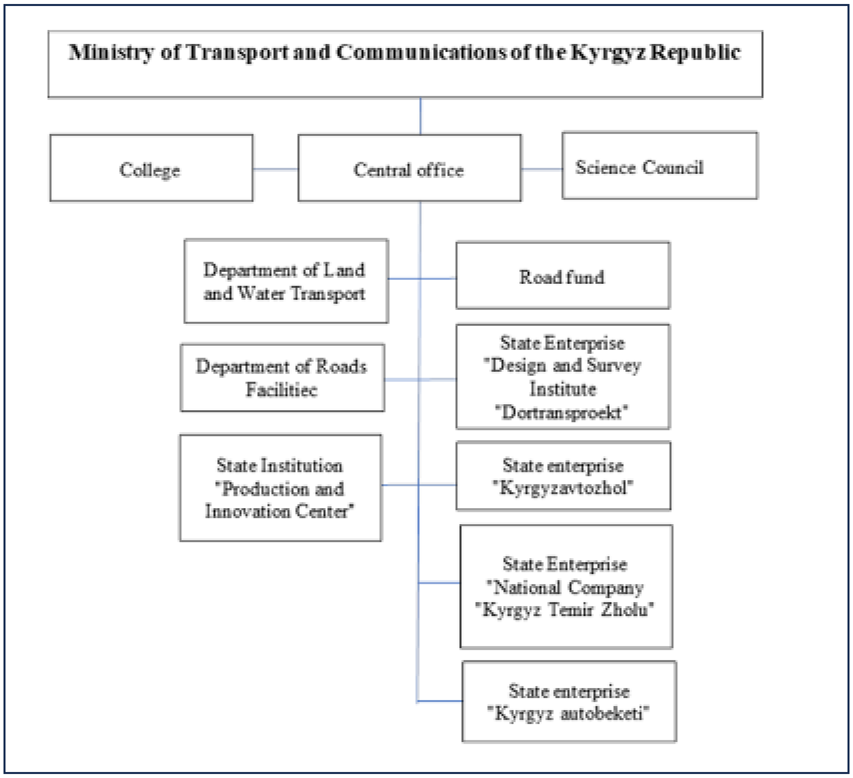


Figure 27: Organizational Structure of the Ministry of Transport and Communications of the Kyrgyz Republic

b) Ministry of Natural Resources, Ecology and Technical Supervision (MNRETS)

170. The Ministry of Natural Resources, Ecology and Technical Supervision of the Kyrgyz Republic is responsible for the development and implementation of state policy and coordination in the areas of environmental protection, ecology, climate, geology and subsoil use, use and protection of natural resources, including biological resources, subsoil and water resources, with the exception of irrigation and reclamation infrastructure. The ministry is the regulatory body responsible for ensuring compliance with the requirements of environmental safety (including chemical, biological, radiation and nuclear), industrial safety, mining safety, subsoil protection, and coal and fuel quality. The regional (oblast) and district (rayon) departments/offices of the Ministry are responsible for environmental monitoring in their respective regions and districts.

c) Other Ministries, Directorates and Departments

171. Other government ministries, agencies, directorates and departments that are concerned with the project include the following:

(i) Ministry of Agriculture, Forest Service – tree planting;

(ii) Ministry of Emergency Situation, Agency for Hydrometeorology (KyrgyzHydromet) – hydrology and meteorology;

(iii) Ministry of Culture, Information, Sports and Youth Policy - archaeological sites; and

(v) Directorate of the Biosphere Territory of Issyk-Kul – overall management of the Biosphere Territory of Issyk-Kul Lake.

B. Legal and Regulatory Framework

1. Environmental Protection

a) Law on Environmental Protection, No. 53 of 1999 (last update 2019)

172. This law states the policy and provides the general framework for environmental protection and natural resource utilization in the Kyrgyz Republic. It provides the legal basis for environmental impact assessment, setting of environmental quality standards, designation of special protected areas, use of natural resources, and environmental monitoring and control systems.

173. Environmental quality standards established by this law that are relevant to the project includes the following:

- (i) Standards of Maximum Permissible Concentrations of Hazardous Substances in Air, Water, Soils and Subsurface;
- (ii) Standards of Maximum Permissible Emissions and Discharges of Hazardous Substances; and
- (iii) Standards of Maximum Safe Noise, Vibration, and Electromagnetic Levels and Other Hazardous Physical Impacts.

174. The details of these standards are discussed in Section III C below.

175. This law prohibits the implementation of projects related to the use of natural resources without obtaining approval from the State Environmental Expertise.

b) Law on Ecological Expertise (Environmental Review), No. 54 of 1999 (last update, 2015)

176. This Law defines the requirements in the field of ecological expertise (assessment) aimed at ensuring the protection of the rights of Kyrgyz citizens for a healthy environment through the prevention of negative ecological impacts of economic and other activities. This law is implemented by Governmental Decree No. 60 on performance of environmental impact assessment (see below).

c) Law on General Technical Regulation concerning Ecological Safety in the Kyrgyz Republic, No. 151 2009 (last update, 2019)

177. This law defines the requirements with regard to ecological protection in the design and implementation of economic and production activities, including the storage, transportation and utilization of products.

178. Appendix 1 of this Law lists “Construction of roads and railways” as one of the economic activities in which an environmental impact assessment is required. The detailed OVOS process is discussed below in Section E.

d) Regulations on the procedure for conducting an environmental impact assessment in the Kyrgyz Republic, Decree No. 60 of 2015

179. These regulations establish the procedure for environmental impact assessment (EIA or OVOS[35]) required for a project or an activity. These regulations reiterate that the purpose of the EIA is to prevent and/or mitigate the impact of the proposed activity on the environment, society, and the economy. The project needs to submit an EIA Report (OVOS) to the Ministry of Natural Resources, Ecology and Technical Supervision and obtain an environmental permit prior to the start of construction.

2. Protected Areas

a) Laws on Protected Areas, No. 18 of 2011 (last update, 2018)

180. This law is concerned with the management, protection and use, and control of protected natural areas. It specifies measures such as conducting research on the unique natural features and formations and biodiversity of the protected areas to facilitate their preservation and conservation. Protected areas include: state nature reserves; state natural parks; state wildlife sanctuaries; state natural monuments; state botanical, dendrological and zoological parks; biosphere reserves; and transboundary protected areas. Measures for the protection and use of these areas include: (a) development of ecosystems; (b) state regulation; (c) use of protected areas for scientific research, culture, education, tourism; (d) liability for the infringement of the legislation on protected areas; (e) participation of natural and legal persons in the management of protected areas; (f) access of information; and (g) international cooperation. It also assigns to the local government the responsibility of enforcement of legislation on protected areas and carrying out conservation and preservation of biodiversity in the protected areas.

181. Law No. 18 was amended by Law No. 58 (issued on 02 June 2018), which defines wetlands and introduces the notion of core zone of protected areas. The core zone is defined as a section of the territory constituting not less than 75 percent of the total area of the state natural reserve necessary for the reproduction of the ecosystem where the entire natural complex is protected, monitoring of the state of ecological systems, scientific research and other activities, that do not violate the natural development of natural processes, are conducted. The core zone is determined by the scientific opinion of the National Academy of Sciences of the Kyrgyz Republic and is approved by the national environmental authority.

182. Activities and projects within the Issyk-Kul Biosphere Territory, where the road project is located, is governed by this regulation.

b) Regulation on biosphere reserve “Issyk-Kul”, Ministerial Decree No. 2000 (updated by Ministerial Decree No. 682, 2006)

183. This Ministerial Decree declares the Issyk-Kul Biosphere Reserve as a protected area set up to carry out the following functions: (a) conservation of natural landscapes, ecosystems and genetic diversity; (b) ensuring sustainable ecological development; (c) conservation of natural resources and ensuring ecologically safe nature management; and (d) ecological education of the population. Land of biosphere reserve can be in state, municipal, private and other forms of ownership.

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[35] OVOS is the acronym for Environmental Impact Assessment in Russian (Оценка воздействия на окружающую среду)

184. Ministerial Decree No. 682, which amended Ministerial Decree No. 40, requires the establishment of ecological stations in the Issyk-Kul Biosphere and collection of environmental fees for the passage of vehicles.

185. The details of the extent (boundaries) of the biosphere reserve are provided in Chapter 5 (Baseline Environmental Conditions) while the impacts of the project on the biosphere reserve is discussed in details in Chapter 6 (Impacts Assessment and Mitigation).

c) Law on sustainable development of ecological and economic area of Issyk-Kul, No. 115 of 2004 (last updated 2013)

186. This law provides a framework and the requirements for the protection and sustainable use and development of the environmental and economic area of Issyk-Kul Lake taking into consideration its special status as a natural ecosystem of global importance with a series of objects of cultural heritage protected by the state. The law defines the basic conservation principles shall consider the following: (a) conservation of global and local biological diversity; (b) conservation of cultural heritage; (c) recreational tourism; and (d) sustainable development of the area. Natural resources of the Issyk-Kul area subject to conservation and protection shall include Issyk-Kul Lake, glaciers and forests. Issyk-Kul area shall be classified as biosphere territory, reserves, sanctuaries, glaciers, wetlands, forests and health resort institutions.

187. Article 32 (Transport) of the law stipulates that construction of new roads is not allowed in the area except for the reconstruction and improvement of existing road and for the creation of tourist park highways (parkways) and bypass routes in order to reduce traffic flows in densely populated areas.

188. The International Union for Conservation of Nature (IUCN) lists two species of fish in Issyk-Kul Lake as vulnerable (VU)[36]: Issyk-Kul Dace (*Leuciscus bergi*) and Schmidt's Dace (*Leuciscus schmidti*).

d) Law on Biosphere Territories in the Kyrgyz Republic, No. 48 of 1999

189. This law defines the legal basis for the creation and operation of biosphere territories in the Kyrgyz Republic. Biosphere territories are created to preserve, restore and use areas that are rich in natural and cultural heritage, support long-term sustainable economic and social development of the territories, including the use of these territories for sustainable recreation and ecological research, awareness, and education. Biosphere territories have the status of protected territories at the national level.

190. Biosphere territories are divided on zones with various modes of protection and use:

(i) **Core zone**. Strictly protected area for the preservation of all landscape and biodiversity where economic activities are forbidden. Only research and nature protection work and monitoring with minimally possible impact on protected communities is authorized.

(ii) **Buffer zone**. Various forms of protection and conservations activities are allowed and carried out: (a) Scientific researches and establishment training centers; (b) Environmental monitoring and ecosystems management; (c) Management and protection of forests; (d) Traditional land use within the framework of conservation and preservation of biodiversity; (e) Recreational use and ecological tourism; (f) Use of mineral water and medical resources; (g) Ecological awareness, demonstration sites,

[36] VU (vulnerable) means in the IUCN Red List of Threatened Species when the best available evidence indicates that the species is considered to be facing a high risk of extinction in the wild.

establishment of centers of new environmental technologies and carrying out of training programs and management of wildlife management.

(iii) **Transition zone**. Allowed activities include: (a) Sustainable use of natural resources; (b) agricultural, industrial, medical, recreational facilities; (c) Extraction of mineral waters; and (d) Experimental sites with the industrial centers.

(iv) **Rehabilitation zone**. Allowed activities: reclamation, recultivation, and rehabilitation of areas under erosion, pastures, and forestry.

3. Biodiversity, Flora and Fauna

a) Law on Protection and Use of Flora, No. 53 of 2001 (last update, 2016)

191. This law regulates the rational use, protection, and reproduction of flora in Kyrgyz Republic. It contains seven (7) sections, namely: I - General provisions; II - Governmental management in the area of protection use and reproduction of flora; III - Use of flora; IV - Protection and rational use of flora; V- The state cadastre of flora and control over their protection and use. VI - Dispute settlement regarding the issues of the protection and use of flora; VII - Final provisions.

b) Forest Code of the Kyrgyz Republic, No. 66 of 1999 (last update 2019)

192. The Forest Code establishes the legal basis for the protection, conservation, reproduction and sustainable and rational management of forests that should result to conservation of biodiversity and ecosystem, increasing the ecological and economic potential of forests, meeting the demand of the society for forest resources in accordance with scientifically substantiated multi-use forestry.

193. The Law consists of 11 Sections: 1 - General provisions; 2 - State management and control relating to guarding, protection, regeneration and use of forest fund; 3 - Rights and obligations of forest fund plot owners and forest users; 4 - Forest uses; 5 Forest fund guarding and protection; 6 - Forest fund monitoring, registration, forest cadastre, forest inventory, forest planning; 7 - Reproduction of forests; 8 - Settlement of forest disputes and responsibility for violation of forest legislation; 9 - Financing of forestry, reimbursement of losses; 10 - Social protection and guarantees of state forest management body employees and their family members; 11 - Final provisions.

c) Law of the Kyrgyz Republic on Fish Industry, No. 39 of 1997 (last update, 2013)

194. This law regulates the legal, economic and organizational aspects for the comprehensive development of the fisheries industry of the Kyrgyz Republic aimed at the preservation and increase of fish stocks, improvement of fish productivity of water bodies and fishponds, and fully meet the needs of the population for fishery products.

195. Article 4 (Management of Fish Farms) of the Law specifies that the Government of the Kyrgyz Republic shall supervise fish reserves in fish farming reservoirs of government significance that include Issyk-Kul Lake.

d) Decree of the Government of the Kyrgyz Republic on Approval of the Lists of Rare and Endangered Species of Animals and Plants for Inclusion in The Red Book of the Kyrgyz Republic, No. 170 of 2005 (last updated, 2009)

196. This Ministerial Decree validates the list of rare, protected and endangered wild fauna and wild flora species, with a view of recording them in the national Red Book of Kyrgyz Republic. The Red Book contains information on rare, endangered or endangered species, including the number of globally important species (subspecies, populations) of wild animals, wild plants and mushrooms (hereinafter referred to as rare animals, plants and mushrooms), biology, condition and environment of their habitat and growth, acting and recommended measures for conservation, restoration, breeding (cultivation) and their possible use.

197. This decree approves the inclusion following number of flora and fauna in the Red Book:

(i) Embryophytes and fungi (99 species);

(ii) Mammals (26 species);

(iii) Birds (59 species);

(iv) Insects (18 species);

(v) Amphibians and reptiles (10 species); and

(vi) Fishes (7 species).

198. Ministerial Decree No. 471 (2009), amending Ministerial Decree No. 170 updated the list of protected and endangered wild fauna and wild flora species in the Redbook.

e) Government of the Kyrgyz Republic Decree on approval of the Regulations on the Red Book of the Kyrgyz Republic, No. 189 of 2016

199. This Decree approves the Regulations on the Red Book of the Kyrgyz Republic. It establishes a uniform procedure for the entry and exclusion of rare protected or endangered of species (subspecies, populations) (including those with global significance global significance) of wild animals, wild plants and fungi permanently or temporarily inhabiting and growing on territory of the Kyrgyz Republic, in the Red Book of the Kyrgyz Republic, determines its structure, content, as well as the procedure for its maintenance. The Red Book shall be composed of two volumes: (1) wild fauna species; and (2) wild flora species, including mushrooms.

f) Law on Wild Fauna (Wildlife), No. 59 of 1999 (last update, 2016)

200. This law establishes that wild fauna is the property of the state. The law regulates the conservation, protection, management and reproduction of wild fauna.

4. Air Quality, Noise, Greenhouse Gas Emission and Climate Change

a) Law on the Protection of Atmospheric (Ambient) Air, No. 51 of 1999 (last update, 2015)

201. This law covers the protection of atmospheric air. Protection is done through the implementation of the following measures: air quality standards, maximum emission limits, regulations of emissions from stationary and non-stationary sources, emissions fees, monitoring systems, registration of emission sources, fines and penalties for violation of the law. It also covers

the protection of the ozone layer, including the import, manufacturing and use of ozone depleting substances.

b) Law on State Regulation and Policy in the Field of Greenhouse Gas Emissions and Absorption, No. 71 of 2007

202. This law declares the policy and specifies the right, duties and responsibility of state and local government bodies, individual and legal entities on greenhouse gas (GHG) emissions reduction and carbon capture in the Kyrgyz Republic. GHG emissions reduction and capture will be carried out through the following measures: (a) state regulation; (b) compliance with environmental standards and international obligations: (c) stabilization and reduction of emissions as national priority; (d) state monitoring and registration of emissions; and (e) access to information on emissions.

c) Methodology for the design and content of report for maximum permissible and temporarily agreed emissions into the atmosphere, No. 479 of 2016.

203. This methodology was approved through Decree No. 479 of the Government of the Kyrgyz Republic dated September 2, 2016. It validates the methodology for the design and contents of the report on maximum allowable emissions to the atmospheric air by companies (business entities) in the process of planning their project/facility. Maximum allowable emissions shall be calculated for each facility and the ground level concentration of pollutants shall not exceed the established air quality standards. It contains calculation formula for emissions.

5. Water

a) Law of the Kyrgyz Republic on Water, No. 1422-XII, 1994 (last amended, 2019)

204. This law sets the framework for water management and conservation in the Kyrgyz Republic. The law stipulates that all water bodies and water resources belong to the Kyrgyz Republic and forms part of its water budget.

205. This law regulates the use and protection of water resources, including the prevention and control of adverse environmental effects of economic and other activities on the quality of water bodies and resources. This law also aims to improve water quality in bodies of water. It also defines the powers and responsibilities of state bodies on the issue of water resources management.

b) Water Code of the Kyrgyz Republic, Law No. 8 of 2005 (last update, 2019)

206. This code provides national water policies and principles based on integrated water resources management for the protection of human health and the environment. It regulates water use, protection and development of water resources to ensure adequate and safe water supply for the people of the Kyrgyz Republic, to protect the environment, and to promote rational development of the water resources of the country. It establishes the roles, responsibilities and powers of state bodies concerning water resources and management. This law declares that water resources of the Kyrgyz Republic are the exclusive and inalienable property of the State.

c) Regulation on Water Zones and Strips of Water Bodies, Government Decree No. 271 of 1995

207. This regulation establishes the procedure for setting up protected water zones and strips of water bodies to prevent pollution, depletion and/or siltation, as applicable. The boundaries of protected water zones and strips are established base on the geography, topography, hydrogeology, and beneficial use of the water body.

d) Law on Water disposal and treatment facilities of the biosphere reserve Issyk-Kul Biosphere Territory, No. 133 of 2020

208. This law aims to safeguard the rights of citizens to a healthy environment and to preserve the unique ecological system of the Issyk-Kul biosphere territory, taking into account its inclusion to the Planetary Network of Biosphere Reserves of the UNESCO. This law also aims to reduce the adverse impacts of wastewater on the environment and to prevent pollution of the ecosystem of Issyk-Kul Lake from direct discharge of domestic (sewage) and other wastewater from economic, commercial, recreational and other activities. It requires inhabited areas, recreation facilities, industrial facilities, restaurants within the biosphere territory to have water disposal (sewerage) and/or wastewater treatment facilities.

e) Rules on Protection of Surface Waters of the Kyrgyz Republic, Decree No. 128 of 2016

209. These rules aim to protect surface water against pollution, contamination and depletion as a result of economic activities that could negatively impact surface water. These rules also provide the maximum allowable limits for discharge of pollutants into surface water and encourages industrial facility to optimize recycling of water.

f) Law on Potable (Drinking) Water, No. 33 of 1999 (last updated, 2011)

210. This law regulates potable water supply including water source and water quality, in the Kyrgyz Republic. It sets the requirements for selection of water supply (which should be safe, clean and sustainable), water supply sufficiency and water quality. It also establishes the standards and requirements for bottled potable water, including certification. It also mandates the right of water consumers to access reliable information on potable water quality.

g) Technical Regulation on Safety of Potable (Drinking) Water, No. 34 of 2011 (last update, 2017)

211. This law establishes the requirements for production, supply and distribution of safe potable water to consumers to protect human health and human life from harmful contaminants that maybe present in potable water. It specifies requirements for potable water safety management system and other requirements to ensure safe potable water.

6. Cultural Heritage

212. The legal framework for the archaeological works (survey, field evaluation, and excavations) in the Kyrgyz Republic consists of state laws, regulations, and instructions adopted by the parliament and/or the government of the country. The main law in the cultural heritage area is the Law (No. 91) of the Kyrgyz Republic “On the Protection and Use of Historical and Cultural Heritage” adopted on 26 July 1999 (with amendments: 13.02.2006, No. 38; 07/25/2012, No. 143; 01/13/2014, No. 10; 11/13/2014, No. 151; 03/20/2015, No. 65; and 03/18/2017, No. 47). There

are a number of regulations and instructions drafted and adopted on the basis of this law, which regulates different aspects of the cultural heritage in the Kyrgyz Republic. Among them, the following are relevant to the project:

(i) “Regulation on the registration, protection, restoration, and use of historical and cultural heritage objects” adopted on August 20, 2002, No. 568 (with amendments: 08.25.2006, No. 614, 09/22/2014, No. 543);

(ii) “Instructions for organizing the protection zones of immovable objects of the historical and cultural heritage of the Kyrgyz Republic” adopted on 27.07.2015 № 351;

(iii) “Instructions for the registration and storage of museum objects and museum collections located in the museums of the Kyrgyz Republic” adopted on December 15, 2016, No. 617;

(iv) "The Regulation on the Archaeological Field Committee, the procedure for conducting archaeological field research and reporting scientific documentation", National Academy of Sciences of the Kyrgyz Republic, 2016; and

(v) "Procedure for registering Permit" from March 26, 2019, No. 121.

213. It should be noted that according to paragraphs 2.1, 3.1. of the “Instructions for organizing the protection zones of immovable objects of the historical and cultural heritage of the Kyrgyz Republic” all kinds of construction and economic activities, which are not related to the preservation and museumification, are prohibited within the protection area of an immovable cultural heritage object. The Instructions define the protection area of cultural heritage as an area within a radius of 50 meters from it. Consequently, an archaeological field evaluation of the construction area of the Barskoon – Karakol road will be conducted within 50 meters from the edge of the road.

7. Waste Management

a) Law on Generation and Utilization of Waste, No. 89 of 2001

214. This law declares the policy of the Kyrgyz Republic on wastes (industrial and domestic) that is aimed at the prevention of adverse impacts on the environmental and human health from improper waste management (generation, collection, storage, transportation and final disposal in landfill) and optimizing utilization (recycling) of wastes. It declares the basic principles of the of waste management in the Kyrgyz Republic to include: (a) priority of eco-friendly processes; (b) use of economic incentives for recycling; (c) penalties for improper waste handling and disposal; (d) compulsory environmental audit; and (e) free access to information on waste management. The law also prohibits the import of waste for waste disposal in the territory of Kyrgyz Republic. This law is not applicable to radioactive waste.

b) Classification of hazardous waste and guideline for determining hazard classification of waste, Decree No. 9 of 2010 (last update, 2018)

215. This decree defines the waste classification in Kyrgyz Republic for industrial (non-domestic) and hazardous wastes. It classifies wastes using a list that specifies waste characteristics and waste codes. Waste classification forms part of the waste management system and is utilized in waste inventory, transport, waste handling and disposal fees, permit issuance for transboundary movement and disposal waste. The law also specifies the requirements for designing waste treatment facilities, waste management measures and risks assessment from accidents and disasters.

8. Transport

a) Law No. 89 (of 8 July 1988) on transport

The law was adopted in 1998, covering all means of transport in the Kyrgyz Republic.

b) Law on highways, No. 72 of 1998 (last update 2014)

216. This law establishes the economic, legal basis and the principles of management of all highways in the Kyrgyz Republic. It identifies the organizations and road authorities in the field of transport and roads providing development, repair, operation of highways. It also specifies the rights, obligations, and responsibility of owners, owners and users of highways.

217. Article 3 of this law defines the right of way and establish its width depending on road category, as follows:

- Category 1 – 32 m each side from the central line of the road;
- Category 2 – 16 m each side from the central line of the road;
- Category 3 – 14 m each side from the central line of the road;
- Category 4 – 13 m each side from the central line of the road;
- Category 5 – 12 m each side from the central line of the road.
- Chapter 4 regulates repair and maintenance of the roads.

218. The proposed road project is a Category 2 road.

c) Law of the Kyrgyz Republic "On highways" No. 104 May 22, 2023.

219. This law defines the legal, economic and organizational framework for the management and use of roads, covering the development the network of roads, and the implementation of road activities aimed at ensuring the construction, preservation and improvement of the technical level and operational condition of roads. This law covers all motor roads, as well as users of the roads, in the Kyrgyz Republic, regardless of their ownership and significance.

d) Government Resolution No. 421 of 4 August 1999

220. This resolution established traffic regulations and established traffic rules, the technical conditions required for a vehicle to be permitted to operate on the roads, as well as the responsibilities for ensuring the safety of all parties involved in transport.

9. International Conventions, Agreements and Commitment Signed by the Government of Kyrgyz Republic

221. Kyrgyz Republic is a signatory or party to various international conventions, agreements and treaties related to environmental conservation, those that are relevant to the project are listed in Table 8 and discussed in the subsections below. Table 8 also shows the relevance of these conventions/agreements and the specific requirements for the project.

Table 8: International Conventions, Agreements and Commitment Signed by the Kyrgyz Republic.

SN	Convention/ Agreement/ Protocol	Date of accession and entry into force in Kyrgyz Republic	Relevance to the Project	Requirements for Projects
1	Ramsar Convention on Wetlands	Entry into force - 12 March 2003	The project site is adjacent to Issyk-Kul Lake, a Ramsar site.	The contractor shall develop and implement control measures to prevent or minimize impacts on the project.
2	United Nations Framework Convention on Climate Change (UNFCCC), Kyoto Protocol and the Paris Agreement	Kyrgyz Republic acceded to the Convention on 25 May 2000. Accession to the Kyoto Protocol - 13 May 2003. Kyrgyz Republic signed the Paris Agreement on 21 September 2016 and ratified it on 18 February 2020.	The project, being a transport project will have impacts on GHG emissions. A report on the alignment of the project with the Paris Agreement will be prepared.	The contractor shall identify and implement climate change mitigation and adaptation measures.
3	Vienna Convention for Protection of the Ozone Layer and Montreal Protocol on Substances that Deplete the Ozone Layer	’s accession to the Convention and the Protocol - 31 May 2000.	Banned ozone depleting substances (ODS) will not be used in the project.	The contractor is not allowed to use any ODS-containing materials. The PIU will confirm during implementation.
4	CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora)	Accession - 04 June 2007, Entry into force - 02 Sep 2007.	The project will not be involved in the international trade of endangered species of wild fauna and flora.	The contractor will be prohibited from poaching, hunting, and killing of animals.
5	Stockholm Convention on Persistent Organic Pollutants (POPs)	Ratification – 12 December 2006, Entry into force – March 12, 2007.	POPs listed under the Convention will not be used in the project.	The contractor shall not use POPs listed under the convention.
6	The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal	Accession – 13 August 1996, Entry into force – 11 November 1996	Hazardous wastes generated at the project site will be properly managed in accordance with the requirements of the convention.	The contractor shall develop and implement a waste management plan consistent with the requirements of the convention.
7	Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and	Ratification – 25 March 2000, Entry into Force – 24 February 2004.	The project is not expected to be involved in the international trade of hazardous chemicals and pesticides.	The project shall not be involved in the trading of pesticides.

SN	Convention/ Agreement/ Protocol	Date of accession and entry into force in Kyrgyz Republic	Relevance to the Project	Requirements for Projects
	Pesticides in International Trade			
8	Convention Concerning the Protection of the World Cultural and Natural Heritage	Accession – 03 July 1995	One of the three sites in Kyrgyz Republic inscribed in the World Heritage List is the Silk Roads: the Routes Network of Chang'an-Tianshan Corridor, which include the Issyk-Kul Ring Road. The other two sites (Sulaiman-Too Sacred Mountain and Western Tien-Shan) are far from the project site and would unlikely be affected by the project	The project shall conduct a cultural and natural heritage survey and comply with the requirement of the Ministry of Culture of the Kyrgyz Republic with regards to the management of the identified sites.
9	The UNECE (United Nations Economic Commission for Europe) Convention on Environmental Impact Assessment in a Transboundary Context (Espoo Convention)	Ratification - 01 May 2001, Accession - 30 July 2001	An EIA is required for the “construction of a new road of four or more lanes, or realignment and/or widening of an existing road of two lanes or less so as to provide four or more lanes, where such new road, or realigned and/or widened section of road, would be 10 km or more in a continuous length.	The project shall prepare an EIA for the project.
10	United Nations Convention to Combat Desertification (UNCCD)	Accession - 19 September 1997	The project area will not potentially contribute to desertification.	The project shall ensure that it will not contribute to desertification, i.e., shall not change the ecosystems within the project site.
11	Convention on Biological Diversity (CBD)	Accession – 06 August 1996, Enter into force – 04 November 1996.	The project is in the Issyk-Kul Biosphere Territory, an identified area of biodiversity in Kyrgyz Republic.	The project shall develop and implement a biodiversity management plan.
12	Convention on the Conservation of Migratory Species of Wild Animals	Entry into force - 2014	Kyrgyz Republic is on the migration range of birds, including Issyk-Kul Lake. It is part of the “Central Asian Flyway”.	The project shall conduct an EIA and identify control measures to prevent or minimize disruption of nearby bird habitats.

SN	Convention/ Agreement/ Protocol	Date of accession and entry into force in Kyrgyz Republic	Relevance to the Project	Requirements for Projects
13	UNECE Convention on Long-range Transboundary Air Pollution (CLRTAP)	Accession - 25 May 2000	Increased vehicular emissions are expected during the operation phase of the project.	The project design ensures that travel efficiency is increased with the corresponding decrease in emissions/km travel.
14	UNECE Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (Aarhus Convention)	Accession - 1 May 2001.	Public participation and stakeholders' consultation is carried out as part of the EIA process. The EIA Report is made available to the public.	The EIA Report will be posted for 120 days in ADB website for public comment. Stakeholder consultations are held.
15	International Labor Organization (ILO)	Member since 31 March 1992.	Fundamental labour standards: ▪ freedom of association and the effective recognition of the right to collective bargaining; ▪ the elimination of all forms of forced or compulsory labor; ▪ the effective abolition of child labor; ▪ the elimination of discrimination in respect of employment and occupation; and ▪ a safe and healthy working environment.	The PIU, consultants and contractor will follow all applicable ILO conventions and regulations.

a) *Ramsar Convention on Wetlands (1971)*

222. The Ramsar Convention on Wetlands is an inter-governmental treaty adopted in Ramsar, Iran in 1971 and came into force in 1975. Its mission is "the conservation and wise use of all wetlands through local and national actions and international cooperation"37. The convention entered into force in Kyrgyz Republic on 12 March 2003. Kyrgyz Republic has currently three (3)

[37] Ramsar Convention. https://www.ramsar.org/about-the-convention-on-wetlands-0 last accessed on March 15, 2023.

designated “Wetland of International Importance” (Ramsar Sites) that include the Issyk-Kul Lake, which is adjacent (and at some points only a few meters from) to the project site[38]. A detailed discussion of Issyk-Kul Lake is provided in Chapter 4 of this EIA Report.

b) United Nations Framework Convention on Climate Change (UNFCCC) (1994) and the Paris Agreement (2015)

223. The UNFCCC, which entered into force on 21 March 1994, aims to prevent “dangerous” human interference with the global climate system. Kyrgyz Republic acceded to the Convention on 25 May 2000. The Kyoto Protocol was adopted in Kyoto, Japan on 11 December 1997 and entered into force on 16 February 2005. There are currently 192 parties (Canada withdrew from the protocol, effective December 2012) to the Protocol.

224. The Paris Agreement[39] is a legally binding international treaty on climate change adopted by 196 Parties in Paris, on 12 December 2015 and entered into force on 4 November 2016. Its goal is to limit global warming to well below 2, preferably to 1.5 degrees Celsius, compared to pre-industrial levels. It requires each Party to prepare, communicate and maintain successive nationally determined contributions (NDCs), which specify the plans by each country in reducing its national GHG emissions and adapting to the impacts of climate change. Kyrgyz Republic signed the Paris Agreement on 21 September 2016 and ratified it on 18 February 2020. Kyrgyz Republic submitted the updated version of its First NDC on 09 October 2021.

c) Vienna Convention for Protection of the Ozone Layer (1985) and Montreal Protocol on Substances that Deplete the Ozone Layer (1987)

225. The Vienna Convention is an international convention aimed at protecting human health and the environment against adverse effects of the modifications of the ozone layer due human activities. The Montreal Protocol is a global agreement to protect the Earth’s ozone layer by phasing out the production and consumption of ozone depleting substances (ODS) such as hydrofluorocarbons (HFCs). Kyrgyz Republic’s accession to the Vienna Convention and the Montreal Protocol was on 31 May 2000.

d) CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora)

226. CITES is an international agreement between governments to ensure that international trade in specimens of wild animals and plants does not threaten the survival of the species. Trade in specimens of species included in CITES list is prohibited except in accordance with the provisions of the Convention.

227. Kyrgyz Republic accession to CITES was on 04 Jun 2007 (joining) and 02 Sep 2007 (entry into force).

e) Stockholm Convention on Persistent Organic Pollutants (2006)

228. The Stockholm Convention on Persistent Organic Pollutants aims to eliminate or reduce the release of POPs in the environment. POPs are chemicals that remain intact in the environment for long periods, become widely distributed geographically, accumulate in the fatty tissue of

[38] Kyrgyzstan Ramsar Sites: Issyk-Kul Lake (within a few meters project site), Son-Kol Lake (approximately 150 km from the project site), and Chatyr Kul (more than 200 meters from the project site)
[39] The Paris Agreement. https://unfccc.int/process-and-meetings/the-paris-agreement last accessed on March 15, 2023.

humans and wildlife, and have harmful impacts on human health or on the environment. Exposure to Persistent Organic Pollutants (POPs) can lead to serious health effects including certain cancers, birth defects, dysfunctional immune and reproductive systems, greater susceptibility to disease and damages to the central and peripheral nervous systems. The Stockholm Convention requires its parties to take measures to eliminate or reduce the release of POPs into the environment. The Convention was adopted on 22 May 2001 and entered into force on 17 May 2004.

229. Kyrgyz Republic ratified the convention on 12 December 2006 and it entered into force on 12 March 2007.

f) The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal

230. The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal is a global environmental treaty to protect human health and the environment against the adverse effects of hazardous and other wastes. The Basel Convention regulates the transboundary movements of hazardous and ensure that hazardous and other wastes are managed and disposed of in an environmentally sound manner by minimizing the quantities that are moved across borders, treating and disposing of wastes as close as possible to their place of generation and preventing or minimizing the generation of wastes at source. The convention was adopted in 1989 and entered into force in 1992.

g) Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade

231. The Rotterdam Convention's aims to promote shared responsibility and cooperative efforts in the international trade of certain hazardous chemicals by facilitating information exchange about their characteristics, by providing for a national decision-making process on their import and export. The Rotterdam Convention was adopted on 10 September 1998 and entered into force on 24 February 2004.

232. Kyrgyz Republic ratified the Rotterdam Convention on 25 May 2000 and it entered into force on 24 February 2004.

h) Convention Concerning the Protection of the World Cultural and Natural Heritage

233. The Convention defines the kind of natural or cultural sites that can be considered for inscription on the World Heritage List. Parties to the convention are required to identify potential sites and define their role in protecting and preserving them. The convention promotes integration of protection of the cultural and natural heritage into regional planning, including the allocation of necessary resources, undertaking scientific and technical conservation research and adopting measures that give the heritage a function in the day-to-day life of the community.

234. The following three (3) sites in Kyrgyz Republic are inscribed in the World Heritage List:

(i) Silk Roads: the Routes Network of Chang'an-Tianshan Corridor (year of inscription: 2014);

(ii) Sulaiman-Too Sacred Mountain (year of inscription: 2009); and

(iii) Western Tien-Shan (year of inscription: 2016).

235. The Issyk-Kul Ring Road is part of the route network of the silk roads of the Chang'an-Tianshan Corridor. The other two sites are far from the project site and would unlikely be affected by the project.

i) The UNECE Convention on Environmental Impact Assessment in a Transboundary Context (Espoo Convention)

236. The Espoo Environmental Impact Convention sets out the obligations of Parties to assess the environmental impact of certain activities at an early stage of planning. It also lays down the general obligation of States to notify and consult each other on all major projects under consideration that are likely to have a significant adverse environmental impact across boundaries.

237. The UNECE Convention on EIA, requires the Parties to take all appropriate and effective measures to prevent, reduce and control significant adverse transboundary environmental impact from proposed activities. It requires preparation of the environmental impact assessment documentation for projects that are likely to cause significant adverse transboundary impact as listed in Appendix I of the Convention, including public participation in the EIA. Included in the list of projects is the “construction of a new road of four or more lanes, or realignment and/or widening of an existing road of two lanes or less so as to provide four or more lanes, where such new road, or realigned and/or widened section of road, would be 10 km or more in a continuous length.

238. Kyrgyz Republic adopted the convention on 25 February 1991 and it entered into force on 10 September 1997.

j) United Nations Convention to Combat Desertification (UNCCD)

239. The United Nations Convention to Combat Desertification (UNCCD), which was established in 1994, is a multilateral commitment to mitigate the impact of land degradation, and to protect the land so it can provide food, water, shelter and economic opportunity to all people. Specifically, it envisions a future that “avoids, minimizes, and reverses desertification/land degradation and mitigates the effects of drought in affected areas at all levels and strive to achieve a land degradation neutral world consistent with the 2030 Agenda for Sustainable Development, within the scope of the Convention”.

240. The UNCCD was adopted on 14 October 1994 and ratified on 26 December 1996.

k) Convention on Biological Diversity (CBD)

241. The Convention on Biological Diversity is dedicated to promoting sustainable development and recognizes that biological diversity is about more than plants, animals and microorganisms and their ecosystems – it is about people and our need for food security, medicines, fresh air and water, shelter, and a clean and healthy environment in which to live.

242. The CBD establishes the following requirements, among others: (1) Carry out EIA for all proposed projects that may have adverse effects on biodiversity; (2) Ensure public participation in EIA process.

243. The CBD entered into force on 29 December 1993.

l) Convention on the Conservation of Migratory Species of Wild Animals (CMS)

244. The United Nations Convention on the Conservation of Migratory Species of Wild Animals (CMS) provides a global platform for the conservation and sustainable use of migratory animals

and their habitats. For migratory species threatened with extinction (Appendix I of the Convention), CMS Parties strive towards strictly protecting these animals, conserving or restoring the places where they live, mitigating obstacles to migration and controlling other factors that might endanger them. For migratory species that need or would significantly benefit from international co-operation (listed in Appendix II of the Convention) the Convention encourages the parties on the migratory range (path) to conclude global or regional agreements.

m) UNECE Convention on Long-range Transboundary Air Pollution (CLRTAP)

245. The CLRTAP aims to limit and gradually reduce and prevent air pollution including long-range transboundary air pollution. This will be done through exchanges of information, consultation, research and monitoring, development of policies and strategies on combating the emission of air pollutants (Sulphur emissions, nitrogen oxides, volatile organic compounds, heavy metals, persistent organic pollutants (POPs), ground-level ozone and particulate matters).

246. The CLRTAP was adopted on 13 November 1979 and entered into force on 16 March 1983. Kyrgyz Republic acceded to CLRTAP on 25 May 2000.

n) UNECE Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (Aarhus Convention)

247. The Aarhus Convention guarantees the rights of access to information, public participation in decision-making, and access to justice in environmental matters. The Aarhus Convention provides for:

(i) Access to environmental information. The right of the citizens to receive environmental information that is held by public authorities.

(ii) Public participation in environmental decision making. The right of the citizens to participate in preparing plans, programs, policies, and legislation that may affect the environment.

(iii) Access to justice. The right of the citizens to have access to review procedures when their rights with respect to access to information or public participation have been violated.

248. The convention was adopted on 25 June 1998 and entered into force on 30 October 2001. Kyrgyz Republic acceded to the Aarhus Convention on 01 May 2001.

10. Labor and Working Conditions

a) ILO Declaration on Fundamental Principles and Rights at Work (1998)(as amended in 2022)

249. This declaration[40] requires all members “to respect, to promote and to realize, in good faith… the principles concerning the fundamental rights, namely:

(i) freedom of association and the effective recognition of the right to collective bargaining;

(ii) the elimination of all forms of forced or compulsory labor;

[40] ILO Declaration on Fundamental Principles and Rights at Work (1998).https://www.ilo.org/declaration/thedeclaration/textdeclaration/lang--en/index.htm

(iii) the effective abolition of child labor;

(iv) the elimination of discrimination in respect of employment and occupation; and

(v) a safe and healthy working environment.

250. These requirements are embodied in various conventions, particularly in the following fundamental conventions and protocol:

(i) Forced Labor Convention, 1930 (No. 29);

(ii) Protocol of 2014 to the Forced Labor Convention, 1930;

(iii) Freedom of Association and Protection of the Right to Organize Convention, 1948 (No. 87);

(iv) Right to Organize and Collective Bargaining Convention, 1949 (No. 98);

(v) Equal Remuneration Convention, 1951 (No. 100);

(vi) Abolition of Forced labor Convention, 1957 (No. 105);

(vii) Discrimination (Employment and Occupation) Convention, 1958 (No. 111);

(viii) Minimum Age Convention, 1973 (No. 138);

(ix) Occupational Safety and Health Convention, 1981 (No. 155);

(x) Worst Forms of Child Labour Convention, 1999 (No. 182); and

(xi) Promotional Framework for Occupational Safety and Health Convention, 2006 (No. 187).

251. More than 500 specific instruments guide the implementation of these conventions.

C. Environmental Standards

252. ADB's SPS requires the application of either national or international environmental quality standards, whichever are the more stringent. Thus, the Kyrgyz National standards are compared with the International Finance Corporation/World Bank (IFC/WB) Environment, Health, and Safety General Guidelines ('EHS Guidelines', 2007).

1. Ambient Air Quality

a) Hygienic Norms 'Maximum permissible concentrations of substances in ambient air in urban areas'

253. The hygienic norms were set through Decision of the Government of the Kyrgyz Republic No. 201 issued on 11 April 2016. It establishes the maximum permissible concentrations of pollutants in ambient air in urban and rural residential areas. The standards set the maximum one-time and average daily maximum permissible air pollutant concentrations, including the hazard class and the limiting hazard index, which is the basis for setting the standard for a specific substance (Table 9).

b) WHO Air Quality Guidelines

254. The WHO air quality guidelines provide background information and guidance to support policy development and project assessment and decision-making (Table 9). The guidelines identify pollutant levels below which exposure would not constitute a significant public health risk,

based on current scientific understanding. The guidelines are adopted by ADB in its Safeguard Policy Statement as a basis for assessment of projects supported by the bank through its adoption of the IFC Guideline on air quality. Updated guidelines were published by WHO in 2021. Along with other agencies and jurisdictions, ADB is currently considering how these should be incorporated into policy. The previous (2005) guidelines referenced in the IFC Guideline on ambient air quality were used in this assessment.

255. Interim targets are proposed by the WHO as incremental steps in progressive improvements in air quality, and are intended for use in areas where pollution is high. These targets aim to promote a shift from high air pollutant concentrations, which have acute and serious health consequences, to lower air pollutant concentrations. Progressively achieving these targets will deliver improvements in environmental quality and health risks for exposed populations. The WHO considers that countries should seek to achieve the guideline values rather than treating the interim targets as objectives.

Table 9: Air Quality Standards and Guidelines, μg/m^3

Pollutant	Averaging Period	Kyrgyz National Standards	WHO Guideline
NO_2	Annual	-	40
	24 hours	40	-
	Maximum	85	200 (18 hours per year)
PM_{10}	Annual	40	70 (Interim target 1)
			50 (Interim target 2)
			30 (Interim target 3)
			20 (guideline)
	24 hours	60	150 (Interim target 1)
			100 (Interim target 2)
			75 (Interim target 3)
			50 (guideline)
	Maximum	300	-
$PM_{2.5}$	Annual	25	35 (Interim target 1)
			25 (Interim target 2)
			15 (Interim target 3)
			10 (guideline)
	24-hour	35	75 (Interim target 1)
			50 (Interim target 2)
			37.5 (Interim target 3)
			25 (guideline)
	Maximum	160	-
SO_2	Maximum	500	-
	10 minutes	-	500 (guideline)
	24 hours	40	125 (Interim target 1)
			50 (Interim target 2)
			20 (guideline)
CO	15 minutes		100000
	24 hours	5000	

2. Noise

a) *Noise in the workplace, in the premises of residential and public buildings and at the territory of residential development.*

256. Permissible noise levels (norms) at various locations (workplace, residential areas, public buildings) are established by Decision of the Government of the Kyrgyz Republic No. 201 issued on 11 April, 2016. These norms cover: (a) sanitary-epidemiological requirements; (b) standard parameters and permitted levels of noise in the workplace; and (c) permissible noise levels in premises of residential and public buildings, and in residential areas.

257. The Kyrgyz National Noise Standards are shown in Table 10. These take the form of design aims or noise limits, which are not sufficient for use in the environmental impact assessment where the effect of change in noise levels need to be considered. In addition, the absolute noise levels provided in the Table do not provide specific internal noise levels for the community facilities identified within this study including for example shops or mosques.

Table 10: Kyrgyz Republic Noise Standards.

Description of Activity / Category	$L_{pAeq,T}$		$L_{pAmax,F}$	
	Day	Night	Day	Night
Areas immediately adjacent to hospitals and sanatoriums	45	35	60	50
Areas immediately adjacent to dwellings, polyclinics, dispensaries, rest homes, holiday hotels, libraries, schools, etc.	55	45	70	60
Areas immediately adjacent to hotels and dormitories	60	50	75	65
Recreational areas in hospitals and sanatoriums	35		50	
Rest areas at the territories of micro-districts and building estates, rest houses, sanatoriums, schools, homes for the aged, etc.	45		60	

b) *IFC EHS Guidelines - Noise*

258. The International Finance Corporation (IFC) Guidelines[41] are set out in Table 11. These are again in the form of design aims, which it states have been taken from the WHO Community Noise Guidelines 1999 (CNG)[42] and which should not be exceeded. The levels of 55dB and 45dB for day and night time for dwellings are identical to those included in the Kyrgyz Standards, however they are levels below which there are no demonstrable effects of noise on health, and not levels at which there would be considered to be significant noise impacts. The noise levels are referred to as the ‘incident outdoor noise level’ to distinguish them from either façade or free field noise levels. The level of 70dB for industrial and commercial premises is not appropriate as an environmental noise standard and is based on a WHO hearing damage criterion. It should be noted that the WHO CNG has been partially replaced by the WHO Environmental Noise Guidelines (ENG)[43] which prescribes guideline environmental noise levels which are more stringent than those set out in the IFC Guidelines.

[41] Environmental, Health, and Safety (EHS) Guidelines. Environmental Noise Management. International Finance Corporation. World Bank Group. April 30 2017
[42] WHO CNG (World Health Organization) Community Noise Guidelines
[43] WHO ENG (World Health Organization) Environmental Noise Guideline.

Table 11: IFC Noise Guidelines

Receptor	Noise Level Guidelines (LpAeq,$_{1hr}$ (dBA))	
	Daytime (07:00 - 22:00)	Night time (22:00 - 07:00)
Residential, institutional, educational	55	45
Industrial, commercial	70	70

259. The IFC guidelines also state that noise increases should not exceed 3dB, but do not distinguish between the assessment of temporary effects e.g., construction activities, and permanent effects e.g., changes in road traffic noise.

260. Notwithstanding separate assessment criteria have been for the assessment of construction noise and operational noise and to avoid confusion these have set out in the relevant sections.

3. Water

a) Hygienic Norm GN 2.1.5.1315-03 - Safe concentration levels (maximum permissible concentrations, MPC) of chemicals in the water of waterbodies destined for potable, economic, and recreational water uses.

261. These standards as issued under Decree No. 20 of Chief Sanitary Inspector sets the safe concentration levels of pollutants in ground and surface water sources utilized for centralized and non-centralized water supplies for domestic, recreational, drinking and hot water system uses (Table 12 and Table 13). Hygienic Norm GN 2.1.5.1315-03 is amended by GN 2.1.5.2280-07 SanPiN2.1.5.980-00.

Table 12: General Requirements on the composition and properties of water of watercourses and reservoirs for various types of water use (household, domestic and fishery water use)

<table>
<tr><th rowspan="3">No.</th><th rowspan="3">Indicators</th><th colspan="4">Objectives of water use</th></tr>
<tr><th rowspan="2">Household and drinking needs of the population</th><th rowspan="2">Cultural and household needs of the population</th><th colspan="2">Fishing needs</th></tr>
<tr><th>Highest and first category</th><th>Second category</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th></tr>
<tr><td rowspan="3">1</td><td rowspan="3">Suspended solids</td><td colspan="4">When wastewater is discharged by a specific water user, works are carried out on a water body and in the coastal zone, the content of suspended substances in the control alignment (point) should not increase in comparison with natural conditions by more than:</td></tr>
<tr><td>0.25mg/l</td><td>0.75mg/l</td><td>0.25mg/l</td><td>0.75mg/l</td></tr>
<tr><td colspan="4">For watercourses containing more than 30 mg/ cubic dm of natural suspended substances in the boundary, an increase in their content in water within 5% is allowed.
Return (wastewater) containing suspended solids with a deposition rate of more than 0.2 mm/s is prohibited to be discharged into water bodies, and more than 0.4 mm/s into watercourses.</td></tr>
<tr><td>2</td><td>Floating impurities (substances)</td><td colspan="4">On the surface of the water, films of petroleum products, oils, fats and accumulations of other impurities should not be detected.</td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">Coloration</td><td colspan="2">Should not be detected in the column</td><td colspan="2" rowspan="2">Water should not acquire an extraneous color</td></tr>
<tr><td>20 cm</td><td>10 cm</td></tr>
</table>

No.	Indicators	Objectives of water use			
		Household and drinking needs of the population	Cultural and household needs of the population	Fishing needs	
				Highest and first category	Second category
1	2	3	4	5	6
4	Smells, tastes	Water should have odor with an intensity of more than 2 points, detectable, directly or during subsequent chlorination or other methods of treatment		Water should not result to foreign odors and tastes to fish meat.	
5	Temperature	Summer water temperature as a result of wastewater discharge should not rise by more than $3^{o}C$ compared to the average monthly water temperature of the hottest month of the year in the last 10 years.		The water temperature should not rise compared to the natural temperature of the water body, by more than $5^{o}C$ with a total temperature increase of not more than $20^{o}C$ in summer and 5 ^{o}C in winter for water bodies inhabited by cold-water fish (salmon and whitefish), and no more than $28^{o}C$ in summer and $8^{o}C$ in winter in other cases.	
6	Hydrogen index (pH)	Should not go beyond 6.5 - 8.5.			
7	Mineralization of water	Not more than 1000 mg/l, including chlorides 350 mg/l, sulphates - 500 mg/l		Rationed according to the taxations of fishery water bodies	
8	Dissolved oxygen	Must not be less than 4 mg/l at any time of the year in a sample taken before 12 p.m.		In the winter (subglacial) period should be at least:	
				6 mg/l	4 mg/l
				In summer (open) on all water bodies should be at least 6 mg/cubic dm	
9	Chemical oxygen demand (COD), bichromate oxidability	Must not exceed:		-	-
		15 mgO_2/l	30 mgO_2/l		
10	Biochemical oxygen demand (BOD)	At a temperature of 20 degrees Celsius should not exceed:		At a temperature of 20 degrees Celsius should not exceed:	
		2 mgO_2/l	4 mgO_2/l	3 mgO_2/l	3 mgO_2/l
				If in winter the content of dissolved oxygen in water bodies of the highest and first category decreases to 6.0 mg/cubic meter, and in water bodies of the second category to 4 mg/cubic dm, then only wastewater that do not change the BOD of water is allowed to be discharged into them.	

No.	Indicators	Objectives of water use			
		Household and drinking needs of the population	Cultural and household needs of the population	Fishing needs	
				Highest and first category	Second category
1	2	3	4	5	6
11	Chemicals	Must not be contained in the water of water bodies and watercourses in concentrations exceeding the MPC or ODU			
12	Causative agents of diseases	Water should not contain pathogens of intestinal infections, including viable helminth eggs (roundworm, whipworm, toxocara, fasciola), oncospheres and viable cysts of pathogenic intestinal protozoa			
13	Common coliform bacteria, not more than:	1000 CFU/100 ml	500 CFU/100 ml	-	-
13-1	Thermotolerant coliform bacteria, not more than:	100 CFU/100 ml	100 CFU/100 ml	-	-
14	Coliphages (in plaque-forming units), not more than:	10 BOE/100 ml	10 BOE/100 ml	-	-
15	Water toxicity	-	-	Wastewater at the release into the water body should not have an acute toxic effect on test objects. The water of the water body in the control alignment should not have a chronic toxic effect on test objects	
(-) a dash means that the indicator is not standardized.					

Table 13: Maximum Permissible Concentrations of Standardized Substances in the Water of Water Bodies Used for Fishery Water Use[44]

No.	Substance	Limiting indicator of harmfulness	Maximum permissible concentration, mg/dm^3	Hazard class	Method of analysis, controlled indicator
1	2	3	4	5	6
1	Ammonium ion ($NH4^+$)	Poison	0.5 (nitrogen 0.4)	4	Colorimetry, electrochemistry, ion chromatography on ion $NH4^+$
2	Nitrate-anion (NO_3^-)	Sanitary-toxicological	40 (in terms of nitrate nitrogen 9.0)	4E	Ion chromatography, colorimetry, electrochemistry

[44] Source: Government Resolution No 128 "Rules of protection of surface waters of the Kyrgyz Republic" dated 14 March 2016. http://cbd.minjust.gov.kg/act/view/ru-ru/98396

No.	Substance	Limiting indicator of harmfulness	Maximum permissible concentration, mg/dm^3	Hazard class	Method of analysis, controlled indicator
3	Nitrite-anion (NO_2^-)	Poison	0.08 (in terms of nitrite nitrogen 0.02)	4E	Ion chromatography, colorimetry, electrochemistry
4	Oil and petroleum products (dissolved and emulsified)	Fishery	0.05	3	GC, HRMS, IR, gravimetry
5	Phenol, hydroxybenzene (carbolic acid)	Fishery	0.001	3	GH, HRMS, HPLC
6	Anion active synthetic detergents	Poison	0.1	4	
7	Iron (Fe)	Organoleptic	0.1	4	ICP, AAS
8	Copper (Cu)	Poison	0.001	3	ICP, AAS
9	Zinc (Zn)	Poison	0.01	3	ICP, AAS
10	Trivalent chromium (Cr^{3+})	Organoleptic	0.07	3	Ion chromatography, electrochemistry according to Cr^{3+}
11	Hexavalent chromium (Cr^{6+})	Sanitary-toxicological	0.02	3	Ion chromatography, electrochemistry according to Cr^{6+}
12	Cadmium (Cd)	Poison	0.005	2	ISP, AAS
13	Lead (Pb)	Poison	0.006	2	AAS, ICP by Lead (Pb)
14	Cobalt (Co)	Poison	0.01	3	
15	Molybdenum (Mo)	Poison	0.001	2	
16	Nickel (Ni)	Poison	0.01	3	AAS, ICP
17	Mercury (Hg)	Poison	absence	1	AAS, ICP
18	Ferrous manganese (Mn^{2+})	Sanitary-toxicological	0.01	4	AAS, ICP, ion chromatography, electrochemistry
19	Arsenic (As)	Poison	0.05	3	AAS, ICP
20	Cyanide-anion (CN^-)	Poison	0.05	3	Ion chromatography according to CN^-)
21	dichloro-diphenyl-trichloroethane (DDT)	Poison	absence	1	GH, HRMS, HPLC
22	Hexachlorocyclohexane (HCH)	Poison	absence	1	GH, HRMS, HPLC
23	Potassium (K)	Sanitary-toxicological	50.0	4E	ISP, AAS
24	Sodium (Na)	Sanitary-toxicological	120.0	4E	AAS, ICP
25	Calcium (Ca)	Sanitary-toxicological	180.0	4E	AAS, ICP

No.	Substance	Limiting indicator of harmfulness	Maximum permissible concentration, mg/dm^3	Hazard class	Method of analysis, controlled indicator
26	Magnesium (Mg)	Sanitary-toxicological	40.0	4	AAS, ICP
27	Sulphate-anion (SO_4^{2})	Sanitary-toxicological	100.0	4	Ion chromatography, electrochemistry
28	Chlorides (anion) (Cl)	Sanitary-toxicological	300.0	4E	Ion chromatography, electrochemistry
29	Fluoride anion (F)	Poison	0.05 (in addition to the background fluoride content, but not higher than their total content of 0.75)	3	Electrochemistry, ion chromatography
30	Sodium, potassium and calcium phosphates one, two and three substituted	Sanitary	0,05-oligotrophic reservoirs0,15-mesotrophic0,2-eutrophic (in terms of phosphorus)	4E	Photocolorimetry (phosphates)

b) IFC Standard on Wastewater and Ambient Water Quality

262. The IFC EHS Guideline did not specify any wastewater discharge or ambient water quality standards.

4. Vibration

a) Kyrgyz Republic National Vibration Standard, SN 2.2.4 / 21.8.566-96 "Industrial vibration. Vibration in rooms, residential and public buildings".

263. Kyrgyz Republic has a National Vibration Standard, SN 2.2.4 / 21.8.566-96 "Industrial vibration. Vibration in rooms, residential and public buildings". This is currently available in Russian and Kyrgyz, however to date it has not been possible to obtain a copy.

264. There is also a National Standard relating to the sensitivity of buildings to seismic event, Building Norms and Rules of the Kyrgyz Republic 20-02:2009, "Seismic resistant construction. Design standards". This again is only available in Russian and Kyrgyz however the findings of a previous study[45] by the State Agency of Anti-Seismic Construction and Engineering Design placed the adobe buildings typical of many of those alongside the road in the highest class of sensitivity to seismic events.

[45] State Agency of Anti-Seismic Construction and Engineering Design. Technical Statement on the Results of an Engineering Survey of Residence Buildings at Chui Oblast, Petrovka Village Centralnaya Street, Nos. 85, 105, 108, 112, 117, 161, 225, 268, 269, 445. 2017

b) International Ground Borne Vibration Building Damage Criteria

265. International Guidelines and Standards present criteria for vibration related building damage in the form of threshold levels of vibration (peak particle velocity), as either a value or range of values.

266. Key factors in determining these levels are as follows:

(i) the nature of the building including its construction, its condition, and whether it is of historic importance;

(ii) the likely extent of damage i.e., cosmetic, minor structural or major structural; and

(iii) whether the source of vibration is continuous or a single event, and the dominant frequency (Hz).

267. A useful review of some of the Standards, largely of US origin, is presented in the Caltrans Guidance Manual[46], and this has been used as the basis of their own guideline values. On the whole these seem sensible, though they only set a threshold for cosmetic damage, do not specify a frequency range over which these limits apply, and appear to be overly conservative for industrial and framed buildings in comparison with European Standards.

268. Additional useful guidance is presented in the British and German Standards[47,48] both of which include a means of taking account of the variation damage threshold with frequency. In general, the threshold level at which vibration damage will occur increases with frequency. In common with the Caltrans guidance, both Standards differentiate between continuous and discrete vibration sources, with the threshold levels for continuous vibration being roughly half the equivalent level for single event vibration. Using both the Caltrans and BS definitions, vibrating rollers are classified as continuous sources of vibration, as is vibratory pilling, and the operation of hydraulic breakers.

269. The British Standard BS ISO 4866:2010[49] offers a means of qualitatively assessing the sensitivity of the building taking into account its structure, condition and soil but does not provide a means of taking these factors into account in determining vibration damage threshold levels.

270. The British and German standards also offer guidance on the vibration levels at which the onset of minor structural damage might occur, with these being roughly a factor of two higher than those for cosmetic damage. The definitions of cosmetic and minor structural damage set out in BS 7385 are as follows:

(i) **Cosmetic**. The formation of hairline cracks on drywall surfaces or the growth of existing cracks in plaster or drywall surfaces; in addition, the formation of hairline cracks in mortar joints of brick/concrete block construction

(ii) **Minor Structural**. The formation of large cracks or loosening and falling of plaster or drywall surfaces, or cracks through bricks/concrete blocks

271. The criteria which have been used in this study are a combination of the recommendations of the Standards and Guidelines thought most relevant, and are set out in Table 14 below. Unless

[46] Transportation and Construction Vibration Guidance Manual. California Department of Transportation, Division of Environmental Analysis September 2013
[47] British Standard BS 7385 Pt 2. Evaluation and measurement for vibration in buildings. Pt 2. Guide to damage levels from ground borne vibration
[48] DIN 4150-3. Deutsche Norm. Structural Vibration. Part 3. Effects of Vibration on Structures. February 1999
[49] British Standard BS ISO 4866:2010. Mechanical vibration and shock- vibration of fixed structures. Guide to measurement of vibration and evaluation of their effects on structures

stated otherwise, they apply to the onset of cosmetic damage resulting from a continuous vibration source operating at a minimum frequency of 20Hz. Three classes of building are included equivalent to low, medium and high risk of vibration damage. Many of the buildings in the villages alongside the road fall into the High Risk Class as they are of adobe/clay construction, belonging to Class 9.5 in the Kyrgyz Standard SNiP 22-01-98KR and are regarded as highly vulnerable.

272. However, in the current study this Class is also considered to comprise two sub-classes, namely A which has shallow footings (<1m) often comprised of large stones, and B which has concrete foundation/footings. Whilst houses in sub class B are likely to be less sensitive to ground borne vibration damage due to the increase rigidity of the foundation there is insufficient data in the literature on which to base a separate threshold for cosmetic damage and both must be classed as fragile buildings.

Table 14: Building Vibration Damage Assessment Criteria: Cosmetic Damage

Building Vibration Damage Risk Level	Building Description	Cosmetic Damage Threshold ppv (mm/s)	Source Reference for Criteria	Assumed Building Coupling Loss
	Extremely fragile historic buildings, ruins, ancient monuments	2	Caltrans/BART	n/a
High Risk A	Fragile buildings of clay construction with shallow (<1m) rubble footings	3	Caltrans	1
High Risk B	Fragile buildings of clay construction with concrete foundations/footings	3	Caltrans	0.5
Medium Risk	Residential brick built on concrete foundations/footings and light commercial	10	BS 7385/DIN 4150	0.5
Low Risk	Heavy commercial, industrial and framed buildings	25	BS 7385/DIN 4150	0.5

c) *Human Response to Vibration: criteria*

273. The British Standard BS 5228[50] sets out guideline values in terms of peak particle velocity for human response to construction works and these are shown Table 15. Column three includes qualitative descriptors of the scale of vibration impact, which are equivalent to those commonly used in the assessment of construction vibration. The overall results of the assessment are to be presented in the form of building vibration damage contours, hence the human response to vibration must be considered in relation to these contours.

Table 15: BS 5228 Vibration Assessment Criteria for Human Perception

Vibration Level ppv (mms^{-1})	Description of Effect	Description of Impact
<0.3	Vibration unlikely to be perceptible	Negligible
0.3 to 1.0	Increasing likelihood of perceptible vibration in residential	Minor
1.0 to 10	Increasing likelihood of perceptible vibration in residential environments but can be tolerated at the lower end of the scale if prior warning and explanation has been given to residents	Moderate
>10	Vibration is likely to be intolerable for any more than a brief exposure to a level of $10mms^{-1}$	Major

[50] British Standard BS 5228- 2. Code of Practice for noise and vibration control on construction and open sites. Part 2. Vibration. 2009

D. ADB Policies and Environmental Assessment Requirements

1. ADB’s Safeguard Policy Statement (SPS 2009)

274. ADB's safeguard policy aims to help developing member countries address environmental and social risks in development projects and minimize and mitigate, if not avoid, adverse project impacts on people and the environment[51]. This policy is discussed in detail in ADB’s Safeguard Policy Statement (SPS 2009), which applies to all ADB-supported projects reviewed by ADB’s management after 20 January 2010.

275. As stated in SPS 2009, “ADB’s safeguard policy framework consists of three operational policies on the environment, Indigenous Peoples, and involuntary resettlement. These are accompanied by Operations Manual sections on Environmental Considerations in ADB Operations, Involuntary Resettlement, and Indigenous Peoples. ADB’s Handbook on Environmental Assessment Guidelines (2003) provide information on good practice approaches to implementing safeguards.

2. Environmental Screening and Categorization

276. The SPS 2009 establishes an environmental review process to ensure that projects are environmentally sound, are designed to operate in line with applicable regulatory requirements, and are not likely to cause significant environmental, health, social, or safety hazards.

277. ADB categorizes as project based on the significance of a project’s potential environmental impacts. A project’s category is determined based on an analysis of its type, location, scale, and sensitivity and the magnitude of its potential environmental impacts. Projects are assigned to one of the following four categories:

- (i) A proposed project is classified as **Category A** if it is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works. An environmental impact assessment is required.
- (ii) A proposed project is classified as **Category B** if its potential adverse environmental impacts are less adverse than those of category A projects. These impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than for category A projects. An initial environmental examination is required.
- (iii) A proposed project is classified as **Category C** if it is likely to have minimal or no adverse environmental impacts. No environmental assessment is required although environmental implications need to be reviewed.
- (iv) A proposed project is classified as category FI if it involves investment of ADB funds to or through a FI (financial intermediaries).

278. **The Project has been classified by ADB as Category A and requires the preparation of an Environmental Impact Assessment**. As construction works will be undertaken along the Lake Issyk-Kul, which is within the Kyrgyz Republic legislated Biosphere Territory of Issyk-Kul, a UNESCO Biosphere Reserve and a Ramsar site due to the internationally important biodiversity in the area, the project is categorized A for environment.

[51] https://www.adb.org/who-we-are/safeguards/main

279. **Safeguard Review Procedures**. Section F1/OP [operational procedures] (2013). These documents operationalize SPS 2009. The policy sets out the scope of SPS 2009 applicability to ADB operations, and the procedures describe the safeguards process and outputs, including consultation and disclosure requirements, through the various stages of project preparation.

3. Information Disclosure

280. In line with ADB's Public Communications Policy, ADB is committed to working with the borrower/client to ensure that relevant information (whether positive or negative) about social and environmental safeguard issues is made available in a timely manner, in an accessible place, and in a form and language(s) understandable to affected people and to other stakeholders, including the general public, so they can provide meaningful inputs into project design and implementation. ADB will pos the draft environmental impact assessment reports for environmental Category A projects at least 120 days before ADB Board's consideration.

281. The Access to Information Policy (2018) guides ADB's efforts to be transparent and accountable to the people it serves, which it recognizes are essential to development effectiveness. The policy recognizes the right of people to seek, access, and impart information about ADB's operations, and it aims to enhance stakeholders' trust in and ability to engage with ADB through clearly-stated principles including proactive disclosure, presumption in favor of disclosure, recognition of the right to access and impart information and ideas, country ownership, limited exceptions, and the right to appeal.

E. Environmental Assessment Requirements in the Kyrgyz Republic

282. The environmental impact assessment system in the Kyrgyz Republic is based on two subsystems: (i) Environmental impact assessment (EIA) (or "OVOS", the Russian acronym for "Assessment of Environmental Impacts"); and (ii) State Environmental Review (SER).

283. Environmental assessment requirements in Kyrgyz Republic are mainly specified in the following laws and regulations:

(i) Law on Environmental Protection (Law No. 53 of 1999) which prohibits financing or implementation of projects related to the use of natural resources without obtaining approval from the State Environmental Expertise.

(ii) Law on Ecological Expertise/Environmental Review (Law No. 54 of 1999) which defines the requirements in the field of ecological expertise (assessment) aimed at ensuring the protection of the rights of citizens for healthy environment through the prevention of negative ecological impacts of economic and other activities.

(iii) Regulations on the procedure of the state ecological examination in the Kyrgyz Republic (Decree No. 248, of 2014),

(iv) Regulations on the procedure for conducting an environmental impact assessment in the Kyrgyz Republic (Decree No. 60 of 2015) establish the procedure for assessing the environmental impact assessment (EIA or OVOS) of a project or an activity. As stated in this regulation, the purpose of the EIA is to prevent and/or mitigate the impact of the proposed activity on the environment, and related social, economic and other consequences.

(v) Law on General Technical Regulation concerning Ecological Safety in the Kyrgyz Republic (Law No. 151 of 2009) requires an EIA for construction of roads.

284. Based on the legal requirements, the process in relation to obtaining an environmental approval for a project or activity, includes the following stages:

(i) Making a decision on the need for an OVOS (screening);

(ii) Preliminary OVOS;

(iii) Full OVOS;

(iv) State Environmental Review (SER); and

(v) Post-project analysis.

285. Preparation and revision of OVOS reports and implementation of OVOS process, including consultation is the responsibility of the project proponent. It must be done by a certified organization ("OVOS contractor"), which is usually sub-contracted or arranged by the design institute responsible for designing the "technical" aspects of the project. For this project, the Project Implementation Unit (PIU) will arrange for adaptation of this EIA Report to conform to Kyrgyz national requirements.

286. **Need for OVOS**. The project proponent (or "project initiator") uses an inclusion list (Appendix 2 Procedure on conducting OVOS in the Kyrgyz Republic) to identify whether a proposed economic activity is subject to an OVOS. Projects on the inclusion list or with possible significant harmful transboundary effects, and those in hazard class I, require full OVOS. Projects in hazard classes II and III are subject to a reduced level of OVOS.

287. **Preliminary OVOS**: The preliminary OVOS is carried out to comprehensively analyze the possible consequences of a proposed project, to assess alternatives, and to develop a plan for environmental protection. The results are presented in an OVOS report. The OVOS Report is submitted together with the project's Feasibility Study for regulatory approval.

288. As per the Regulation on OVOS, this proposed road project requires an OVOS to be prepared. The construction of road and railway is included in the list of activities requiring an OVOS (No. 17 in the inclusion the list of the Regulation on OVOS).

289. Full OVOS: The results of a full OVOS is included in the project's final working draft documentation, as a section called "Environmental Protection". In addition to a comprehensive environmental assessment of the project, the full OVOS must include: (a) a detailed Environmental Management Plan (EMP) for all project phases (construction, operation, decommissioning); (b) details of resources needed to implement the EMP; and (3) a Statement of Environmental Impacts form. Full OVOS documentation is listed in Section 6 of the Regulation on the Procedure for OVOS.

290. **State Environmental Review (SER)**. After the OVOS report is revised based on the feedback received during consultations, it is submitted to the State Expert Commission for the State Environmental Review (SER) together with the Statement of Environmental Impacts and other relevant documents by the proponent (the PIU for this project). SER is carried out by registered experts. The duration of the review depends on the complexity of the project, but should not exceed 3 months after submission of all OVOS documents and associated payment to the SER agency by the project proponent. The Commission provides a decision, which may be positive or negative. Positive conclusions may be conditional. Negative conclusions either require amendments to the submitted plans and designs or may be outright rejections of the proposal.

291. **Post-project analysis**. Post project analysis is carried out a year after the start of an activity for which the OVOS was required. It is undertaken by a specialized organization on behalf of the project proponent. The results are used to check for compliance with the agreed mitigation and management measures and their effectiveness. The results must be disclosed publicly, if requested.

292. Participants in the OVOS process are:

(i) The initiator (proponent) of the project;

(ii) The executor of works on OVOS (the OVOS consultant);

(iii) Local state administrations (rayons) and local state government bodies (Aiyl Okmotu).

(iv) The authorized state body in the field of environmental protection and / or its territorial bodies (Ministry of Natural Resources, Ecology and Technical Supervision);

(v) The public (public organizations, non-government organizations (NGOs), individuals);

293. Other major stakeholders often involved in environmental assessment are:

(i) Ministry of Health (safety and health issues);

(ii) Ministry of Emergency Situations (natural hazards), and its subsidiary agency KyrgyzHydromet is responsible for monitoring weather conditions, rainfall, and wind speed;

(iii) Ministry of Agriculture (agricultural issues) and its subsidiary agency the State Design Institute for Land Management (Kyrgyzgiprozem, responsible for issues relating to land management and the land cadastral); and

(iv) Ministry of Natural Resources, Ecology and Technical Supervision.(conducts and controls environmental monitoring, including instrumental monitoring. In addition, it reviews and issues permits for felling trees, as well as issuing permits for quarries and dumps).

294. The duration of the environmental assessment process varies. Formal public discussion of the draft OVOS documents requires a minimum 30-day notice period and a maximum 30-day period for the proponent to answer unresolved concerns. The SER process may take up to 3 months, depending on work-loads and the complexity of the project.

295. The project will require environmental clearance in the form of a positive conclusion (approval) from the State Expert Commission for SER on the submitted OVOS and other required documents. This is separate from any approvals issued by ADB for the project.

296. In parallel with obtaining the environmental clearance, the PIU will submit the project feasibility study and detailed design to the State Agency for Architecture, Housing, Construction and Communal Services for State Examination. In addition, after tendering, the winning contractor will develop a work plan, which shall be reviewed by the CSC and approved by the MOTC.

297. The Regulation on the Procedure for OVOS also has an exclusion list of project types with “low or insignificant environmental impact” (Appendix 4 of the Regulation). These projects only require a completed Statement of Environmental Impacts form (Appendix 3 of the Regulation). OVOS is also required for a wide variety of activities under the Regulation on the Procedure for State Environmental Review.

298. The Kyrgyz Republic is a signatory to the Espoo Convention that requires an EIA for “construction of a new road of four or more lanes, or realignment and/or widening of an existing road of two lanes or less so as to provide four or more lanes, where such new road, or realigned and/or widened section of road, would be 10 km or more in a continuous length.

IV. Baseline Environmental Conditions

299. This chapter of the EIA Report discusses the existing environmental conditions at the project site and its surrounding areas. An extensive literature review was carried out to gather relevant environmental data. This is complemented by visits to relevant government offices at the national, regional and district levels to obtain additional environmental monitoring data. Field surveys and monitoring were carried out to obtain site-specific data on various aspects of the environment such as biodiversity, noise, water, etc. All collected data were analyzed to provide an assessment of the baseline environmental conditions, which was used as basis in the assessment of the impacts of the activities of the road project on the environment.

300. The specific methodologies used for analyzing the baseline environmental conditions are discussed in the respective sub-sections.

301. The proposed project is located in the Issyk-Kul Region (Oblast) (Figure 28). The region is in the eastern part of the Kyrgyz Republic and shares boundaries with the Almaty Region of Kazakhstan (north), Chuy Region (northwest), Naryn Region (southwest) and Xinjiang, China (southeast). It takes its name from Lake Issyk-Kul ("warm lake"), the second largest saline lake in the world, which never freezes despite its altitude in the Tian Shan mountains. The regional capital is Karakol.

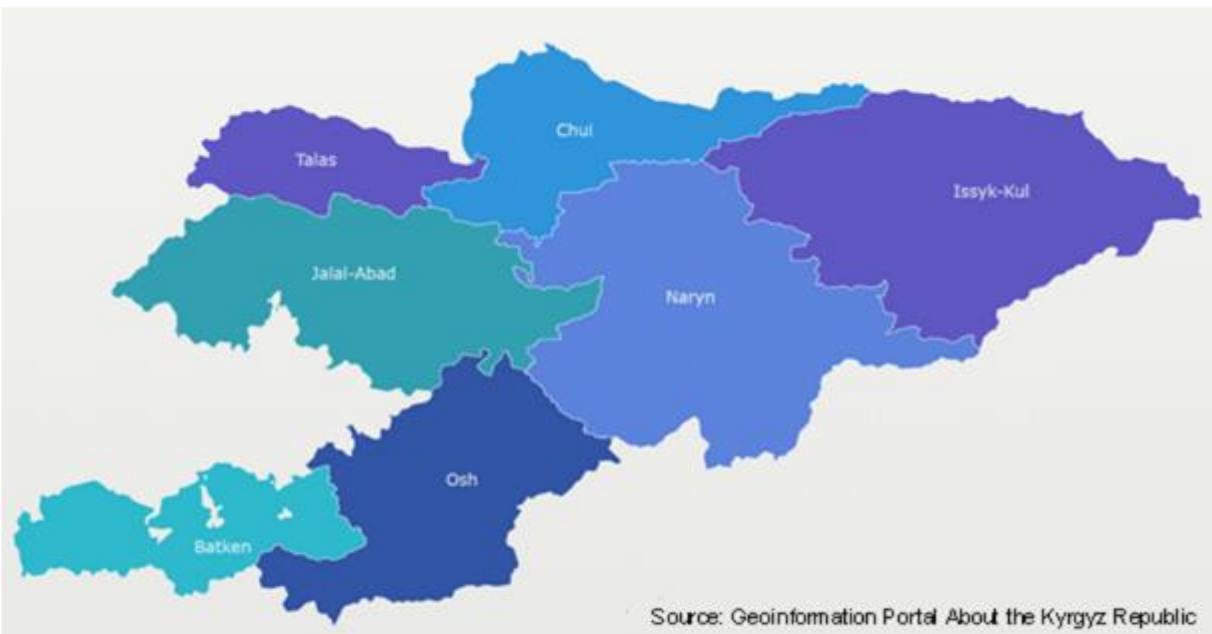


Figure 28: Political map of the Kyrgyz Republic showing the different oblasts.

302. Issyk-Kul Region consists of five 5 districts (rayons), as listed below with their respective capitals:

(i) Ak-Suu District – Karakol;

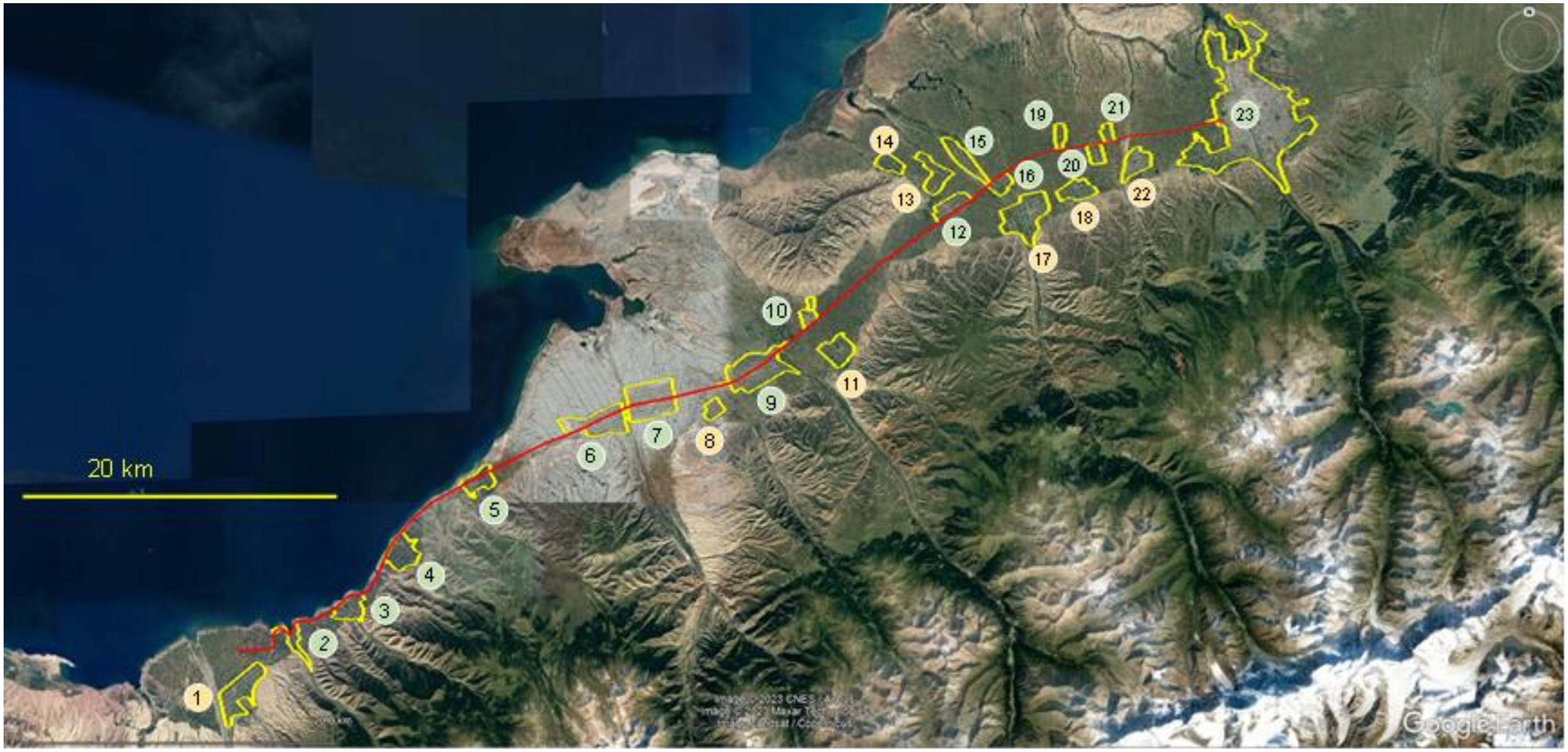
(ii) Jeti-Oguz District – Kyzyl-Suu;

(iii) Tong District – Bokonbaev;

(iv) Tup District – Tup; and

(v) Issyk-Kul District – Cholpon-Ata.

303. The road project is located in the districts of Jeti-Oguz and Ak-Suu. In Jeti-Oguz District the road project crosses the settlements/villages of Chon Zhargylchak, Kichi Zhargylchak, Ak Terek, Chychkan, Darkhan, Saruu, Kyzyl Suu, Orgochor, Shalba, Chirak, Jele Tobe, Kytai, Kyzyl Dyikan and Kalinovka. In the Ak-Suu region it traverses a small portion of Karakol City (Figure 29).



Legend

SN	Settlement	SN	Settlement	SN	Settlement	SN	Settlement
1	Barskoon	7	Saruu	13	Ak Dobo	19	Kytai
2	Chon Zhargylchak	8	Jalgyz Oruk	14	Munduz/ Ak Usten	20	Kyzyl Dykan/ Baltabai
3	Kichi Zhargylchak	9	Kyzyl Suu	15	Chirak	21	Kalinovka/ Konkina
4	Ak Terek	10	Orgochor	16	Jele Tobe/ Zhele-Dobo	22	Yrdyk
5	Zhenish/ Chychkan	11	Svetlaya Polyana	17	Jeti-Oguz	23	Karakol
6	Darkhan	12	Shalba/ Tilekmat	18	Kyzyl Zuu		

Figure 29: Settlements along (green color) and within 2 kilometers (orange color) of the Barskoon-Karakol segment of the Issyk-Kul Ring Road.

A. Physical Environment

1. Landscape

304. The road project traverses meadow and meadow steppe, almost all of which are being utilized for agriculture (Figure 30 and Figure 31).

Figure 30: Landscape map of the project site.

Figure 31: Meadows along the side of the road project.

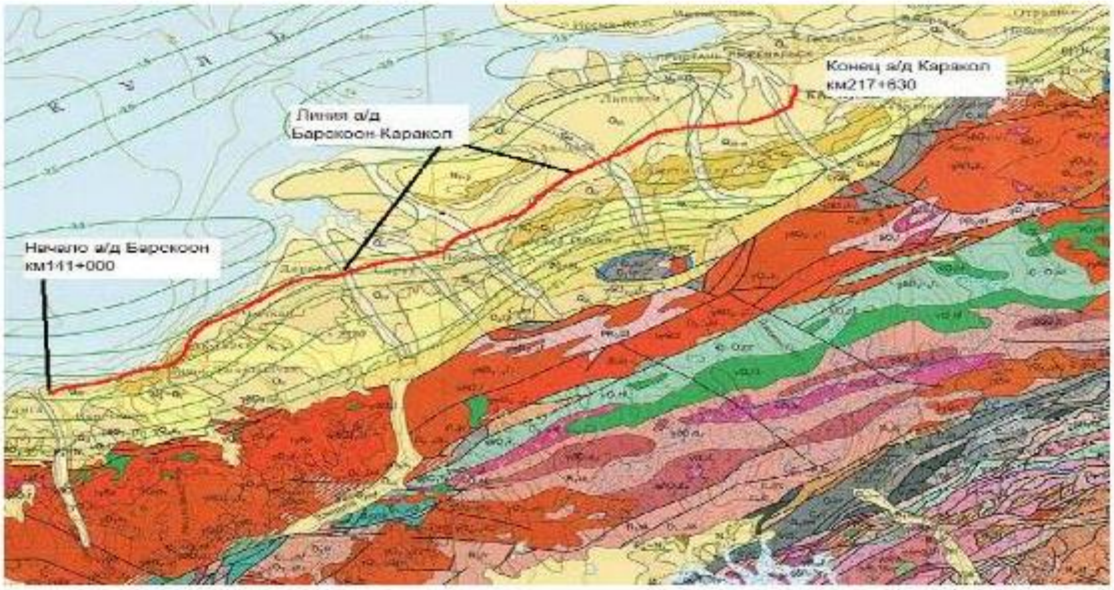
2. Topography

305. The project site has an elevation of approximately 1600m (Figure 32).

Figure 32: Topographical map of the Kyrgyz Republic.

3. Geology

306. Figure 33 shows the geological map of areas in and around the project site. As shown, the project area consists of Upper Quaternary deposits: pebbles, crushed stones, sands, clays, loams.



Legend for the geological map

QIII-IV	Stratigraphic complexes - Upper Quaternary deposits: pebbles, crushed stones, sands, clays, loams

Figure 33: Geological map of the project site.

4. Seismicity and Faults

307. The Kyrgyz Republic is in a region of high seismic hazard where earthquakes of magnitude Mw≥5 occurs about once per month and potentially devastating earthquakes of magnitude Mw≥7 occurs with return periods of several decades[52]. The strongest earthquake of the past 10 years near Issyk-Kul occurred on Dec 28, 2022 and had a magnitude of 5.6 with epicenter located at 128 km southeast of Karakol.[53] The Institute of Seismology, National Academy of Science of the Kyrgyz Republic publishes in its website (https://seismo.kg/) information about earthquakes that occurred in its territory.[54]

308. There are no nearby major faults to the project site (Figure 34), with the nearest fault line more than 15 km away. The road project is within the 8 point Seismic Zone, except for the section near Karakol (Figure 35).

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[52] The World Bank. Measuring Seismic Risk in the Kyrgyz Republic Development of Fragility Functions. November 2017.
[53] Issyk-Kul Earthquake Report. The complete Issyk-Kul, Kyrgyzstan earthquake report (up-to-date 2023). (earthquakelist.org).
[54] Institute of Seismology, National Academy of Science of the Kyrgyz Republic. Home (seismo.kg).

Figure 34: Map showing major fault lines near the project site.

Source: Geoinformation Portal About the Kyrgyz Republic

Figure 35: Map showing flood-prone areas near the project site.

5. Natural Hazards

309. In general, the road is not susceptible to flooding except for a short section near the settlement of Orgochor based on the map for the Geoinformation Portal of the Kyrgyz Republic (Figure 36).

310. The project site is not in an area the is susceptible to rock fall (Figure 37).

Source: Geoinformation Portal About the Kyrgyz Republic

Figure 36: Flood map of the project site.

Source: Geoinformation Portal About the Kyrgyz Republic

Figure 37: Rock fall hazard map of the project site.

6. Climate

311. The Kyrgyz Republic have an extreme continental climate due its location in the center of the Eurasian continent, far from major water bodies and in close proximity to desert areas. The majority of the country is arid[55].

312. In the Issyk-Kul Region, based on climatological data from 1991 to 2020, the monthly mean temperature varies from -16.17ºC in January to + 12.84ºC in July (Figure 38)[56]. During the months of October to April, the mean temperatures are normally below 0ºC. The maximum mean monthly precipitation occurs during the month of July at 55.51 mm while the minimum happens in January at 5.53 mm.

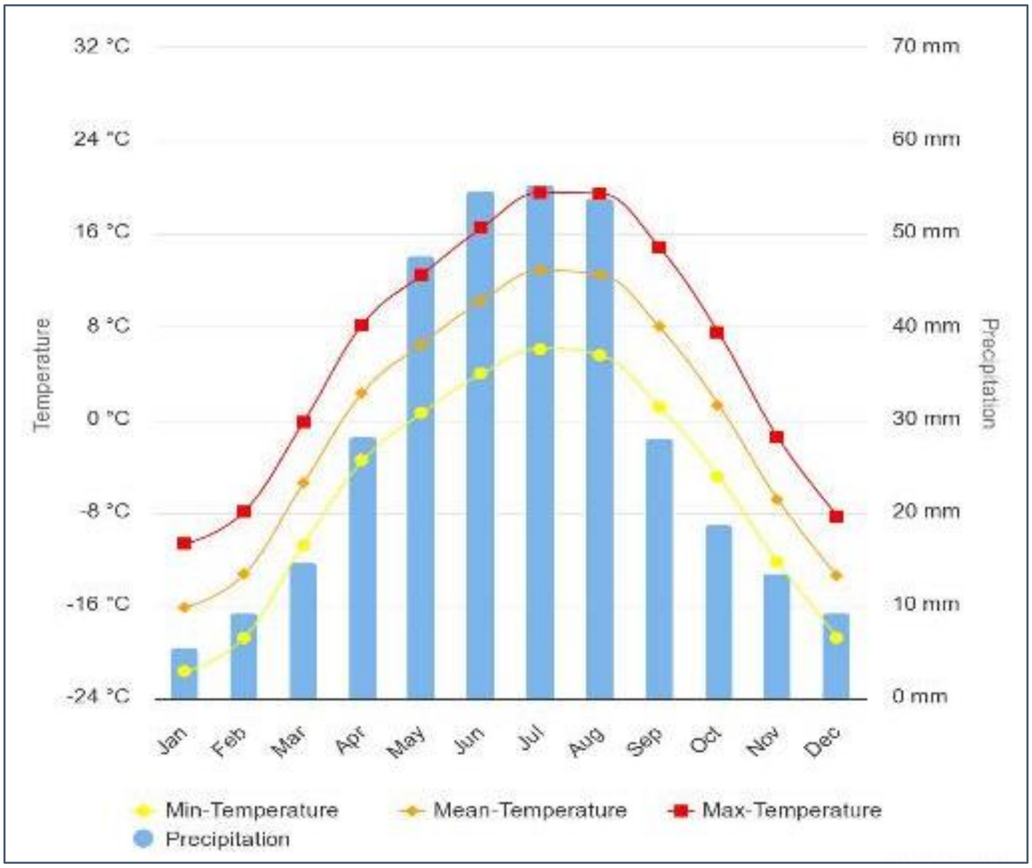


Figure 38: Monthly climatology of minimum temperature, mean temperature, maximum temperature and precipitation 1991-2020, Issyk-Kul.

(Source: World Bank, Climate Change Knowledge Portal)[57]

[55] Climate Risk Profile: Kyrgyz Republic (2021): The World Bank Group and Asian Development Bank. https://climateknowledgeportal.worldbank.org/sites/default/files/2021-06/15814-WB_Kyrgyz%20Republic%20Country%20Profile-WEB.pdf

[56] World Bank. Climate Change Knowledge Portal. Kyrgyz Republic - Climatology | Climate Change Knowledge Portal (worldbank.org)

[57] World Bank. Climate Change Knowledge Portal. Kyrgyz Republic - Climatology | Climate Change Knowledge Portal (worldbank.org)

7. Air Quality

a) Methodology

313. The spatial extent of the road corridor, including access roads, has been provided by the PIU. The road corridor runs through a mixture of rural and urban settings. There are a number of settlements located along the corridor, and as a result there are a significant number of human receptors located within 500m of the road.

314. Assessment of baseline conditions along the corridor was carried out in three stages:

- Identification of sensitive receptors close to the road corridor;
- A review of existing monitoring data; and
- Detailed dispersion modelling of road transport emissions from existing traffic along the road corridor in 2023, using observed traffic flows from on-site surveys carried out by JOC in spring 2023. Annex 2 details the dispersion modelling methodology and assumptions.

b) Sensitive receptors

315. **Human**. Table 16 shows the approximate population within each distance band of the road, calculated assuming that population density is uniform within each settlement area. The extent of each settlement area was derived from aerial imagery, with boundaries confirmed during the site visit.

Table 16: Approximate population numbers in the vicinity of the road.

Settlement	Total population	Approximate population within distance of road (m)				
		<10	< 20m	< 50m	< 100m	< 350m
Chon Jargylchak	1065	0	12	50	130	580
Kichi Jargylchak	3872	4	16	110	290	1200
Ak Terek	4479	0	0	40	160	800
Zhenish/Chychkan	3563	4	350	700	900	2090
Darkhan	7398	300	1000	1700	2000	3360
Saruu	8501	350	1200	2000	2500	3000
Kyzyl Suu	15464	400	600	830	1650	5580
Orgochor	2806	8	40	100	250	900
Shalba/ Tilekmat	3366	0	0	50	260	1290
Jele Tobe/Zhele-Dobo	1340	0	0	100	150	600
Kyzyl Dyikan/Alkym	1213	0	20	40	90	340
Konkino/Kalinovka	842	5	30	50	80	230
Karakol	81952	40	350	500	600	2310

Source of population data: National Statistics Committee of the Kyrgyz Republic. 2021.

316. A catalogue of key air pollution sensitive receptors was developed through onsite surveys. Buildings such as schools, hospitals, and hotels were included, together with the closest dwellings to the road kerb in each settlement. Results of the site survey were corroborated using aerial photography and Google Maps (Figure 39 to Figure 42). The locations and categories of these

sensitive receptors are presented in Table 17. The closest sensitive receptors are located approximately 20m from the road.

Table 17: Sensitive receptors in the vicinity of the road.

ID	Type	Name	Settlement	Coordinate (UTM 42N Projection)		Distance to road (m)
				x	y	
1	Mosque	Chon Jargylchak Mosque	Chon Jargylchak	1214152	4707223	54
2	School	Shkola	Chon Jargylchak	1214308	4707225	208
3	Residential		Chon Jargylchak	1214140	4707525	25
4	Mosque	Kichi Jargylchak Mosque	Kichi Jargylchak	1217498	4709632	211
5	Residential		Kichi Jargylchak	1216802	4709036	22
6	Hospital		Ak Terek	1220027	4713653	44
7	Mosque	Mechet	Ak Terek	1220302	4713566	326
8	School	Detskiy Sad	Ak Terek	1220491	4713618	455
9	Residential		Ak Terek	1219951	4713416	79
10	Mosque	Chychkan Mosque	Chychkan	1224500	4718056	23
11	School	Beyshenbek Ukuyev Mektebi	Chychkan	1224473	4717792	172
12	Residential		Chychkan	1224533	4718007	31
13	Hotel	Qwer Hotel	Chychkan	1225315	4718457	105
15	School	Shkola Im Abylaya Satylganova	Darkhan	1231934	4722489	55
16	School	Shkola Im Kudaybergenasaaliyeva	Darkhan	1232468	4722805	70
17	Mosque	Darkhan Mosque	Darkhan	1232716	4722984	44
18	School	Detskiy Sad Saruu Pre-School	Saruu	1235571	4724136	176
19	School	Saratov Secondary School	Saruu	1235621	4724296	38
20	Mosque	Dzhangyz-Uryuk Mosque	Saruu	1236823	4724638	67
21	School	Lenin School	Kyzyl Suu	1240956	4726323	44
22	School	Detskiy Sad Archa	Kyzyl Suu	1242437	4727129	322
23	School	Detskiy Sad Archa	Kyzyl Suu	1242191	4727123	177
24	Mosque	Kyzyl Suu Mosque	Kyzyl Suu	1241943	4727101	43
25	Gment	Biblioteka (Children's Library)	Kyzyl Suu	1241837	4727121	32
27	School	Erkinbek Gaparov	Kyzyl Suu	1242014	4727108	81
28	Hospital	Kyzyl Suu Hospital Complex	Kyzyl Suu	1241640	4727264	266
29	School	Rayonyy Detskiy Sad Pre-School	Kyzyl Suu	1241809	4727392	264
30	School	S. Abdrakmanov	Kyzyl Suu	1242273	4727498	65
31	School	Kut-Knowledge Issyk-Kul Children's Training Complex	Kyzyl Suu	1243047	4728289	42
32	School	Orgochor Secondary School named after Mambet Tynaev	Orgochor	1244998	4730330	100

ID	Type	Name	Settlement	Coordinate (UTM 42N Projection)		Distance to road (m)
				x	y	
33	Mosque	Orgochor Mosque	Orgochor	1245212	4730706	210
34	Residential	Jele Tobe	Jele Tobe	1256204		25
35	Residential	Alkym	Alkym	1261817	4743640	21
36	Residential	Konkino	Konkino	1262976	4743983	19
38	Residential	Karakol	Karakol	1270349	4746186	18
39	Hotel	Guest House Fatima	Karakol	1270169	4746175	53
40	Mosque	Shalba Mosque	Shalba	1253011	4738068	20
41	Mosque	Mechet	Ak Terek	1219192	4711453	29
42	Residential	Saruyskaya Sel'skaya Uprava	Saruu	1235473	4724266	23
43	Hotel	Gostinitsa Nur-Ordo	Kyzyl Suu	1241741	4726793	164
45	Hotel	Asia Plus	Karakol	1270456	4746172	19

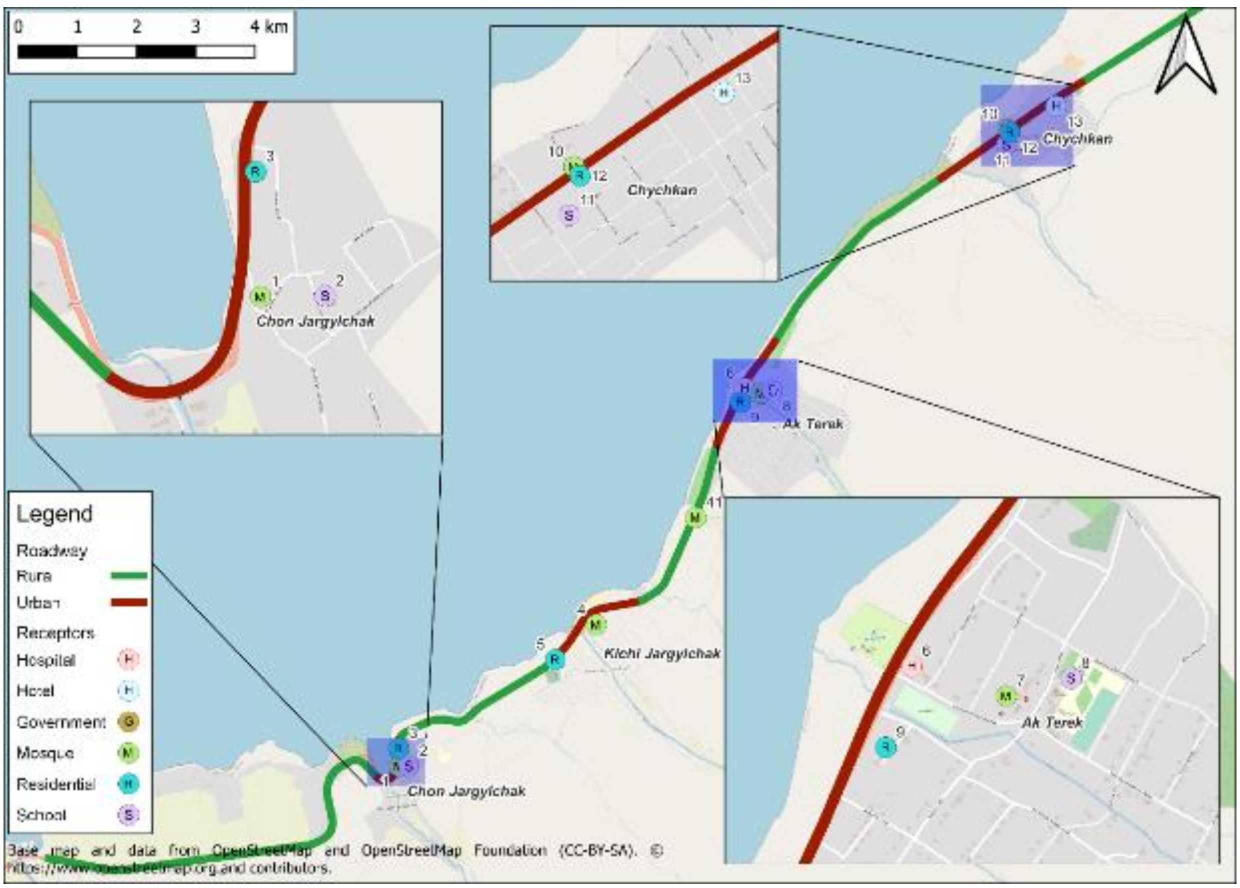


Figure 39: Sensitive receptors, Chon Jargylchak to Chychkan.

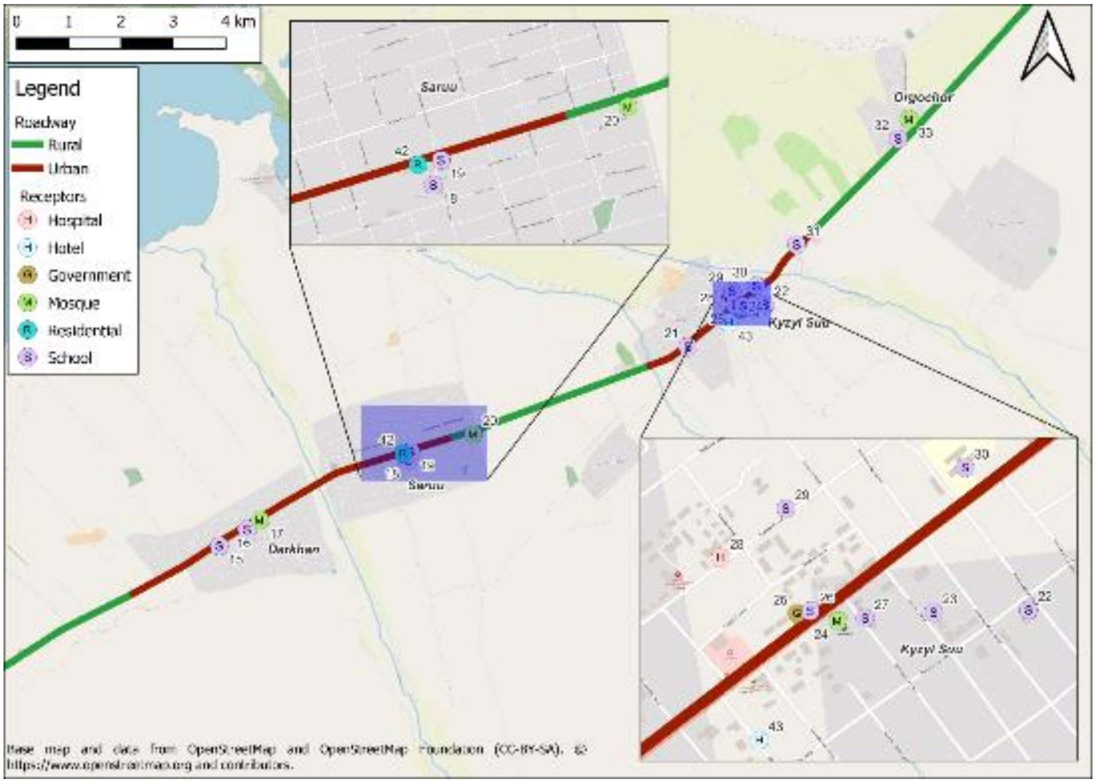


Figure 40: Sensitive receptors, Darkhan to Orgochor.

Figure 41: Sensitive receptors, Tilekmat to Karakol.

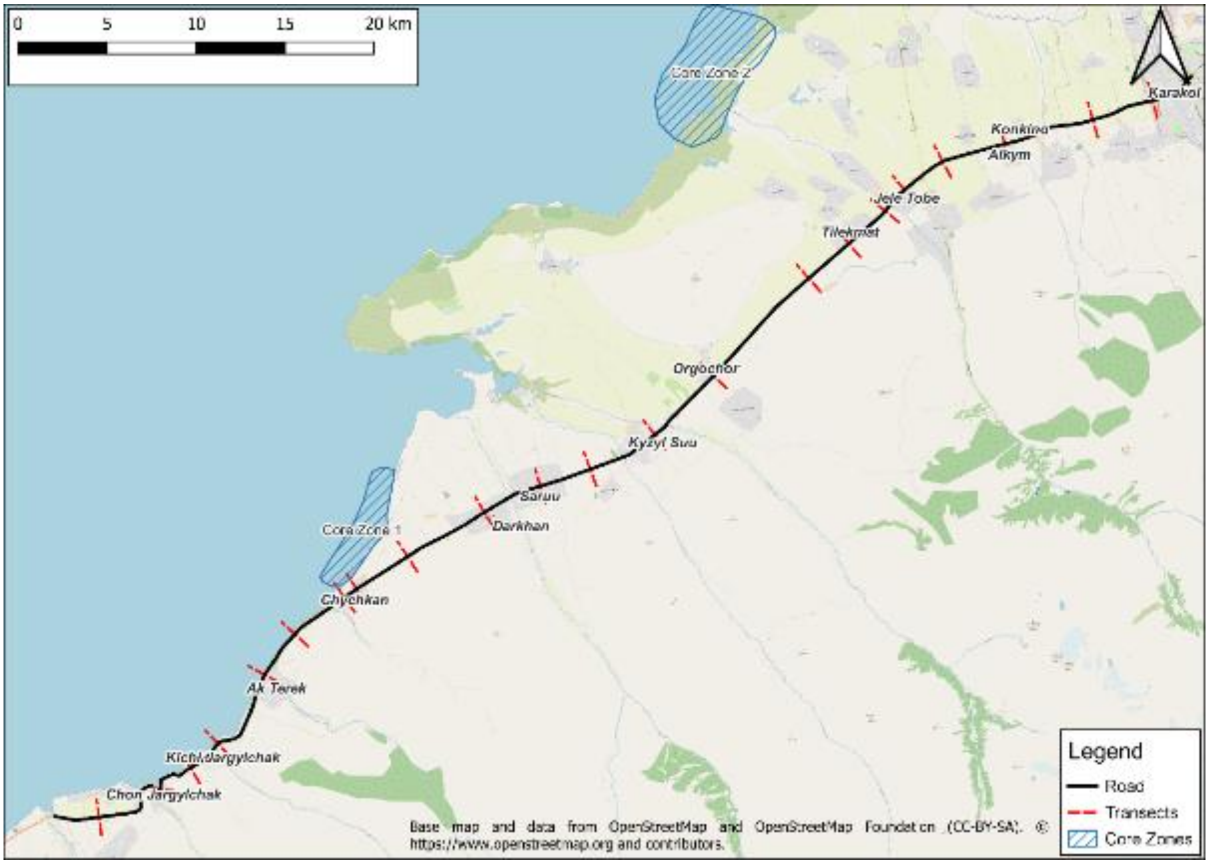


Figure 42: Locations of modelled transects and core zones.

317. **Ecological**. The road runs within 1km of a core zone of the Issyk-Kul Biosphere Reserve near Chychkan; the impacts of the proposed road improvement on NO_x, SO_2 and ammonia concentrations were assessed on a 500m grid covering the core zone. A second core zone is located approximately 9km north of the road corridor; this is too great a distance for the emissions from the road to significantly impact concentrations, so this core zone was not included in the assessment.

318. The road passes within 500m of Lake Issyk-Kul for most of its length between Barskoon and Chychkan. The lake is a Ramsar wetland of globally significant biodiversity and forms part of the Issyk-Kul Biosphere Reserve. The site is of primary importance as a wintering site for migratory waterbirds (up to 70,000 birds recorded annually). Notable waterbird species include the endangered White-headed Duck (*Oxyura leucocephala*). The lake is home to 28 fish species of which 7 are found nowhere else in the world. The lake has been included as a sensitive receptor in the assessment. Concentrations were modelled at 100m intervals along the edge of the lake as shown in Figure 42.

c) Existing Air Quality Monitoring

319. Ambient air pollutant concentrations from other sources in the region are based on available monitoring data from the following sources:

(i)

(i) "MoveGreen", an environmental non-governmental organization in Kyrgyz Republic that conducts public activities on issues related to air pollution and its consequences for human health and the environment, provides a database of PM_{10} and $PM_{2.5}$ monitoring data across Kyrgyz Republic. This database includes data for one site in Karakol, where monitoring commenced in June 2022.

(ii) The Volunteer Organization "Leadership", based in Karakol City, carries out hourly PM_{10} and $PM_{2.5}$ monitoring at 7 locations around the Issyk-Kul Lake, including sites in Kyzyl-Suu, Bokonbaevo (45 km to the west of the road) and Ak-Suu (10km east of Karakol). Measurements are also carried out at sites in Karakol; however, data capture at the Karakol sites is below data capture thresholds and was not used in the study.

(iii) Short-term air quality monitoring for NO_2, SO_2, PM_{10} and $PM_{2.5}$ in Karakol is available from previous EIAs in the region. The key source of short-term monitoring information used in this assessment is the ESIA for the Tyup-Karakol portion of the road rehabilitation project[58]. For this assessment, SO_2 and NO_2 measurements were taken using diffusion tubes at 5 locations in the vicinity of Karakol, and short-term gas bag sampling was carried out at one location in Karakol.

320. Table 18 presents the results of passive diffusion tube monitoring carried out in the Karakol area as part of the Tyup-Karakol road corridor ESIA. In each location, three diffusion tubes were placed. The average of the three values is presented at each site.

321. Average NO_2 concentrations were between 6.3 and 22.4 µg/m^3. The highest concentration was recorded within Karakol, reflecting the high density of road traffic and non-traffic emissions sources in the city. In rural locations, average NO_2 concentrations away from the Tyup-Karakol road corridor are around 7µg/m^3, while concentrations at roadside locations were measured between 11 and 12 µg/m^3.

322. Average SO_2 concentrations were below the limit of detection at most sites. In Karakol, the measured average SO_2 concentration was 1.9 µg/m^3.

Table 18: Diffusion tube monitoring, July 2022 (Tyup-Karakol ESIA), µg/m^3

ID	Location	NO_2	SO_2
3	Rural roadside	11.2	Below detection limit
4	Rural roadside (outside Karakol)	11.8	Below detection limit
6	Rural	6.3	Below detection limit
7	Karakol roadside	22.4	1.88
10	Rural	7.6	Below detection limit

Source: Kyrgyz Republic: Environmental and Social Impact Assessment (ESIA) – Tyup-Karakol Road

323. Table 19 presents the results of 20-minute sampling using gas bags and hand-held dust monitoring (DustTrack 8533) equipment in Karakol, carried out as part of the Tyup-Karakol road corridor ESIA. The monitoring was carried out in June 2021. The majority of the measurements are below the maximum permissible concentrations in Kyrgyz Republic legislation.

324. A single NO_2 sample (sample 106) is above the national MPC, but complies with the WHO guideline value. As these measurements are taken over 20-minute periods, they are not directly comparable with the national standard or WHO guideline levels.

[58] (April 2022) Kyrgyz Republic: Environmental and Social Impact Assessment (ESIA) - Tyup-Karakol Road

Table 19: Short-term sampling, July 2022 (Tyup-Karakol ESIA), μg/m³.

Sample ID	Location	SO_2	NO_2	CO	$PM_{2.5}$	PM_{10}
105	Karakol City	12 (±3)	32 (±8)	400 (±80)	26 (±52)	55 (±11)
106		10 (±2.5)	105 (±26)	400 (±8)	24 (±4.8)	52 (±1)
107		13 (±3.3)	62 (±16)	300 (±60)	47 (±9.4)	106 (±21)

Source: Kyrgyz Republic: Environmental and Social Impact Assessment (ESIA) - Tyup-Karakol Road

325. Long-term monitoring for one urban site in Karakol is available from the MoveGreen air quality database. This site provides hourly PM_{10} and $PM_{2.5}$ concentrations, with monitoring commencing in June 2022. The monthly average PM_{10} and $PM_{2.5}$ measurements from the site are presented in Table 20. The WHO guideline and Kyrgyz national limits for annual mean concentrations are also presented. However, as monitoring data is not available for a year, the measurements cannot be directly compared with these limit values.

326. In December 2022, PM_{10} measurements at this site undergo a sudden shift, with concentrations consistently measuring above 500 μg/m³; measurements after this shift are unlikely to be accurate, and as a result have not been considered in the baseline assessment.

Table 20: Long-term PM_{10} and $PM_{2.5}$ monitoring, Karakol.

Year	Month	PM_{10} (μg/m³)	$PM_{2.5}$ (μg/m³)
2022	June	11.4	9.4
	July	11.7	10.1
	August	11.6	10.2
	September	15.5	13.6
	October	31.1	26.1
	November	44.5	37.3
	December	-	38.3
2023	January	-	56.6
	February	-	47.1
Average		21.0 (33*)	27.6
WHO guideline		20	10
National standard		40	25

Source: MoveGreen, http://data.movegreen.kg/. * = annualized to match $PM_{2.5}$ concentrations

327. Additional monitoring of long-term PM_{10} and $PM_{2.5}$ concentrations is available at sites in Kyzyl Suu, Ak Suu, and Bokonbaevo. Monitoring commenced towards the end of December 2022. Monthly and average concentrations measured at these sites in 2023 are presented in Table 21.

Table 21: Long-term PM_{10} and $PM_{2.5}$ monitoring in Kyzyl-Suu, Ak-Suu, and Bokonbaevo.

Year	Month	Kyzyl Suu		Ak-Suu		Bokonbaevo	
		PM_{10} (μg/m³)	$PM_{2.5}$ (μg/m³)	PM_{10} (μg/m³)	$PM_{2.5}$ (μg/m³)	PM_{10} (μg/m³)	$PM_{2.5}$ (μg/m³)
2023	January	154	106	79.5	61.5	89.9	73.2
	February	87.5	66.3	94.1	73.5	164	139
	March	59.9	42.3	39.1	28.9	57.0	45.4
	April	27.7	19.5	11.5	7.9	33.1	26.0

Year	Month	Kyzyl Suu		Ak-Suu		Bokonbaevo	
		PM_{10} (µg/m³)	$PM_{2.5}$ (µg/m³)	PM_{10} (µg/m³)	$PM_{2.5}$ (µg/m³)	PM_{10} (µg/m³)	$PM_{2.5}$ (µg/m³)
	May	16.6	12.4	6.9	5.0	15.8	12.9
	June	12.5	9.5	2.5	1.7	14.3	11.3
Average		59.7	42.7	38.9	29.8	62.4	51.3
WHO guideline		20	10	20	10	20	10
National standard		40	25	40	25	40	25

Source: www.aq.kg

328. Figure 43 shows the portable sensor in Kyzyl-Suu, which is installed at the administrative building of the Kyzyl Suu Rayon.

Figure 43: Portable sensor in Kyzyl Suu.

329. Monitored concentrations of both PM10 and $PM_{2.5}$ exceed the WHO guideline levels for annual mean concentrations at the Karakol, Kyzyl-Suu, Ak-Suu, and Bokonbaevo sites. A strong seasonal trend is seen in $PM_{2.5}$ concentrations across all measurement locations, with high concentrations seen in winter months. These seasonal trends are presented in Figure 44.

330. As PM_{10} data is missing for winter months at the Karakol site, the reported average PM_{10} concentration is likely to be lower than the true annual mean. In months where data is available for both pollutants, 85% of PM_{10} is $PM_{2.5}$; assuming that this relationship is also true over the winter months, the annual mean PM_{10} concentration at the site would be expected to be approximately 33 µg/m³.

331. It is recommended that additional monitoring is carried out at roadside sites to allow the effectiveness of mitigation activities during the construction and operational phases to be monitored. Approximate monitoring locations have been identified using the results of the modelling study, and are provided in Chapter 7.

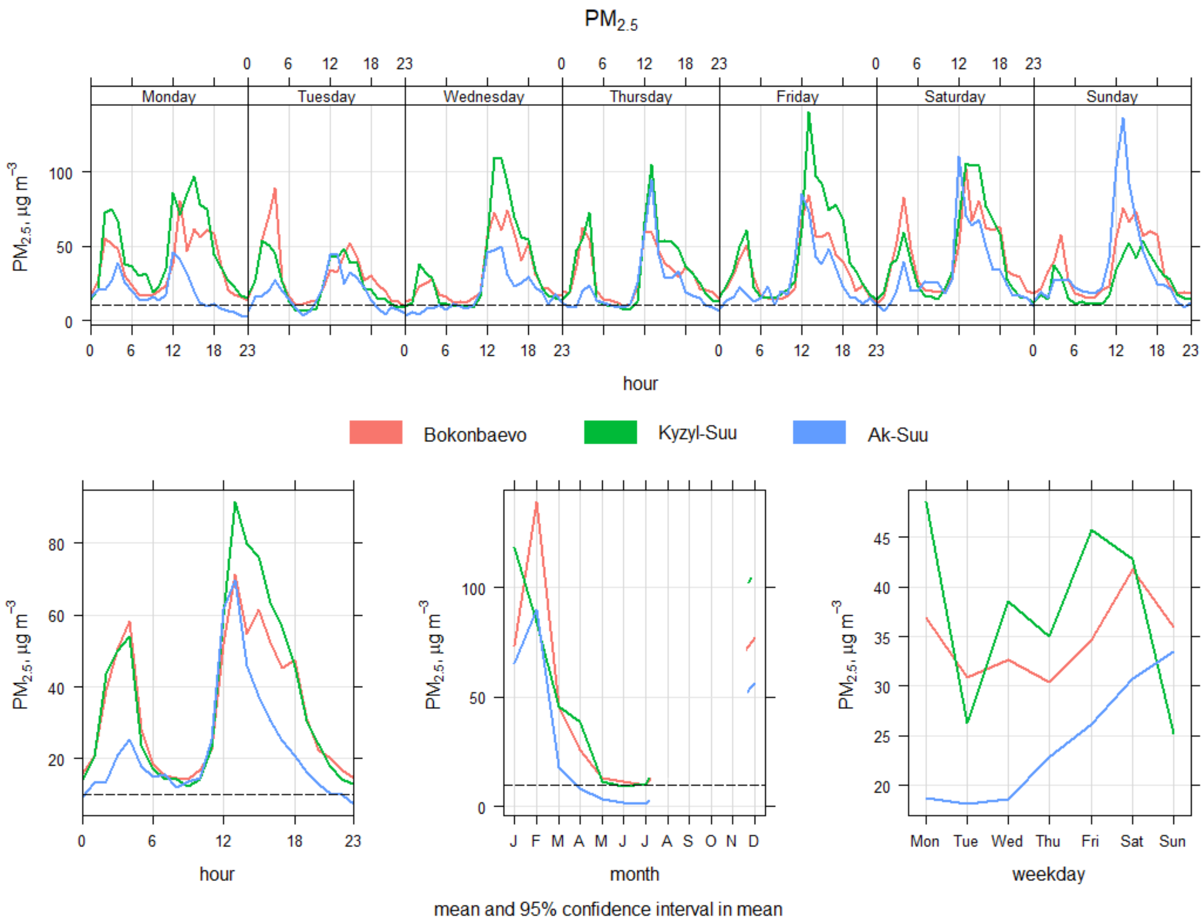


Figure 44: Hourly, daily and seasonal trends in $PM_{2.5}$ concentration at the Bokonbaevo, Kyzyl Suu, and Ak Suu monitoring sites.

d) Current Corridor

332. The current road contribution to pollutant concentrations was assessed through detailed dispersion modelling of road transport impacts along the corridor in 2023. An outline of the modelling methodology is provided above and details of model inputs and outputs are available in Annex 2.

333. Concentrations were modelled along 1km transects in settlements to assess the contribution from the current road to concentrations. The maximum predicted contribution from the road corridor at receptors by distance from the current road kerb is given in Table 22.

(1) <u>NO_2</u>

334. No exceedances of any Kyrgyz Republic national air quality objectives or WHO air quality guidelines for annual mean or 24-hour mean NO_2 are predicted within the vicinity of the road. Maximum predicted NO_2 concentrations 5m from the kerb are 75% of the MPC of 85 µg/m^3.

335. The sensitivity of the area to impacts from increased NO_2 concentrations has therefore been classified as "Moderate".

(2) PM_{10}

336. There are potential exceedances of the WHO guideline and national standard for annual mean PM_{10} concentrations across the region due to high background levels. These background levels were measured in Karakol, and may represent and overprediction of regional background levels, particularly in rural areas. However, comparison with short-term sampling from the Tyup-Karakol ESIA and monitoring from Kyzyl Suu indicates that these values are typical in other urban areas in the region, where most receptors are located.

337. As a result of these high measurements, the airshed has been categorized as "degraded" with respect to PM_{10} concentrations.

338. The road is also a significant contributor to PM_{10} concentrations. The largest contribution to annual mean PM_{10} concentrations occurs in Karakol (a major regional population and industrial hub), where the process contribution is up to 60% of the WHO guideline level 5m from the kerb. In general, PM_{10} concentrations are predicted to be higher towards the eastern end of the corridor (approaching Karakol) as this area has higher traffic flows than the western section of the road.

339. Slightly higher concentrations are seen on the southern side of the road corridor, because of the topography in the area; the area south of the corridor is typically more elevated than the northern side. This side of the road also typically has more sensitive receptors, as most settlements are located to the south of the road.

340. The sensitivity of the area to impacts from increased PM_{10} concentrations has therefore been classified as "High". Additional monitoring at sensitive receptors along the corridor is recommended to confirm the findings of this study; this is described in Section 7.

(3) $PM_{2.5}$

341. Similar to PM_{10}, there are potential exceedances of the WHO guideline for annual mean $PM_{2.5}$ concentrations across the region due to high background levels and a relatively high contribution to concentrations from the road corridor. Close to the road, levels of $PM_{2.5}$ may also exceed the less stringent national standard for annual mean $PM_{2.5}$. As a result, the airshed has been categorized as "degraded" with respect to $PM_{2.5}$ concentrations.

342. Exceedances of the WHO air quality guideline for 24-hour mean $PM_{2.5}$ concentrations are predicted at all locations.

343. The sensitivity of the area to impacts from increased $PM_{2.5}$ concentrations has therefore been classified as "High". Additional monitoring at sensitive receptors along the corridor is recommended to confirm the findings of this study; this is described in Section 7.

(4) CO and SO_2

344. Background levels of SO_2 in the region are low. The road contribution to CO and SO_2 concentrations is also low relative to the WHO air quality guidelines and Kyrgyz MPCs. As a result, no exceedances of any relevant objectives are predicted for CO concentrations. This is typical of rural settings in Central Asia, where SO_2 and CO concentrations do not typically exceed the WHO air quality guidelines near roadsides.

345. The sensitivity of the area to impacts from increased SO_2 and CO concentrations has therefore been classified as "Low".

Table 22: Maximum predicted contribution to ambient air pollutant concentrations from the road corridor at set distances from the current kerb, 2020.

Pol	Averaging time	Air quality standard/ guideline (μg/m³)		Background conc.	Distance from kerb, m													
					Left kerb (towards lake Issyk-Kul)							Right kerb (away from lake Issyk-Kul)						
		WHO	KG		5	10	20	30	50	100	200	5	10	20	30	50	100	200
NO_2	Annual	40	-	11.2	6.5	5.4	4.0	3.2	2.4	1.5	0.7	8.1	6.6	4.8	3.8	2.7	1.6	0.9
	24 hours	-	40	22.4	8.7	7.4	5.8	4.8	3.8	2.6	1.4	9.6	8.0	6.1	5.0	3.6	2.4	1.6
	Maximum	200	85	22.4	38.1	33.1	26.6	22.6	17.7	13.0	7.8	37.8	32.9	26.7	22.9	18.4	13.2	9.4
PM_{10}	Annual	20	40	33.0	8.8	7.3	5.4	4.4	3.2	2.1	1.1	11.6	9.5	6.9	5.5	3.9	2.3	1.3
	24 hours	50	60	66.0	21.4	17.7	13.5	11.1	8.1	5.6	3.2	25.9	21.9	16.5	13.4	9.9	6.1	3.6
	Maximum	-	300	66.0	117.3	100.8	80.3	67.7	53.6	37.0	25.5	114.7	99.4	79.7	68.0	53.5	37.2	26.9
$PM_{2.5}$	Annual	10	25	27.6	2.2	1.8	1.3	1.1	0.8	0.5	0.3	2.8	2.3	1.7	1.3	0.9	0.5	0.3
	24 hours	25	35	55.2	5.1	4.2	3.3	2.7	2.0	1.4	0.8	6.3	5.3	4.0	3.3	2.4	1.5	0.9
	Maximum	-	160	55.2	28.1	24.1	19.2	16.2	12.9	8.9	6.1	27.5	23.8	19.1	16.3	12.8	9.0	6.5
SO_2	24 hours	20	40	3.8	0.4	0.3	0.2	0.2	0.1	0.1	0.1	0.5	0.4	0.3	0.2	0.2	0.1	0.1
	Maximum	-	500	3.8	2.1	1.8	1.5	1.2	1.0	0.7	0.5	2.1	1.8	1.4	1.2	1.0	0.7	0.5
	10 minutes	-	500	3.8	2.4	2.1	1.7	1.5	1.3	1.0	0.6	2.4	2.1	1.7	1.5	1.2	0.9	0.5
CO	15 minutes	100000	-	800	336	292	238	203	163	111	75	336	292	236	202	161	113	70
	24 hours	-	5000	800	59.6	49.7	38.0	31.6	22.9	15.3	8.4	74.9	63.7	47.9	39.0	28.5	16.9	10.1

8. Noise

a) Noise Units and Indices

346. Noise can be defined as 'unwanted sound'. Sound is a fluctuation of air pressure and can be detected by the human ear when it occurs between 20 and 20,000 times per second. This is referred to as the frequency of the sound and is measured in Hertz (Hz). The ear is not equally sensitive to sound over this whole range and therefore, when measuring sound this effect is considered by applying a frequency weighting, referred to as the A weighting, to the measured signal.

347. The loudness of the sound is dependent on the magnitude of the pressure fluctuation. The human ear has an approximately logarithmic response to this and therefore the sound pressure level (SPL) is expressed using logarithmic unit, the decibel, written (dB (A)), where the 'A' indicates that the sound has been A weighted.

348. Noise outdoors from industry and transportation is generally referred to as environmental noise and a typical feature is its continual change in level. In order to describe and take account of community response to this varying noise level, additional noise indices are used. The most commonly used of these is the equivalent continuous 'A' weighted sound pressure level, ($L_{pAeq,T}$), which is defined as the steady sound pressure level which has the same energy as a varying noise level measured over a period (T). It takes account of both the number and level of noise events and is generally referred to as the ambient noise level. This index is used within this report for the description of construction and road traffic noise levels.

349. Statistical noise indices are also used to describe the noise environment, principally the L_{A10} and L_{A90}. The L_{A10} is the level of sound exceeded for 10% of the measurement period and is commonly used in the measurement of road traffic noise. The L_{A90} is the level of sound exceeded for 90 percent of the measurement period, and is referred to as the background noise level, as noise rarely drops below this level. A further index that is useful particularly for the description of night time noise events, such as the pass-by noise level of a train, is the maximum sound A weighted pressure level $L_{Amax,F}$. The 'F' denotes that the level has been measured using a fast averaging time (125 milliseconds), which reflects the sensitivity of the human ear to rapidly varying noise events.

350. There are a number of simple rules of thumb that can be applied to noise. For example, a 10 dB increase in noise level is equivalent to a subjective doubling in noise level. When two sources of the same sound pressure level are added together, the resultant sound pressure is approximately 3 dB(A) higher than the individual sounds. Individuals can typically detect changes in environmental noise levels when the change is greater than 1-3 dB(A).

351. A summary of the noise terminologies and parameters are listed in Table 23.

Table 23: Noise terminologies and parameters.

ID	Location
SPL	Sound pressure level is defined as the logarithm of the ratio of a given sound pressure to the reference sound pressure ($2x10^{-5}$ Pa) in dB is 20 times the logarithm to the base ten of the ratio.
A-weighting	A frequency-dependent correction that is applied to a measured or calculated sound of moderate intensity to mimic the varying sensitivity of the ear to sound for different frequencies.

ID	Location
C-weighting	A frequency-dependent correction that is applied to a measured or calculated sound of moderate intensity to mimic the varying sensitivity of the ear to sound for different frequencies. C-weighting is usually used for peak measurements.
$L_{pAeq,T}$	A-weighted, equivalent continuous sound pressure level over time interval T, expressed in decibels (dB). Index for ambient noise level.
L_{pAF}	A-weighted sound pressure level with fast time constant (125 milliseconds).
$L_{pAF,max}$	Maximum time-weighted and A-weighted sound pressure level with fast time constant (0.125s) (dB)
$L_{pAS,max}$	Maximum time-weighted and A-weighted sound pressure level with slow time.
L_{day}	Equivalent continuous sound pressure level when the reference time interval is the day.
L_{den}	Day-evening-night-weighted sound pressure level as defined as: $L_{den} = 10\lg\frac{1}{24}\left(12*10^{\frac{L_{day}}{10}} + 4*10^{\frac{L_{evening}+5}{10}} + 8*10^{\frac{L_{night}+10}{10}}\right)$
$L_{evening}$	Equivalent continuous sound pressure level when the reference time interval is the evening.
L_{night}	Equivalent continuous sound pressure level when the reference time interval is the night.
$L_{peak,C}$	Level of peak sound pressure with C-weighting, within a specified time interval.
$L_{peak,lin}$	Level of peak sound pressure with linear frequency weighting, within a specified time interval.
L_{90}	Sound pressure level exceeded for 90 % of measurement period. Index for background noise level.

b) Noise Measurement/Survey

352. Environmental noise levels are measured using a sound level meter, usually connected via a cable to a microphone mounted on a tripod or A Frame (Figure 45). When the microphone is positioned at the building façade, noise levels are referred to as ‘façade’ measurements, as distinct from those measured away from reflecting surfaces, which are referred to as ‘free field’. Façade levels are generally taken to be 2.5 dB higher than the equivalent free field measurement as a result of the effect of reflected noise from the building façade.

353. A noise survey spanning two one-week periods, from 15th to 20th May 2023 and 29th May to 05th June 2023 were conducted at various locations near the road project. During the first week, daytime noise measurements were conducted in Kichi Jargylchak, Ak Terek, Chychkan, Darkhan, Saruu and Jalgz-Uryuk. Weather conditions in the first week were good, with predominantly light winds and very little rain. Access to residential properties (houses) was facilitated by PIU, who contacted the relevant local officials who facilitated obtaining permission from the residents and explain the nature of the noise survey.

354. During the second week, monitoring was carried out in the remaining villages at Kyzyl Suu, Orgochor, Shalba, Jele Tobe, Balatbay (formerly Kyzyl Dyikan), and Konkino. During this period, the weather conditions were good with light winds and no precipitation until Friday (02nd June) when brief period of thunderstorm with heavy rain occurred. The last survey was completed at the outskirts of the Karakol City 05th June (Monday).

Figure 45– Noise meter used to measure (free field) ambient noise level near the road at Ak Terek Village

355. The noise measurement followed the procedures set out in BS 7445: 2003 (Description and Measurement of Environmental Noise)[59]. Measurements were made using Type 1 sound level meters with a microphone height of approximately 1.2 m above local ground level, and wherever possible, were free field i.e., placed beyond the influence of vertical reflective facades. A weatherproof microphone windshield was be used to minimize wind induced microphone noise and to provide protection against light rain.

356. All measurements were made using A weighting and fast response (125ms) settings and included the following noise indices: $L_{pAeq,15min}$, L_E, L_1, L_{50}, $L_{pAmax,F}$, L_{pAmin}, L_{10}, L_{90}, L_{95}.

357. For each measurement a record was made of the following information:

(i) Date, time and location;

(ii) A photograph showing the microphone position relative to the house and/or the road;

(iii) Description of noise sources that might be contributing to ambient noise;

(iv) The type and serial numbers of all instruments used;

(v) Where appropriate, a sketch map or GoogleEarth® image of the area; and

(vi) Local weather conditions including temperature, wind speed and direction, precipitation, and cloud cover (Octa).

358. The following conditions were also met during the measurement, as far as is practicable: (i) Wind speeds measured (at microphone height) below 5m/s; and (ii) No significant precipitation.

359. Two Class 1 Precision Integrating sound level meters were employed for the noise survey. The first, a Rion NL-32, was used for the 24 hour monitoring, and retained outside properties within an environmental housing locked to suitable strong point. The second, a Rion NL-52 was

[59] BS 7445: Description and Measurement of Environmental Noise, 2003.

used for short term monitoring of between 1 to 6 hours duration during the day time. Each sound level meter was calibrated using a portable Type 1 acoustic calibrator prior to and following each measurement.

360. All acoustic instrumentation had been either factory calibrated or by a certified calibration laboratory. Calibration certificates are shown in Annex 3.

c) Results of Baseline Noise Monitoring

361. A comprehensive survey was made of baseline noise levels at properties within the villages along the route and the results are reported in detail in Annex 4. The results of monitoring have been processed to give the relevant day and night time $L_{Aeq,T}$ noise levels and are presented in Table 24.

362. At properties alongside the road, noise levels are dominated by road traffic noise and at the majority of the properties close to the road, currently exceed the IFC EHS day and night time guidelines. In these cases, assessment of the effects of the upgraded road will be based on noise change, which will be dominated by changes in road layout and traffic flows.

363. On moving away from the road, ambient noise levels decrease and start to be dominated by activity on local roads and domestic activities.

Table 24: Results of noise monitoring

Location	No.	Start Date & Time	Approx. Duration (hr)	L_{Aeq} dB	L_{Aeq} dB
				Day	Night
Kichi Jargylchak	1	15/05/2023 12:48	6	58.6	
Kichi Jargylchak	2	15/05/2023 13:09	24	49.8	48.7
Ak Terek	3	16/05/2023 11:02	6	51.6	
Ak Terek	4	16/05/2023 11:33	24	48.6	46.4
Chychkan	5	17/05/2023 11:43	6	43.8	
Chychkan	6	17/05/2023 11:17	24	60.5	52.8
Darkhan	7	18/05/2023 11:34	6	50.4	
Darkhan	8	18/05/2023 11:55	24	55.1	48.8
Jalgyz Oruk	9	19/05/2023 11:48	6	39.5	
Saruu	10	19/05/2023 12:16	24	62.4	55.8
Kyzyl Suu	11	29/05/2023 12:00	6	42.9	
Kyzyl Suu	12	29/05/2023 11:37	24	58.3	53.6
Orgochor	13	30/05/2023 12:33	6	48.7	
Orgochor	14	30/05/2023 12:20	24	60.2	54.5
Shalba	15	31/05/2023 11:56	6	49.6	
Shalba	16	31/05/2023 11:38	24	53.6	51.5
Jele Tobe	17	01/06/2023 11:50	6	44.6	
Jele Tobe	18	01/06/2023 11:35	24	62.8	55.7
Baltabay	19	02/06/2023 11:04	6	53.5	
Baltabay	20	02/06/2023 10:50	24	57.7	48.7
Konkino	21	03/06/2023 10:25	6	62.2	
Karakol	22	05/06/2023 10:01	6	48.1	
Karakol	23	05/06/2023 10:18	24	61.0	58.2

9. Vibration

a) Introduction

364. A baseline vibration survey (ground borne vibration monitoring) was carried out at selected locations in five (5) villages/settlement through which the road passes (Figure 47 to Figure 51). Monitoring was carried out (where practicable) at the nearest adobe-built single storey residential property to the road in each of the villages. In some of the villages, e.g., Ak Terek monitoring was unnecessary as there were no building structures sufficiently close to the road, or alternatively the communities were sufficiently close to one another to be confident of similar ground conditions, for example Saruu and Darkhan.

365. The purpose of the survey was to confirm the absence of abnormal ground conditions along the route which might give rise to higher than expected levels of vibration. The geological map (Figure 33) and the results of borehole testing showed the underlying lithology to be reasonably consistent over the length of the road thus simplifying the selection of monitoring locations.

366. The monitoring was carried out between 15th May – 1st June, 2023 starting at Kichi Jargylchak, followed by locations at Chychkan, Darkhan, Kyzyl Suu, and Jele Tobe. Weather conditions during the survey were good with no substantial precipitation. Access to houses was facilitated by PIU who provided contact details for the relevant local officials who were able to be present on site during contact with residents and explain the nature of the survey. In each village the site chosen, where possible, was the property nearest to the road. Factors limiting the choice of location included accessibility, presence of residents, suitable ground conditions (well compacted made ground or dense sward) and absence of livestock.

b) Baseline Vibration Monitoring Procedure

367. Vibration monitoring equipment comprised a Svantek 958a vibration meter connected to a Svantek SV84 triaxial accelerometer. Measurements were made in free-field i.e., on the ground, away from the building foundations, following the guidelines set out in BS ISO 4866[60]. Preparation had been made for two accelerometer mounting procedures, depending on the ground conditions encountered on site. The first comprised an 18mm diameter 300mm long steel ground spike, to be driven into well-made ground to within a few millimeters of the surface (Figure 46(a)). In the second, the accelerometer was to be mounted on a concrete paving slab, levelled and well bedded onto the ground surface using building sand (Figure 46(b)). In practice, the ground conditions found on site favored the use of the ground spike.

[60] British Standard BS ISO 4866:2010. Mechanical vibration and shock- vibration of fixed structures. Guide to measurement of vibration and evaluation of their effects on structures

Figure 46: Vibration monitoring equipment used in vibration measurement

368. At all locations, the x and y axes of the accelerometer were aligned tangentially and parallel to the road, with the z axis aligned vertically.

369. The Svantek meter was set to acquire maximum peak particle velocity over contiguous 30 second intervals. Measurements were made attended for the duration of the monitoring and a note made of the time of events likely to give rise to higher vibration events such as residents footfalls near the monitoring location, or pass-by of heavy goods vehicles. A monitoring period of approximately 2 hours was used for most locations which was considered sufficient to get a reasonable sample of road traffic vibration levels.

c) *Results of Vibration Survey*

370. The results of the vibration survey showed existing baseline vibration levels at dwellings alongside the road were below 1mm/s. This is consistent with normal levels of vibration expected from road traffic at the distances of 10-30m from a main road at which measurements were made. It is also consistent with the guidance given in the UK Design Manual for Roads and Bridges[61] which states that peak particle velocities in the structure of buildings close to heavily trafficked roads rarely exceed 2 mm/s and typically are below 1 mm/s.

371. No evidence was found of abnormal ground conditions likely to give rise to higher levels of vibration than might otherwise be expected.

372. The results of the vibration monitoring are shown below in graphical form, preceded by a photograph and map showing the monitoring location (Figure 47 to Figure 51). Channels 1-3 in the graphs represent the levels of vibration along x, y and z axes respectively. At all locations, the x and y axes of the accelerometer were aligned tangentially and parallel to the road, with the z axis aligned vertically.

373. At Location L1 in Kichi Jargylchak (Figure 47), levels are for the most part below 0.5mm/s. However, it proved difficult to prevent residents from moving around the garden area and as they passed near the accelerometer, measured levels rose to approximately 1.5mm/s. Similarly, at

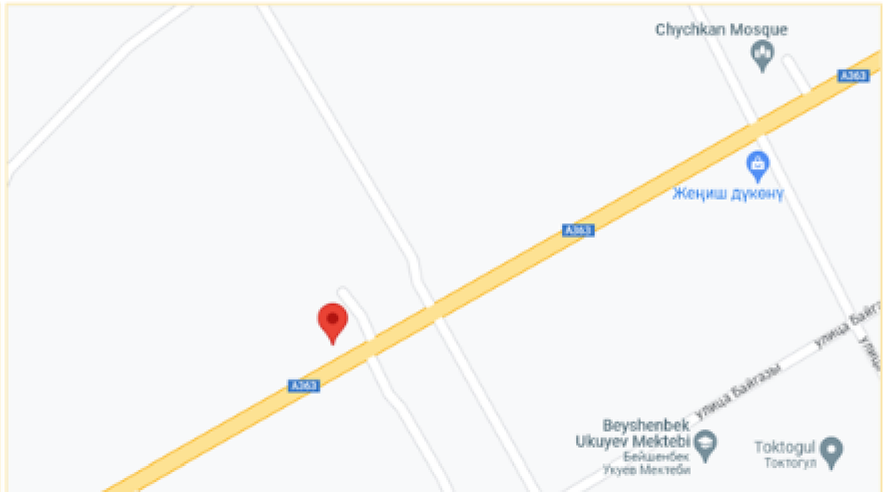
[61] Design Manual for Roads and Bridges (DMRB). https://nationalhighways.co.uk/suppliers/design-standards-and-specifications/design-manual-for-roads-and-bridges-dmrb/

location L5 in Jele Tobe (Figure 51), a resident moving outside the house caused measured levels to rise to approximately 2.0mm/s.

374. The levels of vibration measured along the x and y axes are higher than the z axis during these events which is unusual and may be a result of rocking of the spike as a result of poor support at the ground surface.

Figure 47: Vibration monitoring at location L1: Kichi Jargylchak

House no. unmarked. Date: 17/5/23.
Accel. location: 3m from foundation, centre of façade, 30m from asphalt road edge.
Start time 12:15. Finish 14:35



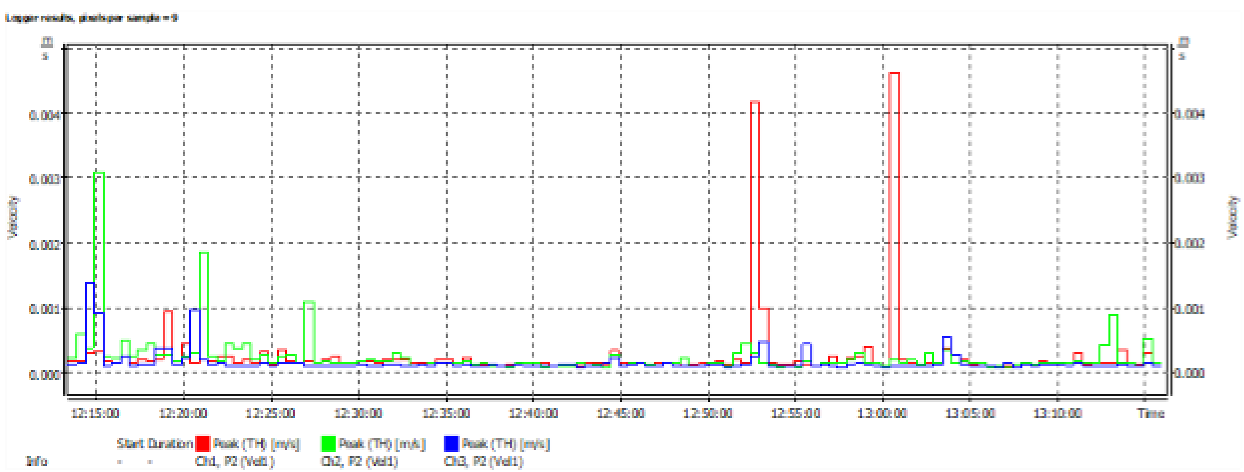


Figure 48: Vibration monitoring at Location L2: Chychkan

Figure 49: Vibration monitoring at Location L3: Darkan

Figure 50: Vibration monitoring at Location L4: Kyzyl Suu

House no: 6. Date: 1/6/23.
Accel. location: 1.5m from RHS of house, 1m from front façade & 10m to asphalt road edge Start time 11:30. Finish 13:30

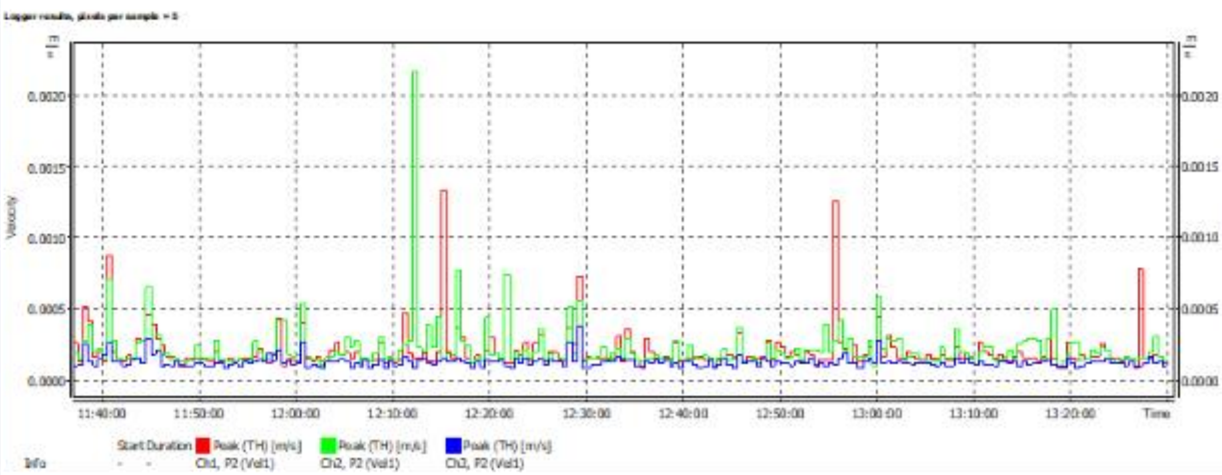


Figure 51: Vibration monitoring at Location L5: Jele Tobe

10. Hydrology

a) Information and Data Sources

375. Available data on river flow, maps, and other information has been collected from different sources:

(i) Ministry of Natural Resources, Ecology and Technical Supervision: National level in Bishkek and Issyk-Kul-Naryn Regional Department in Cholpon-Ata;

(ii) The subordinate units of the Ministry of Health: Department of State Sanitary and Epidemiological Surveillance, Bishkek, Issyk-Kul Regional Center of State Sanitary and Collection of baseline data;

(iii) Epidemiological Surveillance, Karakol and Jeti-Oguz Rayon Center of State Sanitary and Epidemiological Surveillance, Kyzyl-Suu;

(iv) The subordinate units of the Ministry of Agriculture: Water Resources Management Agency in Bishkek, Issyk-Kul Oblast Water Management Department in Karakol and Jeti-Oguz Rayon Water Management Department, Kyzyl-Suu;

(v) Ministry of Emergency: Jeti-Oguz Rayon Department of Ministry of Emergency Situation, Kyzyl-Suu;

(vi) Kyrgyz HydroMet under Ministry of Emergency Situation, Bishkek and meteorological station in Kyzyl-Suu; and

(vii) Literature review: report, studies, etc.

b) Background

376. Water resources in Kyrgyz Republic are formed by rivers with constant and episodic flows, springs and streams and fresh and low-mineral waters. The headwaters of most rivers are located in glaciers or are formed when snow melts.[62] Rainwater is of secondary importance in feeding the rivers. During low water, the rivers are fed from the upper layer of groundwater (shallow water), which is also formed due to melt flow that has undergone a transformation in the catchment area.

377. There are 9,957 glaciers in the Kyrgyz Republic with a total area of 6,683.1 km^2. These include: 6,229 glaciers with area greater than 0.1 km^2 (total area of 6493,5 km^2) and 3,728 glaciers with area less than 0.1 km^2 (total area of 189,6 km^2)[63].

c) Issyk-Kul Lake Basin

378. Issyk-Kul Lake basin is part of the Issyk-Kul – Tarim basin, one of the five main basins of Kyrgyz Republic (Figure 52)[64]. Issyk-Kul Lake Basin includes 957 glaciers with a total area of about 560.8 km^2 (Table 25).

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[62] FAO. 2012. AQUASTAT Country Profile – Kyrgyzstan. (https://www.fao.org/3/ca0367en/CA0367EN.pdf)
[63] CAIAG. 2018. The Catalogue of Glaciers of Kyrgyzstan. (https://www.caiag.kg/images/2%20Department/2022/Catalogue_of_Glaciers_of_Kyrgyzstan_2018_Edition_2023_EN.pdf)
[64] Geoinformation Portal About Water of the Kyrgyz Republic. The main basins of the Kyrgyz Republic, https://gis.water.gov.kg/portal/home/webmap/viewer.html?webmap=f5cbdd96c9ee4aabb2913c739a131c57).

Figure 52: The main basins of the Kyrgyz Republic

(source: The main basins of the Kyrgyz Republic, https://gis.water.gov.kg/portal/home/webmap/viewer.html?webmap=f5cbdd96c9ee4aabb2913c739a131c57).

Table 25: Distribution of glaciers in Issyk-Kul – Tarim basin

Basin	Total Number of Glaciers		Glaciers Greater than 0.1km² in Area		Glaciers 0.1km² or less in Area	
	Number	Area, km²	Number	Area, km²	Number	Area, km²
Issyk-Kul Lake	957	560.8	635	546.4	322	14.4
Tarim	2,695	2991.7	1843	2946.6	852	45.1
Total	3,652	3,552.5	2,478	3,493.0	1,174	59.5
Source: CAIAG. 2018. The Catalogue of Glaciers of Kyrgyzstan.						

379. The Issyk-Kul Lake basin covers an area of 22,080 km^2, which is 6.5% of the total area of the Kyrgyz Republic. Issyk-Kul Lake is the second largest alpine lake in the world, is a national nature reserve, and at the international level has the following designations - Ramsar Wetland of International Importance and the UNESCO Biosphere Reserve[65].

380. One hundred eighteen (118) rivers flow into the endorheic Issyk-Kul Lake. In the western part of the lake basin that is poor in precipitation, the river network is poorly developed with low normal water flow. The middle and the eastern parts of the Issyk-Kul basin are characterized by a developed river network with a higher normal water flow. The lake is fed mainly by rivers from the east, where the hydraulic network is denser, reflecting heavier rainfall in the area. Only 21 run into the lake[66].

[65] Ramsar. Ramsar Sites Information Service. The Issyk-kul State Nature Reserve with the Issyk-kul Lake. (https://rsis.ramsar.org/ris/1231)
[66] CA0367EN.pdf (fao.org). Country profile.

381. Water resources of Issyk-Kul Lake basin are intensively used for irrigation of agricultural crops. Based on statistical data for recent years (Table 26), the average annual volume of water use in the Issyk-Kul region varied from 360 to 450 million m^3, which is 70% of the total volume of water intake. Up to 95-97% used for irrigation and only 2-3 % is used for household, drinking and industrial needs[67].

Table 26: Water intake from water bodies of the Issyk-Kul region, million m^3

	Year							average
	2013	2014	2015	2016	2017	2018	2019	
Water intake	628.3	628.5	578.9	524.6	623.7	621.1	635.0	605.7
Water use	451.1	440.4	421.1	359.3	438.9	427.5	435.2	424.8
%Use	72	70	73	68	70	69	69	70

Source: Issyk-Kul-Tamrinsky Basin Plan for the Development, Use and Protection of Water Resources, 2022

382. The use of river water for irrigation is associated with irretrievable consumption and with the formation of water returned from irrigated fields. In the Issyk-Kul basin, the quantity of irretrievable losses for irrigation is 45% of water intake[12].

d) Issyk-Kul Lake

383. Lake basin of Issyk-Kul is confined to a pothole of tectonic origin, located between the Kungei-Ala-Too and Terskey-Ala-Too ridges. The surface level is located at an altitude of 1609 m above sea level. The surface area is 6280 sq. km. The length of the lake is 177 km. The maximum width is 60 km. The volume is about 1700 cubic km. The length of the coastline is 688 km. The average depth is 278 m, the greatest depth is 668 m. The length of the lake from west to east is 178 km and its width from south to north is 60.1 km. The total length of its beaches is about 320 km.

384. The level of Issyk-Kul Lake since 1870 has a general downward trend – for the period of measurements from 1927 to 1998, its level had been decreasing by an average of 3.0 cm per year with the lowest level of 1606.18 m observed in 1998. After that, the level increased to 1606.98 m in 2006 (Figure 53), or almost 10 cm per year. From 2011, the level has been again decreasing but has not yet reached the lowest level recorded in 1998 (Annex 5).

385. Lake Issyk-Kul is salty and is not used as a source of water for drinking or irrigation.

[67] Issyk-Kul-Tamrinsky Basin Plan for the Development, Use and Protection of Water Resources, 2022

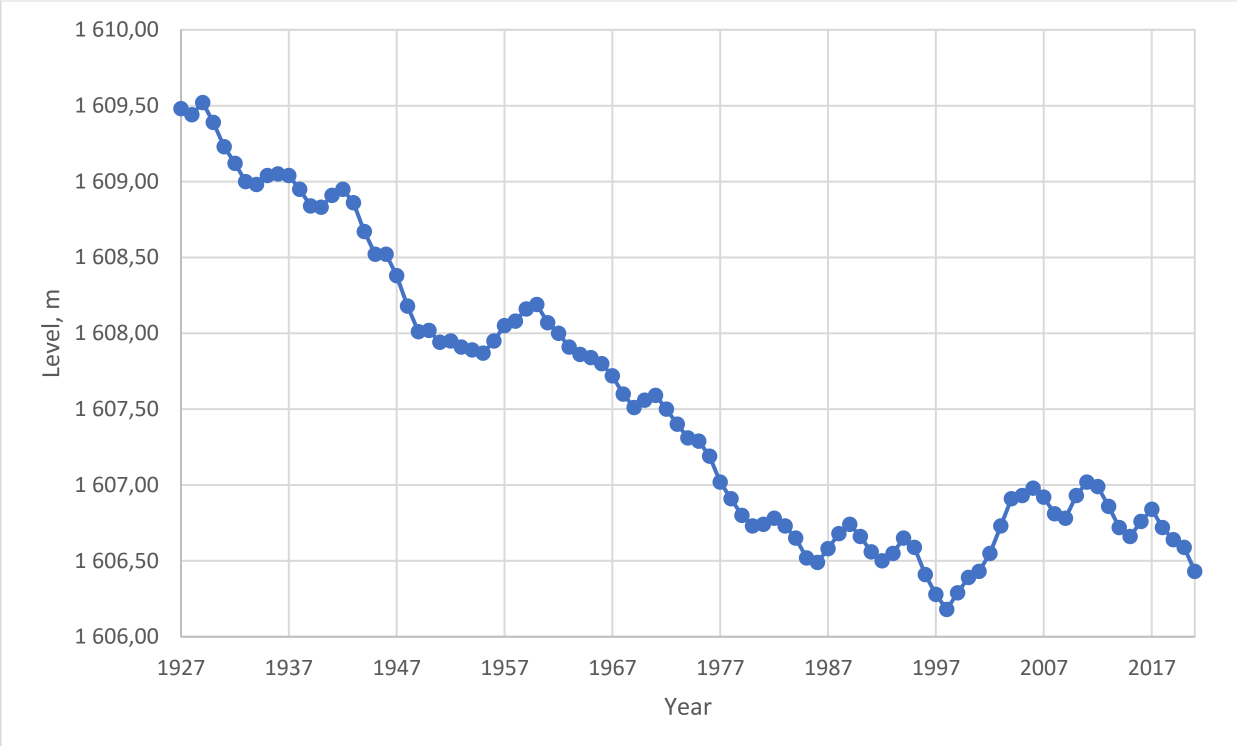

Figure 53: Dynamics of changes in the level of Lake Issyk-Kul, 1927-2021

e) Rivers

386. The road at the project site is crossed by eight (8) major rivers, as well as other streams and irrigation canals (Figure 54). The eight (8) major rivers are Chon-Jargylchak, Kichi-Jargylchak, Chychkan, Juuku, Chon-Kyzyl-Suu, Kichi-Kyzyl-Suu, Jeti-Oguz and Yrdyk.

387. There is also an extensive network of irrigation canals that were spotted during the site visit, which could be affected by the project (Figure 55). Other rivers crossed by the road include the Sary-Bulak River and the Ak-Terek River and a number of unnamed streams, culverts and irrigation system.

388. The construction of a new or expansion of the existing bridges is expected on river crossings. Existing culverts will be replaced or enhanced at all irrigation canals crossing the road project.

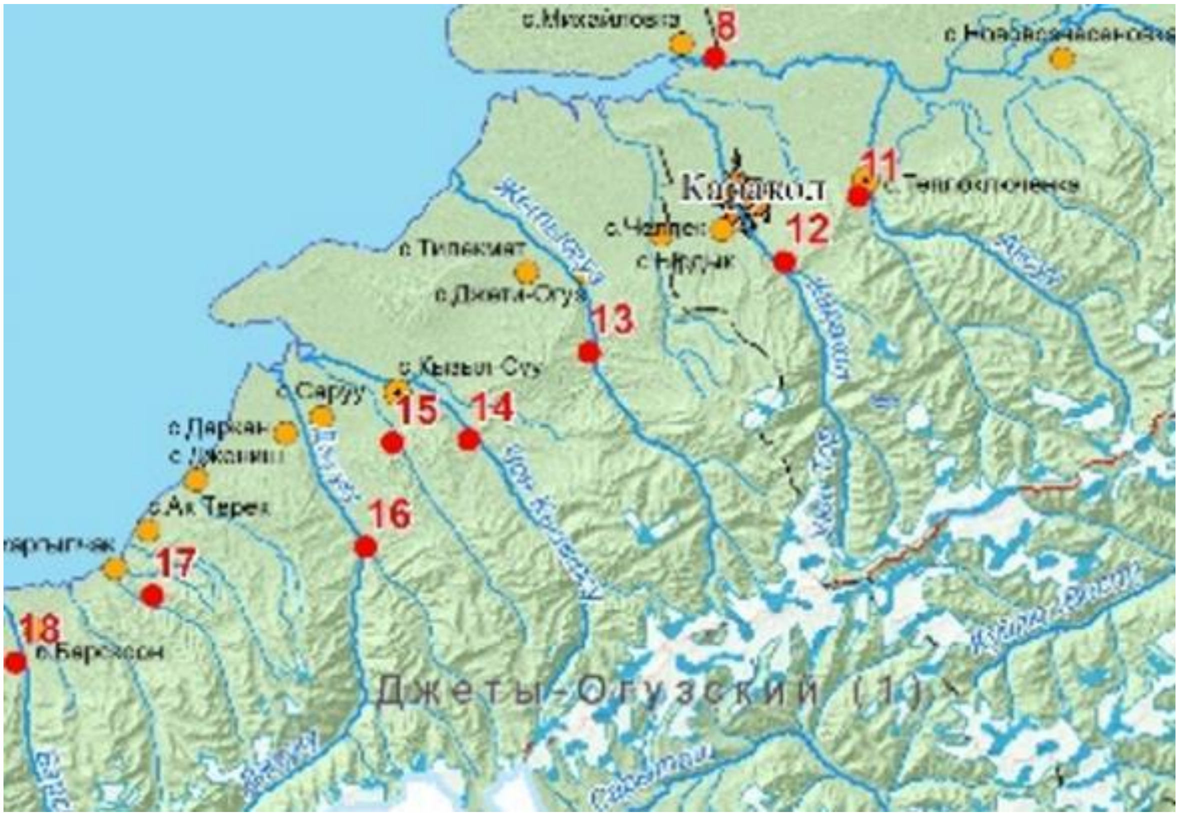

Figure 54: Hydrography of rivers of Jeti-Oguz region

Figure 55: Irrigation canals in (a) Orgochor Village (b) Saruu Village

389. **Chon-Jargylchak River**. The Chon-Jargylchak River (Figure 56) flows through the village of the same name and crosses the existing road through a bridge (42.188306, 77.643170). It originates from the northern slopes of the Teskey Ala-Too Ridge and flows into Issyk-Kul Lake. It is 53 km long and has 24 tributaries. The main source of recharge is melted glacial and snow

waters. The average annual flow rate is 2.32 m^3/s, the maximum is 25.3 m^3/s and the minimum is 0.22 m^3/s. The high water season is May-October. It is used for irrigation.

390. At the time of the visit, there was almost no flow in the river. The distance from the bridge to the lake is 105 meters. The coastal environment is characterized by thickets of shrubs and trees.

Figure 56: Chon-Jargylchak River

391. **Kichi-Jargylchak River**. The Kichi-Jargylchak River flows (Figure 57) through the village of the same name and intersects with the existing road through a bridge (42.2078700, 77.6849740). The river flows down from the northern Teskey-Ala-Too Ridge and runs into Issyk-Kul Lake. The length of the river is 31 km, the catchment area is 110 km^2 and has 11 tributaries of various lengths. The high water is in May-October. The average annual flow is 1.05 m^3/s. Its water is used for irrigation.

392. At the time of the visit, water flow was minimal. The distance from the bridge to the lake is about 100 meters.

Figure 57: Kichi-Jargylchak River

393. **Chychkan River**. Chychkan River (Figure 58) is a small river in Jenish Village that intersects with the existing road through a culvert (42. 262305, 77. 772286). Water flow occurs only during either snow melting or heavy rains. During the visit, the riverbed was dry.

Figure 58: Chychkan River

394. **Juuku River**. The length of Juuku River is approximately 63 km with a catchment area of 590 km^2. The river has more than 60 tributaries. It originates on the Teskey-Ala-Too mountains and flows into Issyk-Kul Lake. There are 11 lakes in the Juuku River basin with a total area of 1.36 km^2, the largest of which is Juuku Lake. The average annual flow is 6.28 m^3/s with its maximum of 52.2 m^3/s. At the mouth of the river there is a thermal spring. Melted glacial and snow water is the main source of the Juuku River. High water flow occurs in May-October.

395. The tributaries of the Juuku River cross the road at two places: one within Darkhan village (42.355499, 77.865702) (Figure 59) and at the entrance to Saruu village of (42.32019, 77.90132) (Figure 60). The river has a winding course with a variety of morphological features. There are many different structures upstream and downstream of the intersections.

396. At the time of the visit, the water flow was negligible, and the water was completely taken into an irrigation canal. Both tributaries get into Issyk-Kul Lake approximately 5 to 6 km downstream of the existing road intersection and passing through agricultural fields.

Figure 59: A tributary of the Juuku River within Darkhan Village

Figure 60: Juuku River at the entrance to Saruu Village

397. **Kichi-Kyzyl-Suu River**. Kichi-Kyzyl-Suu River crosses the road through a bridge (42.3342, 77.98137). The length of the river is 37 km with a catchment area of 139 km^2. It flows from the northern slopes of the eastern part of Teskey-Ala-Too. Kichi-Kyzyl-Suu River has 8 tributary streams with a total length of 21 km. The average annual flow of Kichi-Kyzyl-Suu River is 3.2 m^3/s with its maximum in August and minimum in February. Water flow starts increasing in May and decreasing in October. The river crosses Kyzyl-Suu village.

398. At the time of the visits in April and May 2023, there was no water in the riverbed as the water was taken for irrigation upstream before the river reaches the road (Figure 61). The river flows into Issyk-Kul Lake about 10 km downstream of the existing road intersection.

Figure 61: Kichi-Kyzyl-Suu River

399. **Chon-Kyzyl-Suu River**. Chon-Kyzyl-Suu River crosses the road through a bridge (42.34895, 78.01417) (Figure 62). The length of the river is 48 km with the catchment area of 340 km^2. It begins at Ashuu-Tor glacier on the northern slope of the central part of Teskey-Ala-Too. The upper section of the river is called Ashuu-Too. After the confluence with Kashka-Tor it is called Chon-Kyzyl-Suu. It has 14 tributaries. The type of recharging is glacial-snow with soil impregnation. The average annual flow is 4.7 m^3/s with its maximum of 20.8 m^3/s and minimum of 0.7 m^3/s. The maximum flow occurs in July-August. The river has a winding course with a variety of morphological features. There are many different structures upstream and downstream of the intersection with the road. The distance from the existing road intersection to Issyk-Kul Lake is about 10 km downstream.

Figure 62: Chon-Kyzyl-Suu River

400. **Jeti-Oguz River**. Jeti-Oguz River crosses the road through a bridge (42.44858,78.18155) (Figure 63). The length of the river is 52 km with a catchment area of 387 km^2. It begins on the northern slopes of Teskey Ala-Too. The section of the river passes through a wooded narrow gorge. Near Jeti-Oguz Village its floodplain expands. Water flow starts increasing in May and

decreasing in October. The average annual flow is 5.6 m^3/s with the maximal 57.2 m^3/s and minimal 0.55 m^3/s. It has 36 tributaries with a total length of 110 km. The river basin comprises 18 small lakes with a total surface area of 12.6 km^2. There are radon springs throughout the river's length (e.g., Jeti-Oguz Resort).

401. During the field visits from April to May 2023, the riverbed at the intersection with the existing road was dry. The river course is a large, highly active and morphologically diverse channel.

Figure 63: Jeti-Oguz River

402. **Yrdyk River**. Yrdyk River crosses the road through a culvert (42.47754, 78.29174) (Figure 64). It starts from Ak-Jailoo Lake on the northern slopes of Teskey Ala-Too. It is 28 km long and has a catchment area of 300 km^2. It is formed mainly from snow, glacial waters (85%) and precipitation (15%). The average annual flow is 1.32 m^3/s with maximum flow of 5.72 m^3/s and minimum flow of 0.29m^3/s. The floodplain of the river at the intersection with the existing road indicates the moderate nature of the flow of the river. The riverbed substrate is muddy.

Figure 64: Yrdyk River

403. **Sary-Bulak River**. Sary-Bulak River is a small stream (Figure 65), located between the rivers of Chon-Jargylchak and Kichi-Jargylchak. It crosses the road via a culvert (42.20032, 77.66023). Water in the stream flows only during intense snow melting or heavy rains.

Figure 65: Sary-Bulak River

404. **Ak-Terek River**. The Ak-Terek River (Figure 66) flows near the similarly named Ak-Terek Village and crosses the existing road through a culvert (42.224069, 77.711531). The substrate is silty and sandy. In 300 meters from the intersection of the existing road, Ak-Terek River passing through an orchard empties into Issyk-Kul Lake.

Figure 66: Ak-Terek River

405. **Unnamed Streams**. Immediately, after Barskoon Village towards Chon-Jargylchak River, a canal crosses the road through a bridge (42.18042, 77.63040) (Figure 67). The canal serves as a discharge channel for mudflows during intense melting of snow and glaciers and also during heavy rains that occur normally from June to September.

Figure 67: Old bridge and emergency discharge canal (culvert).

406. An unnamed stream in Ak-Terek village crosses the existing road through a rectangular culvert (42.24188, 77.72256) (Figure 68). During the site visits in April and May 2023, the stream had no water as water flows only during the period of heavy rains and intense melting of snow. The distance from the road intersection to the lake is 250 meters.

Figure 68: An unnamed river in Ak-Terek Village

407. Problematic sites on the Barskoon-Karakol road. During site visits and surface water surveys at the project site, employees of the road operating company responsible for these sections were involved. In addition, potential risks were discussed with representatives of Ministry of Emergency Situations in the Jeti-Oguz District. According to their data and the assessment of the Ministry of Emergency Situations, three (3) problem areas were identified:

(i) A culvert has been built between the villages of Kichi-Jargylchak and Ak-Terek at KM 155 of the road (42.21374, 77.70296). However, the drainage is too small and during heavy rains the drainage pipe cannot accommodate the large volume of water which results to the inundation of the road. The clogging of the drainage during heavy rains worsens the problem (Figure 69). On the average, two to three (2-3) times a year it is necessary to close the road for cleaning of the drainage, during heavy rains.

(ii) In 2022, due to the large flow of water in the Jeti-Oguz River, there was a threat of bridge destruction. To avert this disaster, some parts of the hydraulic structure of the bridge in order to increase the flow capacity (Figure 70).

(iii) The section between Kyzyl-Suu and Jeti-Oguz (42.40038, 78.09744). Snow drift of the road in winter requires constant snow removal (Figure 71).

Figure 69: Clogged culvert at KM 155

Figure 70: The dismantled hydraulic structure of the Jeti-Oguz Bridge

Figure 71: Section of the road affected by snow drift/flow in winter

f) Hydrological Monitoring

408. Available information on hydrology of rivers in the project area is very limited. Hydrological monitoring has significantly decreased after the collapse of Soviet Union in 1991. The reduction in the number of the monitoring stations diminished the accuracy of river flow data. In the beginning of the 1960's there were 104 hydrometeorological stations in the Issyk-Kul Lake basin[68] of which 23 were operated by the Hydrometeorological Service with the rest operated by the Ministry of Water Resources, Giprovodkhoz and other institutions. Currently, out of 23 hydrometeorological stations, 11 are not operational.

409. In addition, in 1980's there were six (6) hydrometeorological stations on Issyk-Kul Lake, of which only one, the Cholpon-Ata Lake Observatory, is currently operational.

410. In the rivers in the project area, there are five (5) hydrometric stations operated by the Hydrometeorological Service (Table 27).

411. Available 25-year (1972-1996) historical data on the flow of the rivers Jeti-Oguz, Chon-Kyzyl-Suu, Chon-Jargylchak, obtained from the Water Management Department of Jeti-Oguz District, are shown in Table 28, Table 29 and Table 30 respectively and in Figure 72.

412. There were incomplete data on the Ak-Terek River. However, based on available data, it is estimated that the annual average flow in the river is 0.8 to 0.9 m^3/s and the maximum water flow for the period 1972-1996 is 1.3 to 1.4 m^3/s.

68 Hydrological Study. Volume 14 Issue 2 Gidrometeoizdat, 1966.

Table 27: River hydrometric stations in the project area.

No.	River – post	Catchment area, km^2	**Operational since, year**
1	Jeti-Oguz - timber mill	330	1949
2	Chon-Kyzyl-Suu – forest cordon	307	1930
3	Kichine-Kyzyl Suu - s. Pokrovka	103	1942
4	Chon-Jargylchak - timber mill	128	1941
5	Juuku - mouth of the Juukuchak River	516	1932

Table 28: Average monthly flow of Jeti-Oguz River, 1972-1996.

Month	Average Monthly Flow Rate	Minimum		Maximum	
		Flow Rate, m^3/s	Year	Flow Rate, m^3/s	Year
January	2.02	1.44	1975	3.07	1987
February	1.69	1.26	1985	2.66	1993
March	1.82	1.16	1979	2.80	1988
April	2.80	1.81	1975	4.08	1985
May	6.15	3.85	1977	10.07	1987
June	10.48	8.00	1982	17.98	1984
July	14.82	8.03	1972	22.32	1978
August	13.85	8.68	1972	20.33	1987
September	5.12	3.60	1991	7.70	1992
October	2.61	1.90	1992	4.83	1981
November	2.47	1.47	1993	3.73	1982
December	2.13	1.60	1991	3.16	1982
The annual average is 5.5 m^3/s, the maximum for the entire period is 30.7m^3/s (July 1978)					

Table 29: Average monthly flow of Chon-Kyzyl-Suu River, 1972-1996.

Month	Average Monthly Flow Rate	Minimum		Maximum	
		Flow Rate, m^3/s	Year	Flow Rate, m^3/s	Year
January	1.53	0.78	1972	2.77	1991
February	1.09	0.8	1981	2.28	1988
March	1.22	0.88	1989	2.04	1991
April	2.10	1.37	1995	3.88	1978
May	4.84	2.44	1996	8.92	1987
June	10.48	7.43	1982	14.60	1981
July	14.82	9.13	1972	18.95	1990
August	14.13	8.54	1989	21.90	1978
September	5.74	3.80	1989	8.70	1990
October	2.88	1.95	1993	4.70	1990
November	1.86	1.00	1996	2.76	1978
December	1.48	1.00	1996	2.44	1979
The annual average is 4.0 m^3/s, the maxim for the entire period is 28.3 m^3/s (July 1983)					

Table 30: Average monthly flow of Chon-Jargylchak River, 1972-1996.

Month	Average Monthly Flow Rate	Minimum		Maximum	
		Flow Rate, m^3/s	Year	Flow Rate, m^3/s	Year
January	0.51	0.32	1976-1978	0.85	1988
February	0.49	0.34	1977	0.86	1993
March	0.52	0.39	1977	0.87	1996
April	0.90	0.46	1977	1.81	1973
May	1.41	0.84	1990	2.55	1981
June	3.22	2.36	1989	5.55	1984
July	5.74	3.02	1989	10.60	1981
August	6.01	3.94	1972	7.98	1984
September	2.51	1.67	1990	7.62	1984
October	1.24	0.40	1982	3.10	1984
November	0.90	0.58	1971	1.10	1992
December	0.72	0.47	1971	0.89	1972
The annual average is 2.01 m^3/s, the maximum for the entire period is 11.8 m^3/s (July 1981).					

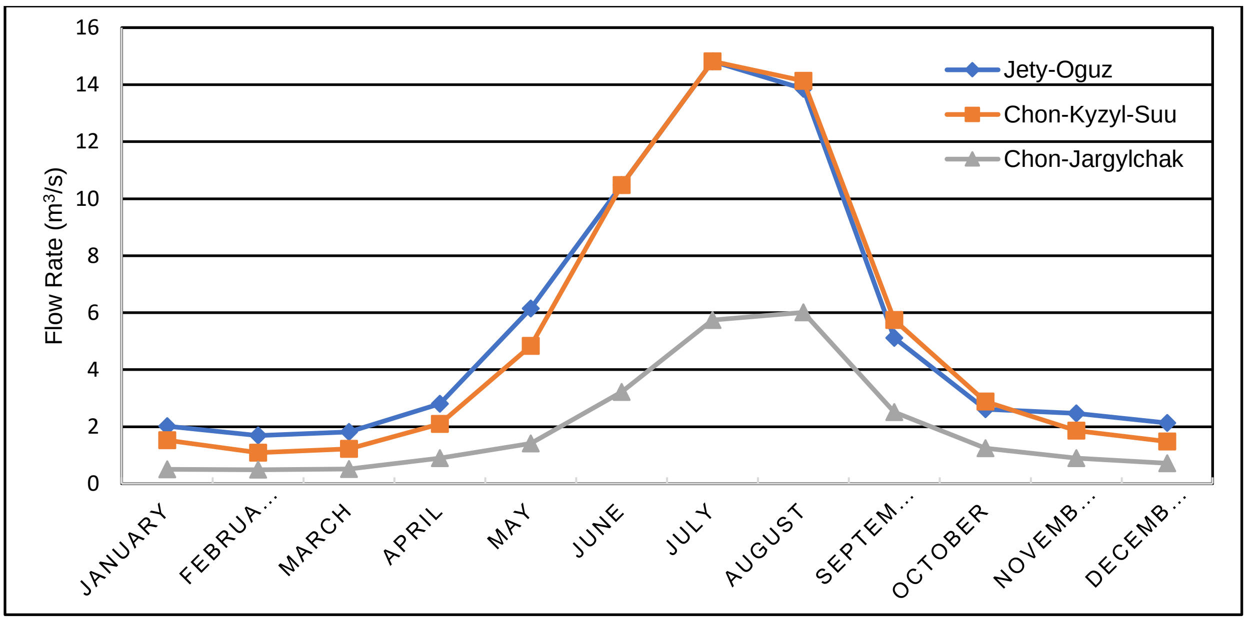

Figure 72: Monthly variations in river flow (25-year averages, 1972-1996).

413. River flow data for the year 2021 from five (5) existing flow monitoring stations were obtained from Kyrgyz HydroMet as shown in Table 31(Detailed monitoring report can be found in Annex 6). Of the five rivers monitored, Jeti-Oguz River has the highest average flow (8.52 m^3/s) while Kichine-Kyzyl-Suu River has the lowest (1.05 m^3/s). As shown in Figure 73, peak average flows occur in the months of June to September for all the five rivers. Table 32 shows that the maximum flow of three of the five rivers (Jeti-Oguz, Chon-Kyzyl-Suu, and Chon-Jargylchak) occurred in the year 2021.

Table 31: The average, maximum and minimum flows of rivers in Jeti-Oguz District, 2021

	Jeti-Oguz River	Chon-Kyzyl-Suu River	Jukuu River	Chon-Jargylchak River	Kichine-Kyzyl-Suu River
Jan	2.21	2.53	3.2	0.92	0.5
Feb	2.19	2.4	2.64	0.92	0.55
Mar	2.17	2.12	1.64	1.02	0.58
Apr	2.7	3.12	1.47	1.17	0.75
May	8.22	7.09	2.06	1.8	1.52
Jun	15.8	9.98	6.96	4.09	1.8
Jul	22.2	23.4	24	9.32	2.17
Aug	22.1	16.6	21	8.41	1.72
Sep	11.4	7.1	12.4	3.48	0.99
Oct	6.43	3.81	4.72	1.63	0.74
Nov	3.85	2.28	2.83	1.13	0.67
Dec	2.93	1.97	1.88	0.94	0.64
Ave	8.52	6.87	7.07	2.9	1.05
Max	55.7	63.3	64.5	32.2	6.15
Min	2	1.53	1.29	0.85	0.65

Source: Kyrgyz HydroMet

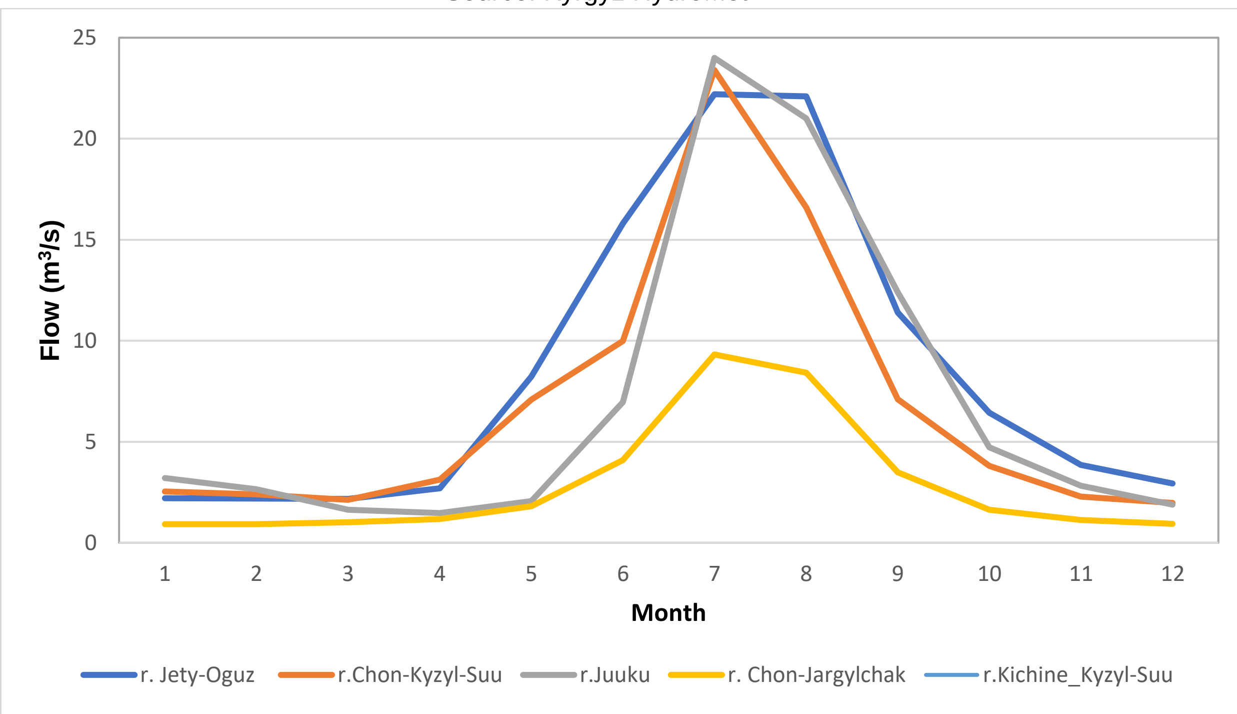

Figure 73: Monthly average flow of rivers in Jeti-Oguz District (m^3/s), 2021

Table 32: Maximum flows of rivers in the Jeti-Oguz District

River	Maximum river flow (m^3/s)	Date
Jeti-Oguz	55.7	30.07.2021

River	Maximum river flow (m^3/s)	Date
Chon-Kyzyl-Suu	63.3	30.07.2021
Juuku	65.4	19.07.1980
Chon-Jargylchak	32.2	30.07.2021
Kichine Kyzyl-Suu	45.0	07.08.1952

Source: Kyrgyz HydroMet

414. As part of the preparation of the Issyk-Kul -Tarim basin plan, a study of the current changes in the flow of 14 rivers of the basin was carried out. Two timeframes were chosen: a long period for the entire observation period and a shorter period from 1990 to 2018. The choice of the latter is due to the fact that in the country a significant increase in air temperature can be traced from the beginning of the 90's of the last century.

415. The study for both timeframes revealed positive annual runoff gradients, and the absolute values determined for two different periods show that the gradients calculated for 1990-2018 are 2.3 times higher than those determined for a longer period (Table 33).

416. But, considering only the rivers within the project area, it can be noted that annual gradients of runoff along the Juuku River increased 3 times, while in Chon-Jargylchak and Kichi-Kyzyl-Suu rivers are unchanged (i.e., ∆Q ratio = 1), and in Ak-Terek River it decreased of 3 times.

417. Thus, on the basis of the study, it can be concluded that the process of increasing river flow has intensified over the past thirty years. This increase can be due to: (i) a continuing increase in air temperature, leading to a shift in the zero isotherm in the high region; and (ii) discovered ongoing process of disintegration of glaciation, which will obviously continue in the event of an increase in air temperature.

Table 33:Actual gradients of annual river flow of the Issyk-Kul-Tarim Basin

	River	Change in river flow (∆Q, m^3/s)		$\frac{\Delta Q_{1990-2018}}{\Delta Q_{all\ period}}$
		1990-2018	Entire observation period	
1	Juuku	0.0889	0.031	3
2	Aksu (heat)	0.0296	0.029	1
3	Aksu (Sem)	0.0462	0.023	2
4	Jyrgalan	0.0667	0.016	4
5	Jong-Koisu	0.0160	0.016	1
6	Chon Jargylchak	0.0185	0.013	1
7	Chon-Uryukty	0.0615	0.012	5
8	Chon-Aksu	0.0154	0.011	1
9	Oytal	0.0077	0.007	1
10	Cholpon Ata	0.0154	0.006	3
11	Barskoon	0.0269	0.005	5
12	Ak-terek	-0.1364	-0.0486	3
13	Kichine-Kyzyl Suu	-0.0037	0.003	1
14	Toruaygyr	-0.0065	-0.005	1
	Average.	0.0176	0.0085	2.3

11. Water Quality

a) Introduction

418. Water quality was determined from literature and information gathered from various government agencies. In addition, 16 spot (grab) samples of surface water were taken at various locations in the project area: 10 samples from 5 rivers and 6 samples from Issyk-Kul Lake in the month of April 2023 (Figure 74). The samples were analyzed for the following parameters: pH, nitrates, nitrites, ammonia, sulfates, suspended solids, chlorides, oil products, BOD5, copper, zinc, iron, lead, cadmium, nickel, mercury, chromium.

419. Water quality is assessed using the standards established for watercourses and reservoirs, depending on the types of water use: household and drinking, cultural and domestic, and fisheries, approved by the Decree of the Government of the Kyrgyz Republic No. 128 "Rules for the Protection of Surface Waters of the Kyrgyz Republic" dated 14.03.2016.

b) Water Quality Field Survey

420. As shown in Table 34 and Figure 74 sixteen (16) spot/grab samples of surface water were taken at various locations in the project area: ten (10) from rivers from five (5) rivers and six (6) from Issyk-Kul Lake. River water samples were taken on April 16 - 17, 2023 and lake water samples on April 23 - 24, 2023 (Figure 75). The samples were delivered to the Stewart Assay and Environmental Laboratories (SAEL) LLC, in Kara-Balta City for analysis of the following parameters: pH, nitrates, nitrites, ammonia, sulfates, suspended solids, chlorides, oil products, BOD_5, copper, zinc, iron, lead, cadmium, nickel, mercury, chromium. SAEL's schedule of laboratory accreditations can be found in Annex 7.

421. The ten (10) river water samples were taken upstream and downstream of the following rivers: Kichi-Jargylchak (R1 and R2), Ak-Terek (R3 and R4), Chon-Kyzyl-Suu (R9 and R10), and at the two tributaries of the Juuku River in Darkhan Village (R5 and R6) and Saruu Village (R7 and R8). Samples were taken only from these five (5) rivers, since there was no water in the other rivers (e.g., Chon-Jargylchak, Jeti-Oguz, Kichi-Kyzyl-Suu). This is due to minimal flow and water intake for irrigation use upstream of the rivers at this time of year.

422. The six (6) surface water samples were taken from Issyk-Kul Lake included one sample each at the point where the Kichi-Jargylchak (L1), Ak-Terek (L5) and Juuku (L4) rivers flow into Issyk-Kul Lake, one sample at a considerable distance from the shore as a reference sample (L6) , one sample at the core zone of the Biosphere Reserve (L3) and one sample at the closest point of the road to the lake (L2).

Table 34: Rivers and Lake Issyk-Kul water sampling locations

SN	Code	Location	Location Description	UTM Coordinates
1	R1	Kichi-Jargylchak River	50 m upstream of the bridge, left bank	42.20787, 77.68498
2	R2	Kichi-Jargylchak River	45 m downstream of the bridge	42.20817, 77.68435
3	R3	Ak-Terek River	50 m upstream of the bridge, right bank of the concrete fence	42.22310, 77.71325
4	R4	Ak-Terek River	40 m downstream of the bridge, below the concrete fence right bank	42.224069, 77.71153
5	R5	Juuku River, Darkhan Village	60 m upstream of the bridge, left bank (in the garden close to a house)	42.31101, 77.88013

SN	Code	Location	Location Description	UTM Coordinates
6	R6	Juuku River, Darkhan Village	40 m downstream of the bridge, across the yard near a house	42.31123, 77.87931
7	R7	Juuku River, Saruu Village	60 m upstream of the bridge, left bank	42.31746, 77.90234
8	R8	Juuku River, Saruu Village	40 m downstream of the bridge, below the concrete fence from a canal (the water after the bridge completely goes into the irrigation canal)	42.3195, 77.9022
9	R9	Chon-Kyzyl-Suu River	60 m upstream of the bridge, left bank	42.35018, 78.0266
10	R10	Chon-Kyzyl-Suu River	40 m downstream of the bridge, below the concrete fence (at the end of the garden of the first house from the highway)	42.352199, 78.019894
11	L1	Issyk-Kul Lake	Area where the Kichi-Jargylchak River enters Issyk-Kul Lake	42.208512, 77.683884
12	L2	Issyk-Kul Lake	Area in the Issyk-Kul Lake nearest the road	42.189691, 77.644888
13	L3	Issyk-Kul Lake	Area where the Ak-Terek River enters Issyk-Kul Lake	42.225823, 77.709615
14	L4	Issyk-Kul Lake	Area where the Juuku River enters Issyk-Kul Lake	42.362268, 77.866073
15	L5	Issyk-Kul Lake	Core zone of Biosphere Reserve near Darkhan Village	42.302401, 77807944
16	L6	Issyk-Kul Lake	Reference point for water quality in Issyk-Kul Lake	42.37125, 77.61691

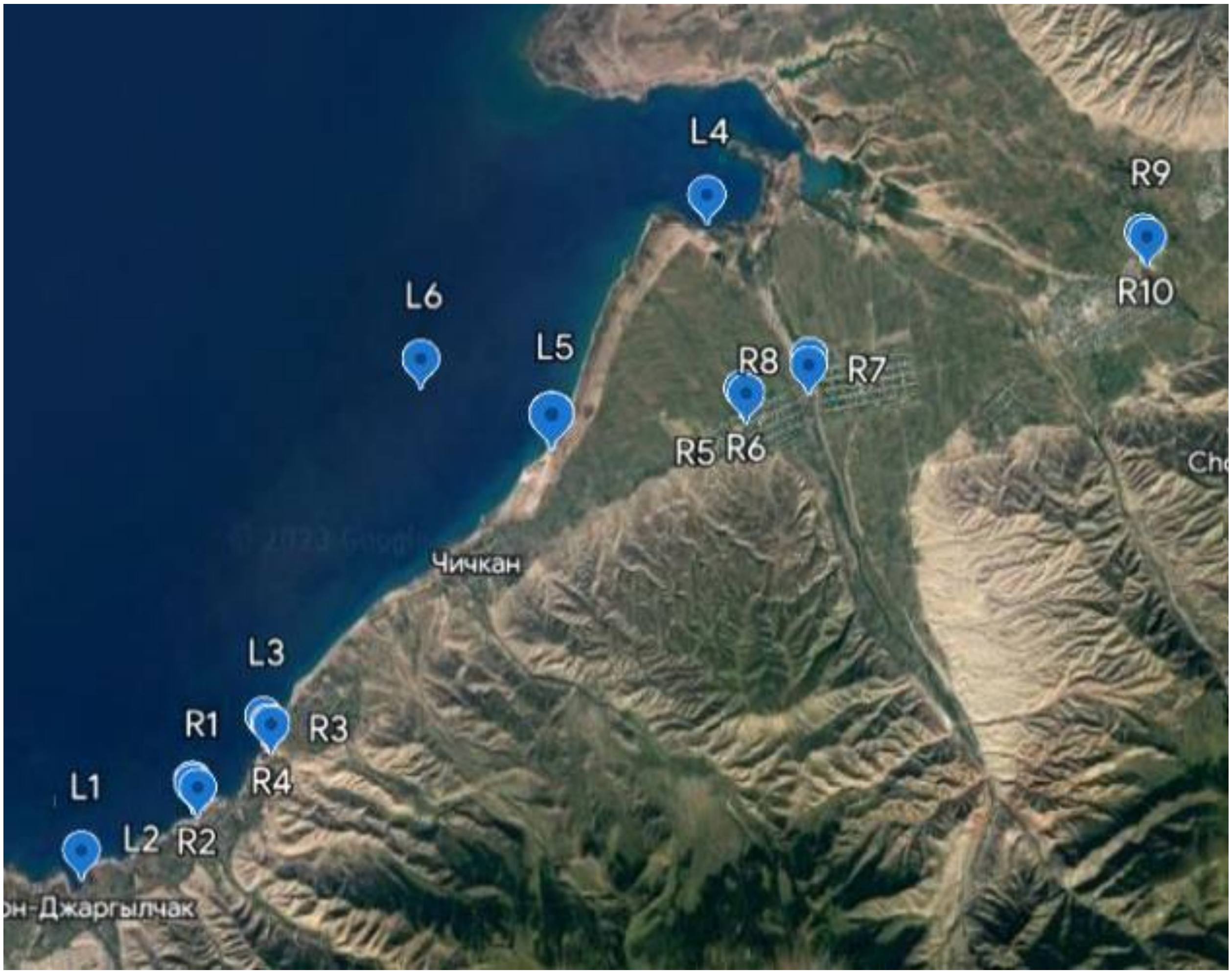

Figure 74: Water sampling locations at rivers and Lake Issyk-Kul

Figure 75: Water specialist conducting sampling at rivers and Lake Issyk-Kul

c) Results of River Water Quality Analysis

423. Results of the laboratory of analysis river water samples are shown in Table 35 (Laboratory reports provided in Annex 8). The results are compared with the national surface water quality standards for the Kyrgyz Republic to describe the water quality in the rivers from which the samples were taken (i.e., they are not used here for conformity assessment). The results show that:

(i) The concentrations of total suspended solids (TSS) exceed the national standards at six sites: upstream and downstream of the Ak-Terek River (R3 and R4), upstream and downstream of Juuku River in Darkhan Village (R5 and R6), and upstream and downstream of Chon-Kyzyl-Suu River (R9 and R10). At other sites (R1, R2, R7, and R8), the concentrations of suspended solids are below the detection limit of 1 mg/l.

(ii) The concentration of iron in samples taken downstream of Ak-Terek River (R4), downstream and upstream in the Chon-Kyzyl Suu River (R9 and R10) exceed the national standard.

(iii) BOD_5 complies with national regulatory values at sampling locations.

(iv) Nitrates, nitrites, ammonia, sulfates, chlorides in all sampling locations do not exceed the maximum permissible concentrations.

(v) The concentrations of heavy metals in water also do not exceed the national standard.

(vi) The concentration of petroleum oils in river water does not exceed the maximum permissible standards.

424. The measured high concentrations of suspended solids in three rivers, may be due to the fact that water samples were taken in mid-April during the rainy season and snowmelt in the mountains. During this time soil and contaminants can fall into rivers with the snow melt and rainwater. Also, washouts from roads can fall into rivers with the runoff. The concentration of suspended solids in Ak-Terek River downstream of the existing road (R4) is more than four (4) times the concentration upstream of the road (R3). For all other rivers, the concentrations of suspended solids are the same downstream and upstream of the road intersection.

425. In the Ak-Terek River, the excess concentration of suspended solids is explained by the features of the river, the smooth flow of the river with a muddy bottom. The excess concentration of suspended solids in the Chon-Kyzyl-Suu River is most likely associated with the soils through which the river flows (hence the name), which is intensively washed out during the rainy and snow melting periods.

426. A slight exceedance of iron concentration in the Chon-Kyzyl-Suu River is most likely due to iron in soil, that is, it has a natural origin. The exceedance of iron concentration downstream of the intersection of the road with the Ak-Terek River is almost 4 times and is most likely due to corrosion of metal structures and soil iron content (high TSS concentration).

Table 35:Results of the laboratory analysis of river water samples

Water Quality Parameter	Kichi-Jargylchak River		Ak-Terek River		Juuku River, Darkhan Village		Juuku River, Saruu Village		Chon-Kyzyl-Suu River		National Norms
	R1	R2	R3	R4	R5	R6	R7	R	R9	R10	
pH	8.017	8.180	8.436	8.424	8.322	8.347	8.435	8.440	8.366	8.349	6.5-8.5
TSS, mg/l	<1	<1	4	17	8	7	<1	<1	14	14	0.75
BOD_5, mg O_2/l	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	3
NO_2^-, mg N/l	0.002	<0.001	0.001	0.002	0.001	0.001	<0.001	0.002	0.003	0.003	0.02
NO_3^-, mg N/l	0.4	0.4	0.3	0.3	0.7	0.7	0.6	0.6	0.6	0.6	9
NH_3, mg N/L	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.4
SO_4, mg/l	36	36	41	40	59	59	62	62	28	28	100
Chloride ions (Cl^-), mg/l	6.4	6.6	61	61	14	14	11	11	2.9	6.0	300
(Cadmium) Cd, mg/l	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	0.005
Chromium (Cr), mg/l	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	0.02
Copper (Cu), mg/l	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.001
Iron (Fe), mg/l	0.014	0.012	0.051	0.192	0.026	0.023	0.004	0.003	0.117	0.101	0.1
Mercury (Hg), mg/l	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0
Nickel (Ni), mg/l	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.01
Lead (Pb), mg/l	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.006
Zinc (Zn), mg/l	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0,005	<0.002	0.01
C10-C19, mcg/l	17	10	11	19	<5	<5	<5	<5	<5	<5	50 mcg/l
C19-C32, mcg/l	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	50 mcg/l

d) Results of Lake Issyk-Kul Water Quality Analysis

427. Results of the laboratory analysis of the water samples from Issyk-Kul Lake are shown in Table 36. The results are compared with the national surface water quality standards for the Kyrgyz Republic to describe the water quality in the lake from which the samples were taken (i.e., they are not used here for conformity assessment). The results show that:

(i) Slight excess of pH in three locations (L2, L5 and L6).

(ii) The concentrations of suspended solids exceed the national standard at all sampling locations.

(iii) BOD_5 complies with the national standard at all sampling locations.

(iv) Nitrates, ammonia, iron in all sampling sites do not exceed the maximum permissible concentrations, except at one location where there was a light excess of nitrites (L4).

(v) Exceedance of concentrations of sulfates and chlorides are recorded at all sampling sites. However, in samples that were taken from the confluence of the river and the lake, the concentrations are less due to dilution of lake water with river water.

(vi) The concentrations of heavy metals in water also do not exceed the maximum permissible limits.

(vii) The concentration of petroleum oils in lake water exceeds the maximum permissible standards at one location (L6). This sample was taken at a distance from the shore of Issyk-Kul Lake. It is more most likely due to the fact that a boat was used for sampling and it may be that the oil was from boat.

428. Most of the analyzed water quality parameters on water samples from Lake Issyk-Kul are within the national standards. The exceedances in suspended solids are most likely due to seasonal rainfall and storm, while the high concentrations of sulfates and chlorides are from natural conditions of the lake.

Table 36: Results of the laboratory analysis of Issyk-Kul Lake water samples.

Water Quality Parameters	L1	L2	L3	L4	L5	L6	National Norms
pH	8.313	8.537	8.415	8.259	8.522	8.529	6.5-8.5
TSS, mg/l	7	5	3	4	9	7	0.75
BOD_5, mg O_2/l	<1	<1	<1	<1	<1	<1	3
NO_2^-, mg N/l	<0.001	<0.001	<0.001	0.003	0.002	0.001	0.02
NO_3^-, mg N/l	0.3	0.1	0.3	0.7	0.1	0.1	9
NH_3, mg N/l	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.4
SO_4^{2-}, mg/l	1075	1779	121	278	2127	2165	100
Cl^-, mg/l	791	1289	123	171	1563	1591	300
Cadmium (Cd), mg/l	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	0.005
Chromium (Cr), mg/l	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	0.02
Copper (Cu), mg/l	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.001
Iron (Fe), mg/l	0.031	0.031	0.072	0.248	0.210	0.067	0.1
Mercury (Hg), mg/l	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0
Nickel (Ni), mg/l	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.01
Lead (Pb), mg/l	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.006
Zinc (Zn), mg/l	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.01
C_{10}-C_{19}, mcg/l	51	26	49	<5	<5	72	50 mcg/l
C_{19}-C_{32}, mcg/l	<30	<30	<30	<30	<30	<30	50 mcg/l

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e) Water quality monitoring carried out by various organizations

429. **Issyk-Kul-Naryn Regional Department under the Ministry of Natural Resources, Ecology and Technical Supervision (MNRETS)**. Data on water quality monitoring of the rivers in the project area and Issyk-Kul Lake for the years 2018 to 2022 years was provided by the Issyk-Kul-Naryn Regional Department under the MNRETS. Water quality monitoring of rivers is carried out twice a year. In the project area, monitoring for 2018-2022 was carried out in the following rivers: Chon-Jargylchak, Jeti-Oguz, Ak-Terek, Darkhan (a tributary of the Juuku River in the village of Darkhan), Juuku, Kyzyl-Suu and Yrdyk. Monitoring is carried out for 11 parameters: pH, electrical conductivity, nitrates, nitrites, ammonia, dissolved oxygen, BOD_5, surfactants, chlorides, sulfates and suspended solids. The monitoring did not find any exceedances from the national standards for all the above sampled rivers (Water quality monitoring results are attached in Annex 9).

430. Monitoring of the water quality of Issyk-Kul Lake is carried out thrice a year (before, during and after the summer season) at 20 sampling points. Monitoring is carried for 8 parameters: pH, electrical conductivity, nitrates, nitrites, ammonia, dissolved oxygen, BOD_5 and surfactants. The monitoring results showed that during this period there were no exceedances of the maximum permissible concentration of all water quality parameters analyzed at all sampling points within the project area.

431. **Jeti-Oguz District Center for Disease Prevention and Sanitary and Epidemiological Surveillance**. Monitoring data were provided by the Jeti-Oguz District Center for Disease Prevention and Sanitary and Epidemiological Surveillance for 2020 to 2022. The monitoring results were provided for the following rivers: Chon-Jargylchak, Juuku, Yrdyk, Kyzyl-Suu. Monitoring was carried out according to bacteriological indicators: total coliforms, thermotolerant coliforms and 8 chemical indicators: pH, odor, color, turbidity, ammonia, nitrites, nitrates and chlorides. The monitoring results showed that there were no exceedances in bacteriological and chemical parameters of the river water (Water Quality Analysis results are provided in Annex 10).

B. Biological Resources – Biodiversity

1. Introduction

432. Key biodiversity features in the project area were identified through the following actions:

(i) Preparatory: field visit to the project site, visual inspection to get an idea about the potential species composition of the territory. Making a schedule of visits of taxonomic groups of organisms in accordance with the accepted methods of research.

(ii) Literature analysis, collection of information on biodiversity and cartographic materials.

(iii) Field research, the stage is usually limited by seasonal requirements.

(iv) The final stage is the preparation of a biodiversity assessment.

433. Methodology for data collection included desktop data gathering and fieldwork to verify available information and gather additional data, such as new species of insects, plants, birds, mammals, etc., which appear in different months and seasons. Field surveys were conducted in 2023 during the winter season (January 23-24, March 21-25, and April 9-13), winter season (April 18-19 and the summer season (July 7-9). The survey were carried out by the national biodiversity team.

434. Biodiversity assessment was conducted using the following methods, categorized by species groups, accounting methods, and species availability:

(i) Identification of main types of plant communities (according to the adopted system), background and/or diagnostic species of vascular plants;

(ii) Assessment of the presence of flora and fauna species from the Red Book (2005), endangered species;

(iii) Identification of endemic and relict species of biodiversity;

(iv) Assessment of the presence of invasive species of biodiversity,

(v) Biodiversity Ecosystem Analysis;

(vi) Bird migration; and

(vii) Identification of indicator species for monitoring.

435. Two methods were employed during the biodiversity inventory: trial accounting areas and route accounting. However, it is important to note that complete identification of biodiversity is not feasible, and the possibility of discovering new species during future surveys cannot be ruled out due to the dynamic nature of flora and fauna. Furthermore, for relatively mobile organisms "stretching" the duration of the inventory for many years leads to the fact that the local species list can change due to single finds of migrating species not related to the habitat of the surveyed area.

436. Information on the species distribution in the local habitats was obtained from the following sources of information: Flora of Kyrgyzstan,1967-1970[69], Atlas of Kyrgyz Republic, (1987)[70], Lazkov (2015)[71], Turdakov (1963)[72], Pivnev (1990)[73], Shukurov (1991)[74], Yanushevich (1959, 1960)[75], Shukurov (1982)[76], Yanushevich (1972)[77] and others.

437. Biodiversity indicators can be generic (e.g., range area, species diversity, in wetlands of protected areas). Inventories, unlike monitoring, do not involve periodic measurements. However, for the project it is important to have temporary data to assess impacts on biodiversity from road construction, mitigate pressures, and develop measures to reduce damages. The biodiversity inventory we use the following approaches:

(i) Taxonomic: target species, larger systematic and biological groups;

(ii) Data studies (presence/absence of species or some quantitative indicators);

(iii) Spatial in the study area: priority (wetlands); priority habitats; and placement of sample areas within natural complexes and habitats; and

(iv) Temporal: duration of the survey; and periodicity of inventory.

438. Obtaining information about biodiversity includes the total number of identified species of the main taxonomic groups of organisms: (i) mammals; (ii) birds; (iii) reptiles, amphibians; (iv) fish and cyclostomes; (v) insects; and (vi) vascular plants.

439. **Mammals** - Information available from references (primary and secondary data sources) were used as the basis for describing the area. Two species of mammals that are listed in Red Book of Kyrgyz Republic are mosaically distributed along the coast and riverbeds flowing into

[69] Flora of Kyrgyz SSR Supplement, edition 1-2.Frunze, 1967-1970
[70] Atlas of the Kyrgyz Republic. Moscow 1987.
[71] Endemic and rare plant species of Kyrgyzstan(Atlas).Ankara 2015. P.50, 126,
[72] F.A. Turdakov Fishes of Kyrgyzstan. Publishing house of the Academy of Sciences of the Kyrgyz SSR, Frunze 1963.
[73] Pivnev I.A. Fishes of Kyrgyzstan. -Frunze: Ilim, 1990. -C.138.
[74] Shukurov E.D. The animal world of the Issyk-Kul hollow in connection with its ecological state// Fauna and ecology of terrestrial vertebrates of Kyrgyzstan. -Bishkek: Ilim, 1991. -C.37-48.
[75] A.I. Yanushevich, P.S. Tyurin, I.D. Yakovlev, A.K. Kydyrov, and N.I. Semenov Birds of Kyrgyzstan Frunze 1959, 1960.
[76] E.D. Shukurov Birds of Kyrgyzstan 1982.
[77] A.I. Yanushevich Mammals of Kyrgyzstan Publishing House Nauka 1972.

Lake Issyk-Kul. Their numbers are low and are steadily declining. These species are very rare and may not occur in the project area.

440. Recording of adult phase of large invertebrates (butterflies, bugs, dragonflies, bees, grasshoppers, spiders, mollusks) was visually carried out. Research methodology comprised included: catching and identification of insects; turning over stones and soil layer; checking of plants and plant residues; and photographing.

441. **Aquatic fauna** - In addition to the desk top work the ichthyofauna study, undertaken in March 2023 included visual audits for identification of habitats suitable for fish species expected to be found in the stream (geomorphology of the substrate, general hydrological data, hypsometry, landform, landscape-visual features). The fish inventory reveals the species composition of the fish fauna, the relative abundance of species and the presence of rare ("red-listed") species.[78]

442. **Avifauna** - Birds are the most mobile and diverse component of vertebrate fauna. At different times of the year, the species composition of birds in the study area may vary greatly depending on the landscape and set of biotopes.[79] Bird counts are conducted according to the general standard methodology at permanent observation points, habitats, in flight, routes, places of mass accumulations of birds, as well as migration of birds, on the study area, from the set of bird species visiting it or permanently inhabiting it, bird counting conducted at January, March, April and July 2023.

443. Visual observation of bird's presence at Issyk-Kul lake, ponds, bogs or rivers on the project territory determined the necessity to carry out censuses of nesting waterfowl, as well as use of these lands by birds during migration in spring. These censuses divided into censuses of nesting and migrating waterfowl, censuses of breeding of waterfowl and censuses of broods are conducted. Birds are counted in different ways depending on their species or ecological belonging. we used two types of counts: direct absolute counts and a second one based on voices during the initial breeding period.

444. Threat categories for the identified plant taxa were determined according to the categories and criteria of International Union for Conservation of Nature (IUCN) guidelines (IUCN, 2022)[80] and The Red List of Kyrgyz Republic (2006). Particular attention was paid to identification of any protected species in the project impact area. Assessment and monitoring processes aimed at maintaining global databases will use data from the International Red List of Threatened Species, Birdlife International[81]

445. The biodiversity assessment identified flora and fauna species within the study area and significant habitats for inhabitant species. The data information gathered are used to determine possible impact on biodiversity of construction and operation phases of the proposed road project. Species, protected under Kyrgyz legislation and international treaties (included in the Red List and species having other conservation status), species bearing special significance for local population have been paid particular attention in the assessment.

2. The Biosphere Territory of Issyk-Kul (BTIK) – A Protected Natural Territory

446. The project is within the Biosphere Territory of Issyk-Kul (BTIK), which encompasses the whole administrative boundaries of the Issyk-Kul Oblast (Region). The BTIK, which has an area of 43.1 square kilometers (4,310 hectares), is a special protected natural area of national significance. It was established by the Resolution of the Government of the Kyrgyz Republic No.

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[78] F.A. Turdakov Pisces of Kyrgyzstan. Publishing house of the Academy of Sciences of the Kirghiz SSR, Frunze 1963.
[79] A.I. Yanushevich, P.S. Tyurin, I.D. Yakovlev, A.K. Kydyrov, and N.I. Semenov Birds of Kyrgyzstan Frunze 1959, 1960.
[80] Guidelines for Using the IUCN Red List Categories and Criteria. Version 15.1.(July 2022).p.114.
[81] http://datazone.birdlife.org/site/factsheet/eastern-issyk-kul-lake-iba-kyrgyzstan/map, https://rsis.ramsar.org/ris-search/?f[0]=regionCountry_en_ss%3AKyrgyzstan&pagetab=1

623 "On the Issyk-Kul Biosphere Territory" of September 25, 1998 and Resolution of the Government of the Kyrgyz Republic No. 40 of January 24, 2000[82].

447. The objectives of creating the BTIK are:

(i) To preserve, restore and use natural areas with rich natural and cultural heritage;

(ii) To support long-term, sustainable economic and social development of the territory, including its recreational use, taking into account the preservation and restoration of natural resources; and

(iii) To carry out long-term environmental management, monitoring and ecological research, as well as environmental education and training.

448. The lands of the biosphere territory are owned by the state, communal, private, and other forms of ownership.

449. The BTIK is divided into four zones as shown in Figure 76, based on the Comprehensive Development Plan for the Issyk-Kul and on the physical and ecological conditions and permissible types of land use. These zones are as follows:

(i) **The core zone** covers a total area of 141,120 hectares. It includes the most important places, species habitat and other natural features. It is strictly protected, with all kinds of economic activities strictly forbidden and only scientific research, monitoring, and conservation activities allowed. The zone includes:

  (a) Ramsar areas: 19,842 ha, of which 3,164 ha are coastal and 16,678 ha is the Lake Issyk-Kul;

  (b) Mountain ecosystems of the forest belts of the Terskey Ala Too slopes within the Karakol State Nature Park (area 8,600 ha);

  (c) Ecosystems of high-mountain forests and pastures (Syrtas) of the Sarychat-Ertash Natural Reserve (72,080 ha); and

  (d) Subalpine, alpine and glacier zones of Terskey Ala Too (59,500 ha).

(ii) **The buffer zone** occupies a total area of 3,501,516 ha. It consists of:

  (a) The buffer zone of the Issyk-Kul Special Protected Nature Reserve (excluding human settlements, resorts and arable lands);

  (b) The Issyk-Kul Lake water area except for a one-kilometer zone near the ports and docks of resorts (457,145 ha);

  (c) State forest lands within the Terskey Ala Too and Kungey Ala Too mountain ranges;

  (d) State land reserves and arable land located on the Kungei Ala Too and the Terskey Ala Too Mountains; and

  (e) The portion of the Issyk-Kul region southeast of the Terskey Ala Too to the Kyrgyz Republic border (except for settlements, industrial lands, energy infrastructure and extractive deposits).

450. The buffer zone covers also a 500-meter strip of land around the shoreline of the Lake. Buffer zone protects the core zone from adverse human activities. Limited activities are allowed as long as they do not result in adverse impacts on the core zone. Such activities include scientific research, ecosystem monitoring, forestry, traditional use of land use, recreation and tourism,

[82] As amended by the resolutions of the Government of the Kyrgyz Republic November 5, 2002, June 28, 2005 No. 263, September 19, 2006 No. 682, March 13, 2013 No 131.

hunting and fishing, use of mineral water and resources for health improvement and collection of medicinal components, raising public awareness and education. Activities that may harm ecological integrity are prohibited, including the establishment of new settlements and industrial facilities, construction, geological work, mining, introduction of alien flora and fauna, and works that would alter the hydrologic regime of the areas.

(iii) **The transition zone** has an area of 688,540 hectares, including agricultural and industrial land, transportation infrastructure, military and other installations, settlements, resorts, and other areas not designated as core or buffer zones. The transition zone focuses on sustainable economic development. Economic activities are permitted, but are regulated so as to ensure sustainable use of ecosystems. Allowed activities include agricultural, industrial, recreational, transportation, communications, defense, and community building.

(iv) **Rehabilitation zone**, which includes areas severely degraded by human activities and in need of rehabilitation, such as mountain areas, settlement areas, and disturbed pastures. Regeneration, rehabilitation, restoration, reclamation, and other measures are taken to In order to restore the ecological integrity of damaged areas.

451. The whole project area lies within the transition zone of the BTIK.

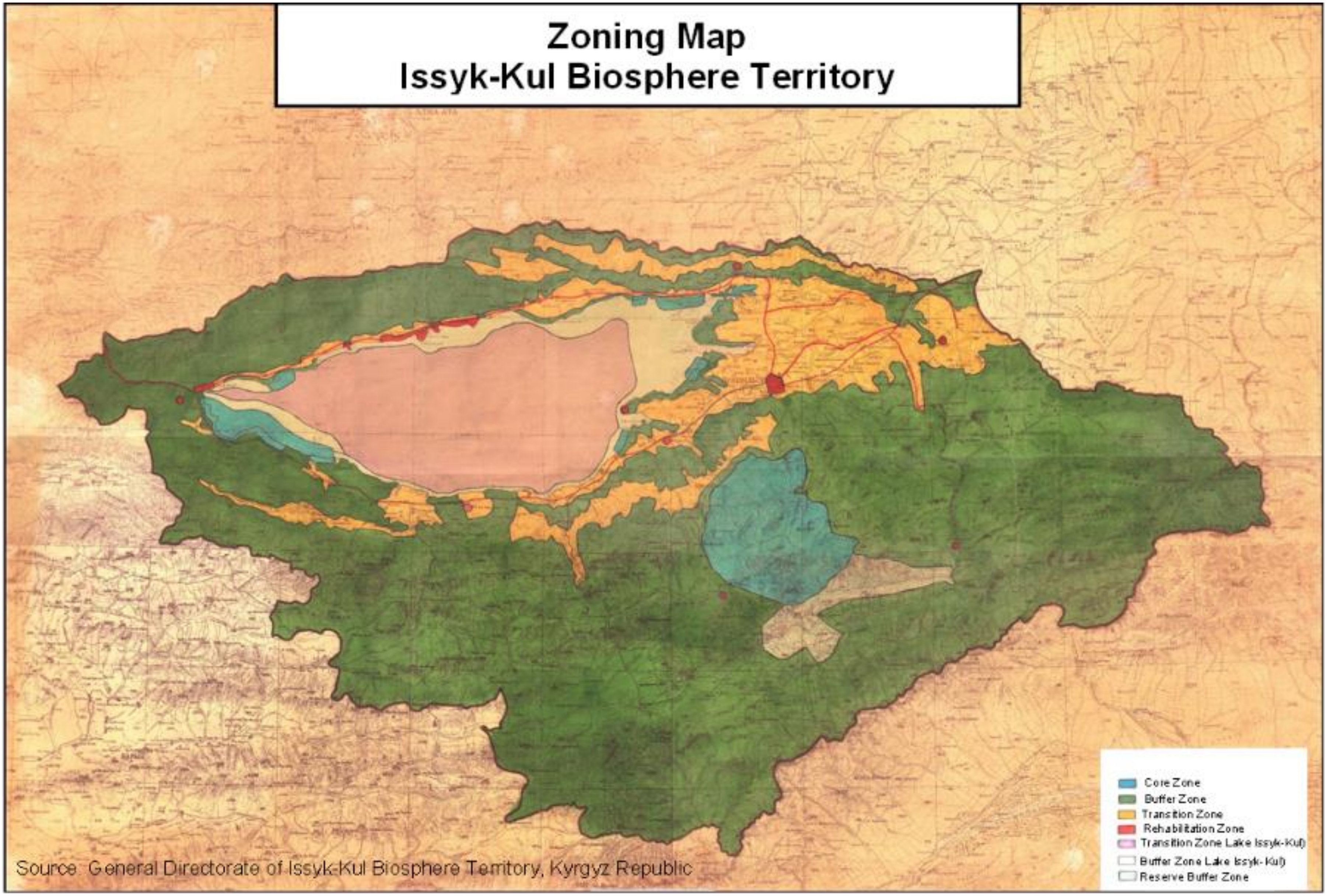

Figure 76: Zoning map of the Biosphere Territory of Issyk-Kul (BTIK)

3. Protected areas in the Issyk-Kul Oblast

452. The Integrated Biodiversity Assessment Tool (IBAT)[83] was utilized to identify biodiversity areas in or near the project site. The IBAT identified one biodiversity area within one km of the road project (Issyk-Kul State Reserve with the Lake Issyk-Kul and Ramsar), another two sites within 10 km (Jeti-Oguz Wildlife Refuge and Karakol Nature Park), and two sites within 50 km (Sarychat-Ertash NR and (State National Nature Park "Kolday koldery") as shown in Table 37 and Figure 77. It should be noted that Kolday Koldery, which is in Kazakhstan and Sarychat-Ertash Nature Reserve are in mountainous areas that are 50 km from the project site and as such will not be impacted by the project. It should also be noted that the other three sites are within the boundaries of the BTIK.

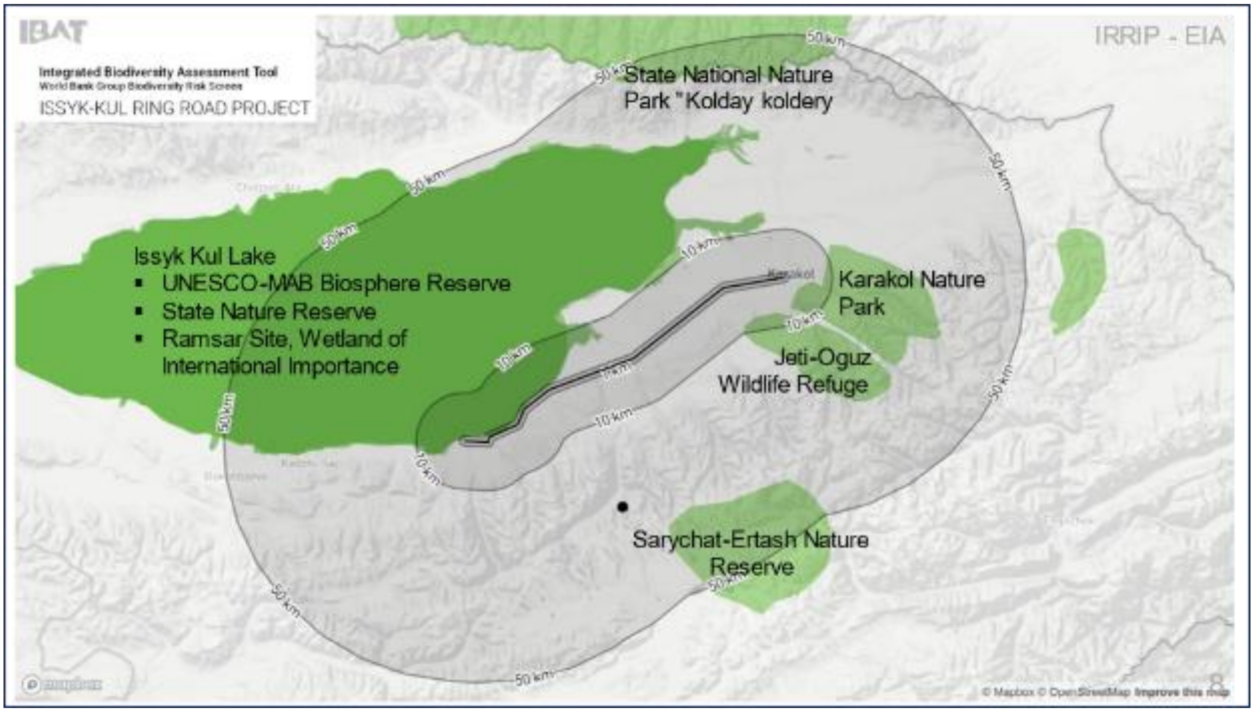

Figure 77: Map of protected areas located within 50 kilometers of the project site

[83] IBAT. https://www.ibat-alliance.org/

Table 37: List of protected areas located within 50 kilometers of the project site

Area name	Distance	IUCN Category*	Status	Designation
Issyk-Kul State Reserve with the Lake Issyk-Kul	1 km	Ia**	Designated	UNESCO-MAB Biosphere Reserve Ramsar Site, Wetland of International Importance State Nature Reserve
Jeti-Oguz	10 km	IV	Designated	Wildlife Refuge
Karakol	10 km	II	Designated	Nature Park
Sarychat-Ertash Nature Reserve	50 km	Ia	Designated	State Nature Reserve
State National Nature Park "Kolday Koldery"	50 km	II	Designated	State National Nature Park
*Category Ia – strict nature reserve; Category II – national park; Category IV – habitat or species management area **Category for Issyk-Kul State Nature Reserve				

a) The Issyk-Kul Nature Reserve with the Issyk-Kul Lake Ramsar site

453. The Issyk-Kul Nature Reserve was established by the Resolution of the Council of Ministers of the Kirghiz SSR No. 1205 of December 10, 1948 (Figure 78), when the Kyrgyz Republic was part of the USSR. It is a special protected natural area of . The reserve has existed within its current borders since 1976. It is located in the eastern part of the Tien Shan mountains, in the Ton, Jeti-Oguz and Tyup districts of the Issyk-Kul region. Its area is 17,310 hectares, including 687 hectares of forest cover and 1,329 hectares of meadows and Issyk-Kul Lake. The main objective of the Issyk-Kul State Nature Reserve is to protect and monitor the wintering sites of waterfowl and near-water birds, such as the redhead pochard, swan goose, etc.

454. Lake Issyk-Kul (Figure 78) was included in the Ramsar list on December 26, 1976 and recognized as a wintering place for waterfowl and as wetlands of international importance, under the Soviet Union. The Kyrgyz Republic gained independence in 1991 and join the Ramsar Convention in 2002. Thus, automatically registering Lake Issyk-Kul as Ramsar Site (No. 1231) of Kyrgyz Republic.

455. The Issyk-Kul State Nature Reserve consists of nine areas, ranging in size from 5 to 11,584 hectares, with coastal and aquatic areas not always forming a single complex. The areas are located on the northern and southern shores of the western and eastern parts of Lake Issyk-Kul, with only one area (5 hectares) located on the northern shore. Two core areas are near the project site, with the Ala Too Core Zone at a distance of from 1 to 5 km of the road project and the Kokuy Kol Core Zone approximately 10 km from the project (Figure 79).Ala Too (Figure 80), between the villages of Jenish and Darkhan, has a total area of 510 hectares (the area is located in the lake's aquatic zone). Kokuy-Kol has a total area of 642 hectares, in Koi-Sary Village and Ak-Dobo in Jeti-Oguz district, with an additional 700 hectares of lakeshore aquatic zone up to 1.5 kilometers wide (Figure 81).

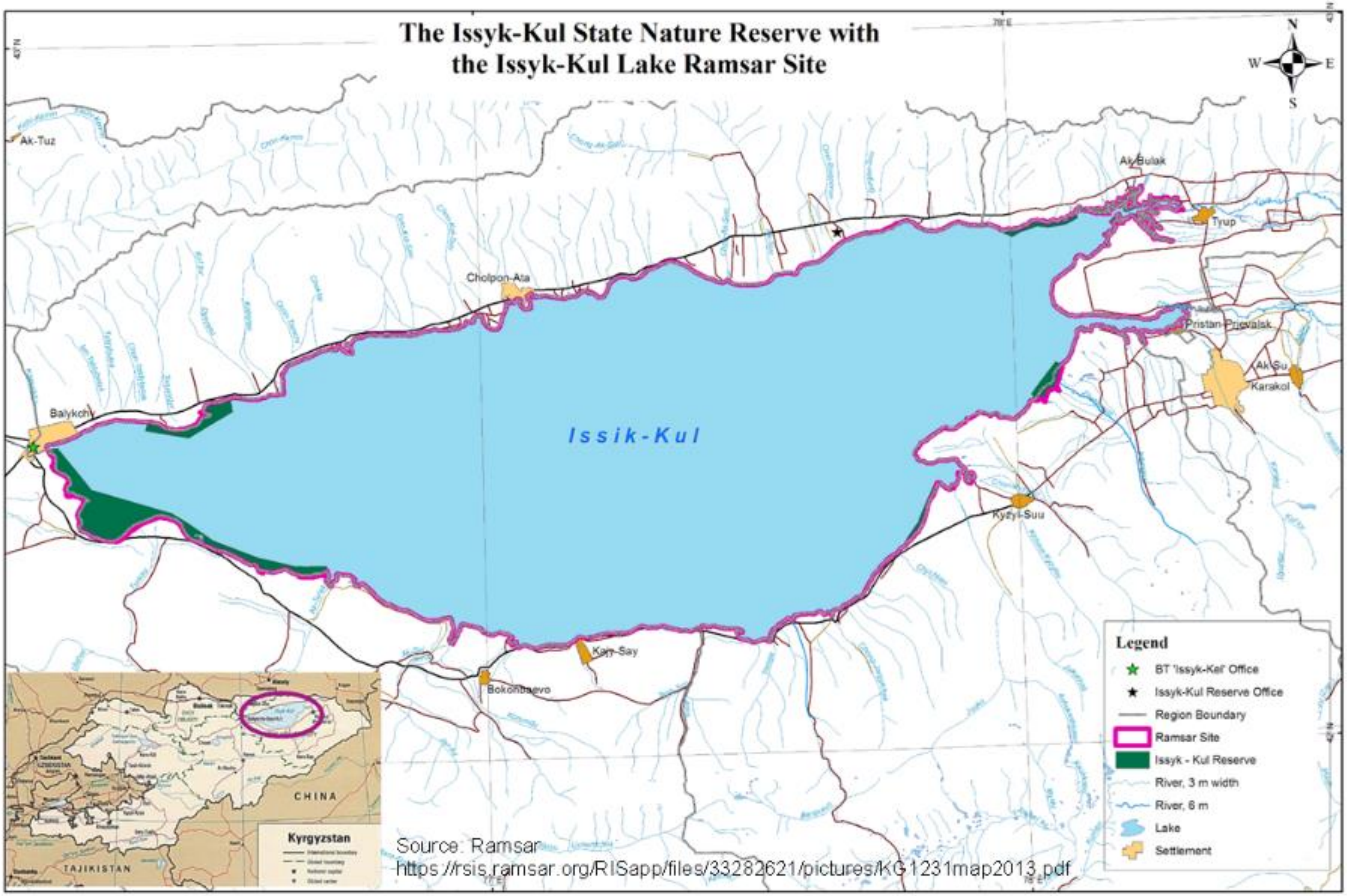

Figure 78: Issyk-Kul Ramsar site boundary

Figure 79: Two core zones of the BTIK that are near the project site, Ala Too and Kokuy Kol

Figure 80: Ala Too Core Zone of the Issyk-Kul Nature Reserve

Figure 81: Kokuy-Kol Core Zone of the Issyk-Kul Nature Reserve

b) Sarychat-Ertash Nature Reserve

456. The Sarychat-Ertash Reserve is a specially protected natural area established by the decree of the Government of the Kyrgyz Republic on March 10, 1995, No. 76. It is part of the core zone of the BTIK (Figure 77). This nature reserve was established to preserve the unique natural complexes, rare and endangered animal and plant species of the alpine zone of the Issyk-Kul region, as well as to maintain the overall ecological balance of the region.

457. The reserve is home to snow leopards (Figure 82), manuls, wolves, foxes, brown bears, stone martens, ermines, mountain goats, Siberian ibexes, gray marmots, and other species.

Figure 82: Snow leopard (*Panthera uncia*)

c) Karakol Nature Park

458. The Karakol Nature Park (Figure 77) was created by the decree of the Government of the Kyrgyz Republic on April 15, 1997, No. 225. Its total area is 38,256 hectares, including 7,690 hectares of forest land and 30,566 hectares of non-forest land. The park was created to preserve the unique natural complexes, forests, and animal and plant life that have particular ecological value for the favorable combination of natural and cultural landscapes, as well as for recreational, educational, scientific, and cultural purposes.

459. The Karakol Gorge, which is part of the nature park, is rich in biodiversity, including Schrenk's pine (Figure 83), Siberian larch, roe deer, Siberian ibex, snow leopards, brown bears, Siberian elk, lynx, golden eagles, black vultures, falcons, and bearded vultures.

Figure 83: Schrenk's pine

d) Jeti-Oguz Wildlife Refuge

460. The reserve was established in 1958 in the basin of the Jeti-Oguz River and has an area of 31,300 hectares (Figure 77). Its main objectives are to preserve high-altitude ecosystems, wildlife, and rare species such as snow leopards, brown bears, lynxes, Siberian elk, roe deer, Siberian ibexes, wild boars, stone martens, and ermines. The area is rich in subalpine and alpine meadows alternating with forests (Figure 84).

Figure 84: Jeti-Oguz Wildlife Refuge

e) Teskei Geopark

461. Located in the Teskei Ala-Too Mountains (Figure 85), along the southern shore of Lake Issyk-Kul. The total area is 9,138 km^2 and the altitude varies from 1,600 to 5,000 meters above sea level. The geopark was created by the Order of the Governor of Issyk-Kul oblast on June 2, 2021.

462. Geopark contributes to development of sustainable tourism. UNESCO sites serve as a platform for the development of sustainable tourism, the preservation of social and cultural values of society, as well as unique natural resources.

463. The altitudinal zoning of the Teskey Geopark landscapes consists of coastal zone 1 600 - 2 000m above sea level, desert and semi-desert 1 800 - 2 200m above sea level, steppe and meadow-steppe 2 100 - 2 500 above sea level, forest-meadow 2000 - 2900 m above sea level, subalpine and alpine meadows, cold tundra and glaciers above 3 500m and above sea level.

464. The uniqueness of the southern coast of Issyk-Kul is that 70% of the glaciers of Central Asia, 457 glaciers, are located in the Teskei Ala Too, there are also geo-canyons: Koinchok, Mykaachy, Aksai, Zhomok, beautiful gorges, waterfalls and geological incisions.

Figure 85: Teskey Ala-Too Mountains

465. Such rivers as Ulakhol, Ak-Terek, Zher-Uy, Tosor, Tamga, Barskoon, Chon-Jargylchak, Chon-Kyzyl-Suu, Juuku and Jeti-Oguz originate in the mountains of Teskey Ala-Too, which flow into Lake Issyk-Kul. The length of the rivers varies from 15 to 35 km.

466. On the territory of Geopark Teskei are located Lake Chun-Kur-Kol (1.5km*0.3km), Chokaly-Kol (3.5km*0.3km) and numerous glacial lakes, located in the high valley of Arabel.

467. There are about 15 species of reptiles in the Teskey Geopark, such as the Tien Shan lizard, Borkin's lizard, Darevsky's multicolored lizard. More than 60 species of birds, ten of which are included in the Red Book of Kyrgyz Republic and the IUCN: Golden Eagle, White-tailed Eagle, Black Vulture, Snowy Vulture, Bearded Vulture, Saker Falcon, Peregrine Falcon, Whooper Swan.

468. There are over 30 species of mammals, including the snow leopard, bear, lynx, wolf, jackal, fox, red deer, Marco Polo sheep, wild boar, roe deer, Siberian ibex, several species of bats,

hedgehog, badger, ermine, polecat, squirrel, American mink, muskrat, etc. Eight species are included in the Red Book of Kyrgyz Republic and the IUCN: Snow leopard, Turkestan lynx, Tien Shan brown bear, Tien Shan red deer, Marco Polo sheep, Stone marten.

4. Ecosystems in the Project Area

469. In the Kyrgyz Republic there are 22 classes of ecosystems, two of which are anthropogenic and occupy no more than 7% of the country. Anthropogenic ecosystems are the focus of ecological tension affected by human activities. The project area is no exception, there are villages and agricultural land throughout the site, in the fields grows wheat, barley, potatoes, corn and forage grass. There are many weeds on the fields, including *Thermopsis lanceolata*, *Convolvulus arvensis*, *Acroptilon repens*, *Centaurea squarrosa*, *Cirsum vulgare*, common thistle and others.

5. Red List at or Near the Project Site

470. Monitoring biodiversity is important for the conservation of animal and plant species, their habitats, and ecosystems. The International Union for Conservation of Nature (IUCN) Red List of Threatened Species is a crucial tool for describing and assessing the global risk of species extinction and biodiversity loss. It has been used to develop biodiversity indicators, such as the Red List Index, which has been adopted as a Sustainable Development Goal and a Global Biodiversity Framework indicator for the period after 2020.[84]

471. Kyrgyz Republic in 2007 republished the Red Book[85], updated the list of endangered species of flora and fauna. The Red Book includes a list of 4 species of fungi, 83 species of higher plants, 18 species of arthropods, 7 species of fish, 2 species of amphibians, 8 species of reptiles, 57 species of birds, and 23 species of mammals. The criteria and methodologies used for the compilation of the Kyrgyz Republic national red lists align with the categories, criteria, and methodologies of the global IUCN Red List of Threatened Species, in accordance with specific IUCN recommendations for regional and national red lists.

472. Table 38 presents the IUCN Red List of endangered species at or near the project site. *Oxyura Leucocephala* was seen once in many years, the Pallas's Fish- eagle is very rarely seen during winter., Egyptian Vulture is not seen in the surveyed area, the Balaban is rarely seen in flight, the Steppe Eagle is rarely seen in flight, the Burkut is found high in the mountains is very rare on the coast. Tiger does not inhabit in the Kyrgyz Republic and the last tiger was killed in 1890 along the Chui River.

473. Two vulnerable species of fishes are also in the Lake Issy-Kul (Table 39).

Table 38: IUCN Red List of Endangered (EN)Species at or Near the Project Site

Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Oxyura leucocephala	White- headed Duck	Aves	EN	Decreasing	Terrestrial, Freshwater
Haliaeetus leucoryphus	Pallas's Fish-eagle	Aves	EN	Decreasing	Terrestrial, Freshwater
Neophron percnopterus	Egyptian Vulture	Aves	EN	Decreasing	Terrestrial, Freshwater

[84] Revised Guidelines for the Application of Environmental Indicators. Available at https://unece.org/sites/default/files/2021-09/2112396E.pdf.
[85] Red Dat Book Kyrgyz Republic, Bishkek, 2007 pp.504

Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Falco cherrug	Saker Falcon	Aves	EN	Decreasing	Terrestrial, Marine, Freshwater
Panthera tigris	Tiger	Mammalia	EN	Decreasing	Terrestrial
Aquila nipalensis	Steppe Eagle	Aves	EN	Decreasing	Terrestrial

Table 39: IUCN Restricted Range Species at or Near the Project Site

Species Name	Common Name	Taxonomic Group	IUCN Category	Population Trend	Biome
Leuciscus bergi	Issyk-Kul Dace	Actinopterygii	VU	Unknown	Freshwater
Leuciscus schmidti	Schmidt's Dace	Actinopterygii	VU	Decreasing	Freshwater
Phoxinus issykkulensis	Issyk-Kul Minnow	Actinopterygii	LC	Decreasing	Freshwater
Triplophysa herzensteini		Actinopterygii	LC	Unknown	Freshwater

6. Key Biodiversity Areas

474. An area on the Eastern side of Lake Issyk-Kul is listed as an Important Bird and Biodiversity Area (IBA) Data Zone site by the Birdlife International (Figure 86). The Eastern Issyk-Kul Lake KBA was established in 2006. It includes mudflats along the shores, sea buckthorn thickets growing along the shores, shallow floodplains, and river estuaries. The territory is situated in close proximity to Karakol city.

475. It was identified as a Key Biodiversity Area (KBA) site because of the big concentration of wintering waterfowl. Species that rest and feed during stopover include up to 2.5 thousand Demoiselle crane, many waders, geese (Bean Goose), as well as White-headed ducks. Whooper swan and White-tailed eagle are common in winter[86].

476. KBAs are the most important places for the habitats and species that they support. They are places that have the greatest importance for biodiversity conservation. The IUCN has published a Global Standard for the Identification of KBAs[87], which target countries can use as a reference when identifying priority areas for the creation of protected areas. The coincidence of protected areas systems with KBAs is an important indicator of the representativeness of national systems in terms of protected areas. Habitats are classified as critical, natural and modified habitat[88].

[86] Bird Life International. Eastern Issyk-Kul Lake. http://datazone.birdlife.org/site/factsheet/eastern-issyk-kul-lake-iba-kyrgyzstan/text
[87] https://portals.iucn.org/library/sites/library/files/documents/2016-048.pdf
[88] IFC Performance Standard 6 Biodiversity Conservation and Sustainable Management of Living Natural Resources. January, 2012

Source: Birdlife International Data Zone, Kyrgyzstan. http://datazone.birdlife.org/country/kyrgyzstan/ibas

Figure 86: Important Bird and Biodiversity Area (IBA) in Lake Issyk-Kul near the Project Site

477. **Critical habitats** are areas with high biodiversity value, including: (i) habitat of significant importance to Critically Endangered and/or Endangered species; (ii) habitat of significant importance to endemic and/or restricted-range species; (iii) habitat supporting globally significant concentrations of migratory species and/or congregatory species; (iv) highly threatened and/or unique ecosystems; and/or (v) areas associated with key evolutionary processes.

478. **Natural habitats** are areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary ecological functions and species composition.

479. **Modified habitats** are areas that may contain a large proportion of plant and/or animal species of non-native origin, and/or where human activity has substantially modified an area's primary ecological functions and species composition. Modified habitats may include areas managed for agriculture, forest plantations, reclaimed coastal zones, and reclaimed wetlands. 18

a) Ecosystem services

480. Kyrgyz Republic's natural ecosystems are among powerful stabilizing factors not only for the country, but also for the Central Asian region. The main external function of Kyrgyz Republic's biota in the region is the accumulation and distribution of fresh water, carbon dioxide runoff, forming a favorable environment for human life, reducing the frequency and scale of damage from natural disasters.

481. Biodiversity plays an important role in sustaining life on earth. The preservation of biodiversity, natural ecosystems, and genetic resources are global-level priorities. Biodiversity and natural resources provide a range of ecosystem services necessary for human livelihoods and a healthy environment.

482. Ecosystem services refer to the diverse benefits that nature provides to society. They include all the direct and indirect benefits that humanity receives from ecosystems, such as the provision of natural resources, a healthy living environment, and other ecologically and economically significant products.

483. All-natural communities participate in providing ecosystem services, including those related to regulating the environment and participating in climate regulation. Ecosystem services can be divided into four groups[89]:

(i) **Provisioning services**: Products obtained from ecosystems. This category includes products such as food, fresh water, natural fibers, wood fuel, and genetic resources. Genetic resources, genes, and genetic information used to grow animals and plants are also included, as are biotechnologies.

(ii) **Regulating services**: Benefits obtained from regulating ecosystem processes. These include the regulation of air quality, climate, water, erosion, epidemics, and water purification. Examples include the filtering of pollutants by wetlands, pollination of plants by insects, and climate regulation through carbon absorption by trees or oceans.

(iii) **Supporting services**: Services necessary for the provision of all other ecosystem services. These include services such as soil formation, photosynthesis, the production of primary materials, the water cycle, and the nitrogen cycle in nature.

(iv) **Cultural services**: These are non-material benefits that people obtain from ecosystems through spiritual enrichment, cognitive development, recreation, aesthetic

[89] MEA 2005

experiences, reflection, and the accumulation of their people's cultural heritage. For example, some natural objects are given a sacred status (mazar).

484. The Kyrgyz Republic has rich diversity of genetic resources, species and ecosystems, much of which are subject to excessive pressures. The anthropogenic load on biodiversity is high. A number of natural ecosystems are structurally and species-wise destroyed to such an extent that they have lost the ability for normal productivity and self-reproduction. The degradation and fragmentation of natural communities, the reduction of the number and area of populations of vulnerable species continues, making it impossible to use them sustainably.[90]

485. Trends in degradation of ecosystem services over the past 50 years, the quality of approximately 60% of global ecosystem services, including 70% of regulating and cultural services, has degraded as a result of human activity, population growth, economic expansion, the use of new technologies in land use, and climate change.

486. The most significant driver of ecosystem transformation is the expansion of agriculture (Figure 87). Currently, about 35% of the Earth's surface is used by the agricultural[91] sector. The exploitation of natural ecosystems in human economic activities destroys the mechanism of biotic regulation at local scales and continuously weakens its global power.

Figure 87: Agricultural field adjacent to the road project

487. An excessively dense network of roads, especially those not connecting permanent settlements, leads to the fragmentation of natural communities and their deformation, which led to the disappearance of a number of species in a strip of up to 500 m and the introduction of alien species. Transport pollution negatively affects the condition of aquatic flora and fauna. Mining enterprises, located among extremely vulnerable high-altitude ecosystems, pose a particular danger, heavy traffic on roads caused the death of amphibians, snakes, hedgehogs, birds and insects.

[90] Government of the Kyrgyz Republic Resolution No. 131 of March 17, 2014 "On the Priorities for the Conservation of Biodiversity of the KR for the period until 2024 and the Action Plan for the Implementation of the Priorities for the Conservation of Biodiversity of the KR for 2014-2020".
[91] Bobylov and others 2009

488. Tree and shrub vegetation has diminished, forest ecosystems are threatened with extinction, tree felling, overgrazing, which has also led to the degradation of pastures. Drainage of swamps, pollution of rivers, destruction of large massifs of tugai led to the destruction of the richest complexes of wetlands.

489. Disturbed ecosystems and artificial biosystems (fields, pastures, exploited forests) are unable to regulate the environment biotically. On the contrary, they act as destabilizers of the environment and use the accumulated resource of stability for their existence.

490. As long as natural ecosystems maintain their original composition and structure, these communities can flexibly respond to fluctuations in the climate, mitigate its sharp fluctuations, and reduce the consequences of negative phenomena. Natural ecosystems create a favorable environment for living organisms and provide conditions for sustainable development.

491. The main ecosystem services related to the environment that may be affected within the framework of the project are the ecosystem services of Lake Issyk-Kul, such as water supply and regulation, such as air purification, regulation of the duration and magnitude of water flows, floods, and replenishment of water reserves in groundwater systems.

492. Drainage of wetlands or replacement of meadows and forests with agricultural land and settlements affects the natural system's ability to accumulate water. Protection against erosion, pollution control, and detoxification, climate regulation.

493. The plant cover plays an important role in soil conservation. Reduction of natural disasters (landslides, avalanches, floods). Biological control of insects and diseases.

494. Provision of consumer goods, such as wood, wool, fibers, a wide range of food products, berries, fish, and some types of birds, medicinal plants, cultural services, such as ecotourism. Supporting services, such as migration corridors, habitats for biodiversity, permanent and seasonal.

b) Flora

495. The project area (includes desert steppe (2,8), meadow steppe (8,13), and water and marsh bushes (25) ecosystems, arable land, irrigated land, rain-fed land on the steppes and deserts (33). Figure 88: Flora of Issyk-Kul Lake

496. The desert steppe (8) is not rich in species of plants, among them are *Nitraria sibirica*, feather-grass (*Stipa capillata*) and Clematis, *Artemísia dracúnculus*, Wormwood (*Artemisia elongata* and *Artemisia tianschanica)*, and tipchak (*Festica sulkata*) (Figure 89).

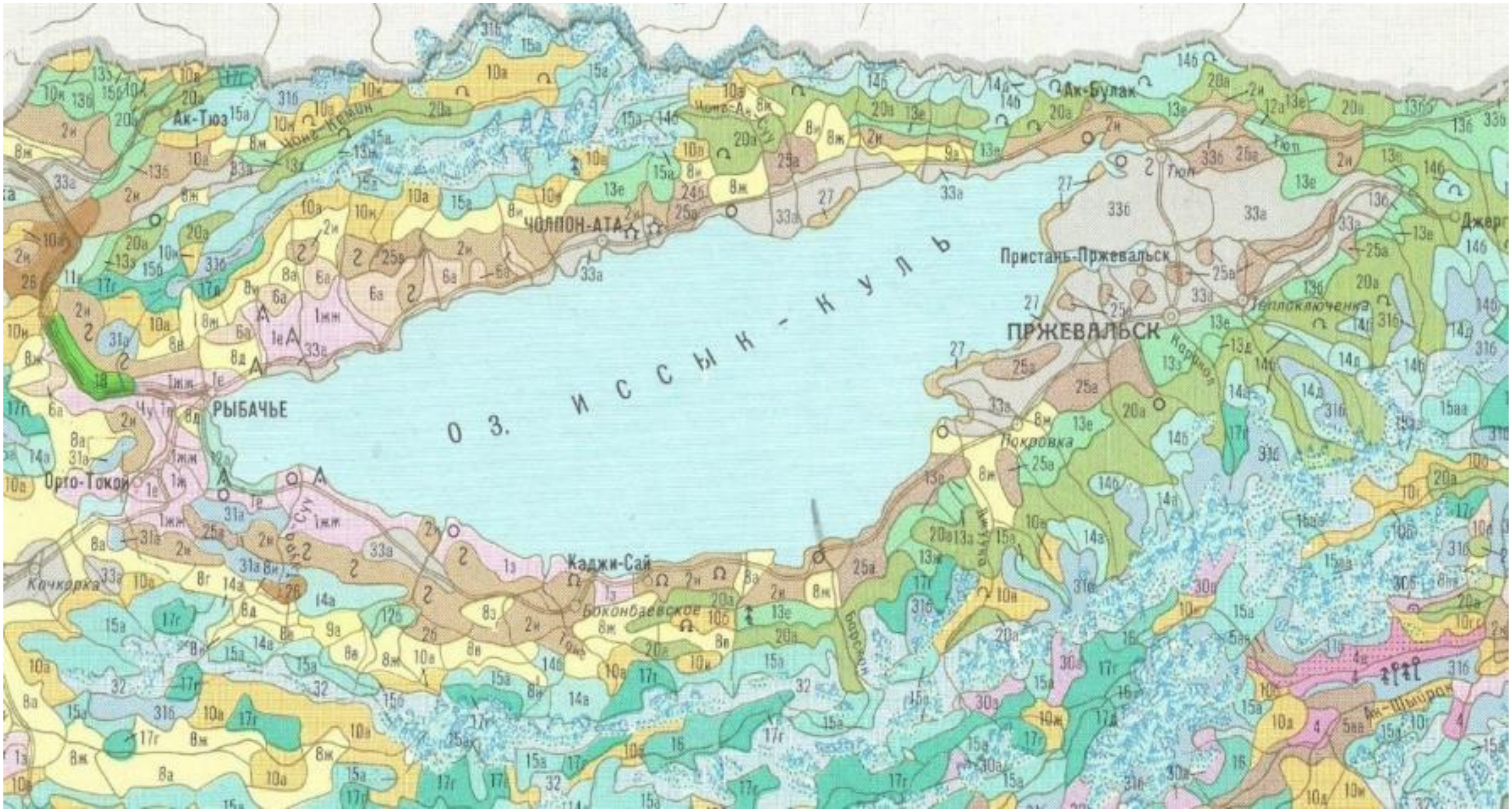

Figure 88: Flora of Issyk-Kul Lake

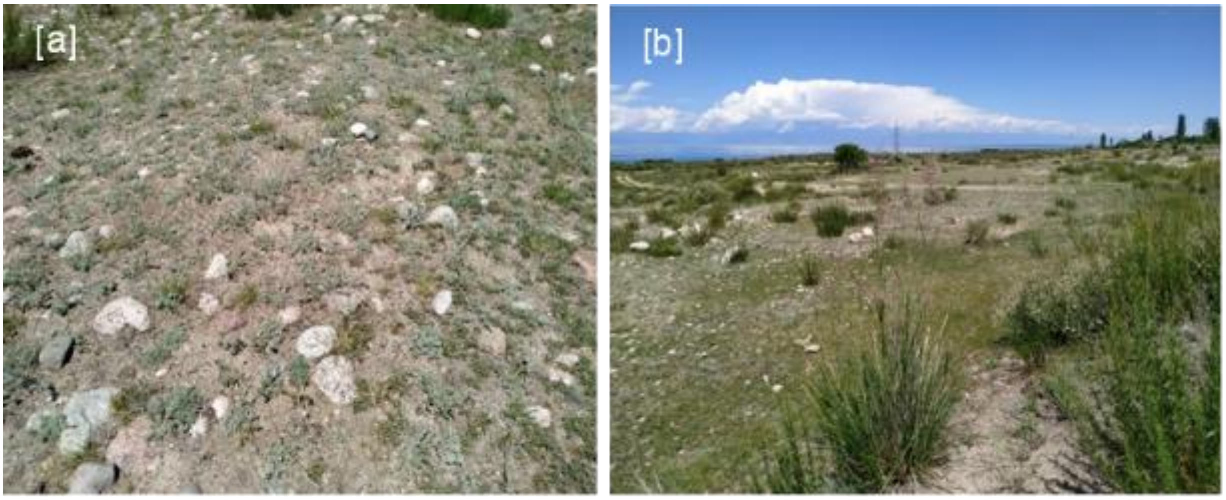

Figure 89: Plants in the project area [a] Tipchak (*Festica sulcate*) and [b] Wormwood (*Artemisia elongata*)

497. The following plant species grow on meadow-steppe ecosystems (8ж, 13): Festuca sulcate, (2и) *Artemisia tianschanica*, *A. serotina*, *A. pollsticha*, *A. freganensis*, with grassy-mixed meadows of *Salvia deserta*, *Betonica follosa*, *Roalitvinovian*a, oat grasses, and *Helictotrichon desertorum*.

498. The meadow ecosystems consist (13) of *Poa pratensis*, *Iris ruthenica, Ligularia macrophylla, Ligularia heterophylla, Aconitum septentrionale, Polygonum nitens, Crepis sibirica*, (15a) *Kobresia capilliformis, Sibbaidia tetrandra, and Carex stenocarpa*[92]. grass *Festuca sulcata, Stipa capillata, S. kirghisorum, and Artemisia elongata*, also grow in this ecosystem.

499. Water and marsh ecosystems play an extremely important role in the ecological and economic stability of the Issyk-Kul region. In the coastal zone grows shrubs of Siberian saltwort (*Nitraria sibirica*), Shrubbery of sea buckthorn (*Hippophae rhamnoides*) (27), *Berberis sphaerocapra*, and common barberry (*Berberis vulgaris*)[93] (Figure 90).

[92] Atlas of the Kyrgyz Republic 1987, Moscow pp.110-111
[93]Laskov G.A., Umralina A.R. Endemic and rare plant species of Kyrgyzstan (Atlas), FAO Ankara 2015 p.126.

Figure 90: Common barberry (Berberis vulgaris)

500. Berries are food for waterfowl and shore species of birds, as well as a resting and nesting place. In shrub and riparian ecosystem different bushes and plants are found including common reed (*Phragmites australis*), sorrel (*Rumex sp.*), *Thermopsis lanceolatum*, varieties of cereals (Poaceae), gooseberry (*Cinquefoils Potentilla anserine*), and *Caragana alopecuroides*.

501. Along the rivers Chon Jargylchak, Juku, Ak-Terek (Figure 91), Chon Kyzyl Suu, Kichi-Kyzyl Suu, Jeti-Oguz, Yrdyk, shrubs grow, including buckthorn (*Hippophae rhamnoides*), barberry (*Berberis integerrima*), German tamarisk (*Myricaria alopecuroides*), narrow-leaved elk (*Elaeagnus angustifolia*), Tian Shan willow (*Salix tianschanica*), and thickets of common hops (*Humulus lupulus*), *Lomonosus orientalis, Clematis orientalis*, and other bushes.

502. Along the road in the village of Jenish are found small glades of four-leaf tulip (Figure 92), which is included in the Red Book of Kyrgyz Republic, but is found in large numbers in Kokuy Kol, and behind the village of Kyzyl Suu on the road behind the landfill.

Figure 91: Shrubs and trees growing along the Ak-Terek River

Figure 92: Four-leafed tulip (*Tulipa tetraphylla Regel*)

c) *Terrestrial vertebrates in their main habitats. Intermountain valleys and basins*[94]

503. At the project site during the survey, animals were not encountered en masse. Their presence were noted through tracks and droppings. A variety of mammal species live in different ecosystems at and near the project site (Figure 93).

[94] Atlas of the Kyrgyz Republic 1987, Moscow pp.118-119.

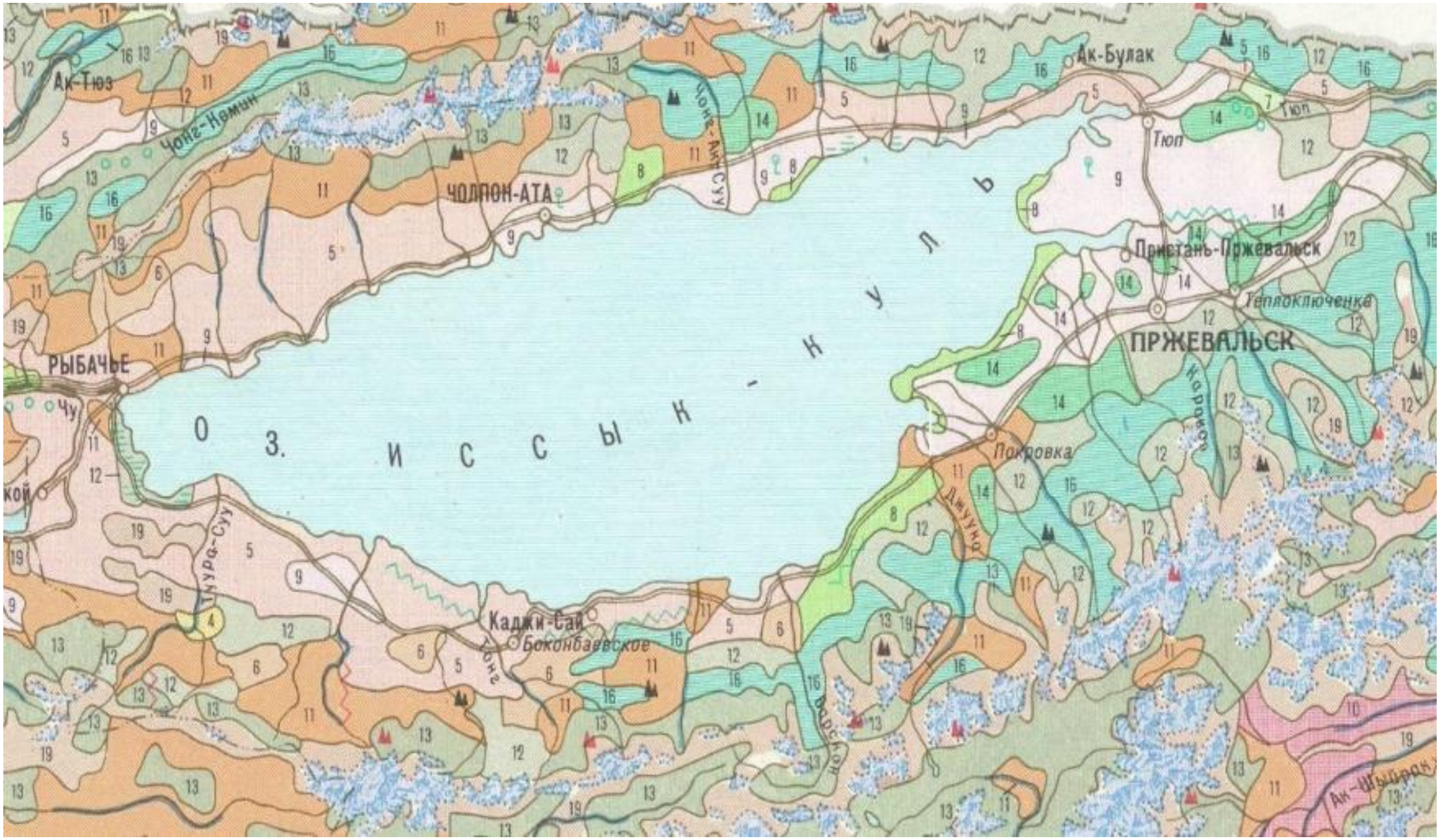

Figure 93: Mammals in Issyk-Kul

504. In **desert and semi-desert ecosystems (5)**, the *desert lacerta*, the eye-lidded, fast Kyrgyz, and multi-colored lizards, and the sand boa can be found. Birds include the griffon vulture, eagle owl, long-eared owl, domestic scops owl, Mongolian finch, saker falcon, common rock thrush, plain lark, rock bunting, and common stonechat. Mammals include the big horseshoe bat, long-eared nightjar, Tolai hare (*Lepus tolai*), sand fox (Cape hare and red-tailed), and steppe pika.

505. The dominant species, in descending order of declining numbers, are the grey toad, rock bunting (common, dance-loving), plain lark, Tolai hare (Figure 94), sand fox (Cape hare and red-tailed), domestic mouse, and forest mouse.

Figure 94: Tolai hare (*Lepus tolai*)

506. In steppe ecosystems (6), reptiles such as the agile lizard, spotted, patterned, and multi-colored racers, steppe viper, and shield-nose can be found. Birds include the black grouse, steppe eagle, swamp and field harriers, stone-curlew, bearded partridge, quail, pheasant, golden plover, azure tit, and pied wagtail, and rock bunting (crested and dance-loving), buntings (pine and ortolan), hempie, myna, magpie, and jackdaw.

507. Mammals include the long-eared hedgehog, Tolai hare, marmot (Tian Shan or relic), grey hamster, sand fox (Cape hare and red-tailed), common blind mole, common suslik, fox, marten, badger, and mink.

508. The dominant species, in descending order of declining numbers, are the green toad, shield-nose reptiles, and stone-curlew, and mammals such as domestic mouse, blind mole, Tolai hare, and relic suslik.

509. **Shrub and riparian (8)** ecosystems in which the water snake, birds such as the quacka, bittern, wagtail, hawk, quail, ordinary lark, siskin, long-eared owl, pheasant, common wood pigeon, cuckoo, magpie (azure-winged, black-billed), thrushes (black, mistle), dark-breasted rosefinch, red-tailed shrike, nightingale, wryneck, warblers (marsh, Eurasian reed, booted), tits (great, tufted), goldfinch, greenfinch, oak titmouse, common linnet, starling, European roller, common raven, magpie.

510. Mammals include the long-eared hedgehog, red vole, dwarf bat, late leatherback, forest dormouse, Turkestan rat, mice (house, forest), voles (Tien Shan forest, common), fox, mountain weasel, pine marten, badger, lynx, wild boar, roe deer.

511. On the shore of Lake Issyk-Kul, the lake frog and the Central Asian frog lives today a number of CA frogs are on the brink of extinction due to uncontrolled capture for use in traditional medicine. Birds such as warblers (gray, Eurasian reed), greenfinch, azure-winged and black-billed magpies, turtle doves (ringed, common), and pheasants. Mammals include the lesser and white-toothed moles, forest mouse, Tien Shan forest vole, and pine marten.

512. In **steppe (11)** occur reptiles: Alai monitor lizard, patterned racerunner, steppe adder, shield-nosed snake. Birds: cranes (Demoiselle, common), larks (woodlark, Eurasian skylark, crested lark), wheatears (northern wheatear), stonechats (*Saxicola torquata*), buntings (corn bunting), quails (common quail), partridges (Chukar partridge, grey partridge), sandgrouse (Pallas's sandgrouse), owls (Eurasian eagle-owl, long-eared owl), hawks (steppe buzzard), falcons (Saker falcon), kestrels (common kestrel), and steppe eagles.

513. Mammals susliks (relict ground squirrel, European ground squirrel), hares (European hare), mice (yellow-necked field mouse, forest dormouse), voles (field vole), wolves, foxes (red fox), and badgers in project area.

514. **Deciduous shrubs and bushes (14)** Reptiles: Alai sand lizard, desert agama, eyed lizard, agile lizard, racers (multicolored, spotted, patterned), and shield-headed snake.

515. Birds: bearded partridge, rock bunting, hoopoe, thrushes (fieldfare, black), quail, reed bunting, great tits, paradise flycatchers (red-spotted, grey-headed), bush warblers (Japanese, grey, Hume's), southern nightingale, chiffchaff, leaf warblers (greenish, green, greenish-yellow), house crickets, reed warblers (great, Clamorous, booted), spotted flycatcher, blackcap, hemp agrimony, lentils (common, pink), common raven, common crow, magpie.

516. Mammals: mole-rats, forest dormouse, Tien Shan vole, mice, grey hamster, field voles, common shrew, mountain hare, pine marten, badger.

517. Amphibians: common toad, rainbow lizard, water snake. Birds: wagtails (white, yellow-headed), red-throated pipit, and common quail. Mammals: house mouse, grey hamster, and Turkestan rat.

d) Anthropogenic ecosystems

518. Anthropogenic ecosystems are cultivated lands that replaced steppes and deserts, known as bogar lands. Productive lands in foothills and high mountains were used for grazing, and the improper use of pastures by the local population led to degradation, reduction of natural plant species, decreased fertility of pastures, and increased weed growth.

519. Despite the ecological regime, the buffer zone of the Biosphere Territory of Issyk-Kul is subject to anthropogenic pressure from the local population and numerous tourists. Part of the foothill plain is occupied by cultivated irrigated lands and orchards. All lands suitable for agriculture in the foothill plain, given the relief and irrigation conditions, have already been developed.

520. Natural ecosystem vegetation, such as typical sedge plants, is replaced by weeds that are not grazed by livestock. Overgrazing leads to a decrease in humus content, a decrease in soil fertility, and erosion reaching 40-50%. Grazing of livestock on the coast of Lake Issyk-Kul and the beach area leads to environmental pollution (Figure 95).

Figure 95: Livestock grazing near the shores of Lake Issyk-Kul

521. The weak development of natural vegetation in the semi-desert and arid steppe zone affects high ecological vulnerability and an increase in the frequency of destructive natural phenomena, such as landslides and floods.

7. Birds of Issyk-Kul

522. Table 40 list the 145 bird species that can be found in Lake Issyk-Kul that include nesting, sedentary and migratory birds.

523. **Sedentary birds**: Magpie, myna, pheasant, black crow, ring-necked duck, blackbird, common titmouse, quail hawk, horned lark, and golden eagle. Sedentary birds that do not fly to other continents and countries live in this place year round.

524. **Wintering birds**: Teal, snipe, eagle, crested duck, marsh harrier, swans, geese, grey heron, greater grebe, kestrel, and kurgunnik. Wintering birds come from the cold parts of Siberia and Kazakhstan to winter. Lake Issyk-Kul does not freeze in winter and where food for waterfowl is in abundance. They arrive in October and leave in March to April.

525. **Migratory birds**: Bald eagle, village swallow, masked wagtail, lake gull, gray duck, chibis, little grebe, oystercatcher, stiltspot, crake, and barrow. Migratory birds arrive during migration, stop to rest and fly further. Some birds stay on nesting grounds, these birds are mainly small birds feeding on insects and in winter there are no insects.

Table 40: Birds inhabiting Lake Issyk-Kul near the project area

№	Russian Name	Scientific Name	English Name	Habitat Type
1	Малая поганка	*Podiceps ruficollis*	Little Grebe	Nesting
2	Черношейная поганка	*Podiceps nigricollis*	Black-necked Grebe	Nesting sedentary
3	Большая поганка	*Podiceps cristatus*	Great Crested Grebe	Nesting
4	Большой баклан	*Pelalacrocorax carbo*	Creat Cormorant	Nesting
5	Большая выпь	*Botaurus stellaris*	Creat Bittem	Nesting
6	Белая цапля	*Egretta alba*	Creat Egret	Sedentary
7	Серая цапля	*Ardea cinerea*	Crey Heron	Nesting
8	Фламинго	*Phoeni copterus roseus*	Createv Flamingo	Migratory
9	Лебедь шипун	*Cygnus olor*	Mute Swan	Migratory
10	Лебедь кликун	*Cygnus*	Whooper Swan	Migratory
11	Огарь	*Tadorna ferruginea*	Ruddy shelduck	Nesting
12	Кряква	*Anas platyvchynchos*	Mallard	Nesting sedentary
13	Чирок свистунок	*Anas crecca*	Common Teal Green-winqed	Nesting
14	Чирок трескунок	*Anas guerguedula*	Garganey	Nesting
15	Серая утка	*Anas strepera*	Gadwall	Nesting
16	Свиязь	*Anas penelope*	Eurasian Wigeon	Migratory
17	Шилохвость	*Anas acuta*	Northern Pintail	Nesting
18	Широконоска	*Anas clypeata*	Northern shoveler	Nesting
19	Красноносый нырок	*Netta rufina*	Red-crested Pochard	Nesting Migratory
20	Красноголовый нырок	*Aythya ferina*	Common Pochard	Migratory
21	Белоглазый нырок	*Aythya nyroca*	Ferruginous Duck Pochard	Nesting
22	Хохлатая чернеть	*Aytha fuligula*	Tufted Duck	Migratory
23	Гоголь	*Bucephala clangula*	Common Goldeneye	Migratory
24	Луток	*Mergus albellus*	Smew	Migratory
25	Длинноносый краколь	*Mergus serrator*	Red-breasted Merganser	Nesting
26	Большой крохаль	*Mergus merganser*	Common Merganser	Nesting
27	Чёрный коршун	*Milvus migrans*	Black Kite	Nesting
28	Полевой лунь	*Circus cyaneus*	Northen Harrier	Migratory
29	Болотный лунь	*Circus aeruginosus*	Western Marsh Harrier	Nesting
30	Тетеревятник	*Aectpiter gentilis*	Northern Goshawk	Nesting
31	Ястреб перепелятник	*Accipiter nisus*	Eurasian Sparrowhawk	Nesting
32	Зимняк	*Buteo Lagopus*	Rough-Legged Buzzard	Migratory
33	Мохноногий курганник	*Buteo hemilasius*	Upland Buzzard	Migratory
34	Курганник	*Buteo rufinus*	Long-Legged Buzzard	Nesting
35	Канюк	*Buteo*	Common Buzzard	Nesting
36	Беркут	*Aguila chrysaelos*	Colden Eagle	Nesting sedentary
37	Орёл белохвост	*Aaliaeetus albicilla*	White-tailed Sea Eagle	Migratory, winter
38	Чёрный гриф	*Aeggypius monaechus*	Black Vulture	Nesting

№	Russian Name	Scientific Name	English Name	Habitat Type
39	Кумай гриф	*Qyps himalayensis*	Himalayan Griffon	Nesting
40	Бородач	*Gypactus Darbatus*	Lammergeier	Nesting
41	Балобан	*Falco cherrug*	Saker Falcon	Nesting
42	Шахин	*Falco pelegrinoides*	Barbary Falcon	Nesting
43	Сокол сапсан	*Falco peregrinus*	Peregrine Falcon	Migratory
44	Чеглок	*Falco subbuteo*	Eurasian Hobby	Nesting
45	Дербник	*Faleo columbarius*	Merlin	Nesting
46	Обыкновенная пустельга	*Falco tinnunculus*	Common Kestrel	Nesting
47	Кеклик	*Alectoris chukar*	Chukar Partridge	Nesting sedentary
48	Перепёлка	*Coturnix*	Common Quail	Migratory
49	Фазан	*Phasianus colchicus*	Common Pheasant	Nesting
50	Журавль. красавка	*Anthvopoides virgo*	Demoiselle Crane	Nesting
51	Пастушок	*Rallus aguaticus*	Water Rail	Migratory
52	Коростель	*Crex*	Com Crake Landrail	Nesting sedentary
53	Камышница	*Callinula chloropus*	Common Marhel	Nesting
54	Лысуха	*Fulica atra*	Common Coot	Nesting winter
55	Чибис	*Vanellus*	Northem Lapwing	Nesting
56	Травник	*Tringa totanus*	Common Redshank	Nesting
57	Черныш	*Tringa ochropus*	Creen Sandpiper	Nesting
58	Перевозчик	*Actitis hypoleucus*	Common Sandpiper	Nesting
59	Бекас	*Callingo gallingo*	Common Snipe	Nesting
60	Вальдшнеп	*Scolopax rusticola*	Woodcock	Nesting
61	Озёрная чайка	*Larus ridibundus*	Common Black-headed Cull	Nesting
62	Речная крачка	*Sterna hirundo*	Black Tern	Nesting
63	Малая крачка	*Srerna albifrons*	Common Tern	Nesting
64	Вяхирь	*Columba palumbus*	Common Wood Pigeon	Nesting sedentary
65	Сизый голубь	*Columba Livia*	Rock Pigeon	Nesting sedentary
66	Кольчатая горлица	*Streptopelia decaocto*	Eurasian Collared Dove	Nesting sedentary
67	Большая горлица	*Streptopella orientalls*	Oriental Turtle Dove	Nesting Migratory
68	Малая горлица	*Streptopella senegalensis*	Laughing Dove	Nesting sedentary
69	Кукушка	*Cuculus canorus*	Common Cuckoo	Migratory
70	Филин	*Bubo*	Eurasian Eagle Owl	Nesting
71	Ушатая сова	*Asio otus*	Long-eared Owl	Nesting
72	Домовой сыч	*Athene noctua*	Little Owl	Nesting
73	Обыкновенный козодой	*Caprimulgus europaeus*	Eurasian Nightjar	Nesting Migratory
74	Чёрный стриж	*Apus*	Common Swift	Nesting
75	Удод	*Upupa epops*	Eurasian Hoopoe	Nesting Migratory
76	Береговая ласточка	*Riparia diluta*	Sand Martin	Nesting
77	Деревенская ласточка	*Hirundo rustica*	Bam Swallow	Nesting
78	Скалистая ласточка	*Ptyonoprogne rupestris*	Eurasian Crag Martin	Nesting
79	Хохлатый жаворонок	*Colerida cristata*	Crested Lark	Nesting sedentary

№	Russian Name	Scientific Name	English Name	Habitat Type
80	Рогатый жаворонок	*Eremophila alpestris*	Homed Lark	Nesting
81	Полевой жаворонок	*Alauda arvensis*	Eurasian Skylark	Nesting
82	Горный конёк	*Anthus spinoletta*	Water Pipit	Nesting
83	Лесной конёк	*Anlhus trivialis*	Tree Pipit	Nesting
84	Луговой конёк	*Anlhus pratensis*	Meadow Pipit	Migratory
85	Жёлтая трясогузка	*Motacilla flava*	Yellow Wagtail	Migratory
86	Горная трясогузка	*Motacilla cineyea*	Water Pipit	Nesting
87	Маскированная трясогузка	*Motacilla personata*	Masked Wagtail	Nesting
88	Туркестанский жулан	*Lanius phoenicuroides*	Turkestan shrike	Nesting
89	Серый сорококуш	*Lanias excubitor*	Great Grey shrike	Migratory
90	Иволга	*Oriolus*	Eurasian Golden Oriole	Nesting
91	Скворец	*Sturnus vulgaris*	Common Starling	Nesting
92	Розовый скворец	*Sturnus roseus*	Rose-colored Starling	Migratory
93	Майка	*Acridotheres tristis*	Indian Myna	Nesting
94	Сорока	*Pica pica*	Black-billed Magpie	Nesting
95	Клушица	*Pyrrhocorax pyrrhocorax*	Red-billed Chough	Nesting sedentary
96	Галка	*Corvus monedula*	Jackdaw	Nesting
97	Грач	*Corvus Frugilegus*	Rook	Nesting
98	Чёрная ворона	*Corvus corone*	Carrion Crow	Nesting
99	Серая ворона	*Corvus cornix*	Hooded Crow	Migratory
100	Ворон	*Corvus corax*	Common Raven	Migratory
101	Оляпка	*Cinclus cindus*	White-throated Dipper	Migratory
102	Крапивник	*Troglodytes troglodytes*	Northern Wren	Nesting
103	Бледная завирушка	*Prunella fulvescens*	Brown Accentor	Nesting
104	Широкохвостая камышовка	*Cettia cetti*	Cettis Warbler	Nesting
105	Обыкновенный сверчок	*Locustella naevia*	Common Grasshopper warber	Migratory
106	Ястребиная славка	*Sylvia nisoria*	Barred Warbler	Nesting
107	Серая славка	*Sylvia communis*	Whitethroat	Nesting
108	Пеночка теньковка	*Phylloscopus collybita*	Common Chiffchaff	Migratory
109	Зелёная пеночка	*Phylloscopus trochilodes*	Creenish Warbler	Nesting
110	Серая мухоловка	*Muscicapa striata*	Spotted Flycatcher	Migratory
111	Черноголовый чекан	*Saxicola torguata*	Common Stonechat	Nesting
112	Каменка клешанка	*Oenanthe pleschanka*	Pied Wheatear	Nesting
113	Каменка плесунья	*Oenanthe isabellina*	Isabelline Wheatear	Nesting
114	Горихвостка чернушка	*Phoenicurus ochvuvos*	Black Redstars	Nesting
115	Красноспинная горихвостка	*Phoenicurus erythronotus*	Eversmans Redstart Rutous-backed R	Nesting
116	Краснобрюхая горихвостка	*Phoenicurus erythvogaster*	Culdenstadts Redstart White-winged R	Nesting

№	Russian Name	Scientific Name	English Name	Habitat Type
117	Зарянка	*Erythacus rubecula*	European Robin Ruddock Robinet	Nesting
118	Южный соловей	*Luscinia megarhynchos*	Common Nightingale	Nesting
119	Варакушка	*Luscinia svecica*	Bluethroat	Nesting
120	Чернозобый дрозд	*Turdus atrogularis*	Black-throated Thrush	Migratory
121	Чёрный дрозд	*Turdus merula*	Eurasian Blackbird	Nesting
122	Деряба	*Turdus viscivorus*	Mistle Thrush	Nesting
123	Белая лазаревка	*Parus cyanus*	Azure Tit	Nesting
124	Большая синица	*Parus major*	Great Tit	Nesting
125	Стенолаз	*Tichodroma muraria*	Wall Creeper	Nesting
126	Домовой воробей	*Passer domesticus*	House Sparrow	Nesting
127	Полевой воробей	*Passer montanus*	Eurasian Tree Sparrow	Nesting
128	Каменный воробей	*Petronia*	Rack Sparrow	Nesting
129	Зяблик	*Fringilla coelebs*	Chaffinch	Migratory
130	Седоголовый щегол	*Carbuelis caniceps*	Crey-headed Goldfinch	Nesting Migratory
131	Красношапочный вьюрок	*Serinus pusillus*	Red-fronted Serin	Nesting
132	Обыкновенная зеленушка	*Chloris turestanicus*	European Greenfinch	Nesting
133	Коноплянка	*Acanthis cannabina*	Linnet	Nesting
134	Обыкновенная чечевица	*Carpodacus erythrinus*	Common Rosefinch	Nesting Migratory
135	Арчовая чечевица	*Carpodacus rhodochlamys*	Red-mantled Rosefinch	Nesting
136	Урагус	*Uragus sibiricus*	Long-tailed Rosefinch	Migratory
137	Обыкновенный клёст-еловик	*Loxia curvirostra*	Red Crossbill	Migratory
138	Арчовый дубонос	*Mycerobac carniceps*	White-winged Grosbeak	Nesting
139	Просянка	*Emberiza calandra*	Com Bunting	Nesting
140	Обыкновенная овсянка	*Emberiza citrinella*	Yellow Hammer	Migratory
141	Белошапочная овсянка	*Emberiza teucocephala*	Pine Bunting	Nesting Migratory
142	Горная овсянка	*Emberiza cia par*	Rock Bunting	Nesting
143	Красноухая овсянка	*Emberiza cioides*	Meadow Bunting	Nesting
144	Тросниковая овсянка	*Emberiza schoeniclus*	Read Bunting	Nesting
145	Желочная овсянка	*Emberiza bruniceps*	Read-headed Bunting	Nesting Migratory

a) *Bird migration at Lake Issyk-Kul*

526. The seasonal movements of large masses of birds from southern Asia and Africa pass through Central Asia to Siberia and in the opposite direction (Figure 96). The migration of birds is

located on the main routes of birds from warm countries to the north and back to the western part of Asia.

527. The high-mountain Lake Issyk-Kul is a place of the main migration routes of the Asian continent and has always played an important role in the life of waterfowl and water-related birds. Surveys were conducted in the Important Bird Area (IBA) by Birdlife International and partners from non-governmental organizations around the world. IBAs are areas of importance as places of nesting, molting, wintering and resting, and stops of birds on migration. According to studies, 400 species of birds occur in Kyrgyz Republic, the vast majority of species make regular seasonal migrations.

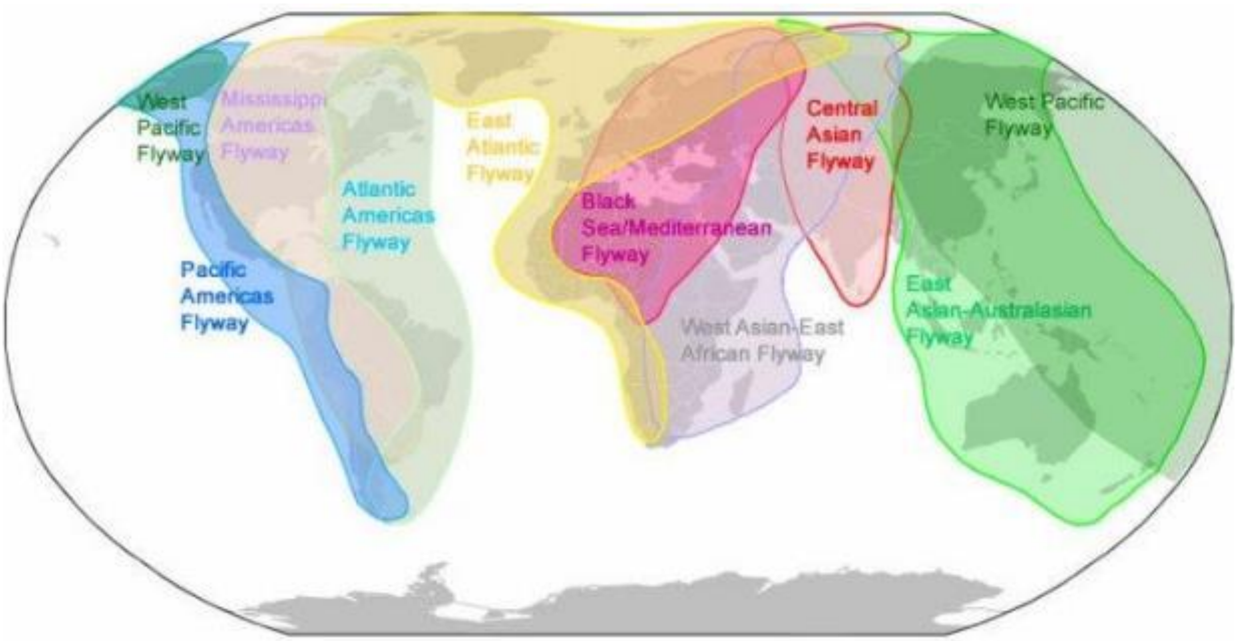

Figure 96: Central Asian Flyway of migratory birds (in red)

528. Lake Issyk-Kul is a place of mass wintering of waterfowl[95]. In general, 60 to 70 thousand individual animals (30 species), on average 66,231, winter on the lake in different years. Mallards, grey ducks, pintails, teals are usually feeding and resting near the shores; coots and goldeneyes are keeping further from the shore, 20-30 m in shallow waters.

529. A shallow coastal strip of the Lake, with a depth of not more than 10 m occupies an area of 478 ha, which is the main feeding base for wintering birds that include red-necked and red-headed divers, grebes (red-necked, black-necked, small, large, gray-cheeked), tufted ducks, long-necked mergansers, and swans (shipun and klikun). During cold winters the number of birds is less compared to warmer winters.

530. In addition, in the eastern shore of Issyk-Kul, from 1.5 to 2 thousand migrating Red-crowned Cranes stop here for resting and feeding during their migrations (Table 40).

531. At Lake Issyk-Kul, the number of wintering birds (waterfowl and near-water birds), according to long-term calculations, is between 40-70 thousand waterfowl. The mass flight of waterfowl starts in April and the return flight starts in October. During wintering period coots from 20-30 thousand individuals are numerous. The coot migration in the lake begins in October, unnoticed

[95] E.J. Shukurov. "The Birds of Kyrgyzstan. Frunze, "Mektep", 1981.

at night, they are difficult to record. Small numbers of coot's nest on Lake Issyk-Kul in the bays of Jeti-Oguz and Tyup.

532. Red-nosed Pochard (*Netta vufina*) numbers from 15-20 thousand during wintering. Grebes (Podiceps) (5 species) - wintering about 6-10 thousand. Swans arrive at the end of October, leave in early April, numbering about 1.5 thousand on the lake. The gray heron arrives at the beginning of March for nesting, at the Jeti-Oguz protected area since 1995. 18 pairs, each year the colony increases. [96]

533. During migrations in springtime, common crane (*Anthropoides vergo*) is common, with great concentration in the eastern part of the lake, in the area of Yntymak Village, in the number of 1,500 to 2,000 specimens.

534. Ruddy shelduck (*Tudorna ferruginea*) is 10,000 to 15,000 individuals in migration in October, large concentration of birds at the mouth of the Zhyrgalan and Tyup Regions.

535. Bean Goose (*Anser Fabalis*) northern geese in recent years up to 30 individuals are found on migration and in wintering.

536. Since 2005, for the first time were marked Balykchy Bay birds, 7 individuals, included in the Red Book of Kyrgyz Republic.

537. Mass bird flights in April were noted, including starlings, swallows, wagtails (Figure 97), cranes, pipits, dark-throated thrushes and mountain swifts, their departure begins in October.

Figure 97: Wagtails (*Motacilla citreola*)

538. In winter there are few passerine birds, mainly rooks, sandpipers and the hooded crow stay for the winter. It is observed that more birds stay for the winter in warm winters than in cold winters.

[96] S.V. Kulagin, A.N. Ostashchenko, S. Sagynbaev Monitoring of wintering waterfowl and near-water birds in Lake Issyk-Kul and other water bodies of Kyrgyzstan. Selevinia Bishkek 2007.

539. For the last ten years, the big cormorant (*Phalacrocorax carbo*) has been nesting in the protected area of Lake Issyk-Kul. On the small island of Ak Olan nesting pairs of 20 to 36 individuals, since 2021. Lake Issyk-Kul is shallow, now from 2022-2023, big cormorant does not nest here, as the island became accessible to foxes and jackals.

8. Ichthyofauna of Lake Issyk-Kul

540. To date, commercial fishing is not conducted in Lake Issyk-Kul due to the fact that the natural stocks of commercial fish species such as Osman (Figure 98 (a)), marinka, whitefish, trout, chebak (Figure 98 (b)), chubak (Figure 98 (a))97, etc. are depleted due to widespread poaching, irrational fishing in the spawning period, catching fish in floodplains of natural spawning areas.

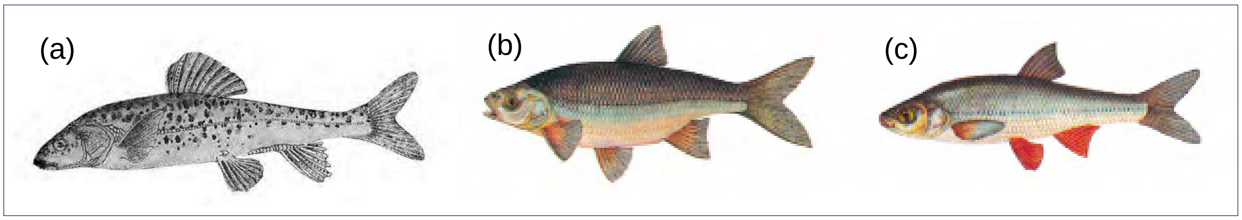

Figure 98: (a) Osman (*Diptychus dybowskii Kessler*); (b) Chebak (*Leuciscus schmidti*); and (c) Chubak (*Leuciscus bergi*)

541. A moratorium on fish catching was carried out in 2003, but after the moratorium period expired, natural reserves were not renewed. In spite of the efforts of the Department of Fishery to annually stock the lake with young trout, whitefish, carp-salmon, the number of commercial species of fish was not restored.

542. Therefore, the resumption of fishing in the near future is not considered, only sport and amateur fishing, catching of producers for the purpose of artificial reproduction and fishing for research purposes are carried out.

543. Lake Issyk-Kul is home to 20 fish species (Table 41), of which 7 are endemic (Table 41) the lake and its watershed, four are endemic to Central Asia, and 10 have been introduced (Table 43). There are several fish species common to all study sites. These include endemic species, Osman (registered / presumably inhabiting all water bodies) and marinka (both included in the Red Book). Introduced species (Table 44) as Sevan trout, registered and inhabiting all the studied water bodies.

544. Overall, the water bodies studied are home to a wide range of fish species that are feeding/spawning habitat to support the broader freshwater fish population in the region. These fish species are part of critical habitat that is important for both endemic and geographically restricted fish species.

545. Invasive alien species pose a certain threat to biodiversity and ecosystems, habitats and species growth (Table 45), which is expressed in direct economic consequences, loss of crops and livestock production, impacts on fisheries and others. In order to reduce such impacts, it is necessary to take measures to restore populations of endemic fish species to the level of their sustainable use, to clarify and classify invasive alien species by priority, ways of their introduction and movement to prevent their importation and spread in the territory of .

[97] Chelpakova J.M., Davletbakov A.T., Kustareva L.A. The animal world of Kyrgyzstan, Bishkek 2011 p.264

Table 41: Fishes of Lake Issyk-Kul[98]

Russian Name	Scientific Name
1 Иссык-Кульский голый Осман	*Diptychus dybowskii Kessler*
2 Иссык-Кульская Маринка	*Schizothorax pseudoaksaiensis Herz*
3 Чебак	*Leuciscus schmidti Herz*
4 Чебачок	*Leuciscus bergi Kaschkarov*
5 Гольян	*Phoxinus issykkulensis Berg*
6 Пескарь	*Gobio gobio Latus Anikin*
7 Губач	*Nemachilus ulacholicus Anikin*
8. Сиг-лудога	*Coregonus Lavaretus*
9. Карп-Сазан	*Cyprinus carpio*
10. Судак	*Lucioperca Lucioperca*
11. Лещ	*Abramis brama orientalis Berg*
12. Линь	*Tinca tinca*
13. Белый амур	*Ctenopharingodon Idella Vallen*
14. Белый толстолоб	*Hypophtalmichthus molitrix*
15. Балхашский окунь	*Perca schrenki Kessler*
16. Корейская востробрюшка	*Hemiculter Leucisculus Bleeker*
17. Амурский бычок	*Rhinogobius*
18. Амурский чебачок	*Pseudorasbora parva Schlegel*
19. Элеотрис	*Hypseleotris Cinctus Darby*
20. Горчак	*Rhodeus sericeus rhodeus*

Table 42: Endemics of Lake Issyk-Kul

Russian Name	Scientific Name
1 Иссык-Кульский голый Осман	*Diptychus dybowskii Kessler*
2 Иссык-Кульская Маринка	*Schizothorax pseudoaksaiensis Herz*
3 Чебак	*Leuciscus schmidti Herz*
4 Чебачок	*Leuciscus bergi Kaschkarov*
5 Гольян	*Phoxinus issykkulensis Berg*
6 Пескарь	*Gobio gobio Latus Anikin*
7 Губач	*Nemachilus ulacholicus Anikin*

Table 43: Fish species introduced into Lake Issyk-Kul[99]

Russian Name	Scientific Name	Source (Mother Reservoir)
1 Форель гегаркуни	*Salmo ischchan Issykogegarkuni Lushin*	Sevan lake, Armenia
2 Лещ восточный	*Abramis brama orientalis Berg*	Aral Sea
3 Карп	*Cyprinus carpio*	Frunzensky State Fishery Farm
4 Судак	*Lucioperca Lucioperca*	Lake Seliger ыефке of the Ural River
5 Храмуля	*Varicorhinus capoeta heratensis*	Kuyu-Mazar Reservoir
6 Пелядь	*Coregonus peled*	Fish farm "Ropsha

[98] Pivnev I.A. Fish of Kyrgyzstan, Frunze, 1989.
[99] Nikitin A.A. Acclimatization and artificial reproduction of whitefish in water bodies of Kyrgyzstan. Frunze 1976.

Russian Name	Scientific Name	Source (Mother Reservoir)
7 Ряпушка	*Coregonus albula*	Fish farm "Ropsha
8 Сиг лудога	*Coregonus Lavaretus*	Sevan Lake
9 Омуль Байкальский	*Coregonus migratorius*	Baikal lake
10 Линь	*Tinca tinca*	Frunzensky State Fishery Farm

Table 44: Randomly introduced fish species in Lake Issyk-Kul

Russian Name	Scientific Name
Карась серебряный	Carassius auratus gibelio Blich
Елец Киргизский	Leuciscus Leuciscus Kirgisorum Berg
Голец Штрауха	Nemachilus strauchi Kessler
Амурский чебачок	Pseudorasbora parva Schlegel
Полосатая быстрянка	Alburnoides taeniatus Kessler

Table 45: Invasive fish species in Lake Issyk-Kul

Russian Name	Scientific Name
Элеотрис	*Hypseleotris Cinctus Darby*
Горчак	*Hemiculter Leucisculus Bleeker*
Амурский чебачок	*Pseudorasbora parva Schlegel*
Амурский бычок	*Carassius auratus gibelio*
Корейская востробрюшка	*Hemiculter Leucisculus Bleeker*
Серебряный карась	*Carassius auratus gibelio*

546. Table 46 presents literature data on hydrobiota and ichthyofauna in nine (9) rivers in the project site[100]. Sampling sites were the following rivers: S1 - Barskoon; S2-Chon Jargylchak; S3 - Kichi Jargylchak; S4 - Ak Terek; S5 - Juuku; S6 - Kichi Kyzyl-Suu; S7 - Cheon Kyzyl-Suu; S8 - Jeti-Oguz; and S9 - Yrdyk.

Table 46: Hydrobiota, ichthyofauna species recorded at 9 rivers at the Project site

Species	Sampling sites								
	S1	S2	S3	S4	S5	S6	S7	S8	S9
Хирономиды/ Chironomids	+	+	+	+	+:	+	+	+	+
Личинки хирономид/ Chironomid Larvae	+	+	+	+	+	+	+	+	+
Бокоплавы/Amphipod	+	+	+	+	+	+	+	+	+
Веслоногие/Copepods	+	+	+	+	+	+	+	+	+
Гаммарус/Gammarus	+	+	+	+	+	+	+	+	+
Остракоды/Ostracods	+	+	+	+	+	+	+	+	+
Личинки стрекозы/Dragonfly Larvae	+	+	+	+	+	+	+	+	+

[100] Problems of Lake Issyk-Kul and its mountainous frame (1990), Pivnev I.A. Pisces of Kyrgyzstan (1990), A.O. Konurbaev, A.B. Zhadin. Zhadin Commercial Fishes of Lake Issyk-Kul (2000), L.A. Kustaryova L.V. Lemzina Life in Water Bodies of Kyrgyzstan (2007), D.U. Karabekova, Sh.M. Asylbaeva, M.N. Alpiev, A.A. Ryspaev Species Composition of Fishes of Kyrgyzstan (2009). I.A.

Species	Sampling sites								
	S1	S2	S3	S4	S5	S6	S7	S8	S9
Куколки двукрылых/Diptera pupae	+	+	+	+	+	+	+	+	+
Олигохеты/Oligochetes	+	+	+	+	+	+	+	+	+
Нематоды/Nematodes	+	+	+	+	+	+	+	+	+
Планарии/Planiria	+	+	+	+	+	+	+	+	+
Пиявки/Leeches	+	+	+	+	+	+	+	+	+
Копеподы/Copepods	+	+	+	+	+	+	+	+	
Подёнки/Mayflies	+	+	+	+	+	+	+	+	+
Личинки подёнок/May fly Larvae	+	+	+	+	+	+	+	+	+
Кладоцеры/Cladocerans	+	+	+	+	+	+	+	+	+
Моллюски/Shellfish	+	+	+	+	+	+	+	+	+
Веснянки/Stoneflies	+	+	+	+	+	+	+	+	+
Личинки веснянок/Larvae of venyanok	+	+	+	+	+	+	+	+	+
Водные клопы/Water bugs	+	+	+	+	+	+	+	+	+
Водные жуки/Water beetles	+	+	+	+	+	+	+	+	+
Водные клеши/Water flares	+	+	+	+	+	+	+	+	+
Ручейники/Caddisflies	+	+	+	+	+	+	+	+	+
Водный скорпион/Nepidae cinereal	+	+	+	+	+	+	+	+	+
Sampling sites were the following rivers: S.1 - Barskoon; S.2-Chon Jargylchak; S.3 - Kichi Jargylchak; S.4 - Ak Terek; S.5 - Juuku; S.6 - Kichi Kyzyl-Suu; S.7 - Cheon Kyzyl-Suu; S.8 - Jeti-Oguz; and S.9 - Yrdyk.									

547. The Chon Jargylchak and Juuku rivers reach the lake in small amounts in the spring summer period, while the Barskoon, Kichi Jargylchak, Ak Terek, Kichi Kyzyl Suu, Chon Kyzyl Suu, Jeti-Oguz and Yrdyk rivers are taken to irrigate fields and do not reach Lake Issyk-Kul. Accordingly, in the absence of water in the rivers, hydrobiota of fish food and fish themselves disappear. Some of the fish go upstream and some remain in the lake until water appears in the rivers.

9. Medicinal plants growing in the project area[101]

548. In the Kyrgyz Republic, there are 200 species of medicinal plants that are decreasing in number every year. The local population collects wild berries, such as rowan, buckthorn (Figure 99) barberry, hawthorn, currant, raspberry and others use them as medicinal plants.

549. Wild-growing plants are susceptible to degradation to a large extent. The resource of medicinal plants is diminishing due to uncontrolled removal from nature. Local residents collect medicinal plants, animals graze around the villages and feed on all vegetation. Conservation of medicinal plants is important for the resource potential of the country, work with the local community to raise awareness about the importance of natural resources need of the present time.

[101] Atlas of the Kyrgyz Republic, Moscow. 1987/ p.113

Figure 99: Sea buckthorn (*Hippophae rhamnoides*)

550. In project area we find a medicinal plant, as well as plants of decorative, technical and practical importance are subject to destruction. Illegal collection of wild flowers, excessive harvesting of medicinal plants led to the extinction of 3 species with 54 species are under the threat of extinction. It is known that Chinese traditional medicine is advance, their healers export medicinal resources of flora and fauna from Kyrgyz Republic, which causes damage and reduces the number of species. Table 47 list medicinal plants on the project site, some of which as shown Figure 100.

Table 47: Medicinal plants in the project area[102]

Russian	Scientific Name	English
Барбарис обыкновенный	*Berberis vulgaris*	Common barberry
Шиповник иглистый	*Rosa acicularis Lindl.*	Acicular rose
Шиповник щитконосный	*Rosa corymbifera Borkh*	Corymbifera rose
Облепиха	*Hippophae rhamnoides*	Sea buckthorn
Тимьян Маршаллов	*Thymus marschallianus Willd*	Marshall's thyme
Зверобой продырявленный	*Hypericum perforatum L.,*	Hypericum
Солодка голая	*Clycyrrhiza glabra L.,*	Licorice
Девясил высокий	*Inula helenium L.,*	Elecampane
Тысячелистник азиатский	*Achillea asatica Serg.*	Yarrow Asiatic
Мать и мачеха обыкновенная	*Tussilago farfara L.*	Common mother and stepmother
Душица обыкновенная	*Origanum vulgare*	Oregano
Пижма обыкновенная	*Tanacetum vulgare*	Common Pimson
Крапива двудомная	*Urtica dioica*	Nettles
Пастушья сумка	*Capsella bursa pastoris*	Shepherd's Purse
Мята азиатская	*Mentha asiatica Boriss*	Mint

[102] Altymyshev A.A. Natural medicinal means (medicinal plants). Frunze, Kyrgyzstan, 1990. pp. 78-214; 78-80; 103-104;139-140; 143-144; 203,206.

Russian	Scientific Name	English
Тысячелистник щетинистый	*Achillea setacea*	Yarrow Stubble
Горец перечный	*Polygonum hydropiper*	Water pepper

Figure 100: Medicinal plants in the project site (a) Corymbifera rose (*Rosa corymbifera Borkh*), (b) Sage (*Salvia officinalis*), and (c) Common Pimson (*Tanacetum vulgare*)

10. Flora and Fauna in the Project Area Listed in the Red Book of Kyrgyz Republic

551. According to the analysis of literature data and field studies in the project area in the coastal zone of Lake Issyk-Kul, there are rare and endangered species in the Issyk-Kul Nature Reserve, which are included in the Red Book of Kyrgyz Republic. These data are given in the tables: plants 1 species, arthropods 2 species, fish 2 species, amphibians 1 species, birds 18 species, mammals 2 species (Table 48, Figure 101 and Figure 102).

Table 48: Flora and fauna listed in the Red Book of Kyrgyz Republic found in the project area.

№		Name of the species	Category in Kyrgyz Republic	IUCN	Population status in the reserve and adjacent areas	Notes
1	Flora	Тюльпан четырёхлистный (*Tulipa tetraphylla Regel*) Four-leafed tulip	VU (Vulnerable)	-	Isolated area (a few square meters)	Endemic in the Inner Tien Shan
2	Arthropod	Аполлон обыкновенный, подвид Мерцбахера (Parnassius (s.str.) apollo ssp. merzbacheri Merzbacher' Apollo Butterfly	III (LR-nt) Lower Risk near threatened	VU A2cde	Populations are vulnerable, species needs monitoring	Cause of extinction - agricultural developme nt of habitats, haying
3	Arthropod	Оса Мазарис длинноусая (Masaris longicornis)/ Longicorn Wasp	III (LR-nt)	II	Rare Central Asian species	Found on the southern shore of Issyk-Kul
4	Mammal	Обыкновенная кутора (*Neymys fodiens*)	VI	Near Threatened, NT:R	very rare species	
5	Amphibian	Краснобрюхая лягушка, Центральноазиатс кая лягушка (*Rana asiatica*) Central Asian frog	VU Blab(iv)		Mosaically distributed along the coast and riverbeds flowing into Lake Issyk-Kul. Numbers are low, steadily declining	Natural bioindicator of water pollution
6	Fish	Иссык-кульский голый осман (*Diptychus dybowskii lansdelli*) Gunther Issyk-Kul naked sturgeon	II Critically endangered, D life parameters are limited [CR;D]		Occurs rarely, inhabits areas where tributaries flow into Lake Issyk-Kul	Endemic
7	Fish	Иссык-Кульская Маринка (Scizothorax pseudoaksaiensis issykkuli)	II EN.D. Endangered, D		Sparsely populated everywhere	Endemic
8	Bird	Лебедь – кликун, (*Cygnus Cygnus*) Whooper Swan	VII	LC (Least concern)	Parts of the IK reserve, a rare breeding species	Migratory - 800-1000 individuals found on IK

№		Name of the species	Category in Kyrgyz Republic	IUCN	Population status in the reserve and adjacent areas	Notes
9	Bird	Белоглазый нырок (*Aythya nyroca*)	VI	NT (Near Threatened)	Part of IK reserve	Nesting - solitary species
10	Bird	Длинноносый крохаль, (*Mergus serrator*)	VII	LC (Least concern)	Parts of the IK reserve, eastern zone	monotypic species
11	Bird	Савка (Oxyura Leucocephala)	IV	EN (Endangered)	Unit, monotypic species	Migratory
12	Bird	Балабан, (Falco cherrug)	IV	EN (Endangered)	the number of the species has declined sharply, rare	Migratory
13	Bird	Рыжеговоловый сокол/Шахин, (Falco pelegrinoides)	III	CR (Critically Endangered)	protected in the reserves of Kyrgyz Republic	forms permanent pairs, uses its nest for several years
14	Bird	Обыкновенный фламинго (*Phoenicopterus ruber)*	VI	NT (Near Threatened)	West part of IK	rare migrant bird
15	Bird	Чёрный аист (*Ciconia nigra*)	VI	NT (Near Threatened)	monotypic species	migrant, migratory bird
16	Bird	Кудрявый пеликан (*Pelecan crispus*)	V	V, A2c+3c Vulnerable	monotypic species	Migratory
17	Bird	Скопа (Pandion Haliaetus)	VII	LC (Least Concern)	rare	Migratory, nesting
18	Bird	Орлан белохвост (Haliaeetus albicilla)	VI	NT (Near Threatened)	rare	comes only for wintering
19	Bird	Дрофа (Otis tarda)	III	CR (Critically Endangered)	Rare, Jeti-Oguz	Migratory
20	Bird	Коростель (*Crex crex*)	VI	NT (Near Threatened)	monotypic species	Migratory, nesting
21	Bird	Журавль – красавка (*Anthropoides virgo*)	VI	NT (Near Threatened)	About 100 birds nest in Kyrgyz Republic	Migratory
22	Bird	Серпоклюв (Ibidorhyncha struthersii)	V	VU:R,D1 Vulnerable	protected in the reserves of Kyrgyz Republic	Nesting, sedentary
23	Bird	Черноголовый хохотун (*Larus ichtyaetus*)	VI	NT (Near Threatened)	Jeti-Oguz	Migratory

№		Name of the species	Category in Kyrgyz Republic	IUCN	Population status in the reserve and adjacent areas	Notes
24	Bird	Саджа (Syrrhaptes paradoxus)	V	VU (Vulnerable)	a rare monotypic species	Migratory, nesting
25	Bird	Филин (Bubo bubo)	VII	LC (Least Concern)	protected in the reserves of Kyrgyz Republic	Sedentary

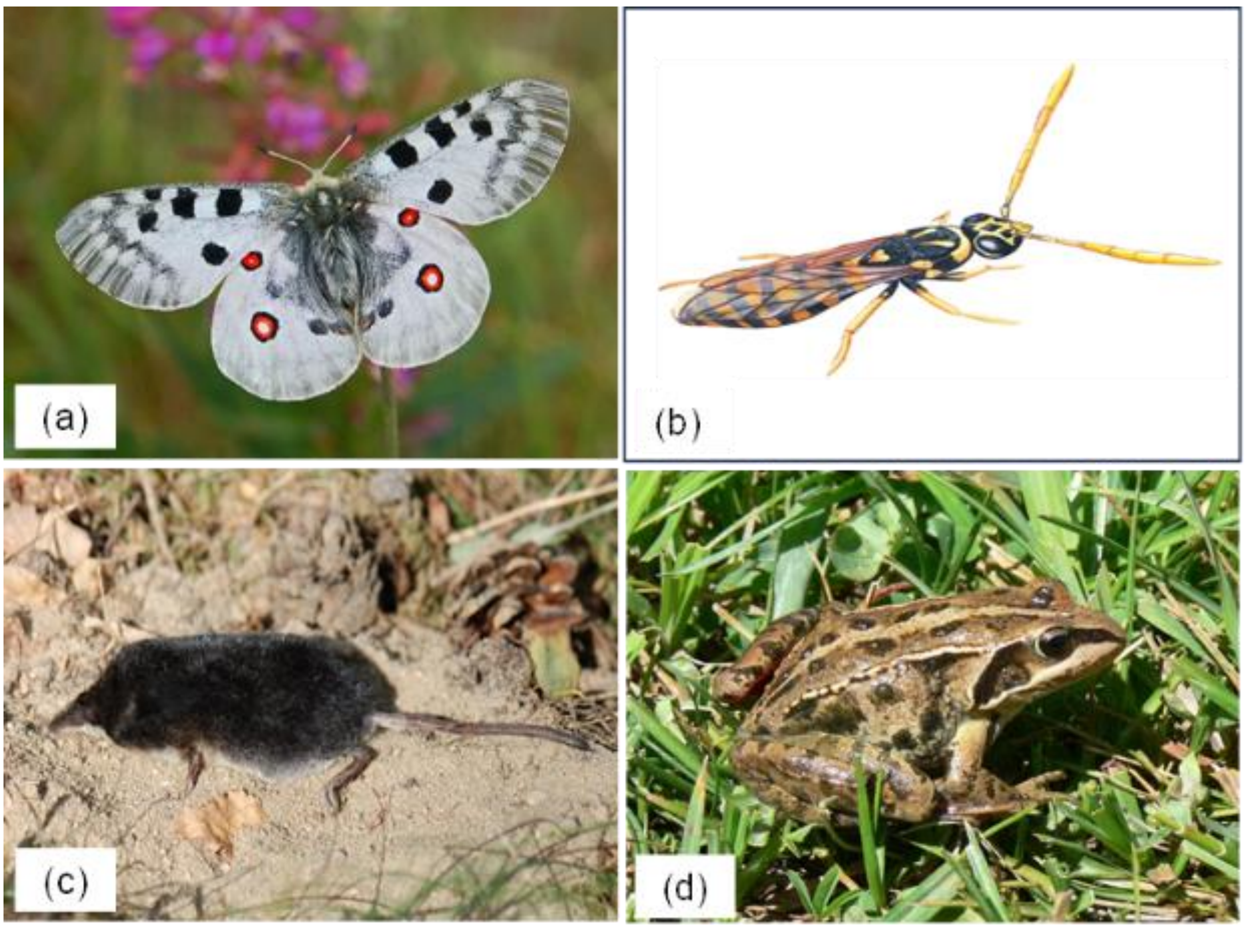

Figure 101: Some of the fauna listed in the Red Book of Kyrgyz Republic found in the project area: (a) Apollo Common, a subspecies of Merzbacher (*Parnassius apollo*); (b) Mazaris wasp long mustache (*Masarislongicornis*); (c) Pennant (Neymys fodiens); and (d) Central Asian frog (*Rana Asiatica Bedriaga*)

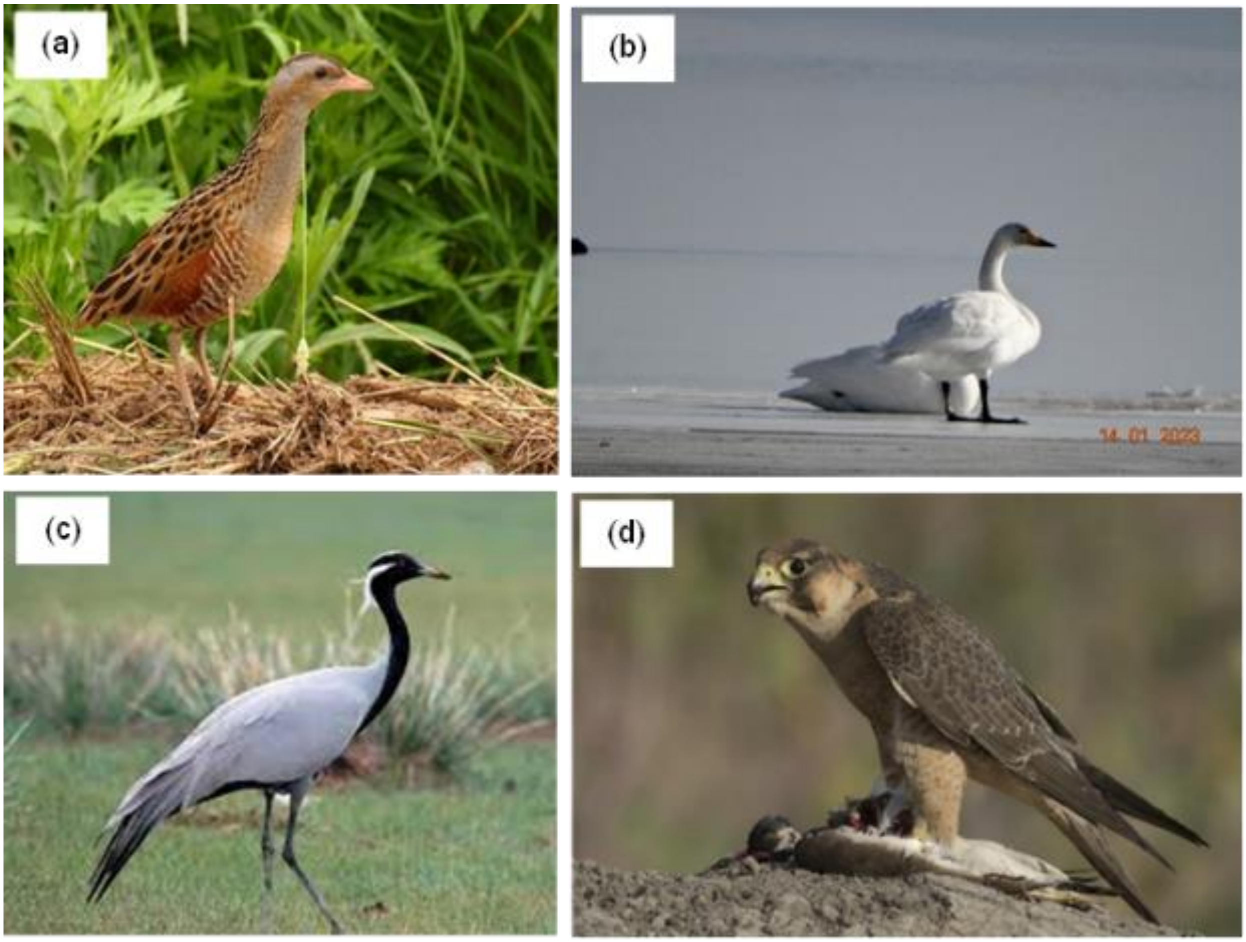

Figure 102: Birds listed in the Red Book of Kyrgyz Republic sighted in the project area during the site surveys: (a) *Crex crex*; (b) Whooper Swan (*Cygnus Cygnus*); (c) *Anthropoides virgo*; (d) *Falco pelegrinoides*.

11. Biodiversity Site Survey

552. The project site and nearby areas consists of highly modified environment that include farmlands, orchards (mainly apricots), and number of settlements along the road. Floral species at project site include wild cherry, wild apricot, shrubs of silver berry (*Elaeangus angustifolia*), Karagach (elm tree), poplar (*Populus sp.*), willow (*Salix sp.*). The biodiversity analysis showed that natural ecosystems are subject to strong anthropogenic impacts.

553. Three field visits were conducted in 2023 in the months of January, March, and April. The first visit was conducted in winter time on 24 to 25 January 2023. As it was winter there was limited visual observation of broad sector of biodiversity.

a) Site Survey during Winter Season (25^{th} to 25^{th} January 2013)

554. The existing road sides are mostly covered with elm (*Ulmus pumila*) and poplar (*Populus sp.*) trees. Along the road trees planted in 2 or 3 rows. The trees in the first two rows are the low-growing elm (Ulmus pumila), apricot (Armeniaca vulgaris), and in the third are trees of the species pine (*Pinus pallasiana*), willow (*Salix babylonica*), poplar (*Populus nigra* and *Populus afghanica*), maple (*Acer negundo*), and birch (*Betula pendula*). These are all planted species. The average age of these trees is 60-80 years.

555. Along the road, many of these trees need to be cut down due to the road widening, and many of the trees have aged and died and are a threat to fall onto the roadway. The poor condition of the trees is due to lack of maintenance (watering).

556. Along the coastal area large numbers of sea buckthorn shrubs (Hippophae), and barberry shrubs (*Berberis vulgaris L.,* Figure 103) (Berberidaceae) form the wetland ecosystems. Two invasive species were recorded - wild chamomile (*Matricaria chamomilla*) and field mustard (*Sinapis arvensis*). Medicinal plants are also found in the project area.

557. In the surveyed area of the Kokuy Kol, long-nosed merganser and white-eyed pochard, which are in the Red Data Book and other birds were observed as listed in Table 40.

558. The team observed traces of mammals: jackal (*Canis aureus*), fox (*Vulpes vulpes*), common vole mouse (*Microtus arvalis*), weasel (*Mustela nivalis*), stoat (*Mustela erminia*), American mink (*Neogale vison*) (Figure 104).

Figure 103: Berberis vulgaris L. (*Berberidaceae*)

Table 49: Bird count along the road project during winter (23-24 January 2023)

No.	Name of birds Russian, Latin, English	Barskoon/ Jenish	Chon Jargylchak	Darkhan	Kyzyl Suu	Kokuy Kol/ Tilekmat	Yrdyk	Karakol
1	Малая поганка-Podiceps ruficollis Little Grebe				4			
2	Черношейная поганка-Podiceps nigricollis Black-necked Grebe		16		6			

No.	Name of birds Russian, Latin, English	Barskoon/ Jenish	Chon Jargylchak	Darkhan	Kyzyl Suu	Kokuy Kol/ Tilekmat	Yrdyk	Karakol
3	Большая поганка-Podiceps cristatus Creat crested Grebe		1					
4	Огарь-Tadorna ferruginea Ruddy shelduck		1					
5	Кряква-Anas platyrchynchos Mallard		26					
6	Красноносый нырок-Netta rufina Red-crested pochava		20					
7	Хохлатая чернеть-Aythya fuligula Tufted Duck		2					
8	Полевой лунь-Circus cyancus Northern Harrier				1			
9	Ястреб перепелятник-Accipiter nisus Eurasian Sparrowhawk				2			
10	Зимняк-Buteo lagopus Rough-Legged Buzzard					1		
11	Мохноногий курганник-Buteo hemilasius Upland Buzzard				1			
12	Канюк-Buteo buteo Common Buzzard		1			1		
13	Курганник-Buteo rufinus Lond-Legged Buzzard	2	1	2		3	2	2
14	Чёрный гриф-Aegypius monachus Black vulture	5						
15	Дербник-Falco columbarius Merlin	1						
16	Пустельга обыкновенная-Falco tinnunculus-Common Kestrel Eurasian Kestrel							
17	Фазан-Phasianus colchicus-Cenus Pheasantan	3						
18	Голубь-Columba Livia Rock Pigeon			200			200	
19	Кольчатая горлица-Streptopelia decgocto	4				3		
20	Малая горлица-Streptopelia senegalensis-Laughing Dove		2					
21	Хохлатый жаворонок Galerida cristata Crested Lark		20					
22	Рогатый жаворонок-Eremophila alpestris albigula Homes Lark	4	4	3	4	4		2

No.	Name of birds Russian, Latin, English	Barskoon/ Jenish	Chon Jargylchak	Darkhan	Kyzyl Suu	Kokuy Kol/ Tilekmat	Yrdyk	Karakol
23	Майна-Acridotheres tristis Indian Mayna					7	11	
24	Сорока-Pica Black-billed Magpie	3	4	4	2	4	2	2
25	Клушица-Pyrrhocorax Red-billed Chough	4						
26	Галка-Corvus monedula Jackdaw	4				8		
27	Грач-Corvus frugilegus Rook				250	50	200	
28	Чёрная ворона-Corvus Corene Carrion Crow	1	5					
29	Серая ворона-Corvus cornix Hooded crow				2	2	2	
30	Оляпка белобрюхая-Cinclus cinclus White-throated Dippev		2					
31	Красноспинная горихвостка-Phoenicurus erythvonotus-Eversman s Redstart Rufous	2	1					
32	Зарянка-Erythacus vubecula-European Robin Ruddock Robinet		1					
33	Чернозобый дрозд-Turdus atrogularis Black-throated thrush	1						
34	Чёрный дрозд-Turdus vnerula-Eurasian Blackbird	6	3					
35	Дрозд деряба-Turdus viscivorus Mistle Thrush		1					
36	Белая лазаревка-Parus cyanus tianschanicus-Yellow-breasted Tit		1					
37	Большая синица-Parus major major Creat tit		2			2		
38	Домовой воробей-Passer domesticus House Sparrow	2						
39	Полевой воробей-Passer montanus Eurasian Tree Sparrow		2			28		
40	Зяблик-Fringilla coelebs-Chaffinch		20					
41	Вьюрок-Fringilla montifringilla-Brambling		2					
42	Седоголовый шегол-Carduelis caniceps Greg-headed Goldfinch		2					

No.	Name of birds Russian, Latin, English	Barskoon/ Jenish	Chon Jargylchak	Darkhan	Kyzyl Suu	Kokuy Kol/ Tilekmat	Yrdyk	Karakol
43	Арчовый дубонос-Mycerobas carniceps Hawfinch					2		
44	Просянка-Emberiza calandra-Com Bunting					40		
45	Обыкновенная овсянка-Emberiza citronella-Yellow Hammer					8		
46	Белошапочная овсянка-Emberiza Leucocephala Pime Buntina					2		
47	Красношапочный вьюрок-Serinus pusillus-Red fronted serin		10					

Figure 104: Jackal (Canis aureus)

b) *First Spring Season Site Survey (22nd to 25th March 2023)*

559. From 22nd to 25th March 22 2023, visual biodiversity assessment along the road project was conducted, including the south shore of Lake Issyk-Kul, the protected area of Ala-Too and Kokuy-Kol core zones, and Jeti-Oguz (Figure 105).

560. Migratory rooks arrive to nest on March and leave their nests at the end of May. As such, the trees along the road can be cut down during the fall and winter seasons so as not to destroy the nests. In the next year, the rooks will find nesting places in other tall trees.

561. Two areas of the Ala-Too core zone, between the villages of Jenish and Darkhan, was visited. The core zone, which has a total area of 510 hectares, is located in the lake water area at approximately 1 to 3 kilometers from the road.

562. The second site is Kokuy-Kol core zone, with the total area of 642,.2 hectares is located in Koy-Sary, Ak-Dobo village, Jeti-Oguz District. It has an additional 700 hectares of water area in

Lake Issyk-Kul, with the depth of up to 1.5 meters. The site is located approximately 9 kilometers from the road.

Figure 105: Migratory birds at Kokuy Kol

563. The weather was cool, with day time temperature of +6 to +8 ^oC and -2 ^oC at night. There were no vegetation yet, buds on trees had not yet budded, and insects were found sporadically. Migrating birds fly in from mid-March to late May. Birds are now in mating season, after pairing, birds will start to build nests and they rarely use old nests. The migratory and nested birds along the project site were counted. The lists of birds that were prepared from literature sources were confirmed during the field study period, and new birds were included in the list as shown in Table 50.

Table 50: Bird count along the road project during spring (22nd – 25th March 2023)

№	Russian Name	English Name	Common	Mass	Numerous	Rare
1	Малая поганка	Little Grebe			+	
2	Черношейная поганка	Black-necked Grebe		+		
3	Большая поганка	Great Crested Grebe			+	
4	Большой баклан	Great Cormorant			+	
5	Большая выпь	Great Bittem				+
6	Белая цапля	Great Egret			+	
7	Серая цапля	Grey Heron			+	
8	Фламинго	Flamingo				+
9	Лебедь шипун	Mute Swan			+	
10	Лебедь кликун	Whooper Swan				+
11	Огарь	Ruddy shelduck		+		
12	Кряква	Mallard	+			
13	Чирок свистунок	Common Teal Green-winqed			+	
14	Чирок трескунок	Garganey	+			
15	Серая утка	Gadwall	+			
16	Свиязь	Eurasian Wigeon			+	
17	Шилохвость	Northern Pintail			+	
18	Широконоска	Northern shoveler			+	
19	Красноносый нырок	Red-crested Pochard	+			

№	Russian Name	English Name	Common	Mass	Numerous	Rare
20	Красноголовый нырок	Common Pochard	+			
21	Белоглазый нырок	Ferruginous Duck Pochard				+
22	Хохлатая чернеть	Tufted Duck	+			
23	Гоголь	Common Goldeneye				+
24	Луток	Smew			+	
25	Длинноносый краколь	Red-breasted Merganser				+
26	Большой крохаль	Common Merganser			+	
27	Чёрный коршун	Black Kite			+	
27	Полевой лунь	Northern Harrier			+	
29	Болотный лунь	Western Marsh Harrier	+			
30	Тетеревятник	Northern Goshawk				+
31	Ястреб перепелятник	Eurasian Sparrowhawk	+			
32	Зимняк	Rough-Legged Buzzard				+
33	Мохноногий курганник	Upland Buzzard				+
34	Курганник	Long-Legged Buzzard	+			
35	Канюк	Common Buzzard			+	
36	Беркут	Colden Eagle				+
37	Орёл белохвост	White-tailed Sea Eagle			+	
38	Чёрный гриф	Black Vulture				+
39	Кумай гриф	Himalayan Griffon				+
40	Бородач	Lammergeier				+
41	Балобан	Saker Falcon				+
42	Шахин	Peregrine Falcon				+
43	Сокол сапсан	Barbary Falcon				+
44	Чеглок	Eurasian Hobby			+	
45	Дербник	Merlin			+	
46	Обыкновенная пустельга	Common Kestrel	+			
46	Кеклик	Chukar Partridge				+
47	Перепёлка	Common Quail				+
49	Фазан	Common Pheasant			+	
50	Журавль красавка	Demoiselle Crane				+
51	Пастушок	Water Rail			+	
52	Коростель	Com Crake Landrail				+
53	Камышница	Common Marhel	+			
54	Лысуха	Common Coot	+			
55	Чибис	Northern Lapwing			+	
56	Травник	Common Redshank			+	
57	Черныш	Green Sandpiper			+	
58	Перевозчик	Common Sandpiper			+	
59	Бекас	Common Snipe				+
60	Вальдшнеп	Woodcock				+
61	Озёрная чайка	Common Black- headed Cull			+	
62	Речная крачка	Black Tern			+	

№	Russian Name	English Name	Common	Mass	Numerous	Rare
63	Малая крачка	Common Tern				+
64	Вяхирь	Common Wood Pigeon			+	
65	Сизый голубь	Rock Pigeon			+	
66	Кольчатая горлица	Eurasian Collared Dove			+	
67	Большая горлица	Oriental Turtle Dove			+	
68	Малая горлица	Laughing Dove	+			
69	Кукушка	Common Cuckoo	+			
70	Филин	Eurasian Eagle Owl				+
71	Ушатая сова	Long-eared Owl			+	
72	Домовой сыч	Little Owl				+
73	Обыкновенный козодой	Eurasian Nightjar				+
74	Чёрный стриж	Common Swift			+	
75	Удод	Eurasian Hoopoe			+	
76	Береговая ласточка	Sand Martin	+			
77	Деревенская ласточка	Bam Swallow	+			
78	Скалистая ласточка	Eurasian Crag Martin				+
79	Хохлатый жаворонок	Crested Lark			+	
80	Рогатый жаворонок	Homed Lark			+	
81	Полевой жаворонок	Eurasian Skylark			+	
82	Горный конёк	Water Pipit			+	
83	Лесной конёк	Tree Pipit				+
84	Луговой конёк	Meadow Pipt				+
85	Жёлтая трясогузка	Yellow Wagtail			+	
86	Горная трясогузка	Water Pipit				+
87	Маскированная трясогузка	Masked Wagtail			+	
88	Туркестанский жулан	Turkestan shrike			+	
89	Серый сорококуш	Great Grey shrike				+
90	Иволга	Eurasian Golden Oriole			+	
9199	Скворец	Common Starling	+			
92	Розовый скворец	Rose-colored Starling			+	
93	Майна	Indian Mayna	+			
94	Сорока	Black-billed Magpie	+			
95	Клушица	Red-billed Chough				+
96	Галка	Jackdaw			+	
97	Грач	Rook		+		
98	Чёрная	Carrion Crow	+			
99	Серая ворона	Hooded Crow			+	
100	Ворон	Common Raven				+
101	Оляпка	White-throated Dipper				+
102	Крапивник	Norhern Wren				+
103	Бледная завирушка	Brown Accentor				+
104	Широкохвостая камышовка	Cettis Warbler			+	

№	Russian Name	English Name	Common	Mass	Numerous	Rare
105	Обыкновенный сверчок	Common Grasshopper warber			+	
106	Ястребиная славка	Barred Warbler			+	
107	Серая славка	Whitethroat			+	
108	Пеночка теньковка	Common Chiffchaff			+	
109	Зелёная пеночка	Greenish Warbler			+	
110	Серая мухоловка	Spotted Flycatcher				+
111	Черноголовый чекан	Common Stonechat			+	
112	Каменка клешанка	Pied Wheatear			+	
113	Каменка плесунья	Isabelline Wheatear			+	
114	Горихвостка чернушка	Black Redstars			+	
115	Красноспинная горихвостка	Eversmans Redstars Rutous-backed R	+			
116	Краснобрюхая горихвостка	Culdenstadts Redstart White-winged R			+	
117	Зарянка	European Robin Ruddock Robinet			+	
118	Южный соловей	Common Nightingale				+
119	Варакушка	Bluethroat				+
120	Чернозобый дрозд	Black-throated Thrush			+	
121	Чёрный дрозд	Eurasian Blackbird			+	
122	Деряба	Mistle Thrush			+	
123	Белая лазаревка	Azure Tit	+			
124	Большая синица	Great Tit	+			
125	Стенолаз	Wall Creeper				+
126	Домовой воробей	House Sparrow	+			
127	Полевой воробей	Eurasian Tree Sparrow		+		
128	Каменный воробей	Rack Sparrow			+	
129	Зяблик	Chaffinch			+	
130	Седоголовый щегол	Grey-headed Goldfinch			+	
131	Красношапочный вьюрок	Red-fronted Serin			+	
132	Обыкновенная зеленушка	European Greenfinch			+	
133	Коноплянка	Linnet			+	
134	Обыкновенная чечевица	Common Rosefinch			+	
135	Арчовая чечевица	Red-mantled Rosefinch			+	
136	Урагус	Long-tailed Rosefinch				+
137	Обыкновенный клёст-еловик	Red Crossbill				+
138	Арчовый дубонос	White-winged Grosbeak			+	
139	Просянка	Com Bunting	+			
140	Обыкновенная овсянка	Yellow Hammer	+			
141	Белошапочная овсянка	Pine Bunting			+	
142	Горная овсянка	Rock Bunting			+	
143	Красноухая овсянка	Meadow Bunting				+

№	Russian Name	English Name	Common	Mass	Numerous	Rare
144	Тросниковая овсянка	Read Bunfing			+	
145	Желочная овсянка	Read-headed Bunting				+

564. In the surveyed area of Kokuy Kol core zone, long-nosed merganser and white-eyed pochard, which are both in the Red Book of the Kyrgyz Republic were observe. Migratory rooks were observed nesting on trees along the road.

565. On the agricultural lands, cultivation of has begun. In some places there is burning - fallow, to destroy dry grass. Such activities should be carried out in autumn, to clear the fields of weeds and pests.

566. The apricot and apple orchards have not yet bloomed. The trees along the road are still budding, only the willows are starting to green. Along the Jeti-Oguz River, willow, meadowsweet, barberry, buckthorn and rose hips grow.

567. Water in the Chon Jargylchak and Juuku rivers reach the lake in small amounts in the spring summer period, while water in the Barskoon, Kichi Jargylchak, Ak Terek, Kichi Kyzyl Suu, Chon Kyzyl Suu, Jeti-Oguz and Yrdyk rivers are taken to irrigate fields and do not reach Lake Issyk-Kul. Accordingly, in the absence of water in the rivers, hydrobiota that serve as fish food and fish themselves disappear. Some of the fish go upstream and some remain in the lake until water appears in the rivers.

568. All nine rivers in the Barskoon-Karakol project section have four levels of flow: upstream, lower upstream, midstream and downstream, which differ in fish species composition (Table 51).

Table 51: Fish species in rivers in the project site

Location	Russian Name	Scientific Name
Upstream	Редко чешуйчатый Осман Северцева	Diptychus sewerzowi Kessler
Lower upstream	Осман чешуйчатый	Diptychus maculatus
	Голец Тибетский	Triplophysa stoliczkai steindachner
Midstream	Осман голый	Diptychus dybowskii Kessler
	Форель Иссык-Кульская	Salmo ischchan Issykogegarkuni Lushin
Downstream	Форель Иссык-Кульская	Salmo ischchan Issykogegarkuni Lushin
	Маринка Иссык-Кульская	Schizothorax pseudoaksaiensis Herzenstein
	Голец гребенчатый	Triplophysa dorsalis Kessler
	Губач Иссык-Кульский	Triplophysa ulacholica

569. The Barskoon, Kichi Kyzyl Suu, Chon Kyzyl Suu, Jeti-Oguz and Yrdyk rivers have unequal amounts of water in different seasons, in spring and summer water is taken from them to irrigate fields and orchards, so water does not reach Lake Issyk-Kul. Due to the lack of water in rivers, hydrobiota that are food for fish and fish themselves die, a small part of fish go into the lake before the water in rivers disappears, so under such conditions, ichthyofauna in such rivers is quite scarce.

570. In the project area, only water from the tree rivers Chon Jargylchak, Ak-Terek and Juku reaches the lake, but the composition of fish is different from the current, the species composition is presented below:

571. Due to the lack of water in the rivers, the reconstruction of the road Barskoon Karakol on fish ichthyofauna will not have a negative impact.

c) Second Spring Season Site Survey (9th to 13th April 2023)

572. On 9th to 13th of April 2023, another survey was carried by the biodiversity team of the south shores of Lake Issyk-Kul's protected areas. Ala-Too and Kokuy-Kol core zones. A visit of different areas in Jeti-Oguz and Ak-Suu districts were carried out including a tree nursery at Ak Suu. Along the Jeti-Oguz River several marmots were encountered (Figure 106).

Figure 106: Marmot (*Marmota baibacina*)

573. The site survey was carried out during early spring when wild cherry and apricot trees were in bloom along the road and migrating birds started arriving, forming pairs and nesting. The ornithologist counted nests and birds. Red data book listed four-leafed tulip bloomed at the glades of the road at KM 142, in the village of village of Sary along the road to the waste processing plant. and near the Lake Kokuy-Kol. The preservation of the four-leaved tulip is important. New leaves were also just appearing on barberries and sea buckthorn. The observed terrestrial invertebrate species during this survey are listed in Table 52 and Figure 107.

Table 52: Terrestrial invertebrate species recorded at the Project site during the second spring season site survey (9th to 13th April 2023)

Name of birds Russian, Latin, English		Yrdyk	Tamga	Chon Jargylchak	Kokuy-Kol	Ak Terek	Jenish/ Darhan	Kyzyl Suu
1	Фазан-Phasianus colchicus-Genus Pheasantan	2	1	121				
2	Большая синица-Parus major Great Tit		1					
3	Огарь-Tadorna ferruginca Ruddy Shelduck		2		5	8		
4	Майна-Acridotheres tristis-Indian Mayna		2	1	1			6

Name of birds Russian, Latin, English		Yrdyk	Tamga	Chon Jargylchak	Kokuy-Kol	Ak Terek	Jenish/ Darhan	Kyzyl Suu
5	Сорока-Pica Black-billed Magpie		2	2	4		3	2
6	Чёрная ворона-Corvus covonc-Carrion crow		2	1	2	2	1	
7	Полевой воробей-Passer montanus-Eurasian Tree sparrow		2		30			10
8	Кольчатая горлица-Streptopelia decgocto-Eurasian Collared Dove		2		2			4
9	Галка обыкновенная-Corvus monedula-Jackdaw	2	2				2	14
10	Дрозд чёрный-Turdus merula-Eurasian Blackbird		3	2				1
11	Маскированная трясогузка-Motacilla personata-Masked wagtail			5	1		2	4
12	Деревенская ласточка-Hirundo rustica-Bam swallow			2	6			
13	Голубь-Columba livia-Rock Pigeon			3	3		84	10
14	Грач-Corvus frugilegus-Rook	50					5	150
15	Коршун чёрный-Milvus migrans-Black kite	1			2		1	3
16	Каменка обыкновенная-Oenanthe Oenanthe-Northem Wheatear						2	
17	Красноносый нырок-Netta rufina-Red crested Duck				40			
18	Чирок трескунок-Anas guerguedula-Garganey				3			
19	Лысуха-Fulica atra-Common Coot				110			
20	Поганка большая-Dodiceps cristatus-				4		2	

Name of birds Russian, Latin, English		Yrdyk	Tamga	Chon Jargylchak	Kokuy-Kol	Ak Terek	Jenish/ Darhan	Kyzyl Suu
	Great Crested Grebe							
21	Красноспинная горихвостка-Phoenicurus erythrogaster-Eversman s Redstart				1	1		
22	Хохлатая чернеть-Aythya fuligula-Tufted Duck				21			
23	Чайка озёрная-Larus ridibundus-Common Black-headed				1			
24	Лебедь шипун-Cygnus olor-Mute Swan				6			
25	Камышница-Callinula chloropus-Common Moorhen				1			
26	Желтоголовая трясогузка-Motaeilla citreola-Citrine-Citrine Wagtail				1			
27	Просянка-Emberiza calandra-Com Bunting					2		
28	Скворец обыкновенный-Strurnus vulgaris-Common Starling				1	1		
29	Чибис-Vanellus-Northem Lapwing				1	1		
30	Широкохвостка-Cettia cetti-Cettis Warbler						1	
31	Жулан-Lanius colluria-Red-backed Shrike							1
32	Чекан черноголовый-Saxicolatorguata-Common Stonechat				1	1		

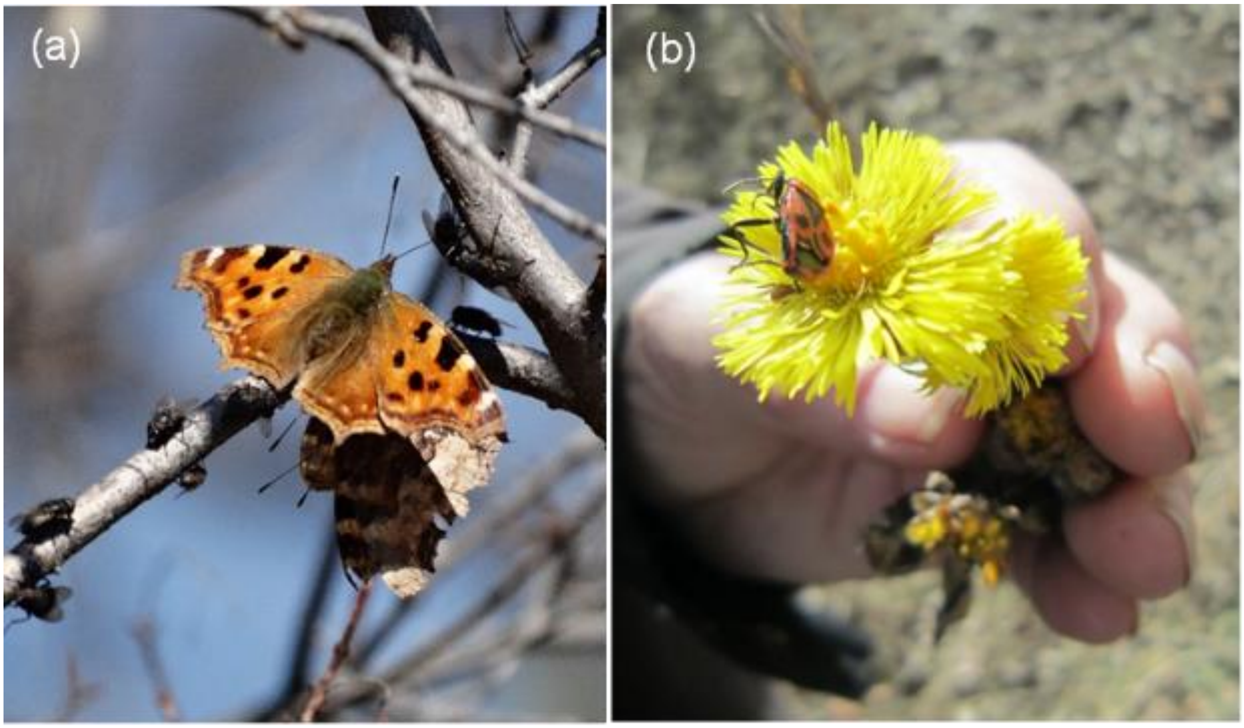

Figure 107: Invertebrates found during the second spring season site survey (9th to 13th April 2023): (a) butterfly (*Polygonis c-aidum*) and (b) Firebug (*Pyrrhocoris apterus*)

d) *Third Spring Season Site Survey (18th to 19th April 2023)*

574. During the third spring season site survey from 18th to 19th April 2023, bird counts were conducted by the ornithologist at six (6) observation points. Table 53 list the species and number of birds sighted during the survey. As seen in the Table, from 17th to 18th April 2023, wintering and migratory birds were seen: magpie, myna, pheasant, black crow, ring-necked dove, blackbird, common shrike, quail hawk. Overwintering birds included: teal, snipe, eagle, tufted duck, marsh harrier, whooper swan, gray heron, greater grebe, kestrel, moorhen. Migratory birds: bald eagle, barn swallow, masked wagtail, lake gull, gray duck. Herbivore: teal, little grebe, oystercatcher, stiltspot, crake, moorhen.

Table 53: Bird count during the third spring survey (18th to 19th April 2023) the project site

No.	Name of birds	Point 1	Point 2	Point 3	Point 4	Point 5	Point 6
		Barskoon	Jenish	Saruu	Kokuy-Kol	Kyzyl Suu	Darkhan
1	Lake Gull	2			6	4	
2	Chuckler Gull	1					
3	Eurasian Blackbird	4	2				
4	Common chat	1	1				
5	Common redstart	1					
6	Eurasian magpie	6			4	2	
7	Masked Wagtail	4	2		2	2	
8	Indian myna	1					
9	Rook	5		200			200
10	Ruddy shelduck	8			6		

No.	Name of birds	Point 1	Point 2	Point 3	Point 4	Point 5	Point 6
		Barskoon	Jenish	Saruu	Kokuy-Kol	Kyzyl Suu	Darkhan
11	Ring-necked Pheasant		2		3	5	
12	Mallard		2		2	2	
13	Carrion crow		2		2	2	
14	Western jackdaw			12			12
15	Great crested grebe				10	4	
16	Great cormorant				12	1	
17	Mute swan				8		
18	Red-crested pochard				142	4	
19	Garganey				6		
20	Osprey				1		
21	Black kite				2		
22	Short-toed snake eagle				2		
23	Common moorhen				2	1	
24	Eurasian coot				365	100	
25	Northern lapwing				2	2	
26	Barn swallow				6		
27	Citrine wagtail				2		
28	European stonechat				2		
29	Corn bunting				2		
30	Eurasian tree sparrow				30		
31	Common starling				4		
32	Whooper swan					1	
33	Cetti's warbler					2	

e) *Summer Season Site Survey (6th to 8th July 2023)*

575. A summer site survey was conducted from 6th to 8th July 2023, which included a bird count. The result of the bird count is shown in Table 54.

Table 54: Bird count during the summer survey (6th to 8th July 2023) the project site

No.	Name of birds Russian, Latin, English	Barskoon	Ak Terek	Chon Jargylchak	Jenish/ Darhan	Jeti-Oguz/ Chyrak	Yrdyk
1	Коршун чёрный-Milvus migrant-Black Kite	1	1	1	2	3	2
2	Камышевка широкохвостая-Cettia cetti-Cettis Warbler	1		1		1	1

No.	Name of birds Russian, Latin, English	Barskoon	Ak Terek	Chon Jargylchak	Jenish/ Darhan	Jeti-Oguz/ Chyrak	Yrdyk
3	Сорока-Pica pica-Black-billed Magpie					3	2
4	Грач-Corvus frugilegus-Rook				12		150
5	Маскированная трясогузка-Motacilla personata-Masked wagtail				2		2
6	Майна-Actidotheres tristis-Indian Mayna		1				2
7	Сорокопут жулан-Lanius collurio-Red-backed shrike						2
8	Каменка плесунья Oenanthe isabelline-Isabelline wheatear						2
9	Чёрный стриж Apus Common Swift	4					4
10	Чёрный дрозд-Turdus merula-Eurasian Black bird	1	1				2
11	Деревенская ласточка-Hirundo rustica Bam Swallow						2
12	Береговая ласточка-Riparia riparia-Sand Martin					12	200
13	Большая горлица-Streptopelia orientalis						3
14	Удод-Upupa epops-Eurasian Hoopoe						1
15	Чечевица обыкновенная-Carpodacus erythrinus-Common Rosefinch				1		1
16	Иволга-Oriolus orolus-Eurasian Golden Oriole		1				
17	Кукушка-Cuculus canorus-Common cuckoo						1
18	Серая славка-Sylvia communis-Whitethroat					1	
19	Просянка-Emberiza calandra-Com Bunting	2					
20	Голубь-Columba Livia-Rock Pigeon						50
21	Скворец обыкновенный-Stuvnus vulgaris-Common starling		2				
22	Полевой воробей-Passer montanus-Eurasian Tree Sparrow						10
23	Зеленушка-Chloris chloris-European Greenfinch						1

C. Economic Resources

1. Kyrgyz Republic

576. Kyrgyz Republic is an underdeveloped county with widespread poverty.

(i) It is ranked at 118 out of 191[103] in terms of human development index (HDI);

(ii) 33.3% of its population live below the national poverty line in 2021[104];

(iii) Its per capita gross national income was US$ 1,410 in 2022 and is ranked at 166 out of 196 countries[105]; and

(iv) Its competitiveness index ranked 113 out of 141 countries by the World Economic Forum.

577. Kyrgyz heavily depends on road transport as about 95% of passengers and over 50% freight traffic are carried by road. Poor transport condition is still one of the key factors causing poor economy and widespread poverty. Rehabilitating the project road is expected to significantly contribute to tourism and economic development for Issyk-Kul Oblast, as well as for Kyrgyz as a whole.

2. Issyk-Kul Oblast and Impacted Rayons

578. The Project is within Issyk-Kul Oblast, which has a land area of 43,100km^2 or 21.5% of the country's total. The oblast's economy is dominated by agriculture (animal husbandry cropping) and tourism. The oblast's poverty incidence was as high as 38.1% in 2022; slightly higher than the national average of 33.3%. The average per capita monthly income was at the same level of the national average of ctinopterygii 7,173 in 2022 (Table 55).

Table 55: Basic economic data of Kyrgyz Republic, Issyk-Kul Oblast and Jeti-Oguz Rayon and Ak-Suu Rayon (2022)

	Kyrgyz Republic	Issyk-Kul Oblast	Jeti-Oguz Rayon	Ak-Suu Rayon
Per capita income (KGS/month)	6,649	7,173	n.d.	n.d.
Land area (km^2)	199,900	43,100	14,499	9,917
Per capita GDP (KGS)	143,900	163,200	n.d.	n.d.
Poverty incidence (%)	33.3	38.1	n.d.	n.d.
Poverty line (KGS/month/capita)	6,268	5,828	n.d.	n.d.

Source: official statistics and local authorities; n.d. = not data available

579. Cattle herding is one of the major sources of livelihood, and agricultural lands are mostly used for cultivating perennial forage crops of clover, alfalfa and rye. Over 90% of local households keep cattle, horse and sheep, ranging from 8 to 120.

580. The agricultural land holding is 0.7-2.5ha per household in the four project affected villages. Irrigation is available to most of the agricultural lands next to the project road.

[103] UNDP. Human Development Report, 2021/2022. 2022. https://hdr.undp.org/system/files/documents/global-report-document/hdr2021-22pdf_1.pdf
[104] ADB, Statistics and Data Innovation Unit, Economic Research and Regional Cooperation Department. Basic 2023 Statistics. April 2023. https://www.adb.org/sites/default/files/publication/875291/basic-statistics-2023.pdf
[105] World Bank. Gross national income per capita 2022, Atlas method and PPP. 1 July 2023. https://databankfiles.worldbank.org/public/ddpext_download/GNIPC.pdf

3. Land Use

581. As shown in Figure 3, for its entire length, the existing segment of the ring road from Barskoon to Karakol City crosses settlements (Figure 108) and farmlands (Figure 109) planted with vegetables, wheat and fodder grasses.

Figure 108: Settlement along the Issyk-Kul Ring Road in Darkhan Village

Figure 109: Farmlands along the Issyk-Kul Ring Road near Jele Tobe Village

4. Agriculture

582. In 2021, in the Issyk-Kul Region the main agricultural crop produced is potato (Figure 110), which accounts for 40.0% of the agricultural production. It is followed by vegetables (37.12%), fruits and berries (13.53%) and the remainder consisting of wheat, barley and vegetable oil (Figure 111 and Figure 112).

583. The main economic activity along the project site is agriculture. This has been confirmed through the site visits that were conducted by the EIA team. The main agricultural crops cultivated includes potatoes, wheat, barley, vegetables, fruits and berries.

Figure 110: Potato farm near the Issyk-Kul Lake in Jeti-Oguz District

Figure 111: Wheat farm along the road project in Jeti-Oguz District

Figure 112: Fruit orchard near Lake Issyk-Kul along the road project in Jeti-Oguz District

5. Industry

584. Based on interview with the Deputy Akim (Head) for Social Services of Jeti-Oguz Rayon, Ms. Beishenbaeva Venera Mukambetovna, there are no major manufacturing plants in the project area. The main industries include: milk factory, tailoring and brick making.

6. Commercial Center

585. Commercial establishments are mainly based in the Kyzyl Suu, the capital of Jeti-Oguz and in Karakol City, the capital of Issyk-Kul Oblast. Similarly, the government operations at the rayon level are centered in Kyzyl Suu (Figure 113) while at the oblast level in Karakol City.

Figure 113: Administration Building of the Jeti-Oguz Rayon located along the road project in Kyzyl-Suu.

7. Tourism

586. The main tourist attractions in the Jeti-Oguz Rayon and Karakol City are the Issyk-Kul Lake, the Jeti-Oguz Rocks and Teskei Geopark. Foreign tourist that visits these areas are normally part

of group tours of Central Asia, which include visits in Kazakhstan, Uzbekistan, Tajikistan and Kyrgyz Republic (Figure 114). There are no available data on the number of tourist arrivals in Jeti-Oguz.

587. Most of the tourists who visit Issyk-Kul normally stays and visits the Northern shores as the road there are in much better conditions and there are available tourist accommodation facilities. In the Southern shores, there are very few accommodation facilities (hotels) and yurts that caters to foreign travelers (mostly backpackers and tour groups) (Figure 115 and Figure 116).

Figure 114: Malaysian tourists visiting Jeti-Oguz Rocks as part of a tour of Central Asia (April 2023)

Figure 115: Tourists biking on the Issyk-Kul Ring Road near Barskoon (April 2023)

Figure 116: Tradition yurts that accommodates tourist on the South shores of Issyk-Kul Lake

D. Sociocultural Resources

1. Population and Demographics

588. The Issyk-Kul Oblast has a total population of 0.53 million in 2022, which is 7.86% of the total population of the Kyrgyz Republic[106]. (Table 56). The Jeti-Oguz and Ak-Suu rayons are considered rural areas, with population densities of 6 and 7 persons/km^2, respectively. The female to male ratio of the population is one, i.e., one female for every one male population. Ethnic minorities in the two rayons are much lower than the national average at around 8% of the total population. Table 57 shows that the populations at settlements along the road project is relatively small. In the Jeti-Oguz Rayon, all settlements along the road have populations of less than 10,000 except its capital, Kyzyl Suu which has 15,464. Karakol City the capital of the Issyk-Kul Oblast has only 81,952.

Table 56: Basic Socio-cultural data of Kyrgyz Republic, Issyk-Kul Oblast and Jeti-Oguz Rayon and Ak-Suu Rayon (2022)

	Kyrgyz Republic	Issyk-Kul Oblast	Jeti-Oguz Rayon	Ak-Suu Rayon
Population (million)	6.74	0.53	0.09	0.07
% Rural Population	66.0	70.6	100	100
% Female Population	50.4	50.17	50.1	50.14
% Ethnic Minority	25.9	10.3	8.7	7.9

Source: official statistics and local authorities

Table 57: Population of settlements along the road project

Settlement	Total population
Chon Jargylchak	1,065
Kichi Jargylchak	3,872
Ak Terek	4,479
Zhenish/Chychkan	3,563
Darkhan	7,398

[106] National Statistical Committee of the Kyrgyz Republic. Resident population as of the beginning of the year. http://stat.kg/en/opendata/category/39/

Settlement	Total population
Saruu	8,501
Kyzyl Suu	15,464
Orgochor	2,806
Shalba/ Tilekmat	3,366
Jele Tobe/Zhele-Dobo	1,340
Kyzyl Dyikan/Alkym	1,213
Konkino/Kalinovka	842
Karakol	81,952

Source of population data: National Statistics Committee of the Kyrgyz Republic. 2021.

2. Cultural and Archaeological Resources

a) *Historical Background*

589. The study of archaeological monuments of the Issyk-Kul basin began in the middle of the 19th century. The first mention in the literature on the archaeological antiquities of Issyk-Kul region dates back to 1842 and is associated with the find of the bronze cauldron of the Saka time. But the first archaeological works, conducted by the local administration and travelers, were devoted to the collection and description of random finds and documentation of the burial mounds and other monuments of antiquity (Mokrynin, 2010. p. 111).

590. The first scientific research in the territory of Kyrgyz Republic in general that include the Issyk-Kul basin was carried out in 1928 by archaeologists M.V. Voevodsky and M.P. Gryaznov. They excavated several Early Iron Age burials near the city of Przhevalsk (now known as Karakol). The data obtained during excavations were systematized and published in an academic journal, which the basis for subsequent works (Voevodsky, Gryaznov, 1938).

591. In subsequent years, in different parts of Issyk-Kul basin, the monuments of ancient nomads were studied by A.N. Bernstam, D.F. Vinnik, V.P. Mokrynin, P.P. Gavryushenko, and other specialists.

592. In different areas of the Issyk-Kul basin, the remains of early Medieval cities and settlements are known, which indicate a developed settled life in the region (Vinnik, 1967). According to archaeologists, there are about 100 settlements in the Issyk-Kul basin, which presented a variety of materials on the history and culture of the Medieval population of the region. These researches were conducted by P.P. Ivanov, A.N. Bernshtam, D.F. Vinnik, V.P. Mokrynin and other specialists. Recently, V.A. Kolchenko and D. Luzhansky have been studying medieval settlements of the Issyk-Kul basin. It is gratifying to note that in the study of these monuments, interdisciplinary methods are used, namely, archaeoseismological analysis of the preserved walls of the city and settlements (Korzhenkov et al., 2015).

593. One of the most common archaeological monuments in the Issyk-Kul basin are petroglyphs. They are located in areas where large stone and boulders are scattered on the coastal areas and foothills of the Issyk-Kul basin (Vinnik, Pomaskin, 1975). The images of people and animals are drawn on stone and boulders, e.g., goats, deer, bulls, dogs, horses. There are tribal tamgas and various signs, including solar ones, which, apparently, are associated with the cult of the sun and fire. Some petroglyphs depict multi-figure scenes, like hunting scenes, “ritual dancing” etc. According to the stylistic features of the pictures, petroglyphs of the Bronze Age, Early Iron and Middle Ages, and Ethnographical period were distinguished. Petroglyphs of the Issyk-Kul basin were studied by G.A. Pomaskina, D.F. Vinnik, K.I. Tashbaeva, E. Miklashevich, K.Sh. Tabaldiev, K.T. Akmatov, and other specialists.

594. The underwater archaeological sites of Issyk-Kul have been studied by the archaeological group of the B. Yeltsin Kyrgyz-Slavic University. In the course of research, they found archaeological artifacts related to various historical periods. Of particular interest are the treasures of bronze items found on the northern shore of Issyk-Kul and related to the Bronze and Early Iron Ages (Mokrynin, Ploskih, 1988; Ploskih, 2012). Currently, these items are exhibited in the historical and archaeological museum of this university.

595. Along with the above monuments of the historical and cultural heritage in Issyk-Kul basin, the settlement and workshop sites of the Paleolithic era, the burial grounds of the Middle Ages and ethnographical modernity, the stone sculptures of the ancient Turkic time, the treasures of bronze items, medieval epigraphic monuments, Tash-Koroo have been discovered and studied (Figure 117) (Zyablin, 1957; Archaeological monuments..., 1975; Biosphere territory..., 2003)

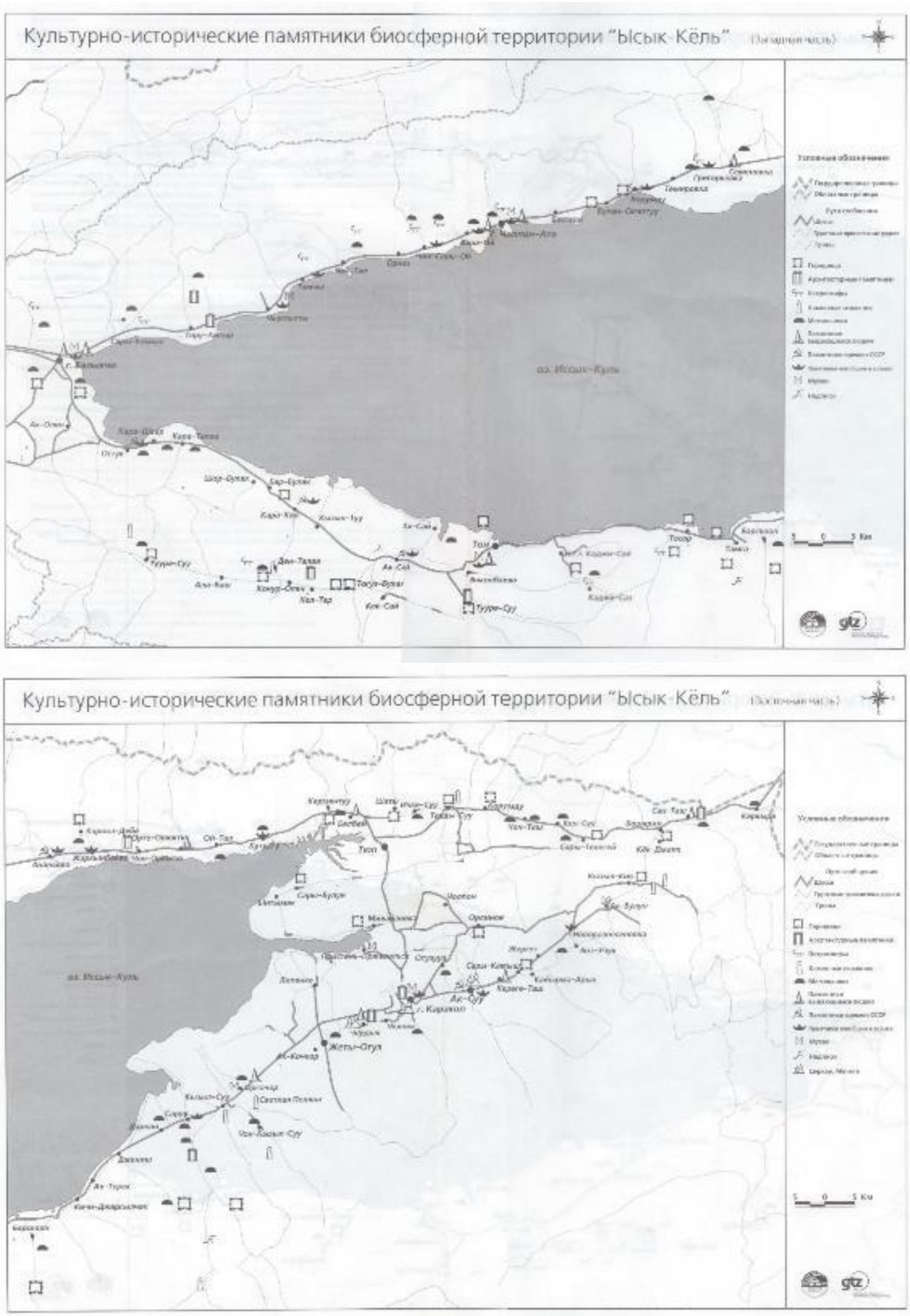

Figure 117: Archaeological map of the Issyk-Kul depression

(source: Biosphere area of Issyk-Kul. Cultural and Historical Monuments, 2003).

b) Archaeological Survey Methodology

596. An archaeological survey of the road project from Barskoon (KM 141+600) to Karakol (KM 220+000) was carried out to determine the presence or absence of archaeological sites in the immediate vicinity of the road (at least 50 meters). The survey was carried out in the first half of April 2023 on the basis of permit form No. 3 - on the right to conduct an archaeological survey in Kyrgyz Republic, issued by the Institute of History, Archaeology and Ethnology of the National Academy of Sciences of the Kyrgyz Republic to Kunbolot Akmatov, the project's Archeological expert (Figure 118).

597. The archaeological field evaluation of the road project consisted of the following three stages:

(i) **Preparatory stage**. As part of the preparatory stage, the following activities were carried out: (a) A review of scientific papers and books on the archaeology of Jeti-Oguz and Ak Suu regions, specifically the road project area; (b) A study of archival and museum materials and collections related to the survey area; (c) Preparation of cartographic materials; (d) Aerial survey of the study area and mapping of the potential cultural heritage sites from the satellite imagery; and (e) A study of geomorphological and geographical conditions of the survey area. Based on the results of these works a plan for the field survey was worked out.

(ii) **Field survey**. In this stage, a visual survey of the area within 50 meters from the edge of the road project was conducted (Figure 118). The aim of the visual survey is to ascertain the presence or absence and extent of any archaeological and ethnographical remains, which might be impacted by the project's construction activities. When remains are found, a complete documentation is carried out through photography and written description, recording of geographical coordinates and mapping of all moveable and immovable finds.

(iii) **Report preparation**. At this stage, all data compiled during the preparatory stage and field survey were processed and systematized. The character, extent, and quantity of the discovered archaeological and ethnographical sites were established and evaluated. Moreover, efforts were made to determine their chronological and/or ethnocultural attributions. On the basis of these works a final report was written and submitted.

Figure 118: The Project's Archaeological Expert, Dr. Kunbolot Akmatov marking an archaeological find (burial mound) near the road project

c) Results of the Archeological Survey

598. Fourteen (14) objects of historical and cultural heritage are located within the 50-meter zone from the road that include the following (Figure 119 and Table 58):

(i) Five (5) burial grounds of the early Iron Age and/or the Middle Ages, which include 15 burial mounds;

(ii) Seven (7) modern Muslim cemeteries and sculptural monuments; and

(iii) Two (2) ethnographical Muslim cemeteries.

599. In addition, six (6) cultural heritage sites located outside the 50-meter zone from the road were identified, which include (Figure 119 and Table 59):

(i) Three (3) burial grounds of the early Iron Age;

(ii) Two (2) ethnographical cemeteries; and

(iii) One (1) - is a modern memorial complex (sculptural monument).

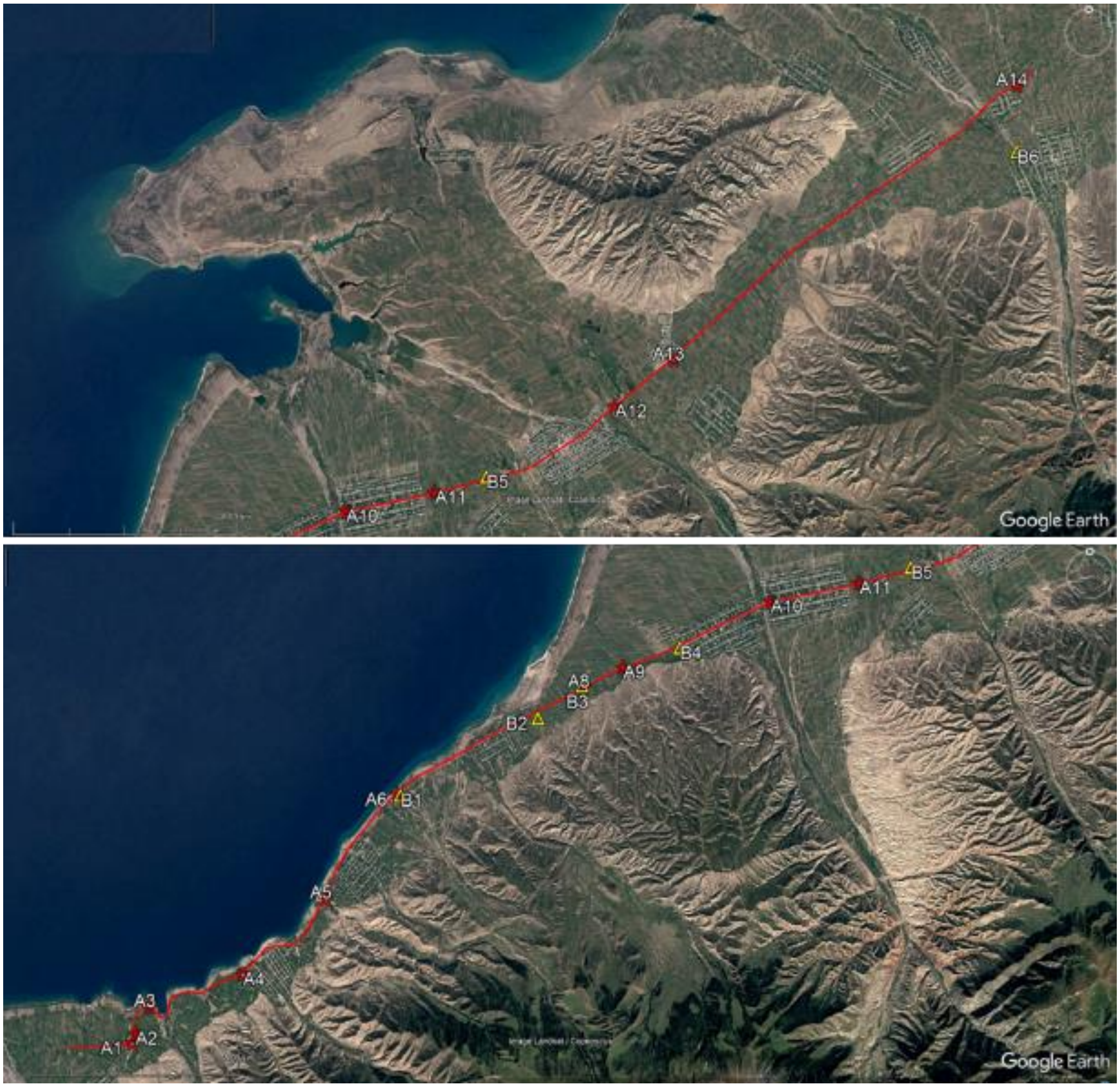

Figure 119: Historical and cultural heritage sites near the project site

Table 58: Historical and cultural heritage sites located within 50 m from the road

SN	LOCATION		Distance from the Road	Description
	Road KM	UTM Coordinates		
A1	142+920	42°10.822'N; 77°37.807'E	46 m South	Flat stone-earthen burial mound
A2	143+245	42°11.004'N; 77°37.874'E	7 m South	Human thigh bone and ceramic vessel fragment
A3	144+520	42°11.509'N; 77°38.251'E	20 m South	Flat stone-earthen burial mound
A4	148+840	42°12.137'N; 77°40.667'E	35 m South	Modern Muslim cemetery
A5	153+020 - 153+120	42°13.576'N; 77°42.825'E	13 m South	Modern Muslim cemetery

SN	LOCATION		Distance from the Road	Description
	Road KM	UTM Coordinates		
A6	157+600	42° 5.547'N; 77°44.685'E	20 m South	Flat stone-earthen burial mound. One-room clay structure.
A7	162+660 - 162+780	42°16.926'N; 77°47.882'E	24 m South	Modern Muslim cemetery
A8	165+290 - 165+330	42°17.583'N; 77°49.530'E	16 m North	Seven (7) burial mounds
A9	166+840 - 166+940	42°17.967'N; 77°50.551'E	30 to 73m North	Ethnographical Muslim cemetery and burial mounds
A10	172+600 - 178+680	42°19.215'N; 77°54.393'E	18 m North	Modern Muslim cemetery
A11	175+620 - 176+150	42°19.567'N; 77°56.711'E	16 m North	Modern Muslim cemetery
A12	183+130 - 183+190	42°21.198'N; 78°1.400'E	9 to 24 m North	Ethnographical Muslim cemetery
A13	185+810	42°22.074'N; 78°2.934'E	10 to 46 m South	Memorial monument to Sart Ake and Tilekmat Ake
A14	201+420 - 201+540	42°27.249'N; 78°11.908'E	10 to 12 m South	Modern Muslim cemetery

Table 59: Historical and cultural heritage sites located >50 m from the road

SN	LOCATION		Distance from the Road	Description
	Road KM	UTM Coordinates		
B1	157+650	42°15.530'N; 77°44.758'E	100 to 143 m South	Five (5) stone-earthen burial mounds
B2	163+320	42°16.994'N; 77° 48.337'E	200 to 240 m South	Two (2) large earthen mounds
B3	165+180 - 165+400	42°17.613'N; 77°49.493'E	70 to 100 m North	Ethnographical Muslim cemetery (5 mausoleums and about 60 earthen mounds)
B4	169+000	42°18.331'N; 77°52.029'E	55 m South	Memorial monument to Karga Ake
B5	177+810	42°19.863'N; 77°58.058'E	78 m North	Ethnographical Muslim cemetery
B6	200+500	42°26.000'N; 78°11.900'E	1 km South	Group of large burial mounds in Zhele-Dobo,

(1) Historical and cultural heritage sites located within 50 meters from the road.

600. **Site A1**. At KM142+920 of the road, 46 m south from its edge, in the Tash-Koo area, a flat stone-earthen burial mound was recorded (Figure 120). On the modern surface, an arched row of 6 stones can be traced - part of the stone ring around the perimeter of the mound.

Figure 120: Site A1 - Burial mound at the Tash-Koo locality

601. **Site A2**. At KM143+245 of the road, 7 m south from its edge, a human thigh-bone was discovered. A fragment of a ceramic vessel (Figure 121) was found 12 m to the west of the latter. Apparently, they come from relatively recently destroyed burial.

Figure 121: Site A2 - A human thigh bone and a fragment of the ceramic vessel

602. **Site A3**. At 144+520 km of the road, 20 m to the south from its edge, a flat stone-earthen burial mound was found with the dimensions of 6 m x 6 m (Figure 122).

Figure 122: Site A3 - Burial mound to the Northwest of the Chon-Jargylchak village.

603. **Site A4**. At 148+840 km of the road, 35 m south from its edge, a modern Muslim cemetery is situated (Figure 123).

Figure 123: Site A4 – Modern Muslim cemetery.

604. **Site A5**. At KM153+020 – KM 153+120 of the road, 13 m south from its edge, a modern Muslim cemetery is situated (Figure 124).

Figure 124: Site A5 – Modern Muslim cemetery

605. **Site A6**. At KM 157+600 of the road, 20 m south from its edge, a flat stone-earthen burial mound with dimensions of 3.5 x 2.3 m was recorded (Figure 125). Ten (10) m east of the burial mound is the remains of a one-room clay structure is situated (Figure 126). At the eastern end of its southern wall there is a doorway. Apparently, this structure is not a mausoleum and cannot be older than 50-60 years.

Figure 125: Site A6 – Burial mound

Figure 126: Site A6 – Remains of the clay structure

606. **Site A7**. At KM 162+660 – KM 162+780 of the road, 24 m south from its edge, a modern Muslim cemetery is situated (Figure 127).

Figure 127: Site A7 – Modern Muslim cemetery

607. **Site A8**. At KM 165+290 - 165+330, 16 m north from its edge, seven (7) burial mounds were recorded (Figure 128). Two of them are flat stone-earth mounds with a diameter of 6 and 8 m (Figure 129 and Figure 130). The remaining 5 burials have a small flattened mound with a diameter of up to 2.5 m (Figure 131 to Figure 135). There is no complete confidence that the last

five (5) mounds represent ancient burial mounds. But the only way to know that is to excavate, at least two (2) of them. The geographical coordinates of the seven burial mounds as follows:

(i) Burial mound no. 1: 42°17.583', 77°49.530';

(ii) Burial mound no. 2: 42°17.580', 77°49.522';

(iii) Burial mound no. 3: 42°17.584', 77°49.534';

(iv) Burial mound no. 4: 42°17.585', 77°49.538';

(v) Burial mound no. 5: 42°17.588', 77°49.543';

(vi) Burial mound no. 6: 42°17.589', 77°49.548'; and

(vii) Burial mound no. 7: 42°17.591', 77°49.552'.

Figure 128: Site A8 – Burial mounds and ethnographical cemetery (Site B3)

Figure 129: Site A8 – Ancient burial mound No. 1

Figure 130: Site A8 – Ancient burial mound No. 2

Figure 131: Site A8 – Ancient burial mound No. 3

Figure 132: Site A8 – Ancient burial mound No.4.

Figure 133: Site A8 – Ancient burial mound No.5.

Figure 134: Site A8 – Ancient burial mound No.6.

Figure 135: Site A8 – Ancient burial mound No.7.

608. **Site A9**. At KM 166+840-166+940 of the road, 30 to 73 m to the North from its edge, an ethnographical Muslim cemetery is located (Figure 136 and Figure 137). It includes earthen and stone-earthly mounds with diameters up to 8 m, shallow pits, apparently formed as a result of the collapse of the ceiling of Muslim catacomb burials and mausoleums built of sun-dried-earth brick (Figure 138 to Figure 142). The total number of individual sites is about 30. Flat stone-land mounds (4) with a diameter of more than 4 to 5 m (Figure 142), judging by the analogies, should be dated back to the Early Iron Age. They are located 39 to 48 m North from the edge of the road. The remaining mounds represent Muslim funeral structures of the ethnographical time. The land to the west of the cemetery was turned into a landfill for construction and other garbage. Perhaps some burial mounds were covered by this garbage. Apparently, some burials were destroyed during the construction of the landfill.

Figure 136: Site A9 – Location of burial mounds and ethnographical cemetery

Figure 137: Site A9 – Burial mounds and ethnographical cemetery

Figure 138: Site A9 – Muslim ethnographical cemetery

Figure 139: Site A9 – Burial mound

Figure 140: Site A9 – A pit over Muslim burial

Figure 141: Site A9 – A pit over Muslim burial

Figure 142: Site A9 – Burial mound

609. **Site A10**. At KM 172+600 to KM 178+680 of the road, 18 m to the North from its edge, a modern Muslim cemetery is situated (Figure 143).

Figure 143: Site A10 – Modern Muslim cemetery

610. **Site A11**. At KM 175+620 to KM 176+150 of the road, 16 m North from its edge, a modern Muslim cemetery is situated (Figure 144).

Figure 144: Site A11 – Modern Muslim cemetery

611. **Site A12**. At KM 183+130 to KM 183+190 of the road, 9 to 24 m to the north from its edge, an ethnographical Muslim cemetery is situated (Figure 145). It consists of earthen mounds with a diameter of 1.5-2.5 m (some of them are fenced) and mausoleum (Figure 147 to Figure 150). The latter is located at the eastern end of the cemetery. Some mounds on the western part of the cemetery are located on a flat hill with a diameter of 4 to 5 m, which, possibly, represents a burial mound of the early Iron Age.

Figure 145: Site A12 – Location of ethnographical Muslim cemetery

Figure 146: Site A12 – Aerial view of ethnographical Muslim cemetery

Figure 147: Site A12 – A Muslim mausoleum

Figure 148: Site A12 – A Muslim burial site

Figure 149: Site A12 – A Muslim burial site

Figure 150: Site A12 – A Muslim burial site

612. **Site A13**. At KM 185+810 of the road, 10 to 46 m South from its edge, a memorial monument to Sart Ake and Tilekmat Ake is situated (Figure 151). The monument was established in 1998. On the territory of the monument, to the left of the sculptures of Sart Ake and Tilelekmate Aka, three stone sculptures of the 7th-9th centuries were recently erected, which apparently, were brought from neighboring territories (Figure 152).

Figure 151: Site A13 – The Sart Ake and Tilekmat Ake monument and three stone sculptures

Figure 152: Site A13 – Three stone sculptures (7th-9th centuries) erected at the site

613. **Site A14**. At KM 201+420 to KM 201+540 of the road, 10 to 12 m South from its edge, a modern Muslim cemetery is situated (Figure 153).

Figure 153: Site A14 – Modern Muslim cemetery

(2) <u>Historical and cultural heritage sites located more than 50 meters from the road.</u>

614. **Site B1**. At KM 157+650 of the road, 100 to 143 m south from its edge, five (5) stone-earthen burial mounds are concentrated (Figure 154). The diameters of the mounds are from 3.5 to 9 m (Figure 155 to Figure 159). The geographical coordinates of the burial mounds are:

(i) Burial mound No. 1: 42°15.530', 77°44.758';

(ii) Burial mound No. 2: 42°15.526', 77°44.753';

(iii) Burial mound No. 3: 42°15.519', 77°44.759';

(iv) Burial mound No. 4: 42°15.517', 77°44.759'; and

(v) Burial mound No. 5: 42°15.509', 77°44.761'.

Figure 154: Site B1 – Location of the five burial mounds (1, 2, 3, 4 and 5) East of the Ak-Terek village

Figure 155: Site B1 – Burial mound No. 1

Figure 156: Site B1 – Burial mound No. 2.

Figure 157: Site B1 – Burial mound No. 3

Figure 158: Site B1 – Burial mound No. 4

Figure 159: Site B1 – Burial mound No. 5.

615. **Site B2**. At KM 163+320 of the road, 200 to 240 m South from its edge, two (2) large earthen mounds with a diameter of 28 and 30 m and about 1 and 1.8 m high, respectively were found (Figure 160 and Figure 161). They represent typical burial mounds of the Early Iron Age. The mounds are located in the middle of two narrow and long agricultural lands dividing them into two parts. According to the owner of one of the land due to the mounds, agricultural machinery cannot pass from one end to another. The machinery cannot bypass the mounds, since in neighboring areas there are young plantations of apple trees, pears, apricots, etc. That is why the mounds are in danger of destruction. The geographical coordinates of the two mounds: (i) Burial mound no. 1: 42°16.994', 77°48.337'; and (ii) Burial mound no. 2: 42°16.971', 77°48.339'.

Figure 160: Site B2 – Location of two (2) big burial mounds

Figure 161: Site B2 – Two (2) big burial mounds

616. **Site B3**. At KM 165+180 to KM 165+400 of the road, 70 to 110 m North from its edge, an ethnographical Muslim cemetery is situated (Figure 128 and Figure 162). It consists of five (5) mausoleums and about 60 earthen mounds with diameters of from 1 to 6 m (Figure 163 and Figure 166).

Figure 162: Site B3 – Burial mounds and ethnographical cemetery.

Figure 163: Site B3 – Ethnographical Muslim mausoleum.

Figure 164: Site B3 – Ethnographical Muslim mausoleum.

Figure 165: Site B3 – Ethnographical Muslim burial mound.

Figure 166: Site B3 – Ethnographical Muslim burial mound.

617. **Site B4**. At KM 169+000 of the road, 55 m South from its edge, the memorial monument to Karga Ake, established in 2018, is situated (Figure 167).

Figure 167: Site B4 – The location of the Karga Ake monument

618. **Site B5**. At 177+810 km of the road, 78 m North from its edge, an ethnographical Muslim cemetery is located. The cemetery, consisting of earthen and stone-earth mounds with a diameter of from 1 to 2.5 m (about 50 mounds), is located on a flat, rounded hill with a diameter of up to 60

m (Figure 168 and Figure 169). Perhaps the hill represents a burial mound of the Early Iron Age, on which burials were placed in the Ethnographical time.

Figure 168: Site B5 – Ethnographical Muslim cemetery.

Figure 169: Site B5 – Ethnographical Muslim burial site.

619. **Site B6**. At KM 200+500 of the road, 1 km south from its edge, in the southern part of the village Zhele-Dobo, a chain of large burial mounds, stretched along the north-south axis, was discovered (Figure 170 to Figure 172). In the center of the mounds, there is a hole - traces of looting. Apparently, some burial mounds in the chain, as well as outside of it, were destroyed by construction and earthwork. The diameter of the mounds is 40-60 m, the height is 2-3 m. The

mounds are dated back to the VI-III centuries BC and belong to Saka culture. Geographic coordinates of the northern burial mound: 42° 26.500', 78° 11.620'; Southern burial mound: 42° 26.000', 78° 11.900'.

Figure 170: Site B6 – The location of the burial mounds (yellow shapes) in Zhele-Dobo

Figure 171: Site B6 – Burial mounds in Zhele-Dobo Village.

Figure 172: Site B6 – Burial mounds in Jele-Dobo Village.

V. Anticipated Environmental Impacts and Mitigation Measures

620. This Chapter of the EIA predicts and assesses the project's likely impacts to physical, biological, socioeconomic and physical cultural resources in the project's area of influence. Where data are available, the impacts were assessed quantitatively using international accepted models and estimation. Where data are not sufficient, a qualitative assessment was carried out using internally accepted or best practices including expert judgment. This chapter also identifies and discusses mitigation measures to address the identified impacts.

621. The impacts were assessed during the construction and operational phases. Sections on climate change risks, cumulative impacts and induced impacts are included at the end of the chapter.

A. Construction Phase

1. Air Quality

a) Introduction

622. Emissions to air can occur during the preparation of the land and during construction. This part of the EIA presents the potential construction impacts, effects and proposed mitigation measures for significant environmental impacts. Construction impacts are those which may arise during the construction works, temporary use of land, movement of construction vehicles, presence of any construction camp and workers, and all other construction-related activities.

623. Potential sources of dust and particulate matter emissions include:

(i) Preparation and use of temporary haul roads;

(ii) Loading, transporting, and unloading dust generating construction materials;

(iii) Excavations of foundations and earth moving activities;

(iv) Concrete batching;

(v) Onsite crushers for the asphalt plant;

(vi) Construction vehicle movements;

(vii) Topsoil storage piles; and

(viii) Rehabilitation of temporarily disturbed areas.

624. Potential sources of gaseous and GHG emissions include construction equipment and machinery, construction vehicle movements, and fumes containing small quantities of volatile organic compounds and poly-aromatic hydrocarbons from asphalt paving.

b) Impacts Assessment and Mitigation of Dust Emissions During the Construction Phase

625. The assessment of construction phase impacts has been carried out following guidance published by the UK Institute of Air Quality Management (IAQM)[107]. This guidance is commonly used in the UK and internationally for the assessment of construction dust, and provides a framework for the qualitative assessment of air quality impacts arising from construction activities.

[107] https://iaqm.co.uk/text/guidance/construction-dust-2014.pdf

The assessment comprises four steps as listed below and discussed in the succeeding paragraphs:

(i) Step 1: Screen the need for a Detailed Assessment.

(ii) Step 2: Assess the risk of dust impacts separately for demolition, earthworks, construction, and track out. This step is carried out in three stages:

- ✓ Step 2A: Define the potential dust emission magnitude
- ✓ Step 2B: Define the sensitivity of the area
- ✓ Step 2C: Define the risks of impacts

(iii) Step 3: Site specific mitigation. The risk categorization for the site is used to identify site-specific mitigation measures to reduce the impacts of construction on nearby receptors. Where risk is categorized as ‘negligible’, no additional mitigation is required. However, mitigation may still be applied as good practice.

(iv) Step 4: Determine significant effects.

626. The assessment methodology considers three separate potential dust impacts:

(i) annoyance due to dust soiling (dust deposition on structures and land);

(ii) the risk of health effects due to an increase in exposure to PM_{10} ; and

(iii) harm to ecological receptors.

627. A qualitative assessment of gaseous emissions was also carried out.

(1) <u>Step 1: Screening</u>

628. Large dust particles tend to be deposited near the source of emissions. Following IAQM guidance, an assessment is required where there is:

(i) a ‘human receptor’ within 350m of the boundary of the site; or 50 m of the routes to be used by construction vehicles on the public highway; and

(ii) An ecological receptor within 50m of the boundary of the site; or 50m of the route(s) used by construction vehicles on the public highway.

629. As the road to be rehabilitated runs through several settlements, there are a large number of human receptors within 350m of the site boundary, and as such a detailed assessment is required. Table 16 (in Chapter 4) shows the approximate population within each distance band of the road, calculated assuming that population density is uniform within each urban area. The extent of each urban area was derived from aerial imagery, with boundaries confirmed during the site visit.

630. The Lake Issyk-Kul is considered an ecological receptor; the proposed road passes within 50m of the lake at several points near Chon Jargylchak and as a result ecological impacts are also considered in the study.

(2) <u>Step 2: Assess Risk of Dust Impacts</u>

631. A site is allocated to a risk category based on the scale and nature of the works (Step 2A) and the sensitivity of the area to dust impacts (Step 2B). These two factors are combined in Step 2C to determine the risk of dust impacts before the allocation of mitigation measures. Risks are described in terms of there being a low, medium or high risk of dust impacts for each of the four separate potential activities (demolition, construction, earthworks and trackout):

(i) **Demolition**: Any activity involved with the removal of an existing structure.

(ii) **Construction**: The key issues when determining the potential dust emission magnitude during the construction phase include the size of the building(s)/infrastructure, method of construction, construction materials, and duration of build.

(iii) **Earthworks**: Excavating material, haulage, tipping and stockpiling. The process can also involve levelling the site and landscaping. Earthworks will result in exposed areas of soil which will potentially generate dust when it is windy, with dust potentially being generated when winds blow at all times of day or night, not just during active periods of construction.

(iv) **Trackout**: The transport of dust and dirt from the construction/demolition site onto the public road network, where it may be deposited and then re-suspended by vehicles using the network.

632. **2A - Determining Potential Dust Emission Magnitude**. The potential dust emission magnitude is based on the scale of the anticipated works and should be classified as small, medium or large. Table 60 presents the dust emission criteria outlined for each construction activity.

Table 60: Example dust magnitude definitions

Construction Activity	Large	Medium	Small
Demolition	▪ Building volume >50,000m^3 ▪ Potentially dusty construction material (e.g., concrete) ▪ On-site crushing and screening, ▪ Demolition activities >20m above ground level.	▪ Building volume 20,000m^3 to 50,000m^3 ▪ Potentially dusty construction material ▪ Demolition activities 10 to 20m above ground level.	▪ Building volume <20,000m^3 ▪ Construction material with low potential for dust release (e.g., metal cladding or timber) ▪ Demolition activities <10m above ground ▪ Demolition during wetter months.
Earthworks	▪ Site area >10,000m^2 ▪ Potentially dusty soil type ▪ >10 heavy earth moving vehicles active at any one time ▪ Formation of >8m bunds ▪ Total material >100,000t	▪ Site area 2,500m^2 to 10,000m^2 ▪ Moderately dusty soil type ▪ 5 to 10 heavy earth moving vehicles active at any one time ▪ Formation of 4m to 8m bunds ▪ Total material 20,000-100,000t	▪ Total site area <2,500 m^2, soil type with large grain size (e.g., sand), ▪ <5 heavy earth moving vehicles active at any one time, ▪ Formation of <4m bunds ▪ Total material <20,000t
Construction	▪ Total building volume >100,000m^3, ▪ On site concrete batching, sandblasting.	▪ Total building volume 25,000m^3 to 100,000m^3 ▪ Potentially dusty construction material (e.g., concrete) ▪ On site concrete batching.	▪ Total building volume <25,000m^3 ▪ Construction material with low potential for dust release (e.g., metal cladding or timber).
Trackout	▪ >50 Heavy Duty Vehicles (HDV) outward movements in any one day	▪ 10 to 50 HDV (>3.5t) outward movements in any one day	▪ <10 HDV (3.5t) outward movements in any one day

Construction Activity	Large	Medium	Small
	▪ Potentially dusty surface material (e.g., high clay content) ▪ Unpaved road length >100m.	▪ Moderately dusty surface material (e.g., high clay content), ▪ Unpaved road length 50m to 100m.	▪ Surface material with low potential for dust release ▪ Unpaved road length <50m.

Source: IAQM Guidance on the assessment of dust from demolition and construction (2016)

633. A detailed timeline of the construction works is not yet available at the time of writing, and will depend on weather and the judgement of the contractor. It is anticipated that the construction will take place over 2 to 3 construction seasons and years. The construction season will vary across the project length, as climatic conditions vary across the length of the road. Construction work will be carried out in stages, and as a result impacts on any single area will be temporary.

634. Information relating to the maximum number of earth-moving vehicles on site, maximum Heavy Duty Vehicles (HDVs) outward movements per day, the proposed haul routes (on-site and off-site) and the likely stockpiling heights have been assumed based on onsite observations during construction activities on the Balykchy-Barskoon section of the road to allow determination of activity specific dust emission magnitudes, as presented in Table 61.

Table 61: Dust Emission Magnitude

Construction activity	Dust Emission Magnitude	Rationale
Demolition	Large	Full details of demotion activities are provided in Chapter 3. Total area to be demolished including asphalt > 50,000m^3 Demolition of approximately 1500m^3 of concrete structures including curbstones, parapets, signal posts, chutes with high potential for dust release.
Earthworks	Large	Total site area > 10,000m^2. Soil type in many areas is clay-heavy, which will be prone to suspension when dry due to small particle size.
Construction	Large	Large potential building volume including the road pavement. Potentially dusty construction materials including concrete. Construction traffic will use the existing road.
Trackout	Large	High unpaved road length expected during construction. Dusty surface material. Potential for moderate daily outward vehicle movements.

635. **2B - Defining the Sensitivity of the Area**. The sensitivity of the area to dust and gaseous emissions from construction depends on a number of factors, including:

(i) the specific sensitivities of receptors in the area;

(ii) the proximity to source and number of those receptors;

(iii) background concentrations; and

(iv) site-specific factors.

636. Sensitive receptors during the road construction phase will include cities, towns and villages along the road, isolated properties along the length of the road, and agricultural crops. Lake Issyk-Kul itself is also a sensitive ecological receptor. Communities and businesses in the centers close to the main road may also be affected by emissions from construction vehicles.

637. Receptors could be affected by changes in air quality where they are within 200m of a road due to changes in traffic and vehicular emissions, or by an increase in dust and particulate matter where they are within 350m of construction activities.

638. Risk is considered at the nearest receptors to each construction activity. Where multiple receptors are present in a location, the highest applicable sensitivity is allocated. Table 62 provides examples of the sensitivity of different types of receptors.

Table 62: Examples of the sensitivity of different types of receptors

Sensitivity	Sensitivities of people and ecological receptors		
	Dust soiling effects	Health effects of PM_{10}	Ecological effects
High	Houses, museums and other culturally important collections, medium and long-term car parks and car showrooms.	Residential properties, hospitals, schools and residential care homes.	▪ Locations with an international or national designation and the designated features may be affected by dust soiling (e.g., SAC/SPA/Ramsar). ▪ Locations where there is a community of a particularly dust sensitive species such as vascular species included in the Red Data list for Great Britain.
Medium	Parks, places of work.	Office and shop workers not occupationally exposed to PM_{10}.	▪ Locations where there is a particularly important plant species, where dust sensitivity is uncertain or unknown. ▪ Locations with a national designation where the features may be affected by dust deposition (e.g., SSSIs).
Low	Playing fields, farmland, footpaths, short-term car parks and roads.	Public footpaths, playing fields, parks and shopping streets.	▪ Locations with a local designation where the features may be affected by dust deposition (e.g., local nature reserves).

Source: IAQM Guidance on the assessment of dust from demolition and construction (2016)

639. The key sensitive receptors during the construction phase are residential properties, which are classified as high sensitivity receptors for dust soiling and human health impacts. There are many agricultural areas in the vicinity of the road corridor. These receptors are classified as low sensitivity receptors following the approach laid out in Table 62.

640. The IAQM guidance provides criteria for categorizing the sensitivity of an area to dust soiling and human health impacts based on the number and sensitivity of receptors in the vicinity of the site; these are provided in Table 63 and Table 64. For this assessment, background PM_{10} concentrations have been assumed to be high, reflecting the monitoring results presented in Chapter 4 of this EIA Report.

Table 63: Sensitivity of the area to dust soiling effects on people and property

Receptor sensitivity	Number of receptors	Distance from the source (m)			
		< 20	< 50	< 100	< 350m
High	> 100	High	High	Medium	Low
	10 – 100	High	Medium	Low	Low
	1 - 10	Medium	Low	Low	Low

Receptor sensitivity	Number of receptors	Distance from the source (m)			
		< 20	< 50	< 100	< 350m
Medium	> 1	Medium	Low	Low	Low
Low	> 1	Low	Low	Low	Low

Table 64: Sensitivity of the area to human health impacts

Receptor sensitivity	Number of receptors	Distance from the source (m)				
		< 20	< 50	< 100	< 200	< 350m
High	> 100	High	High	High	Medium	Low
	10 – 100	High	High	Medium	Low	Low
	1 - 10	High	Medium	Low	Low	Low
Medium	> 10	High	Medium	Low	Low	Low
	1 - 10	Medium	Low	Low	Low	Low
Low	1 - 10	Low	Low	Low	Low	Low

641. Table 65 summarizes the sensitivity of the surrounding area to demolition, earthworks, construction and trackout. The sensitivity for both dust soiling and human health is categorized as "High" for demolition, earthworks, construction, and trackout. The sensitivity of adjacent farmland is categorized as "Low".

Table 65: Sensitivity of surrounding area

Potential impact	Sensitivity of the surrounding area			
	Demolition	**Earthworks**	**Construction**	**Trackout**
Dust soiling	High	High	High	High
Dust soiling (farmland, orchards)	Low	Low	Low	Low
Human health (dust)	High	High	High	High
Ecological	High	High	High	High

642. **2C - Defining the Risk of Impacts**. The dust emission magnitude is combined with the sensitivity of the area to determine the overall risk of impacts without mitigation measures applied using the matrix in Table 66. This risk is then used to determine the level of mitigation that is required.

Table 66: Criteria for determining risk of dust impacts

Activity	Sensitivity of area	Dust Emission Magnitude		
		Large	Medium	Small
Earthworks	High	High Risk	Medium Risk	Low Risk
	Medium	Medium Risk	Medium Risk	Low Risk
	Low	Low Risk	Low Risk	Negligible
Construction	High	High Risk	Medium Risk	Low Risk
	Medium	Medium Risk	Medium Risk	Low Risk
	Low	Low Risk	Low Risk	Negligible
Trackout	High	High Risk	Medium Risk	Low Risk
	Medium	Medium Risk	Low Risk	Negligible
	Low	Low Risk	Low Risk	Negligible

Source: IAQM Guidance on the assessment of dust from demolition and construction (2016)

643. A summary risk table showing the risk associated with each activity is provided in Table 67. The predicted magnitude of dust impacts is high, and there are large numbers of high sensitivity receptors close to the construction works; as a result, the risk in terms of both dust soiling and human health is categorized as “High” for earthworks, construction and trackout activities. As a result, mitigation is recommended.

Table 67: Summary risk table.

Potential impact	Risk			
	Demolition	Earthworks	Construction	Trackout
Dust soiling	High risk	High Risk	High Risk	High Risk
Dust soiling (farmland, orchards)	Low risk	Low risk	Low risk	Low risk
Human health (dust)	High risk	High Risk	High Risk	High Risk
Ecological	High risk	High Risk	High Risk	High Risk

(3) <u>Step 3 - Site-Specific Mitigation Measures</u>

644. Recommended mitigation measures are summarized in Table 68. These measures should form part of the Dust Management Plan.

Table 68: Recommended mitigation measures during the project’s construction phase

Mitigation Category	Measure
Communication	Develop and implement a stakeholder communications plan that includes community engagement before work commences on site.
	Display the head or regional office contact information at the site boundary.
	Inform local communities of construction schedule at least 3 months in advance of activities starting
Site Management	Record all dust and air quality complaints, identify causes, take appropriate measures to reduce emissions in a timely manner, and record the measures taken.
	Record any exceptional incidents that cause dust and/or air emissions.
	Speed limits for all construction vehicles < 20km/h.
	Earth material transporting trucks to be covered.
	Regular cleaning of crusher site to remove fine dust.
	Stockpiles will be pre-wetted and sprayed during loading operations in dry or windy conditions.

Mitigation Category	Measure
	Cover stockpiles.
	Avoid site runoff of water or mud from site compounds by providing appropriate temporary drainage.
Preparing and maintaining the site	Locate machinery and dust causing activities away from receptors, as far as is possible.
	Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extended period.
	Keep site fencing, barriers and scaffolding clean using wet methods.
	Parked construction vehicles and equipment will not be located in proximity to sensitive receptors (e.g., health centers, schools).
Operating vehicles/machinery	Remove materials that have a potential to produce dust from site as soon as possible, unless being reused on site. Cover if they are being reused on-site.
	Ensure all vehicles switch off engines when stationary.
Operations	Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.
	Use enclosed chutes and conveyors and covered bins.
	Minimize drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.
	Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.
Demolition	Ensure effective water suppression is used during demolition operations.
	Avoid explosive blasting where possible, using appropriate manual or mechanical alternatives.
Earthworks	Re-vegetate earthworks and exposed areas/soil stockpiles to stabilize surfaces as soon as practicable.
	Regular dust suppression (watering) along roads and the earthwork sites, when necessary.
	Only remove the cover in small areas during work.
Construction	Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate control measures are in place.
	Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and if possible, stored in silos with suitable systems to prevent escape of material and overfilling during delivery.
	For smaller supplies of fine power materials ensure bags are sealed after use and stored appropriately to prevent dust.
Trackout	Use water-assisted dust sweepers on the access and local roads.
	Avoid dry sweeping of large areas.
	Inspect haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable.
	Implement a wheel washing system.

(4) Step 4 - Determine Significant Effects

645. The significance of impacts without mitigation would be classified as "High Risk" due to the high sensitivity of receptors and the potential for large dust emissions from earthworks, construction and track out without mitigation.

646. For almost all construction activities, the aim should be to prevent significant effects on receptors through the use of effective mitigation. Experience shows that this is normally possible provided that appropriate management measures, which may include low- or no-cost measures, are properly implemented. Access to adequate water supplies where this is needed for dust suppression is important.

647. Provided the mitigation measures identified in Step 3 are carried out, the residual effect can be classified as 'Minor Adverse'. It is not possible to completely eliminate all dust emissions during construction, especially during high wind conditions, and as a result some temporary exceedances of air quality guidelines may still occur.

c) Gaseous Emissions During the Construction Phase

648. As there is limited information on road construction machinery, equipment, and trucks to be used a quantitative assessment of gaseous emissions is not possible.

649. Guidance published by the UK Highways England identifies that local air quality (ambient concentrations of NO_2 and PM_{10}) may be affected within 200 m of a road project meeting the following criteria:

(i) An increase in traffic flows of 1,000 Annual Average Daily Flow (AADT) or more; or

(ii) An increase in Heavy Duty Vehicle flows of 200 AADT or more.

650. It is expected that the total traffic arising from construction vehicles will be low and that traffic generation will be temporary, and as a result the change in concentrations arising from exhaust emissions from traffic generated by the construction site is not expected to be significant.

651. Detailed data was not available for the impact of the construction of the enhanced road on regular traffic flows along the route during construction.

2. Noise

a) Calculation of Construction Noise

652. Noise levels from road construction have been calculated using the method set out in Part 1 of the British Standard BS 5228: 2009 'Code of Practice for Noise and Vibration Control on Construction and Open Sites'[108]. The procedures defined in the Standard are incorporated in the NoiseMap 5.2 computer software, which has been used in this study. This is an Internationally recognized software package used for calculation of noise from transportation systems and construction noise and is used in the UK and world-wide.

653. The method takes into account factors including the sound power level and usage (percentage 'on-time') of construction equipment, and the attenuation of noise with distance (including ground absorption) and as a result of screening provided by local topographical features. The Standard BS5228 also contains a schedule of noise source terms for construction plant from which the sound power levels used in this study have been taken.

[108] British Standard BS 5228-1. (2009) Code of Practice for noise and vibration control on construction and open sites. Part 1. Noise.

654. Noise calculations have been made at specific locations, termed ‘receptors’, placed at the façade of buildings. The results of these calculations represent noise levels both at those buildings and groups of nearby buildings at a similar distance from the road.

655. Daytime construction noise levels have been calculated to give the average level ($L_{pAeq,12hr}$) over the working period, and in order to give a worst-case assessment, noise levels have been calculated for activities taking place at the nearest position on the road to each receptor. It has been assumed that construction would be continuous over the working day.

(1) Assumptions: Construction Noise Calculations

656. It has been assumed in the calculations that the rehabilitation of the road would comprise the following principal activities carried out during normal daytime working:

(i) Stage 1. Removal of earth on shoulders of widened sections/excavation and concreting (where applicable) of ditches.

(ii) Stage 2. Breaking up of existing road, loading spoil onto trucks and moving off site.

(iii) Stage 3. Laying new subgrade and vibratory compaction (where applicable).

(iv) Stage 4. Laying new asphalt with paving machine.

(v) Stage 5. Construction of new bridges at two of the river crossings.

657. The sound power levels for construction equipment and percentage on times for the construction activities is set out in Table 69.

Table 69: Plant Sound Power Levels and Usage

	Activity	Description	L_{WA} (dB)	% on time
1	Ground preparation	40T dumper truck	107	50
		40T dumper truck	107	50
		21T excavator	106	90
		D4 bulldozer	106	50
		Concrete mixer truck	103	20
2	Asphalt breaking	21T excavator	106	90
		21T excavator	106	90
		40T dumper truck	107	50
		Front end loader	111	90
		40T dumper truck	107	50
3	Sub base/ preparation	40T dumper truck	107	30
		18T vibration roller	107	50
		D4 bulldozer	106	50
		Grader	111	30
		40T dumper truck	107	30
4	Asphalt laying	18T vibration roller	107	50
		Road pavement laying machine	103	50
5	Bridgeworks	Piling rig	128	20
		Delivery lorry	98	20
		Crane (assume 50 tonne)	95	20
		Hydraulic breaker	120	20

(2) Mapping

658. Digital mapping (2D) of the existing and proposed road project has been supplied by JOC. Whilst the mapping is accurate, there is no detail of topographical features away from the road which limits the accuracy of noise calculations. The inclusion of buildings on the mapping is restricted to those closest to the road and therefore in order to identify the position of noise sensitive receptors further away from the road, the aerial photography in Google Earth has been used. The mapping makes use of a unique coordinate system which is not simply referenced to Lat/Long or the WGS 84 GPS coordinate system.

b) Assessment of Construction Noise

659. The Kyrgyz National Noise Standards and IFC Guidelines have been discussed in detail in Chapter 3 of this EIA Report and hence only specific comments relating to construction noise will be included in this Chapter.

660. In order to remain compliant with IFC Guidelines, a noise change of 3dB is used to identify a significant construction noise impact, which is then rated using the semantic descriptors in Table 70.

Table 70: Description of Construction Noise Impact

Noise change (dB)	Description of Impact	Effect
Increase of 0.1-2.9 dB	Negligible	No Effect
Increase of 3.0-9.9 dB	Low	Negative Effect
Increase of 10.0-14.9 dB	Moderate	
Increase of 15 dB or more	Major	

661. The EHS Guidelines also recommend that WHO CNG Guidelines (1999) should be referred to for indoor noise levels, however these do not specify noise levels for the particular building uses which are required in this study, for example shops, offices or places of worship. Therefore, in this study reference has been made to the British Standard BS 8233 2014[109] and relevant internal noise criteria from the Standard are set out in column 2 of Table 71. These are for the most part equivalent to the noise levels in the Kyrgyz Standards.

662. It is generally assumed that for transient short-term noise, i.e., noise from construction activities, occupants of buildings will close windows and doors or use other areas within buildings whilst the activity is being carried out. Typically for a single glazed window, there will be a reduction of 25dB between external and internal noise levels when windows are closed and thus external noise criteria for specific building types can be derived from the internal noise criteria and these are included in column 3 of Table 71.

663. Many of the dwellings considered in this study have walls constructed from adobe which has a slightly lower sound reduction index (R_w=43dB) in comparison to a typical brick-built wall (R_w=48dB). However, it is still sufficiently high that internal noise levels resulting from external environmental noise will be dominated by sound transmission through the windows (single glazed R_w=28dB) rather than the wall. Thus, the figures in Table 71 apply equally to buildings constructed from adobe.

Table 71: Internal and External Construction Noise Levels for Community Facilities

[109] BS 8233 (2014) Sound Insulation and Noise Reduction for Buildings- Code of Practice

Receptor	Noise Level, $L_{pAeq,T}$ (dBA)	
	Internal	External
School Classroom	40	65
Shop	55	80
Cafe	45	70
Office/ Village Administration Building	50	75
Mosque	35	60

(1) <u>Summary of Construction Noise Assessment Criteria.</u>

664. In summary, the criteria by which construction noise has been assessed are as follows:

665. **Dwellings**. A significant noise impact has been identified where there is an increase in day time noise level of 3dB or more and the terms in Table 70 have been used to describe the noise impact. Compliance with the noise limits set out in the IFC Guideline daytime noise levels (Table 11) will also be addressed.

666. **Community Facilities**. A significant noise impact has been identified where there is an increase in noise levels of 3dB or more and/or internal noise levels exceed those set out in Table 71.

(2) <u>Effects of Construction Noise on Wildlife.</u>

667. A recent study of effects of noise on wildlife was carried out at the University of Belfast looked at a wide geographical evidence base and concluded that noise affects many species of amphibians, arthropods, birds, marine mammals, mollusks and reptiles. The study concluded that: ‘anthropogenic noise must be considered as a serious form of environmental change and pollution as it affects both aquatic and terrestrial species and that their ‘analyses provide the quantitative evidence necessary for legislative bodies to regulate this environmental stressor more effectively.’

668. Quantitative advice was stated more clearly in another recent review of literature by Shannon et al. which concluded that terrestrial wildlife responses begin at noise levels of approximately 40 dBA, and 20% of papers documented impacts below levels of 50 dBA.

669. Unfortunately, there remains no ‘dose response’ relationship which can be applied to assess the effects of change in noise level on wildlife and avian species in particular. However, a useful rule of thumb is that that some species will move away from areas where there are new activities generating high levels of ambient noise, but will return once this cease.

c) Results of Construction Noise Assessment

670. The results of construction noise calculations are presented in Annex 11. The first column gives the receptor number (abbr. ‘rec.no.’) followed by, in column 2, the type of receptor e.g., shop or residential. Noise monitoring locations (NML) are also identified and these are generally at residential properties. The location of receptor numbers i.e., village name is shown in Table 72, and with numbering starting at the west of the project in Barskoon, moving eastwards to Karakol. Where consecutive rows in the table occur with the same receptor number, these refer to noise calculations on ascending floors of the building, starting at the ground floor.

671. Column 3 shows the daytime baseline noise levels $L_{pAeq,12hr}$ (dB) for 2023 taken from the road traffic noise calculations. This level is used to calculate the noise increases for the five

construction activities presented in the Table. The noise levels are ‘incident outdoor noise levels’ with the exception of results presented for the lake shoreline which are freefield.

Table 72: Location of Receptor Numbers

Location	Receptor numbering
Project Start	001
Chon Jargylchak	100
Kichi Jargylchak	120
Ak Terek	140
Chychkan	200
Darkhan	300
Saruu & Dzhang Uryuk	400
Kyzyl Suu	500
Orogochor	600
Shalba,	650
Jele Tobe	700
Baltabay	800
Konkino	850
Karakol	900

672. Details of construction noise effects are set out below for noise sensitive receptors alongside the road where it passes through the villages.

673. The levels of baseline (existing ambient) noise in each village are compared with IFC Guidelines, and for non-residential properties internal noise levels are compared with the relevant criterion for each building. This is followed by the discussion of construction noise impacts.

674. Noise calculations have not been carried out at buildings which lie within the footprint of the project i.e., are likely to be unviable during and post construction. For example, where reference is made to shops, this does not include those immediately on the edge of the existing thoroughfare.

675. At many of the villages, existing ambient noise levels at houses alongside the road already exceed noise levels set out in the IFC Guidelines for the day and night time periods. Thus, noise effects will be largely assessed on the basis of noise change rather than exceedance of the IFC threshold levels.

(1) Isolated Buildings at Project Start and the Outskirts of Barskoon (receptor nos. 001-004 and 102-104)

676. **Dwellings**. Residents at isolate dwellings at the start of the project before the road reaches the outskirt of Barskoon are likely to experience major noise impacts whilst construction activities take place nearby. The road construction will also give rise to major noise impacts at the properties overlooking the road on the outskirts of Barskoon (rec. nos. 102-104). These properties will also experience major noise impact whilst during construction of the new bridge nearby.

(2) Chon Jargylchak (receptor nos. 200-216)

677. **Dwellings**. Although the houses in Chon Jargylchak are set back from the road there will be major noise impacts when construction activities are close by. However, with windows closed internal levels will be below the threshold at which speech interference would occur.

678. **Non-residential properties**. The Mosque (rec. no. 107) lies c.40m from the road, however construction noise levels will exceed the internal noise criterion for a place of worship. Its use therefore may be impaired during working on the road immediately adjacent, however it may be possible to mitigate this effect by arranging work breaks to coincide with prayer times.

679. **Effect of construction noise on shoreline** (rec. nos. 10 & 11). Construction activities on the nearby road are calculated to give rise to noise levels of up to c.77dB $L_{AEq,12hr}$ at the shoreline, an increase of c. 21 dB over existing road traffic noise levels. It is likely that this level of disturbance will deter birdlife from using this section of the shoreline and other sections of a similar distance from the construction works. However, the construction process is transient and once completed and ambient noise levels return to previous road traffic noise levels (see Section IV B 2 of this EIA Report), it is likely that the original usage of the shoreline will return.

(3) <u>Kichi Jargylchak (receptor nos. 200-216)</u>

680. **Dwellings**. At those properties in Kichi Jargylchak which lie alongside the road there will be a major impact when construction activities take place nearby. However, the majority of the properties in the village are set back from the road (e.g., rec. no. 128) and whilst these are still likely to experience a major noise impact, with windows closed internal noise levels will not be sufficiently high to interfere with day to day activities.

681. **Non-residential properties**. At the Community Centre (rec. no. 122) which lies 25m from the roadside, construction noise will give rise internal noise levels which will affect the utility of the building and would be considered to be a significant impact on the Centre.

(4) <u>Ak Terek (receptor nos. 200-216)</u>

682. **Dwellings**. The majority of the dwellings in the village are set back from the road (e.g., rec. nos. 142-144) and whilst these are still likely to experience a major noise impact, with windows closed internal noise levels will not be sufficiently high to interfere with day to day activities.

683. **Non-residential properties**. The village clinic (rec. 145) at Ak Terek lies 25m from the roadside and noise from nearby construction activities is likely to cause internal noise criterion to be exceeded, which will be a significant impact on the clinic.

(5) <u>Chychkan (receptor nos. 200-216)</u>

684. **Dwellings**. Dwellings in Chychkan (e.g., rec. nos. 200-205 & 210-215) line either side of the road and noise from construction works will give rise to a major impact affecting these 65 properties. The combination of screening provided by these houses and attenuation with distance have the result that the houses set back from the road (e.g., rec 216) will experience reduced noise impacts, largely moderate, and maintain internal noise levels which would not interfere with day to day activities.

685. **Non-residential properties**. During construction of the road, internal noise criteria at the Mosque and village offices, which both lie 40m from the road, would be exceeded and would be considered to be a significant impact on these buildings. However internal noise levels at the viable shops in the village would remain marginally below threshold levels and their operation, should they remain open, should be able to continue.

(6) <u>Darkhan (receptor nos. (301-318)</u>

686. **Dwellings**. In Darkhan, 130 dwellings lie closely on either side of the road and during construction of the road are likely to experience a major noise impact. As a result of the screening provided by these houses and attenuation with distance, construction noise levels at the houses

set back from the road (e.g., rec 318) will experience lower noise impacts, largely moderate, and maintain internal noise levels which would not interfere with day to day activities.

687. **Non-residential properties**. Staff and pupils at both schools (rec. nos. 305 and 307) would experience construction noise levels exceeding internal noise criteria and which would be considered to be a significant impact on the schools. Construction noise levels at the Mosque (rec. no. 311) which lies slightly further away from the road (40m) would give rise to a significant effect on the usage of the building. Internal noise levels at the nearby village offices (rec. no. 310) would still allow continued use of the building, assuming windows are closed. On the far side of the road, construction noise levels at the Theatre (rec. no. 308) would severely limit its utility during working hours and would be a significant impact.

688. Levels of construction noise at the viable shops and pharmacy alongside the road in the village are calculated to be below the relevant internal noise criterion. The noise effects on commercial premises in the village will depend on their specific usage, with those containing offices likely to experience a significant noise impact. Internal noise levels at businesses in which less sensitive activities are carried out (e.g., motor repair work) would remain below the noise criterion for light industrial use.

(7) <u>Saruu and Dzang Uryuk (receptor nos. 401-411)</u>

689. **Dwellings**. In the villages of Saruu and Dzang Uryuk, approximately 150 dwellings lie directly on either side of the road and construction activities will give rise to major impacts at these buildings. The partial screening provided by these buildings, combined with the effect of geometric attenuation, will result in reduced levels of construction noise at the next row of houses.

690. **Non-residential properties**. Staff and pupils at the school (rec. no. 405) are likely to experience levels of construction noise exceeding internal noise criterion, and there will be a significant impact on the school. At the nearby village hall, with windows closed, internal noise levels will still meet internal noise criterion for office working.

691. At shops (viable) alongside the road in the village (e.g., rec. no. 406) internal noise levels resulting from construction activities will remain below the relevant criterion, as well as internal noise levels at commercial and light industrial premises, assuming these do not contain offices.

(8) <u>Kyzyl Suu (receptor nos. 501-527)</u>

692. **Dwellings**. In Kyzyl Suu, approximately 100 dwellings alongside the road are calculated to experience a major impact arising from construction of the road. The partial screening provided by building alongside the road, combined with the effect of geometric attenuation, will result in reduced levels of construction noise at the next row of houses back from the road (e.g., rec. no. 513). However, they will still experience a major noise impact and noise levels will exceed IFC EHS daytime thresholds. Work on the new bridge at the approach to the village at chainage 178+ 957 will give rise to major noise impacts at 3 dwellings (rec nos. 501 & 502).

693. **Non-residential properties**. The village has a busy main street with many shops, restaurants banks, offices and commercial/light industrial premises alongside the road. Those businesses in which office work is carried out are likely to experience a significant impact arising from the construction work, however internal noise levels of shops and less sensitive commercial operations will remain below relevant internal noise criteria.

694. As a result of the construction work, staff and pupils at the school (rec. no. 506) which lies approximately 35m from the road are also likely to experience internal noise levels above the noise criterion for education establishments, which would be considered to be a significant impact. Significant noise impacts are also likely to occur at the Military offices, the Police station (rec. no.

508), the Mosque (rec. no 514), the Main Administration Building, Music School (rec. no 519), the Library, Government Architects Office, and the Post Office.

(9) Orgochor (receptor nos. 600-607)

695. **Dwellings**. Approximately 30 dwellings in the village which overlook the road (rec. nos. 602-604) will experience a major noise impact arising from construction activities. The remaining houses further away from the road (e.g., rec. no. 607) will experience moderate noise impacts, however with windows closed internal noise levels will not be sufficiently high to interfere with day to day activities.

696. **Non-residential properties**. Construction noise levels at both the school (rec. no. 606) and Mosque (rec. no. 605) which lie slightly further away from the road are reduced and internal noise levels would meet relevant criteria for their usage. Similarly, calculations indicate that internal noise levels at the village offices (rec. no. 601) will not be exceeded.

(10) Shalba (receptor nos. 650-660)

697. **Dwellings**. At Shalba, approximately 60 dwellings in the village which overlook the road (rec. nos. 652 & 656) will experience a major noise impact arising from construction activities. The remaining houses further away from the road (e.g., rec. no. 607) will experience moderate noise impacts, however, with windows closed internal noise levels will not be sufficiently high to interfere with day to day activities.

698. Non-residential properties. The Mosque (rec. no. 653) is the closest building in the village to the road, and construction noise levels will substantially exceed the internal noise criterion for a place of worship, and represent a significant noise impact.

(11) Jele Tobe (receptor nos. 700-706)

699. **Dwellings**. In Jele Tobe, the majority of the dwellings in the village are set back from the road (e.g., rec. no. 706) and whilst these are still likely to experience a major noise impact, with windows closed internal noise levels will not be sufficiently high to interfere with day to day activities. Those dwellings directly alongside the road (e.g., rec. no. 701) will experience major noise impacts during construction of the road with internal noise levels likely to cause speech interference.

(12) Baltabay (receptor nos. 800-804)

700. **Dwellings**. In the village of Baltabay, the majority of the dwellings in the village are set well back from the road and would be unlikely to suffer more than moderate daytime noise impacts. Properties closer to the road (e.g., rec. no. 803) are likely to experience major noise impacts, but with windows closed internal noise levels will not be sufficiently high to interfere with day to day activities. Those dwellings directly alongside the road (e.g., rec. no. 802) will experience major noise impacts during construction of the road with internal noise levels likely to cause speech interference.

(13) Konkino (receptor nos. 850-854)

701. In the village of Konkino, most of the dwellings in the village are set well back from the road and would be unlikely to suffer more than moderate daytime noise impacts. Properties closer to the road (e.g., rec. no. 853) are likely to experience major noise impacts, but with windows closed internal noise levels will not be sufficiently high to interfere with day to day activities. Those dwellings directly alongside the road (e.g., rec. no. 851) will experience major noise impacts during construction of the road with internal noise levels likely to cause speech interference.

(14) Karakol (receptor nos. 401-411)

702. **Dwellings**. In the outskirts of Karakol, approximately 50 dwellings directly alongside the road will experience a major impact noise impact during construction of the road. Further back from the road, the partial screening provided by these buildings, combined with the effect of geometric attenuation, will result in reduced levels of construction noise at the next row of houses back from the road (e.g., rec. no. 909). However, they will still experience a major noise impact and noise levels will exceed IFC EHS daytime thresholds

703. **Non-residential properties**. Internal noise levels in the police station caused by construction works outside will exceed criterion for office working, and would be a significant impact on the facility.

d) Mitigation of Construction Noise

704. Noise effects arising from construction of road projects are transient and it is not normal practice to provide mitigation in the form of barriers.

705. Good communication with affected communities is often the most effective way to manage potential construction noise effects. Therefore, the Contractor should keep local residents informed of the progress of the works, including when and where the noisiest activities will be taking place and how long they are expected to last. All noise complaints should be effectively recorded, investigated and addressed. Account should be taken of the needs of residents in choice of working hours and where possible these should be chosen to:

706. **Construction Noise Assessment**. The construction noise assessment in this study is a simplified assessment. Hence, as a first step in the noise impact management process , the Contractor will be required to carry out further noise calculations and assessment once their final construction program is in place. This should take account of factors including: (a) plant/equipment to be used; (b) location of haul road; (c) operation of borrow pits; (c) location and operation of workers camps and storage facilities.

707. Construction noise calculations should be carried out by a qualified noise consultant using dedicated noise mapping software. Calculations should be made to similar level of granularity to the present study carried out as part of this EIA. Additional noise sensitive receptors should be included around proposed workers camps and storage facilities as necessary. A report should be produced setting out the results of the study and submitted to the Construction Supervision Consultant.

708. **Construction Noise Management Plan**. The contractor will be required to produce a Construction Noise Management Plan (CNMP) which will set out a description of operations and how key contract requirements are to be implemented. It should comprise the following:

(i) **Description of Construction Operations**. A description will be given of the method of construction, hours of operation, plant to be used and a schedule of calculated noise levels resulting from these operations.

(ii) **Compliance Monitoring**. Compliance with agreed noise levels and mitigation requirements should be monitored weekly throughout the construction period, by a combination of site inspection and noise measurement. The frequency of inspection will depend on the site i.e., the sensitivity of buildings in the environs of the works and the nature of the activity. Noise monitoring should be carried out by qualified noise personnel at selected dwellings during construction, with locations and noise thresholds to be agreed with the Construction Supervision Consultant. Noise monitoring equipment should be a Type 1or Type 2 Precision Integrating sound level meter with up to date traceable calibration. Microphone locations and measurement techniques should follow the guidance set out in BS 7385[110]. The Construction Supervision Consultant should be notified of any issues arising from construction noise exceedances within a 24 hour period and an explanation given of the cause, outcome and remedial action. The results of monitoring and threshold exceedances should also be reported to the Construction Supervision Consultant by means of a quarterly report, including details of equipment used and monitoring locations. Noise values will be measured in case of complaints from the residents to enable identification of the need for any additional mitigation measure. Complaints will be received and dealt with as defined under the Grievance Procedure.

(iii) **Community Consultation Process**. The contractor will set out the means by which regular consultation meetings are to be held with local residents and their officers. These meetings are essential to maintaining good working relations with communities and are an effective way to manage potential construction noise effects, and though them the Contractor should keep local residents informed of the progress of the works, including when and where the noisiest activities will be taking place and how long they are expected to last.

709. **Description of Working Practices to Mitigate Construction Noise**. The contractor will set out and adopt working practices designed to ensure that best practicable means are used to control noise from construction operations. These should include, for example:

(i) Modern, silenced and well-maintained plant and construction equipment should be used;

(ii) All vehicles and plant should be fitted with effective exhaust silencers which should be maintained in good and efficient working order.

(iii) Fitted acoustic covers should be kept in a good state of repair and should be kept closed when plant is in use.

(iv) Vehicles should not wait or queue on the road with engines running and plant in intermittent use should be shut down when not in use or where this is impracticable, throttled down to a minimum.

(v) For equipment and vehicles that will operate for extended periods, during sensitive times or in close proximity to sensitive sites less intrusive reversing warning systems (white noise) will be used;

(vi) If a site compound, or materials storage area is to be used, both it and any static plant within it should be sited as far as is practicable from noise sensitive buildings.

(vii) Where activities, including delivery of material to site, cannot take place during normal working hours they should be carried out as close to normal working hours as is reasonably practicable.

(viii) Concrete mixers should not be cleaned by hammering the drums.

(ix) When handling materials, care should be taken not to drop materials from excessive heights.

(x) Noisy activities will be scheduled for less sensitive times - operations will be scheduled to coincide with periods when people would least likely be affected; work hours and workdays will be limited to less noise-sensitive times. Since the evening periods are important for community rest and recreation and provide respite when noisy work has been conducted throughout the week - work will not be scheduled during these times.

[110] BS 7445 Description and Measurement of Environmental Noise 2003

(xi) Notice as early as possible will be given to the local residence for periods of noisier works such as excavation.

(xii) No horn policy (unless vitally necessary) will be enforced;

(xiii) Excessive noise within the camp areas will not be allowed, in particular in night hours;

(xiv) Construction vehicle speeds will not 40 km/h when driving through communities, and not exceeded 80 km/h when driving on highways.

(xv) Account will be taken of the needs of residents in choice of working hours and where possible these shall chosen to avoid night time and weekend working; avoid working near mosques during prayer time; and to carry out works near schools during holiday periods

(xvi) Whilst of temporary noise barriers are generally not used for transient construction work, while working in juxtaposition to particularly sensitive facilities the installation of temporary hoardings may be a practicable form of noise control.

3. Vibration

a) Impact Assessment Methodology

710. The ADB Guidance Note, Management of Ground-borne Vibration During Construction of Road Schemes[111] sets out the approach in the screening and assessment of the project and this has been implemented in this study.

(1) <u>Screening Study</u>

711. There are vibration sensitive properties within 150m of the project and the upgrading of the road does make use of construction techniques which will give rise to ground borne vibration at the wayside. Therefore, a screening study is required prior to deciding whether to proceed with a full assessment of vibration effects.

712. In this case, the activity most likely to cause the highest levels of vibration was selected, namely vibratory compaction. The methodology set out in the Caltrans document[112] is one option presented in the Guidance note however the suggested vibration source term has no sound basis and is much lower than would be expected from operation of modern road rolling equipment. It was decided therefore, to use the TRL methodology described below to carry out the screening assessment. Whilst this provided a higher level of accuracy than would normally be required for a screening study its adoption ensured consistency with the detailed assessment which was considered highly likely to follow. The buildings most sensitive to vibration alongside the road are adobe constructed dwellings which in many cases will not have concrete foundations and for which the threshold vibration level for cosmetic damage is 3mm/s (Caltrans)[10]. The level of risk was set to 95% probability and design data for a typical large modern road roller was taken from the SEM 520 for low roller vibration setting. Note: the use of high vibration in this type of urban setting has previously proved impracticable.

713. Using mapping provided by JOC, on which adobe constructed buildings had been identified, approximately 130 buildings were found to be at risk of cosmetic damage.

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[111] ADB-CWRD. August 2018. Guidance Note - Management of Ground-borne Vibration During Construction of Road Schemes. https://www.adb.org/sites/default/files/project-documents/48109/48109-001-tacr-en.pdf

[112] Transportation and Construction Vibration Guidance Manual. California Department of Transportation, Division of Environmental Analysis September 2013.

714. The results of the screening study indicated that a full assessment of vibration effects was required and the approach to this is described below.

(2) Calculation of Ground Borne Vibration from Equipment

715. The best means of assessing potential ground borne vibration effects is to carry out measurements of in situ, on which construction vibration calculations are based. This approach improves accuracy both in terms of vibration levels from the equipment used, the effects of local ground conditions and the dynamic response of building structures. This approach cannot be employed at present and therefore, it is proposed to defer equipment vibration monitoring until construction begins. At this stage, use has been made of existing calculation methods and relevant measured data. The principal calculation methodologies are set out below.

(3) Calculation of Vibration from Ground Compaction using Vibratory Roller

716. The most comprehensive method for calculating vibration from ground compaction using vibratory roller was an empirical relationship derived by Hiller and Crabb [3][113] based on an extensive measurement program carried out by the UK Transport Research Laboratory (TRL). They found that for vibration from normal compaction, the following empirical relationship could be used:

717. $V_{res} = k_s n^{0.5} \left[\frac{A}{x+w}\right]^{1.5}$

718. where:

V_{res} = the resultant level of vibration measured on the ground;

k_s = 75, with a 50% probability of the vibration level being exceeded;

k_s = 143, with a 33% probability of the vibration level being exceeded;

k_s = 276, with a 5% probability of the vibration level being exceeded;

n = the number of vibrating drums;

A = the nominal amplitude of the vibrating roller (mm);

x = the distance along the ground surface from the roller (m); and

w = the width of the vibrating drum (m).

719. Note: In this study the statistical term ‘prediction level’ has been used. The 33% probability given by the expression above is the upper bound of the 66% prediction level, and similarly the 5% probability is the upper bound of the 95% prediction level.

720. In this study the TRL method is used to calculate vibration from vibratory compaction. The assumptions made in the calculations, and the factors affecting the accuracy of those calculations are discussed below.

721. **Equipment Data**. For the purposes of this study, it is assumed that the roller used have the operating characteristics of the SEM 520, as described in Figure 173. This equipment was chosen as it is typical of a large vibrating roller used in road construction projects, has both high and low vibration operating modes and can also operate with no vibration. In addition, measured vibration data is available for this equipment, which can give some confidence in the accuracy of the model as described later. It is also almost identical in design to one of the equipment types which were used as the basis of the TRL model, i.e., the Ingersoll Rand SD-150D. A similar model of roller,

[113] Hiller, D & Crabb, 2000, Groundborne Vibration Caused by Mechanised Construction Works, Transportation Research Laboratory.

the SEM 522, is currently being used on the upgrade of the Ring Road on the North side of Lake Issyk-Kul, to the east of Balykchy.

722. The accuracy of the vibration calculations is dependent on the accuracy of manufacturers specified nominal amplitude of vibration of the roller, both high and low vibration operating modes.

Model: Shandong Engineering Machinery SEM 520

- All-wheel hydraulic drive
- Working weight :20000kg
- Load on the front drum: 13500kg
- Linear load 612 N/cm
- Max. speed 10 km/h
- Vibration frequency (min/max) 28/33
- Amplitude of vibrations (max/min) 1,86/0,93 mm
- Vibration strength (max/min) 370/255 kN
- Diameter of the drum :1600 mm
- Width of the drum: 2130 mm

Figure 173: Details of Vibrating Rollers

723. **Effect of Lithology**. The transfer of vibration from the roller into the ground and its propagation away from the road is affected by the stiffness of the sub-base over which the roller is passing and the underlying lithology. The empirical model developed by TRL takes into account these factors, however, these factors are specific to the site at which the measurements on which the model is based were made. When applying the results to another site some considerations must be given to the differences in lithology and the effect this may have on the accuracy of calculations.

724. The measurements on which the TRL model is based were made on sub bases of hoggin and London clay, and the lithology comprised 'made ground', consisting of sands and gravels, over sands which become progressively firmer with depth.

725. The geological survey carried out along the length of the road[114] showed the lithology to be composed of gravelly sand, with the inclusion of gravel and pebbles. It is considered that these lithologies are sufficiently similar to the model basis and that the TRL model could be applied with a good level of confidence for the vibration levels at sites adjacent to the road.

726. Whilst there are no robust empirical or numerical methods of correcting for the changes in the lithology, there are some general guidelines. For example, it has been found that soils have a characteristic frequency (Table 73) which if it were to coincide with the operating frequency of the roller (approx. 25Hz) can give rise to higher levels of vibration than might otherwise occur. It can be seen from Table 73 that the stiffer the soil type the higher the characteristic frequency, and the lower the likelihood of this occurring.

Table 73: Characteristic Frequencies for Soils and Rocks

Material	Frequency (Hz)
Very soft silts and clays	5-20
Soft clays and loose sands	10-25

[114] MOTC, Design Institute (Kyrgyzdortransproect). Reconstruction of the road Balyktchy-Bokonbaevo-Karakol, Section No.3 km 141.6 – km 220. Technical Report on Results of Engineering-Geological Surveys for Preparation of the Project Documentation.

Material	Frequency (Hz)
Compact sands and gravels and stiff clays	15 - 40
Weak rocks	30 - 80
Strong rocks	>50

727. **Effect of Height of Water Table**. Bachman[115] suggests that a water saturated soil may facilitate the propagation of vibration more in comparison with an unsaturated soil. However, for construction operations such as ground preparation and excavation the bulk of the energy (approx. 67%) will propagate via surface waves, known as Rayleigh waves. The magnitude of the surface wave is therefore largely unaffected by changes in the height of the ground water level, provided it remains sufficiently below the surface relative to the wavelength. The geological survey[116] made no mention of a high water table and taking to account the nature of the terrain this is not an issue for the rehabilitation of the road.

728. **Building Coupling Loss**. The building coupling loss, sometimes referred to as the building transfer function, is defined as the ratio between free-field vibration levels and those measured on the building foundation. For a lightly built structure with limited foundations, this would normally be approximately 1 whilst for a typical brick-built structure on a concrete foundation it would be approximately 0.5 (i.e., the level of vibration on the foundation would be approximately half that measured free-field outside the building at the same distance from the source of vibration).

729. The predominance of buildings which are well coupled to the ground i.e., adobe construction with shallow foundations in the populated areas adjacent to the road increases the risk of vibration related damage during the rehabilitation of the road. The limited attenuation of ground-borne vibration as it enters the building means the level of structural vibration is already roughly double the level that would be found on an equivalent brick-built building on concrete foundations. This is compounded by the fragile nature of the adobe clay/adobe construction, resulting in buildings that are much more vulnerable to vibration damage.

730. Levels of vibration during normal operation of the roller, both free-field and measured on the foundation, are generally dominated by the vertical (z) component, and thus in this study only the vertical components have been considered.

(4) Calculation of Vibration from Impact Piling

731. Piling is proposed at one new bridge at chainage 178+957 and as a default, it is assumed that this will be carried out using impact piling. A GIIP method for calculation of vibration from impact piling is set out in BS 5228 Part 2 [5] and this has been adopted in this study. The Standard also presents measured data for impact piling in a range of different lithologies.

(5) Calculation of Vibration from Hydraulic breakers.

732. It has been assumed following discussions with JOC that demolition of concrete structures at existing bridge works requiring replacement will be carried out by the contractor using hydraulic breakers. Vibration data from hydraulic breakers is not included in BS 5228. The guidance in Caltrans suggests that levels of vibration can be calculated using a similar methodology to that used for piling but again does not provide any data with which to justify or calibrate the approach. The results of recent vibration monitoring of hydraulic breaker in operation carried out by the consultant show good agreement with results published in [20] and have therefore been used in

[115] Bachman et al. 1995. Vibration Problems in Structures: Practical Guidelines. Springer Science.
[116] MOTC, Design Institute (Kyrgyzdortransproect). Reconstruction of the road Balyktchy-Bokonbaevo-Karakol, Section No.3 km 141.6 – km 220. Technical Report on Results of Engineering-Geological Surveys for Preparation of the Project Documentation.

conjunction with the geometric spreading relationship from BS 5228 (for piling) to calculate vibration levels at building in the environs of the bridges requiring replacement.

(6) Calculation of Vibration from Operation of Excavator

733. In a previous study, the variation of ground borne vibration velocities (ppv) with distance were measured during operation of an excavator digging out a section of road sub base. The results of this work have been used to calculate the distance to the high risk building class contour (3mm/s).

(7) Results of Calculations: Vibratory Compaction

734. Figure 174 shows the variation in level of vibration with distance calculated using the TRL method described above, for both 95% and 66% prediction levels based on the manufacturer's specification for the SEM 520 road roller described Figure 173. Figure 175 shows the variation of vibration with distance for the same roller operating in low vibration mode.

735.

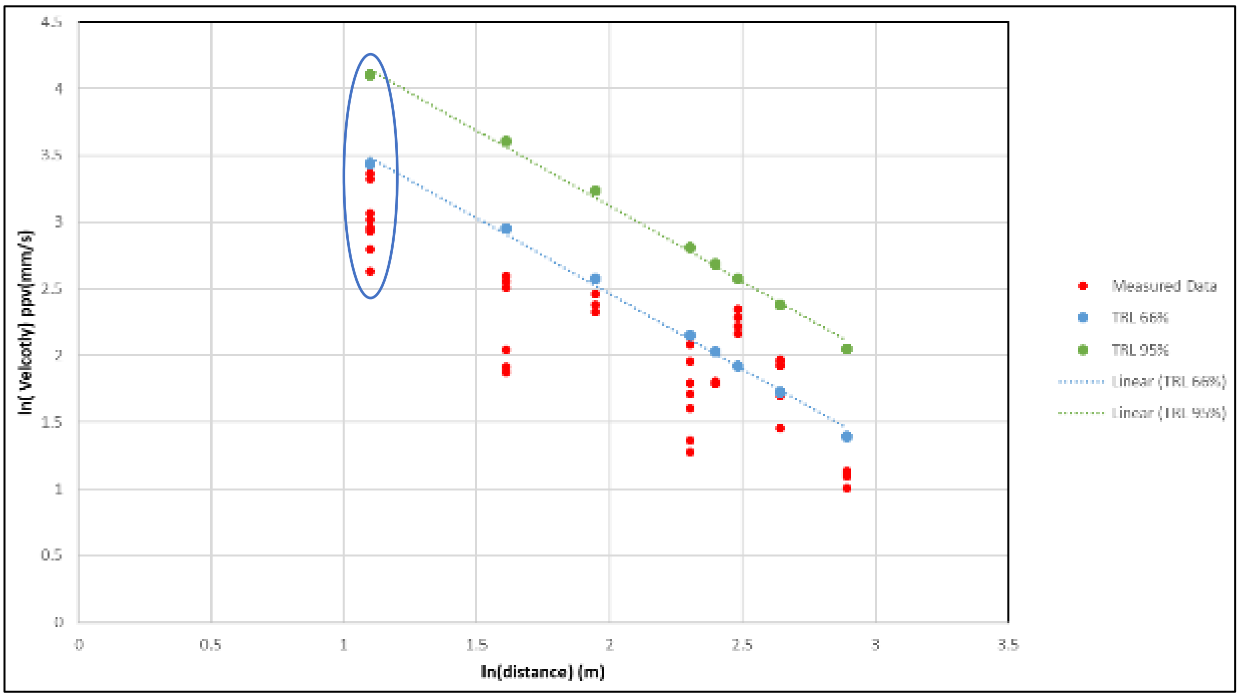

Figure 174: Plot of Velocity (on Foundation) vs Distance to Road Roller at High Vibration.

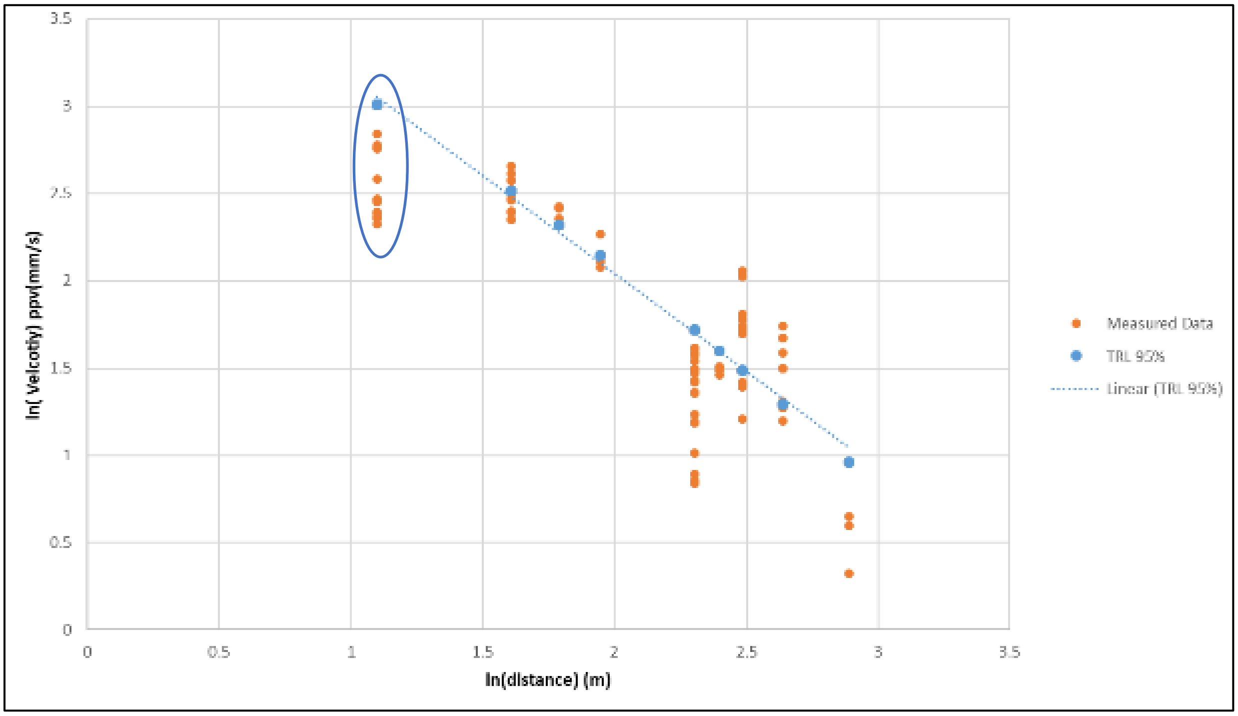

Figure 175: Plot of velocity (on foundation) vs distance to road roller at low vibration.

736. In order to give confidence in modelling of vibration, it is good practice to compare, whenever possible, the calculated values with measured data. In this case vibration data is available from a previous project, measured during operation of the same model of roller i.e., an SEM 520 (Figure 173).

737. The measured data for high and low vibration setting have been plotted on Figure 174 and Figure 175, respectively. The data most relevant for comparison are those measured closest to the equipment, where the effects of variation in propagation at the measurement location are minimized, and on both Figures these data have been encircled.

738. For the roller operating in high vibration mode Figure 174 shows that the TRL 66% prediction level gave best agreement with the measured data, whilst for the low vibration mode the TRL 95% prediction level gives better agreement. The most likely cause of this discrepancy is that the TRL prediction method is over estimating levels of vibration at the higher roller setting. However, though highly unlikely, there is a possibility that the equipment from which the measured data were obtained was not performing to the manufacturer's specification. Therefore, in order to eliminate this factor, even though it is likely to overestimate the levels of vibration, the TRL 95% prediction level for high vibration mode is included in the assessment as well as the TRL 66% prediction level. In the case of the low vibration setting, only the TRL 95% prediction level has been considered.

739. Using these prediction levels, the TRL method has been used to calculate the distance between the road (on which rolling is being carried out) and the position at which buildings of the three vibration damage categories (high, low & medium) would be at risk of cosmetic or structural damage resulting from operation of the roller. The results are presented in the form of vibration damage contour distances, which are shown below.

(8) Vibration Damage Contour Distances

740. Vibration damage contour distances are shown Figure 176 to Figure 179 for both high and low vibration levels of the roller. These are the distances from the road beyond which the risk of vibration damage (cosmetic or minor structural) reduces below 5% (for 95% prediction level), or 33% (for the 66% prediction level).

741. While these are included for building classes at high, medium and low risk of vibration damage, the discussion in each section is restricted to the high risk building class i.e., clay/adobe construction, as these constitute the majority of the buildings in the villages through which the road passes. The buildings of this type within the contour distance can be considered to be at a high risk of vibration damage, whilst those outside the contour can be considered to be at a low risk.

742. Predicted levels are also given assuming the use of an over excavated drainage channel to provide vibration mitigation.

743. A summary of the contour distances specifically for high-risk buildings is provided in Table 74.

Table 74: BS 5228 Vibration Assessment Criteria for Human Perception

Vibration Level ppv (mms^{-1})	Description of Effect	Description of Impact
<0.3	Vibration unlikely to be perceptible	Negligible
0.3 to 1.0	Increasing likelihood of perceptible vibration in residential	Minor
1.0 to 10	Increasing likelihood of perceptible vibration in residential environments but can be tolerated at the lower end of the scale if prior warning and explanation has been given to residents	Moderate
>10	Vibration is likely to be intolerable for any more than a brief exposure to a level of $10mms^{-1}$	Major

744. **High vibration mode: cosmetic damage (TRL 66% & 95% prediction levels)**. Using the TRL vibration prediction level taken from Figure 174, and criterion taken from Table 74, the distance to the vibration damage (cosmetic) contour for high risk buildings is predicted to be 22m and 36m for the 66% and 95% prediction levels respectively, as shown in Figure 176 and Figure 177. In areas where an over excavated drainage channel can be used as a trench it is predicted that this contour distance could be reduced to 13m for high risk buildings, assuming the 66% prediction level, or 22m in the case of the 95% prediction level.

745. **High vibration mode: minor structural damage (TRL 66% & 95% prediction levels)**. Using the TRL 66% prediction level to identify risk of minor structural damage, the distance to the vibration damage contour for high risk buildings would be 13m (Figure 178) which would reduce to 8m, taking into account the addition of mitigation in the form of an over excavated drainage channel.

746. Taking the TRL 95% prediction level as the basis of prediction of minor structural damage the distance to the vibration damage contour for high risk buildings would be 22m (Figure 179) which would reduce to 13m, taking into account the addition of mitigation in the form of an over excavated drainage channel.

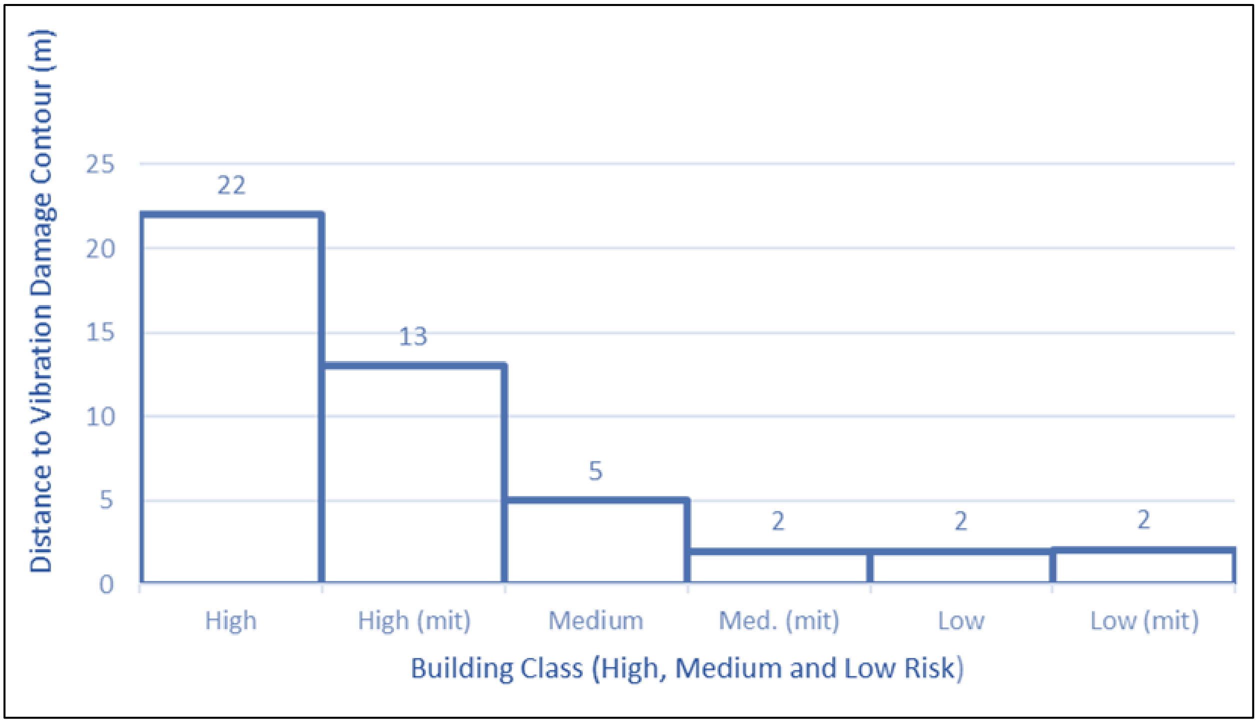

Figure 176: Predicted distance to vibration damage contour (cosmetic) for buildings at high, medium and low risk damage assuming TRL 66% prediction level for vibrating roller operating in high vibration mode.

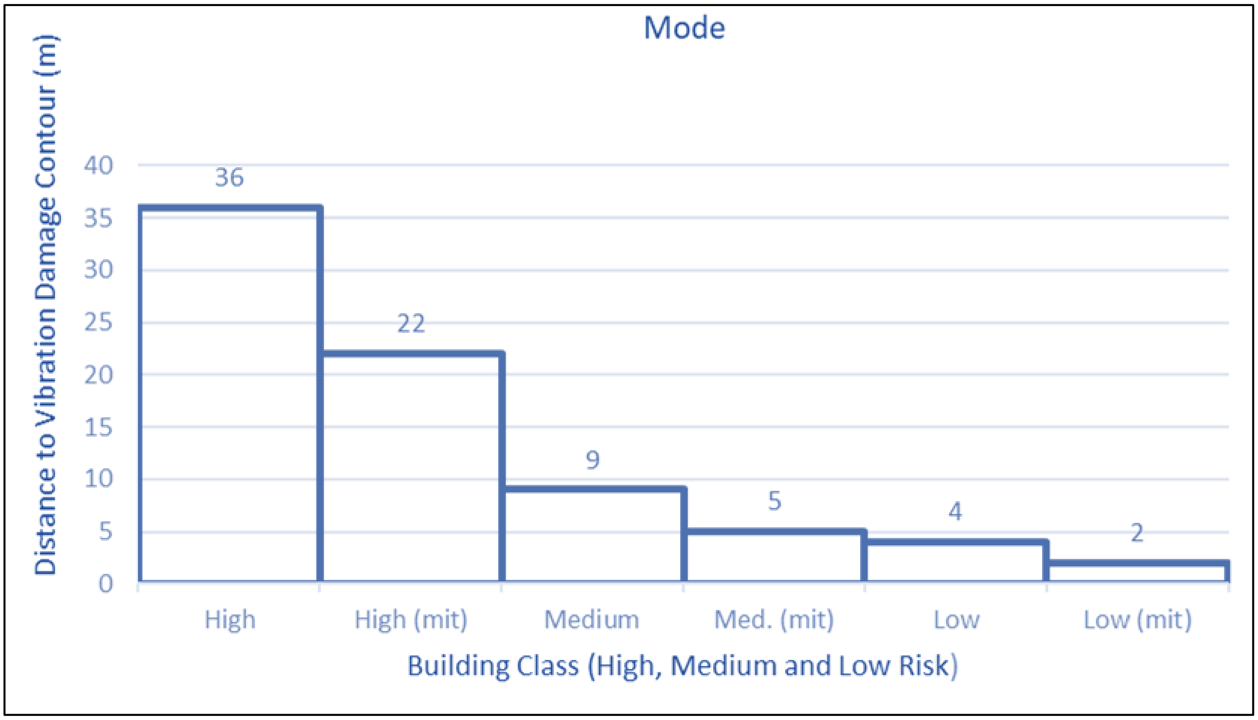

Figure 177: Predicted distance to vibration damage contour (cosmetic) for buildings at high, medium and low risk of damage assuming TRL 95% prediction level for vibrating roller operating in high vibration mode.

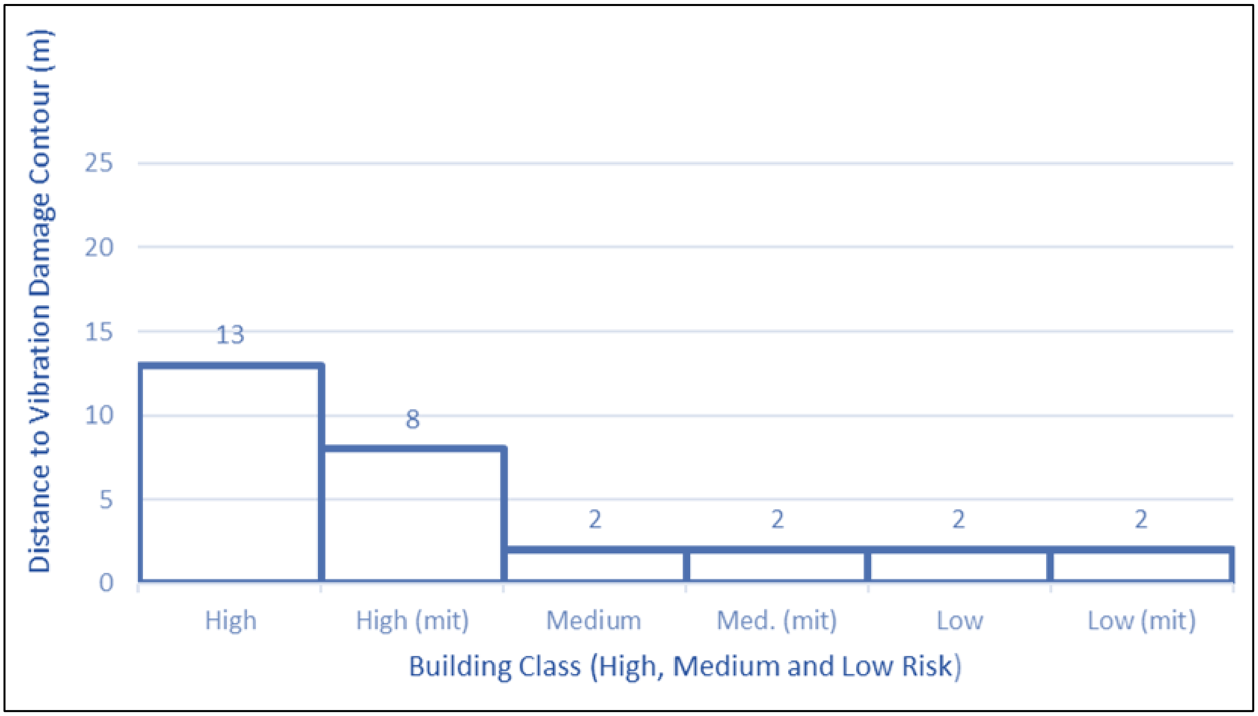

Figure 178: Predicted distance to vibration damage contour (minor structural) for buildings at high, medium and low risk of damage assuming TRL 66% prediction level for vibrating roller operating in high vibration mode.

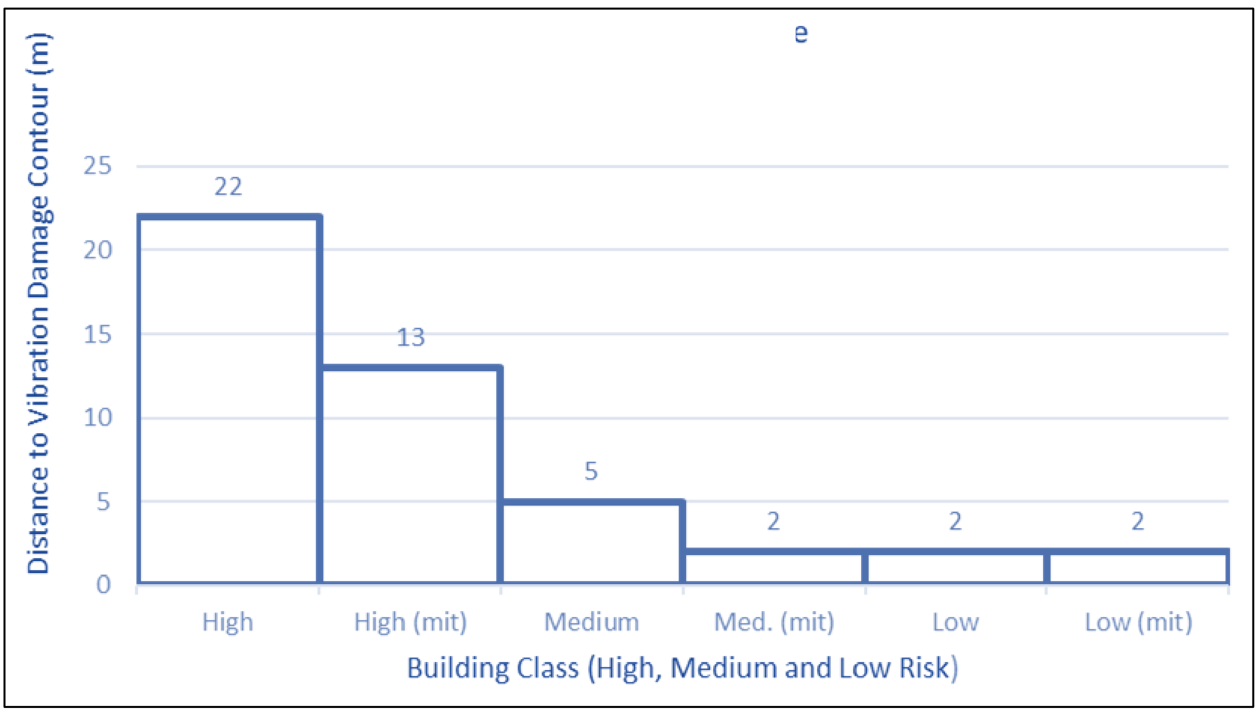

Figure 179: Predicted distance to vibration damage contour (minor structural) for buildings at high, medium and low risk of damage assuming TRL 95% prediction level for vibrating roller operating in high vibration mode.

747. **Roller low vibration mode: cosmetic damage (TRL 95% prediction level)**. Using the TRL 95% prediction level taken from Figure 175, the distance to the vibration damage (cosmetic) contour for high risk buildings is predicted to be 16m as shown in Figure 180. In areas where an over excavated drainage channel can be used as a trench it is predicted that this contour distance could be reduced to 9m.

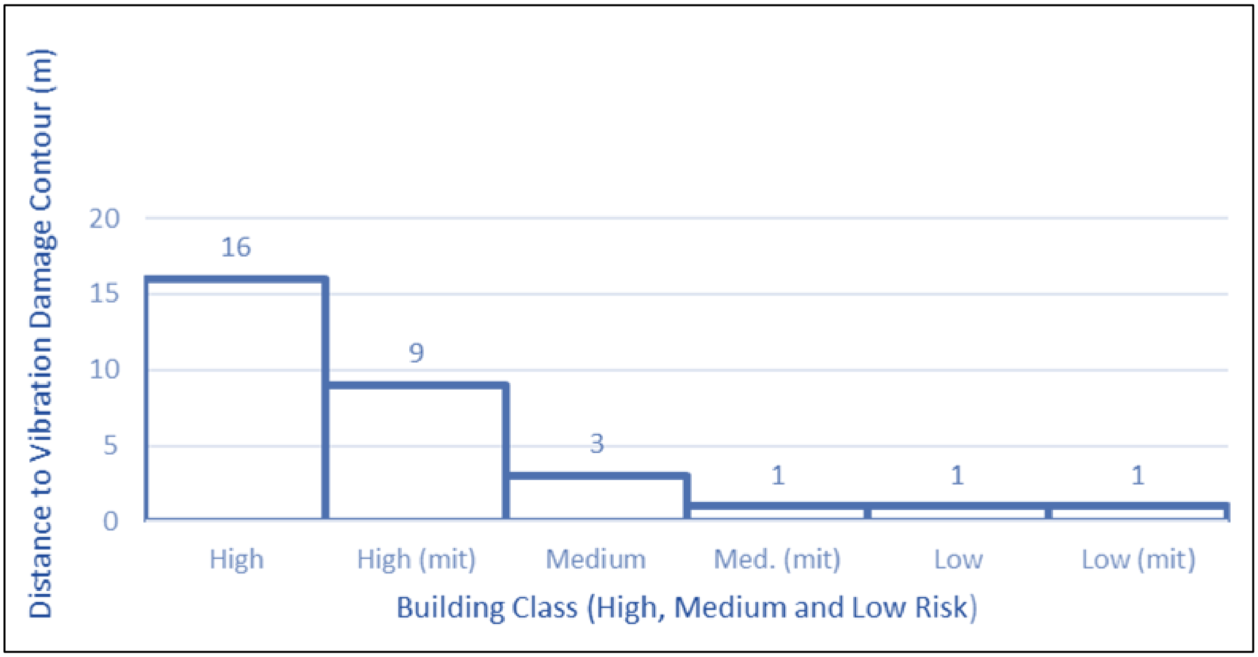

Figure 180: Predicted distance to vibration damage contour (cosmetic) for building at high, medium and low risk of damage assuming TRL 95% prediction level for vibrating roller operating in low vibration mode.

748. **Roller low vibration mode: minor structural damage (TRL 95% prediction level)**. Using the 95% prediction level as the basis of calculation of the vibration damage (minor structural) contour distance (for high risk buildings) would give a distance of 9m to the vibration damage contour as shown in Figure 181. The addition of mitigation in the form of an over excavated drainage channel would reduce the vibration damage (minor structural) contour distance to 5m.

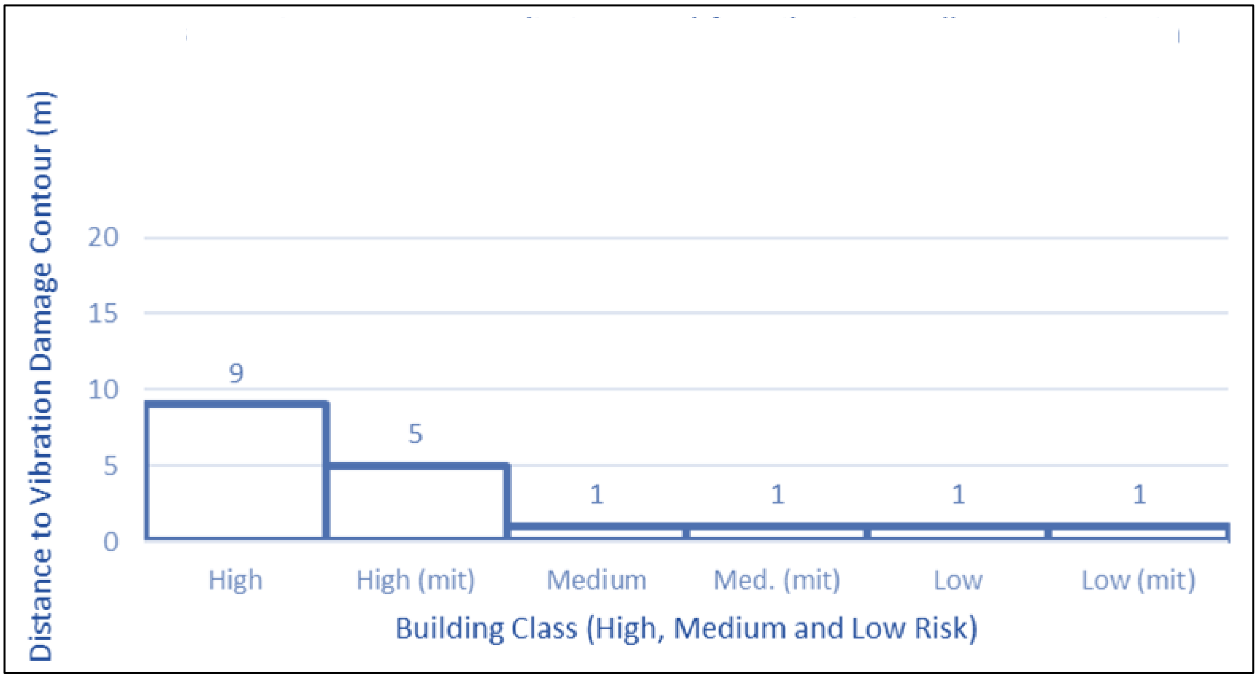

Figure 181: Predicted distance to vibration damage contour (minor structural) for building at high, medium and low risk of damage assuming TRL 95% prediction level for vibrating roller operating in low vibration mode.

749. **Summary of Vibration Damage Contour Distances for Operation of Vibrating Roller: High Risk Buildings**. Table 75 below summarizes the predicted vibration damage contour distances for cosmetic and minor structural damage to high risk building for high and low vibration settings of the roller. Predicted contour distances are also included taking account of the use of a trench.

Table 75: Vibration damage contour distances for high risk buildings.

Roller Vibration Setting	Mitigation Option	Vibration Damage Contour Distance (m)		
		Cosmetic Damage		Minor Structural
		66% prediction level	95% prediction level	95% prediction level
High	No mitigation	22	36	22
Low		n/a	16	9
High	With Trench	13	22	13
Low		n/a	9	5

750. **Plotting of Vibration Damage Contour Distances**. For the final stage of this study JOC have plotted vibration damage threshold contours for the TRL 95% prediction level on mapping of the project thus enabling buildings exceeding the respective thresholds to be identified. The drawings which are presented in Annex 12 are based on the contour distances set out in Table 75. The Plans shows the following:

(i) Contours for high risk buildings, as they are much more likely to suffer building damage and also because in practice it may be difficult to carry out selective rolling of the road i.e., high/low vibration in an area of mixed building type;

(ii) Contours for low vibration operation of the roller as high vibration operation is impracticable in residential areas within the villages; and

(iii) Contours for both cosmetic damage and minor structural damage.

751. In the preparation of the Plans, the contour distances have been taken from the outermost construction point of the road as JOC were able to suggest that ground preparation of the sidewalk and drainage culverts could be carried out using a smaller roller.

(9) Results of Calculations: Vibration from Impact Piling.

752. Piling is proposed at one new bridge at KM 178+957 and as a default, it is assumed that this will be carried out using impact piling. The distances from the piling rig within which the thresholds of cosmetic damage and human response are exceeded are presented below in Table 76, and the effects are reported in Chapter 6.

(10) Results of Calculations: Vibration from Hydraulic breakers.

753. The levels of vibration resulting from the demolition of concrete structures at the existing bridges which require replacement have been calculated based on a combination of measured data and the geometric spreading relationship from BS 5228 (for piling). The distances from the breaker within which the thresholds of cosmetic damage and adverse human response are exceeded are presented below in Table 76, and the effects are reported in Chapter 6.

(11) Result of Calculations: Vibration from Operation of Excavator.

754. The results of calculations of ground borne vibration during the operation of an excavator digging out a section of road sub base gave a distance to the high risk building class contour (3mm/s) of approximately 5m. This indicates that where excavation e.g., of drainage channels, is carried out at distances any less than 5m from a high risk building, there may be a risk of cosmetic damage. The distances from the excavator within which the thresholds for adverse human response are exceeded are presented below in Table 76, and the effects are discussed below.

Table 76: Distances for Exceedance of Vibration Criteria (Cosmetic Damage and Adverse Human Response) for Construction Activities.

Criterion	Level of Vibration, ppv, mm/s	Distance from Equipment			
		Vibratory Compaction (Low, 95%)	Impact Piling	Hydraulic Breaker	Excavator
Cosmetic Damage: high risk buildings	30	≤16	≤25	≤11	≤5
Human Response: moderate impact	>1.0	≤36	≤55	≤25	≤20
Human Response: minor impact	0.3	>36	>55	>25	>20

b) Cosmetic Building Damage and Human Response (Nuisance) from Vibratory Compaction

755. Levels of ground borne vibration from vibratory compaction during construction have been calculated were used to produce maps showing vibration damage threshold contours for high risk buildings (Annex 12). Using this map, properties at risk of structural/cosmetic damage and in which there may be adverse human impact (nuisance) have been identified. These properties lie

within the vibration damage threshold contour for cosmetic damage, assuming a low roller vibration setting.

756. Building usage/construction is denoted on the maps and in the tables as follows:

(i) kH – Non-residential building made of brick;

(ii) kX – House made of brick;

(iii) cH – Non-residential building made of adobe; and

(iv) cX – House made of adobe (residential).

757. The effects of vibration from vibratory compaction and other construction operations on settlements through which the road passes are described below and are provided in details in Annex 13.

(1) <u>Chon Jargylchak</u>

758. **Houses**. At Chon Jargylchak there are no houses at risk of cosmetic vibration damage during vibratory rolling (low vibration). However, residents at one (1) brick house are likely to experience moderate vibration impact whilst road rolling is in progress adjacent to their property. The use of the hydraulic breaker during demolition of the existing concrete bridge structure would be unlikely to be perceptible to residents in this house, which is approximately 60m from the bridge.

759. **Non-residential properties**. The Mosque lies approximately 40m from the road and whilst vibratory compaction (low setting) is carried out on the nearest point, vibration will be clearly perceptible and would be considered to be a minor impact on the Mosque.

(2) <u>Kichi Jargylchak</u>

760. **Houses**. At Kichi Jargylchak two (2) adobe non-residential buildings may be at risk of cosmetic vibration damage during vibratory rolling (low vibration). Residents of two (2) brick-built house are likely to experience a moderate vibration impact whilst road rolling is in progress adjacent to their houses.

761. **Non-residential properties**. At the Community Centre, which lies 25m from the roadside, vibration levels during vibratory compaction on the section of road nearest the building will be sufficiently high to be considered a moderate impact on users of the Centre.

(3) <u>Ak Terek</u>

762. **Houses**. There are no high risk buildings in Ak Terek at which vibratory compaction at a low setting would give rise to a risk of cosmetic damage, as buildings in the village are located sufficiently distance from the edge of the upgraded road.

763. **Non-residential properties**. Similarly, and for the same reason, there are no high risk non-residential buildings in Ak Terek at which vibratory compaction at a low setting would give rise to a risk of cosmetic damage.

764. The village clinic at Ak Terek lies approximately 25m from the roadside and vibratory compaction (low setting) of the nearest section of the road would give rise to a moderate impact on the staff and patients at the clinic. Vibration sensitive equipment within the building would also be likely to be affected. There is also a cemetery at the south of the village adjacent to the road at which graves are positioned atop what appears to be an unstable slope. The graves are 12-15m from the road and may be at risk of damage resulting from vibratory compaction of the road.

(4) Chychkan

765. **Houses**. In Chychkan, 13 houses constructed from adobe are at risk of cosmetic damage during vibratory compaction of the road. At this time, residents of these buildings and of a further 50 houses constructed from brick would be likely to experience perceptible vibration classed as a moderate impact.

766. **Non-residential properties**. During vibratory compaction of the road (low roller vibration setting), 10 non-residential buildings constructed from adobe are at risk of cosmetic damage. Customers and staff at 6 roadside shops in the village would experience levels of vibration during this activity, which would be considered to be a moderate impact. Worshippers at the mosque, and staff and attendees at the village offices, which both lie approximately 40m from the road, would experience levels of vibration which would be considered to be a minor impact.

(5) Darkhan

767. **Houses**. In Darkhan, 60 houses constructed from adobe are at risk of cosmetic damage during vibratory compaction of the road. At this time, residents of these buildings and of a further 65 houses constructed from brick would be likely to experience perceptible vibration classed as a moderate impact.

768. **Non-residential properties**. During vibratory compaction of the road (low vibration), 10 non-residential buildings constructed from adobe are also at risk of cosmetic damage arising from vibratory compaction. Customers and staff at 9 roadside shops, a pharmacy and 4 commercial premises alongside the road in the village would experience levels of vibration during compaction which would be considered to be a moderate impact. Staff and pupils at the school (Im Abylaya), which is approximately 35m from the road would also experience levels of vibration at this time which would be considered to a moderate impact. However, staff and attendees at the village offices and worshippers at the adjacent mosque, which both lie slightly further away from the road (40m) would experience levels of vibration which would be considered to be a minor impact.

(6) Saruu and Dzang Uryuk

769. **Houses**. At Saruu and Dzang Uryuk, two (2) adobe houses may be at risk of cosmetic damage during vibratory rolling (low vibration). Residents of these houses and a further 145 brick built houses are likely to experience moderate vibration impact whilst road rolling is in progress adjacent to their houses.

770. **Non-residential properties**. One adobe constructed non-residential building may be at risk of cosmetic damage during vibratory compaction of the road (low roller setting). Customers and staff at eight (8) roadside shops and 13 commercial and light industrial premises alongside the road in the village would experience levels of vibration during compaction which would be considered to be a moderate impact.

771. Staff in the village offices, users of the nearby Civic Centre and staff and pupils at the adjacent school are all likely to experience levels of vibration during rolling corresponding to a moderate impact.

(7) Kyzyl Suu

772. **Houses**. In Kyzyl Suu, 10 houses constructed from adobe are at risk of cosmetic damage during vibratory compaction of the road. At this time, residents of these buildings and of a further 85 houses constructed from brick would likely to experience perceptible vibration, classed as a moderate impact.

773. Impact piling of the foundations of the bridge on the approach to the village at KM 178+ 957 will not give rise to cosmetic damage at nearby buildings. However, vibration is likely be perceptible in three (3) houses at approximately 55m from the bridge and would be considered to be a minor impact. Occupants of the same houses may also perceive vibration during demolition of existing concrete structures at the bridge and again this would be considered to be a minor impact.

774. **Non-residential properties**. In the village, approximately three (3) non-residential buildings constructed from adobe are at risk of cosmetic damage arising from vibratory compaction.

775. The village has a busy main street with many shops, restaurants banks, offices and commercial/light industrial premises alongside the road. Staff and users of these premises are all likely to experience a moderate vibration impact when road rolling (low vibration) is carried out nearby to each building.

776. Staff and pupils at the school (Lenin Secondary School) which lies approximately 35m from the road are also likely to experience a moderate vibration impact during rolling of the road. During the same activity, workers in the military offices would experience a moderate impact whilst users of the mosque, the main administration building, the music school, the library and the government architect's office, which are all set further back from the road, would likely experience a minor impact.

(8) <u>Orgochor</u>

777. **Houses**. There are no high risk houses in Orgochor at which vibratory compaction at a low setting would give rise to a risk of cosmetic damage. However, residents of one (1) brick built house are likely to experience a moderate vibration impact whilst road rolling is in progress adjacent to their house.

(9) <u>Shalba</u>

778. **Houses**. At Shalba there are no high risk houses at which vibratory compaction at a low setting would give rise to a risk of cosmetic damage, though residents of one brick bult house would be likely to experience a moderate vibration impact whilst road rolling is in progress adjacent to their house.

779. **Non-residential properties**. During the same activity worshippers at the village mosque would experience a minor vibration impact.

(10) <u>Jele Tobe</u>

780. **Houses**. In Jele Tobe, five (5) houses constructed from adobe are at risk of cosmetic damage during vibratory compaction of the road. At this time, residents of these houses would also be likely to experience a moderate vibration impact whilst road rolling is in progress adjacent to their house.

781. **Non-residential properties**. Approximately three (3) non-residential buildings constructed from adobe are also at risk of cosmetic damage.

(11) <u>Baltabay</u>

782. **Houses**. In the village of Baltabay, one (1) house constructed from adobe would be at risk of cosmetic damage during vibratory compaction of the road. The residents and those of a further three (3) brick built houses are likely to experience a moderate vibration impact whilst road rolling is in progress adjacent to their house.

(12) Konkino

783. In the village of Konkino, residents of five (5) brick built houses are likely to experience a moderate vibration impact whilst road rolling is in progress adjacent to their house

(13) Karakol

784. **Houses**. In the outskirts of Karakol, 16 houses constructed from adobe are at risk of cosmetic damage during vibratory compaction of the road. At this time, residents of these houses and of a further 30 houses constructed from brick would likely experience perceptible vibration, classed as a moderate impact.

785. **Non-residential properties**. An additional four (4) non-residential buildings constructed from adobe are also at risk of cosmetic damage arising from vibratory compaction.

c) Mitigation of Ground Borne Vibration from Rollers

(1) Roller Vibration Setting

786. The calculation procedure described in Chapter 4 indicates that there is a clear reduction in vibration resulting from the use of a lower vibration setting on the roller, though more passes of the roller may be required to achieve the same level of ground compaction. In theory, it may also be possible to achieve some mitigation by increasing the operating frequency of the roller as the threshold of building damage generally increases with frequency between 20 and 50Hz, as described in BS 7385 and DIN 4150. However, it is not clear whether the frequency relationships in these Standards can be applied robustly to the building classes under consideration in this study. Increasing the operating frequency would have another potential benefit in that as a general rule, attenuation of ground vibration with distance away from the source increases with frequency.

787. JOC have confirmed that on sections of the road adjacent to high risk buildings ground compaction can be carried out using a roller with no vibration. This would provide the most effective form of mitigation and would eliminate cosmetic damage resulting from vibration in the high risk buildings (within the measurement range).

788. A practical step which can be taken to mitigate vibration effects is to ensure that roller start up and shut down is carried out away from vibration sensitive properties as transient vibration levels during start up and shut down will generally exceed levels for steady state operation. Use of vibratory rollers directly atop the underlying soil adjacent to houses should also be avoided if possible. If compaction of the soil is required this shall be done using a sheep foot type roller in non-vibratory mode or a non-vibratory roller.

(2) Roller No Vibration Mode

789. JOC have confirmed that it is possible to carry out ground compaction without vibration on sections of the road adjacent to high risk buildings. In a previous study, measurements were made of the road roller described above (Figure 173) operating in ‘no vibration’ mode over a prepared sub-base. The results indicated that vibration levels at distances of 3-5m from the roller were less than a third of the threshold level at which a risk of cosmetic damage would be identified at a high risk class building i.e., adobe/clay construction. These measurements were made on a lithology on which higher levels of vibration would be expected in comparison with those likely to occur on the Ring Road, and hence the application of these findings is a worst case.

(3) Use of Alternative Compaction Equipment

790. Alternative means of compaction of the sidewalk sub-base and the sides of embankment could be adopted such as using a non-vibratory rubber tire roller. Selection of an alternative lower vibration roller by the contractor would also offer a means of providing additional mitigation.

(4) Hours of Work

791. It is assumed that construction of the upgraded road will be carried out during normal weekday working. However, some mitigation of vibration effects can be achieved by avoiding work adjacent to vibration sensitive buildings at particular periods. For example, working directly outside the village mosques during times of prayer shall be avoided. Where work needs to be carried out directly outside schools, if possible, activities such as vibratory compaction could be scheduled for holiday periods.

(5) Trench

792. In populated areas the design of the road incorporates a drainage channel or culvert proposed to run alongside the road. The depth of the channel could be temporarily increased during the construction of the road. This would enable it to function as a trench providing vibration isolation to properties alongside the road from operation of the roller.

793. The results of experimental work examining the effectiveness of trenches agree that the degree of attenuation which can be achieved is a function of the depth of the trench in relation to the incident Rayleigh wavelength. The depth of the trench is sometimes expressed in these studies as a fraction of wavelength, thus in order to determine the depth an effective trench it is necessary to calculate the wavelength in the local soil conditions along the road. Assuming that the Rayleigh wave speed in the soil (of the type prevalent adjacent to the road) is about 140 m/s and the main frequency of concern to be 20 Hz, this would give a wavelength of 7m.

794. Richart[117] reports studies showing that reductions of 50-75% were readily achievable using a trench with a depth of 0.6 times Rayleigh wavelength, which for the current study would be 4m. The studies showed that the highest levels of attenuation were achieved close to the trench, and that the screened area extended to a distance of at least ten wavelengths from the trench.

795. Barkan[118] suggested that the depth should not be less than 0.3 times the wavelength i.e., 2.1m, whilst Thompson[119] reports experimental results showing a vibration reduction in the order of 10dB (65%) at frequencies of 16Hz and above, using a trench of 3.5m in depth.

796. Some work has also been carried out by the Kyrgyz State Agency of Anti-Seismic Construction and Engineering Design Institute[120]. The degree of attenuation of vibration (acceleration) from a roller (with identical characteristics to that described Figure 173 was measured at a distance of 6m from the trench using trench depths of 1.5m and 2.0m. With a depth of 1.5m they reported reduced levels of vibration of between 2-4 times the level without the trench.

797. Taking into account the review of the work above, it has been assumed in the calculations that it would be possible to achieve an attenuation in levels of ground-borne vibration of the order of 50% using a trench alongside the road. The depth of the trench would be likely to be between 1.5-3m. However, this assumption will need to be confirmed by carrying out some additional vibration measurements prior to commencement of construction within populated areas.

[117] Vibration of soils and Foundations. Richart, Hall & Woods Prentice Hall International
[118] Dynamics of Bases and Foundations. D. D Barken. McGraw Hill. 1962
[119] Reducing railway-induced vibration by using open trenches and soft filled barriers. D.J. Thompson et al. Soil Dynamics and Earthquake Engineering. May 2016
[120] State Agency of Anti-Seismic Construction and Engineering Design. Seismologic Report. Trenching Method. Chapter 3. 2017

798. Whilst this form of mitigation has been used effectively for permanent developments e.g., in cases where vibration sensitive buildings are adjacent to industrial complexes or railways, it may prove impractical in this application. For example, it may be that there is insufficient space to construct the over-excavated drainage ditch, service utilities may lie in the areas in which the trench could be constructed, or there may be a risk of the trench collapsing during rolling near its edge.

(6) Limitation of Design to Two Lanes

799. The limitation of the rehabilitation of the road within populated areas to two lanes rather than the proposed four lane configuration would provide mitigation in two ways. Firstly, there would be no requirement for ground improvement works (excavation or rolling) on the soil between the existing road and houses, which causes high levels of vibration in comparison to operation of the roller on the road formation. Secondly, the limiting of the widening will move the construction operations 7.5m further away from the housing, hence providing a greater degree of attenuation of vibration with distance, resulting in lower levels at nearby houses.

d) Human Response

800. Adverse human response to construction vibration can be mitigated by good communication between the contractor and local residents. If occupiers of houses are informed of their nature, duration and potential vibration effects prior to the works, then adverse response will be less. Generally, the main concern relating to construction vibration is of damage to property and if this is not likely to occur, then this point shall be made clear to residents.

801. Ultimately where levels of vibration are considered likely to cause cosmetic or structural damage, residents may need to be offered temporary or permanent relocation.

e) Fragile Ancient Monuments

802. No fragile adjacent monuments were identified during the site visits, however should any be located post study, some guidance on means of mitigation has been included. Assuming a low roller vibration setting, the 2mm/s vibration damage contour, (i.e., the threshold of potential damage to ancient monuments, for example mausoleums constructed of adobe) would be 22m from the edge of the road. This could be reduced to 13m through use of a trench, should that be practicable. The use of the excavator at distances closer than 9m may also give rise to damage.

4. Water

a) Impact on water sources and river water quality

803. During construction, there may be some short-term and minor potential negative impacts on water quality, including:

- (i) Clogging of drainage pipes and culverts;
- (ii) Increased soil erosion, sediment runoff and change in drainage pattern resulting from clearing and leveling of land/soil;
- (iii) Potential transport of building materials such as gravel, sand, and aggregates into the river when it rains;
- (iv) Unintentional leakage and/or spillage of fuels and lubricants that are stored and used at the project sites;
- (v) Discharge of sewage from construction camps into the river; and

(vi) Water intake for construction purposes.

804. Construction work such as clearing and leveling of land near rivers can cause sediments and increase turbidity in rivers. There may be an increased risk of contamination during heavy rainfall, snowmelt and high river flows, where sediments can easily be washed away into adjacent surface watercourses downstream and into Lake Issyk-Kul.

805. It is planned to build and/or replace five (5) bridges on the Chon-Jargylchak, Jeti-Oguz, Irdyk Kichin-Kyzyl-Suu and Chon-Kyzyl-Suu rivers. In this regard, the impact of construction work on these rivers will be considered significant adverse, due to the anticipated nature of the work in the riverbed, such as excavation and piling, and the long duration of the execution of these works.

806. Work on other sections such as the Ak-Terek, Chychkan, Juuku rivers and the replacement of drainage and irrigation canals crossing the road will be considered less intensive and are likely to be carried out in a shorter period than bridge reconstructions, and therefore the impact will be marginally adverse.

807. Potential exposure will also be caused by pollution from the storage and use of oils and chemicals from construction equipment operating in or near the river. Accidental spills can enter surface water with runoff (from the ground or road) or seep into groundwater. In general, the magnitude and degree of impact from accidental spills is considered to be Low.

808. The discharge of untreated water and the withdrawal of water from temporary settlements and the withdrawal of water for construction purposes can also affect water quality. Temporary construction site activities (if any), such as household waste management and the use of field latrines, have the potential to contaminate surface and groundwater through surface runoff or surface leaching into underground aquifers. The site for the temporary camp and the location of the latrines must be carefully selected by the Contractor responsible for construction in accordance with the instructions of the local environmental authorities. Given that there is currently no information on which surface water bodies will be affected by these activities during construction, the degree of impact is assessed as Low as it is assumed that all necessary permits will be obtained.

b) Impact on Lake Issyk-Kul.

809. It should be noted that the road section from the village of Barskoon to the village of Chychkan is very close to Lake Issyk-Kul. The points of discharge of Kichi-Jargylchak, Chon-Jargylchak, Ak-Terek rivers to Lake Issyk-Kul area only about 100 meters downstream from the point of intersection with the road. As such, soil and sediment from the road and bridge construction can potentially reach the lake. However, it is necessary to take into account the fact that Lake Issyk-Kul has significant dilution potential and a variety of tributaries, which will provide natural mitigation, in this regard. The impact of construction work in these rivers on Lake Issyk-Kul will be local and insignificant.

810. The other rivers, Juuku, Kichin-Kyzyl-Suu, Chon-Kyzyl-Suu, Irdyk, Jeti-Oguz, due to the sufficient distance of the road to Lake Issyk-Kul, there is a high probability of dilution in the rivers themselves, which, in this regard, will not affect the lake. In addition, soil and sediment can possibly settle prior to reaching the lake.

c) Mitigation Measures During Construction

811. The following general framework will be applied to mitigate impacts on water quality and surface water resources during construction:

(i) It is not allowed to interfere with the natural flow of water in rivers, reservoirs or watercourses at the sites or near the construction, as well as the withdrawal of water from water bodies and pollution of water resources at the project site;

(ii) Watercourses, rivers, bodies of water or streams on or near construction sites shall be protected from pollution, siltation, flooding or erosion as a result of project activities; and

(iii) Streams, rivers and bodies of water (including drainage) on or near construction sites shall be protected from debris and any materials or waste resulting from project activities

812. Table 77 shows the impact assessment and the recommended mitigation and management measures to address the impacts identified.

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Table 77: Impacts on Water Quality and Water Resources and Recommended Mitigation Measures

Aspect and Potential Impact	Receptors	Impact (scale)	Impact Significance	Mitigation measures
Construction work in rivers, streams and other water channels can cause sediments and soils from construction activities to enter water bodies and increase their turbidity.	Kichi-Jargylchak, Chon-Jargylchak, Ak-Terek rivers	Medium	Serious adverse	▪ A Water, Wastewater and Drainage Management Plan shall be prepared and implemented, including sediment management measures. ▪ During work in rivers, streams and other water channels, visual inspections shall be carried out for formation of sediment. ▪ Sedimentation traps will be used in channel work to capture sediment. ▪ The water channel will be repaired in the event of change (i.e., damage or removal of sediment). ▪ Minimize activities and time spent in the channel. ▪ All altered water channels (i.e., disturbed/removed sediments) must be restored. ▪ Water quality monitoring will be carried out before and after construction, as well as, as necessary, during construction and channel works.
	Chychkan, and Juuku Jeti-Oguz, Irdyk Kichin-Kyzyl-Suu and Chon-Kyzyl-Suu rivers	Medium	Serious adverse	
	Issyk-Kul lake (Barskoon to Chychkan)	Medium	Serious adverse	
	Issyk-Kul lake (Darkhan to Karakol)	None	None	
Earthworks (Land clearing & leveling) and road construction	Kichi-Jargylchak, Chon-Jargylchak, Ak-Terek rivers	Medium	Serious adverse	▪ Natural drainage schemes will be preserved where practicable. The amount of soil extracted will be limited as far as practicable, and soils will be treated appropriately (see section on soil assessment), with soil reuse on site where possible. Preservation of the existing drainage network throughout construction, where possible. ▪ Regular inspection and monitoring of existing surface drainage facilities (including a network of pipes) to preserve their character and function. Best practices shall be applied even when there is no current in water bodies located on/near the Project. ▪ The dust level at the site shall be controlled appropriately to prevent dust from entering surface water (see section on air quality assessment). Soil and soil disturbance shall be limited to the "zone(s)" where construction is underway. ▪ Whenever possible, seasonality shall be taken into account when conducting construction work, i.e., carried out during the "drier" months of the year to minimize the impact of runoff
	Chychkan, and Juuku Jeti-Oguz, Irdyk Kichin-Kyzyl-Suu and Chon-Kyzyl-Suu rivers	Medium	Serious adverse	
	Issyk-Kul lake (Barskoon to Chychkan)	Medium	Serious adverse	
	Issyk-Kul lake (Darkhan to Karakol)	None	None	

Aspect and Potential Impact	Receptors	Impact (scale)	Impact Significance	Mitigation measures
Contamination of surface water and groundwater as a result of accidental spills	Kichi-Jargylchak, Chon-Jargylchak, Ak-Terek rivers	Low	Low adverse	▪ A Spill Prevention and Response Plan will be developed and implemented. ▪ Fuel and chemicals shall be stored in special containers, and measures shall be taken to combat accidental spills, such as: storage on an impermeable surface, clear labels, anchoring in an area capable of accommodating 110% of the volume of the largest container. ▪ Train all fuel and chemical personnel in the use of spill response kits in accordance with the emergency preparedness and response plan. ▪ Hazardous materials such as chemicals, fuels and oils, as well as waste, shall be stored properly at the facility (in accordance with best practice recommendations). ▪ When refuelling vehicles and equipment, procedures shall be followed to minimize the risk of spills into the environment (e.g., spill response kits). ▪ In the event that previously undetected contamination is detected during construction, work on the affected area will be stopped and appropriate measures will be developed to reduce the impact or an appropriate disposal process will be determined. ▪ Wastewater treatment shall be organized in a temporary camp(s) for construction workers
	Chychkan, and Juuku Jeti-Oguz, Irdyk Kichin-Kyzyl-Suu and Chon-Kyzyl-Suu rivers	Low	Low, adverse	
	Issyk-Kul Lake (Barskoon to Chychkan)	Low	Low adverse	
	Issyk-Kul Lake (Darkhan to Karakol)	None	None	
Discharge of untreated water from construction sites.	Kichi-Jargylchak, Chon-Jargylchak, Ak-Terek rivers	Low	Low adverse	▪ Vehicles and equipment shall be washed in designated areas where all wastewater can be collected and treated prior to disposal. ▪ No direct or indirect discharge on site or into surface water is permitted. ▪ In the case of temporary camps for workers and latrines, their location shall be carefully chosen under the direction of the local environmental authority, and they shall be at least 500 m any river or Issyk-Kul Lake. ▪ Direct discharge to surface water shall be avoided. ▪ Appropriate measures shall be applied to the necessary effluents, especially in the disposal of sediment/sludge, and, if necessary, permits for their discharge shall be obtained
	Chychkan, and Juuku Jeti-Oguz, Irdyk Kichin-Kyzyl-Suu and Chon-Kyzyl-Suu rivers	Low	Low adverse	
	Issyk-Kul Lake (Barskoon to Chychkan)	Medium	Moderate adverse	
	Issyk-Kul Lake (Darkhan to Karakol)	None	None	
Water intake for construction purposes.	Kichi-Jargylchak, Chon-Jargylchak, Ak-Terek rivers	Low	Low, adverse	▪ The contractor shall conduct a more detailed assessment of water and water supply needs, including potential sources.

Aspect and Potential Impact	Receptors	Impact (scale)	Impact Significance	Mitigation measures
	Chychkan, and Juuku Jeti-Oguz, Irdyk Kichin-Kyzyl-Suu and Chon-Kyzyl-Suu rivers	Low	Low adverse	▪ Surface or groundwater shall not be used without prior permits for relevant authority/agency.
	Issyk-Kul Lake (Barskoon to Chychkan)	None	None	
	Issyk-Kul Lake (Darkhan to Karakol)	None	None	

5. Biodiversity

a) Introduction

813. Potential environmental impacts from the road project on the biodiversity of the project area were identified through the following actions:

(i) Preparatory: field visit to the project site, visual inspection to get an idea about the potential species composition of the territory. Making a schedule of visits of taxonomic groups of organisms in accordance with the accepted methods of research.

(ii) Literature analysis, collection of information on biodiversity and cartographic materials.

(iii) Field research, the stage is usually limited by seasonal requirements.

(iv) The final stage is the preparation of a biodiversity assessment and a plan for monitoring and conservation activities.

814. The environmental baseline study was carried out to identify of flora and fauna species within the study area; to reveal significant habitats for inhabitant species; to determine possible impact on animal biodiversity on construction and operation phases and to develop impact mitigation measures. Species, protected under Kyrgyz legislation and international treaties (included in the Red List and species having other conservation status), species bearing special significance for local population have been paid particular attention to.

815. Table 78 shows the potential impacts of the road project on biodiversity.

Table 78: Screening of potential impacts on biodiversity.

Potential Impacts	Significance		
	Low	Moderate	High
Vegetation removal during Road Construction / Widening of the Road		X	
Tree cutting during Road Construction / Widening of the Road		X	
Impacts on flora & fauna, pressure on wildlife due to project implementation		X	
▪ Spoiling and spreading of oils & chemicals, ▪ Deterioration of air quality, Noise, ▪ Land degradation, solid waste disposal issues, ▪ Water contamination, ▪ Loss of vegetation, ▪ Health and Safety issues during contractor's mobilization and establishment of workers camp and machinery/ equipment parking		X	
Soil erosion and contamination, air pollution, noise pollution, health and safety issues and damage to infrastructure during road Construction / Widening of the Road		X	
Soil erosion during construction, excavation, backfilling and compaction works		X	
Loss of natural vegetation during construction excavation, backfilling and compaction works		X	
Health and safety issues during Road Construction / Road Widening		X	

b) Biodiversity Assessment Process - Characterization of Impacts

816. The assessment of impacts and the identification of significance is generally undertaken in two stages. An assessment in the absence of any mitigation measures identifies those impacts that are significant and require mitigation. A further assessment considers the impact assuming the mitigation measures are implemented and results in a prediction of the residual effect. It should be noted that for the consideration of biodiversity impacts, the assessment of significance has assumed that mitigation measures have been implemented i.e., impacts stated are residual.

817. Characteristics generally taken into account in the identification of impacts are summarized in Table 79. The final stage of the characterization of impacts is usually to determine the overall significance of the impact considering receptor sensitivity and the likelihood and severity of the impact to arrive at an overall assessment of significance categorized as low, low – moderate, moderate, moderate to high or high.

818. The assessment of impacts for the proposed project has been undertaken using expert judgment by the national biodiversity team.

Table 79: Impact Characterization

Categories	Characteristics
Nature	▪ Direct: The environmental parameters are directly affected by the construction or operation of the Project ▪ Indirect: The environmental parameter changes as a result of alteration in another parameter.
Duration	▪ Short-term: the impacts that last only during the construction of the proposed Project e.g., noise from the construction activities. ▪ Medium-term: lasting for a period of few months to a year before naturally reverting to the original condition such as loss of vegetation due to clearing of campsite, contamination of soil or water by fuels or oil. ▪ Long term: lasting for period much greater than medium term impact before naturally reverting to the original condition such as loss of soil due to erosion or visual impacts from the infrastructure itself.
Geographical Extent	▪ The geographical extent may be local or regional (spatial dimension).
Timings	▪ Pre-construction (designing), Construction and Operational
Reversibility	▪ Temporary: Impacts that occur over a short duration e.g., dust associated with construction activities ▪ Permanent: Impacts that cannot be reversed
Likelihood	▪ The probability of a particular impact occurring is assessed on a scale from Certain (impact will definitely occur) – Likely – Possible – Unlikely – Rare (impact is unlikely to occur or only under exceptional circumstances).
Severity	▪ Major: When an activity causes irreversible damage to a unique environmental feature; causes a decline in abundance or change in distribution over more than one generation of an entire population of species of flora or fauna; has long-term effects (period of years) on socio-economic activities of significance or regional level. ▪ Moderate: When an activity causes long-term (period of years), reversible damage to a unique environmental feature; causes reversible damage or change in abundance or distribution over one generation of a population of flora or fauna; has short-term effects (period of months) on socio-economic activities of significance on regional level. ▪ Minor: When an activity causes short-term (period of few months) reversible damage to an environmental feature; slight reversible damage to a few species

Categories	Characteristics
	of flora or fauna within a population over a short period; has short term (period of months) effects on socio-economic activities of local significance. ▪ Negligible: When no measurable damage to physical, socio-economic, or biological environment above the existing level of public concern; and conformance with legislative of statutory requirements.

c) Corridor of Impact / Area of Influence

819. According to the ADB SPS, the area of influence (AoI) refers to various components, including the primary project site(s) and related facilities developed or controlled by the borrower/client, associated facilities essential for the project's successful operation, areas affected by cumulative impacts, and areas affected by predictable developments caused by the project. The AoI does not include potential impacts unrelated to or independent of the project.

820. The extent of the AoI may vary depending on the impact type and potentially affected receptor attributes, but it should encompass all areas where significant impacts are likely to occur. This includes areas affected by the physical extent of the project works, as well as areas where impacts may extend beyond this boundary.

821. For road construction projects, the term "corridor of impact" (CoI) may be used to reflect the linear nature of the project. In IRRIP CoI and AoI can be used interchangeably.

822. Considering the landscape and terrain characteristics along the project route, the CoI has been defined as 50 meters for topics like archeology. Impacts decrease significantly with distance from the project road. However, for biodiversity, a precautionary approach has been taken, and a wider AoI of 5 kilometers has been assessed, taking into account vicinity to Issyk-Kul Lake, its status as Biosphere Reserve and Key Biodiversity Area along the route.

823. The specific locations of contractor camp/s, access routes, material quarry areas and disposal sites will be determined by the contractor. However, biodiversity team has visited the sites of potential 9 of 12 borrow pits proposed by road designers.

824. The Right of Way (RoW) represents the permanent footprint of the project. It involves direct impacts such as vegetation clearing, tree cutting, and potential indirect impacts on shrubs and ornamental trees. The RoW is considered a 32-meter-wide strip as per Kyrgyz Republic Law on Automobile Roads for category II roads.

d) Potential Adverse Impacts

825. While road improvement projects generally aim to enhance transportation infrastructure and provide benefits to communities there are some potential significant adverse environmental impacts on the local environment, particularly when the project involve the expansion of road in ecologically sensitive area.

826. **Impacts from Site Clearance**. The impacts of site clearance on habitat can have significant ecological consequences. The process of site clearance and preparation, as well as the movement of equipment, can lead to the loss of habitat for various species. The effects are particularly notable for ecological receptors, such as terrestrial flora, birds and fauna. Field surveys estimated that 5,217 trees alongside the project road will be cut for road widening purposes (Table 80). None of these trees are red book species.

Table 80: Trees to be cut for road widening purposes

Size (Trunk Diameter, cm)	Number of Trees

	Hardwoods*	Softwoods*
<16	1,954	740
16 - 24	148	525
24 - 32	35	510
>32	233	1,072
Total	2,370	2,847
Total	5,217	
*hardwoods (e.g., poplar, elm, apricot, willow, and birch) and softwoods (e.g., juniper and spruce).		

827. **Loss of Habitat**. Site clearance involves removing vegetation and altering the natural landscape, which directly results in the loss of habitat for many organisms. The removal of trees, shrubs, and other plant species eliminates crucial shelter, nesting, and feeding sites for wildlife. Disrupting the natural habitat structure can have long-term consequences for the affected species.

828. **Impact on Terrestrial Flora**. Terrestrial flora refers to plant species that primarily grow on land. Site clearance can have a severe impact on these species as their habitat is directly destroyed. Many plants may not have the ability to disperse their seeds over long distances, making it challenging for them to recolonize cleared areas. This loss of habitat can lead to a decline in plant diversity and negatively affect the overall ecosystem balance.

829. **Effect on Reptiles and Amphibians**. Reptiles and amphibians often have limited mobility and rely on specific habitats for survival. Site clearance can destroy their preferred habitats, including areas such as wetlands, ponds, and forest floors, which are crucial for breeding, nesting, and foraging. Disrupting these habitats can result in population declines, reduced genetic diversity.

830. **Spread of Invasive Plant Species**. Site clearance and disturbances create opportunities for invasive plant species to colonize the area. Invasive species, which are non-native and aggressive, can quickly establish themselves in disturbed habitats. They outcompete native vegetation, reducing biodiversity and potentially altering the ecological dynamics of the area. This poses a risk to native, endemic, and relict flora, which may struggle to compete with invasive species.

831. **Loss of Plants and Habitat for Fauna**. The removal of vegetation, including uprooting shrubs and cutting trees, directly contributes to the loss of plants. This decline in plant numbers and the alteration of the habitat structure have significant consequences for various species, including mammals, birds, and insects. The removal of vegetation can result in a decline in their populations and a loss of suitable habitat.

832. **Negative impacts on Soil Functions**. Site clearance and the movement of equipment can lead to the removal of topsoil, which is rich in organic matter and supports crucial soil functions. The loss of topsoil can negatively impact carbon storage and reduce biological activity in the soil. This disruption can affect nutrient cycling, soil structure, and water retention capacity, which are vital for supporting healthy ecosystems.

833. **Loss of Breeding, Feeding, and Nesting Sites**. The loss of habitat due to site clearance affects all species, including highly mobile ones. Breeding, feeding, and nesting sites are crucial for the survival and reproductive success of many organisms. Disrupting these sites can impact both sedentary and mobile species, causing declines in population numbers and affecting the overall ecosystem balance.

834. Mitigation measures such as dust control through watering the road and implementing erosion control methods, are necessary to minimize the impact on biodiversity. While birds may not suffer significantly if trees are cut down since they nest in new places each year, it is important to ensure that suitable alternative nesting sites are available to support their populations.

e) Impacts on ecosystems

835. Both terrestrial and aquatic ecosystems, can suffer significant consequences.

836. **Loss of Habitat**. The construction of the Project Road can lead to the loss of habitat for terrestrial species. This loss of habitat can disrupt the natural balance and affect the populations of flora and fauna that rely on the affected areas.

837. **Spread of Invasive Species**. If measures to prevent the spread of invasive species are not implemented, they can have a significant impact on the terrestrial ecosystem. Invasive species can outcompete native flora, leading to changes in the composition and diversity of plant communities. This can have cascading effects on other organisms that depend on these native species for food and shelter.

838. **Irresponsible Waste Disposal**. Improper waste disposal practices can negatively impact both terrestrial and aquatic ecosystems. Dumping waste on the topsoil can degrade soil quality and hinder biological activity, affecting nutrient cycling and overall ecosystem health. Dumping waste in water bodies can lead to water pollution, reducing water quality and harming aquatic organisms.

839. **Aquatic Ecosystems**. Water Pollution: Contamination from irresponsible waste disposal, such as dumping waste directly into water bodies, can have severe consequences for the aquatic ecosystem. Pollutants can disrupt the balance of the ecosystem, impacting water quality, and harming aquatic organisms, including fish, plants, and invertebrates. This pollution can also affect the food chain and overall ecosystem dynamics

840. **Adverse Impacts on Food Chains**. Contamination of both terrestrial and aquatic ecosystems can have adverse effects on the food chain. Pollutants introduced into the environment can accumulate in organisms, leading to bioaccumulation and biomagnification. This can ultimately impact the health and survival of organisms throughout the food chain, from primary producers to top predators.

841. To minimize these impacts, responsible waste management practices, habitat restoration efforts, and measures to prevent the spread of invasive species shall be implemented. By mitigating these potential impacts, it is possible to preserve the integrity and functioning of both terrestrial and aquatic ecosystems.

f) Impacts on Mammals

842. Impacts on mammals during construction are likely. Increases in noise, light and construction related movement and vibration may indirectly disturb mammals, particularly the larger and more sensitive species, including fox, jackal, tolai hare, squirrel, field mouse, weasel, and American mink. Construction activities will be short in duration lasting a few months at most, and infrequent, all mammal species, including the smaller rodent species, are highly mobile and will proactively avoid disturbances. The extent and magnitude of the works is also limited to road section location and engineering difficulties of the works. The road improvement works will be carried out at the existing road and boarders with disturbed agricultural land. Given the extent of suitable and alternative habitat beyond the immediate construction footprint and with the implementation of the EMP, such disturbances will be minimized to a level that is negligible for all species.

g) Impacts on Reptiles

843. Impacts on reptiles during construction are likely. Reptiles maybe killed or injured during the clearance of vegetation. The implementation of the EMP will, however, ensure that all clearance works are managed carefully to encourage reptiles to move offsite naturally into adjacent and

suitable habitat. Vegetation clearance may also lead to the loss of refugia and hunting grounds, but the extent of the loss is negligible. The infrequent and limited clearance of grass and scrub could even enhance the landscapes value for foraging reptiles by creating patches of disturbed land that may be preferentially selected by some invertebrate prey. The magnitude of any such change will, however, be minor and not significant. The severity of the habitat loss and disturbances will be negligible and not significant.

h) Impacts on Amphibians

844. Impacts on amphibians during construction are possible during their terrestrial phase. Amphibians maybe killed or injured during the clearance of vegetation. The implementation of the EMP will, however, ensure that all clearance works are managed carefully to encourage amphibians to move offsite naturally into adjacent and suitable habitat. The magnitude of any such change will be minor and not significant. The severity of the habitat loss and disturbances will be negligible and not significant.

845. No impacts on amphibians during the aquatic phase are likely the EMP will avoid and control any risk of spills, dust, runoff and contaminants adversely affecting water sources.

i) Impacts on Birds

846. Impacts on birds during construction are limited, both via the loss of vegetation and the associated increase in noise, light and movement. The greatest risk will be the destruction of active nests, but implementation of the EMP will minimize such impacts. All other risks will be restricted to the construction sites only, temporary and reversable. Birds are also highly mobile and will move to adjacent areas during infrequent times of disturbance. Further, the species will appear at the road: Red-nosed Duck, Black-necked Grebe, Bluethroat, Shore Swallow, Magpies, Sparrows. Common Kestrel Eurasian Kestrel, Legged Buzzard, Black Kite, Eurasian Sparrowhawk these large birds soar at high altitudes during the day as they scavenge for food. They travel many tens of kilometers each day, prefer areas where there are food sources and generally avoid disturbances. Their range is also extremely large, spanning up to 50 km so they will infrequently be in any one location, particularly near active construction sites. The severity of such works will be minimal on all species if measures listed in EMP will be applied.

j) Habitat Fragmentation

847. Habitat fragmentation refers to the division of habitats into smaller, isolated patches, which can have negative impacts on biodiversity and ecological processes. In the case of the IRRIP road, the design decision to build over an existing road helps to minimize the potential for significant habitat fragmentation during the operation phase of the project. By utilizing the existing road, the project avoids creating new barriers to habitat connectivity.

848. However, it is important to acknowledge that during the construction phase, there may be some minor and temporary habitat fragmentation caused by the presence of access roads and other temporary facilities. These temporary disruptions can create barriers for certain species, limiting their movement and access to resources. While these fragmentation effects are expected to be minor and short-term, they shall still be taken into consideration.

849. To mitigate the potential impacts of habitat fragmentation during construction, careful planning and implementation of best practices are necessary. This can include minimizing the extent and duration of temporary infrastructure, establishing wildlife corridors or alternative pathways to facilitate species movement, and implementing measures to reduce disturbance to wildlife and their habitats.

850. Furthermore, it is crucial to ensure the timely removal of temporary facilities and the restoration of natural habitats once construction is completed. This helps to restore habitat connectivity and minimize long-term fragmentation effects.

851. By considering the potential for habitat fragmentation and implementing appropriate mitigation measures during the construction phase, the project can contribute to the preservation of habitat connectivity and the overall conservation of biodiversity.

k) Impacts from Pollution and Waste Generation

852. The impacts of pollution and improper waste disposal during construction activities can have significant consequences for surrounding fauna and ecosystems. Here are the key points:

853. **Threat to Fauna**. Pollution and improper waste disposal pose a threat to various ecological receptors, including both immobile species and more mobile ones. Fauna with limited mobility, such as terrestrial flora, reptiles, and amphibians, are at risk, as well as mobile receptors like fish and bird fauna that pass through the construction sites.

854. **Contamination of Soil and Vegetation**. Improper waste disposal, including dumping on vegetation, can lead to the contamination of soil. Contaminants from the waste can spread into the ecosystem, affecting the health and vitality of plants and other organisms that rely on them.

855. **Contamination of Issyk-Kul Lake**. Pollution and waste from construction activities can also contaminate Issyk-Kul Lake. This contamination can have adverse effects on the water quality, impacting aquatic organisms such as fish, amphibians, and invertebrates, as well as the overall health of the lake ecosystem.

856. **Impact on the Food Chain**. Land and water pollution resulting from construction activities can lead to the contamination of the food chain. Pollutants can accumulate in organisms, potentially affecting their health and survival. This can have cascading effects throughout the food chain, impacting both aquatic and terrestrial ecosystems.

857. **Habitat Loss and Disturbance**. Pollution, noise, and dust generated from construction activities can render nearby habitats uninhabitable for certain species. This can lead to habitat loss, limiting suitable foraging and breeding sites for various fauna. The disturbance caused by construction activities can disrupt the natural behavior and ecology of affected species.

858. To mitigate these impacts, it is crucial to implement proper waste management practices, including appropriate handling, disposal, and recycling of construction waste. Additionally, measures such as dust and noise control, and the use of responsible construction practices and techniques can help minimize pollution and disturbance to surrounding habitats.

l) Mitigation of Impacts on Biodiversity

859. Table 81 lists the mitigation and control measures to address the impacts of the project during the construction phase.

Table 81: Biodiversity impacts mitigation measures

Biological Resource	Mitigation
Trees	▪ For planting new trees, it is recommended to plant local varieties of trees and shrubs that do not require high level of maintenance and watering. ▪ Recommended tree species for planting: wild apricot, wild cherry, narrow-leaved elk, elm tree, fruits and flowers of these trees are food for birds. ▪ Establish partnership with Jeti-Oguz Forestry Department, sign a memorandum of cooperation, in order to get plants and to plant trees according to the Forestry Department’s instruction.

Biological Resource	Mitigation
Bushes	▪ In the coastal zone, shrubs of sea buckthorn, barberry, and caragana grow well on wet places, the fruits of which are food for birds. ▪ During road construction, these coastal zones will not be affected. Sea buckthorn, barberry, caragana are wild plants, and due to berry picking by local residents, they have been subjected to degradation. ▪ On preservation of the coastal part of Issyk-Kul Lake it is necessary to plant sea buckthorn, barberry, and caragana bushes in the core zone of the Issyk-Kul Reserve.
Plants	▪ Little amount of four leaves tulip was found near the road in Jenish, appear in early spring, bulbs deep in the ground, does not need relocation
Fish	▪ Use of sites designated for dumping to avoid polluting ecologically important aquatic habitat of Issyk-Kul Lake. ▪ Use of sites designated for dumping will also prevent contamination of the aquatic food chain. ▪ Hunting and poaching shall be prevented to protect species of conservation importance and minimize loss of wildlife. ▪ The Contractor shall consult with the MNRETS to confirm when works in rivers shall be suspended in order to limit impacts to fish spawning periods. ▪ The Barskoon, Ak-Terek, Kichi Kyzyl Suu, Chon Kyzyl Suu, Jeti-Oguz and Yrdyk rivers have unequal amounts of water in different seasons, in spring and summer water is taken from them to irrigate fields and orchards, so water does not reach Issyk-Kul lake. ▪ Due to the lack of water in rivers, hydrobiota that are food for fish and fish themselves die, a small part of fish go into the lake before the water in rivers disappears, so under such conditions, ichthyofauna in such rivers is quite scarce. ▪ There are three rivers: Chon Jargylchak, Ak-Terek and Jukuu reach the lake, but the compositions of fish are different.
Birds	▪ Re-plantation will result in some habitat restoration. Wildlife that will re-locate may return once planted vegetation is established ▪ Use of sites designated for dumping to avoid polluting ecologically important areas such as habitat for wildlife ▪ Use of sites designated for dumping will also result in prevention of contamination of the food chain, especially of water bodies which are very important for bird fauna ▪ Noise pollution shall be minimized to reduce the disturbance to birds as far as possible ▪ Dust pollution shall be minimized to reduce disturbance to birds as far as possible ▪ Hunting and poaching shall be prevented to protect species of conservation importance and minimize loss of wildlife
Insects	▪ Insects will not be affected by construction as they are in coastal area, on fields and orchards.
Mammals	▪ There are few wild animals in the project area, they will not appear during construction as they are afraid of people and noises
Amphibians	▪ Central Asian frogs are now very rare due to uncontrolled poaching, from age 1 year. This frog does not produce offspring until it reaches the age of 4 years. ▪ An information campaign on the importance of preserving red-listed species is needed

860. The following mitigation measures shall also be implemented:

(i) **Site Surveys**: Prior to clearing vegetation, site surveys will be conducted by the Contractor in collaboration with national biodiversity specialists. This will help identify any potential ecological concerns and inform appropriate mitigation measures.

(ii) **Bridges with Dry Paths**: Bridges will be designed to include dry paths on either side of streams to facilitate the movement of livestock and wildlife. This design consideration acknowledges the need for wildlife movements, particularly during nighttime when human presence is limited.

(iii) **Prohibition of Wildlife Poaching**: Strict measures will be in place to prohibit wildlife poaching. This ensures the protection and preservation of the local wildlife population and their habitats.

(iv) **Environmental Training**: The Contractor will be responsible for providing environmental protection training sessions to their workers. This training will include information on the prohibition of poaching and other practices that may harm the environment.

(v) **Reduced Glare Street Lights**: Street lights will be designed with lower wattage lamps that direct light downwards to reduce glare. This helps minimize light pollution and its potential impacts on nocturnal wildlife.

(vi) **Proper Waste Disposal**: Waste generated during construction shall be disposed of responsibly, without dumping on vegetation or allowing contamination of waterways. This prevents habitat contamination and the spread of pollution through the food chain, ensuring the integrity of the ecosystem.

(vii) **Noise and Dust Pollution Management**: Specific measures shall be implemented to manage noise and dust pollution generated by construction activities. These measures may include using appropriate equipment, implementing dust control measures, and adhering to noise regulations to minimize disturbance to the surrounding environment.

6. Archaeology

a) Introduction

861. Based on the archaeological survey 14 sites of historical and cultural heritage are found within 50-meter zone from the road:

(i) Five (5) burial grounds of the early Iron Age and/or the Middle Ages, which include 15 burial mounds;

(ii) Seven (7) modern Muslim cemeteries and sculptural monuments; and

(iii) Two (2) ethnographical Muslim cemeteries, where the last burial happened more than 50 years.

862. The detailed descriptions of these sites are provided in Chapter 4.

863. The archaeological report prepared by the project archaeologist has been submitted to the Ministry of Culture, Information, Sport and Youth Policy, as per the instruction of the PIU (Annex 14). Based on the report, the Ministry of Culture issued a resolution (Annex 15) to the Jeti-Oguz and Ak-Suu State Administrations of the Issyk-Kul Region, Architecture and Urban Planning Bureau of the Jeti-Oguz and Ak-Suu Districts, Karakol-Ak-Suu and Jeti-Oguz Branches of the “Cadaster” Government Institution, and MOTC to implement the recommendations given in the archaeological report. The resolution includes an instruction that all construction works are prohibited until archaeological excavations and establishment of protection zones of the historical-cultural properties found along the road project are done and shall involve archaeologists, who

shall monitor all earthworks. It also requires the MOTC to involve an archaeologist to monitor all construction work.

b) Archaeological sites within the 50-meter zone from the road

864. **Sites to be Excavated**. The archaeological report submitted to the Ministry of Culture recommended the excavation of the sites listed in Table 82. The MOTC, through the construction contractor, will be responsible for the excavation works of these sites. After excavation and before construction starts, signage/billboards will be put up that will include the name of the site and other important information about the site.

Table 82: Physical cultural resources and heritage sites within 50m of the road project that will be excavated.

SN	Location		Distance from the Road	Description
	Road KM	UTM Coordinates		
A1	142+920	42°10.822'N; 77°37.807'E	46 m South	One (1) flat stone-earthen burial mound
A2	143+245	42°11.004'N; 77°37.874'E	7 m South	Human thigh bone and ceramic vessel fragment. Apparently from a relatively recently destroyed burial.
A3	144+520	42°11.509'N; 77°38.251'E	20 m South	One (1) flat stone-earthen burial mound
A6	157+600	42° 5.547'N; 77°44.685'E	20 m South	One (1) flat stone-earthen burial mound
A8	165+290 - 165+330	42°17.583'N; 77°49.530'E	16 m North	Seven (7) burial mounds
A9	166+840 - 166+940	42°17.967'N; 77°50.551'E	30 to 73m North	An ethnographical Muslim cemetery. Only the flat stone mounds (4) which dates back to the Early Iron Age will be excavated. Other objects will not be excavated as they are either outside the 50-m zone and/or they are Muslim burial mound.

865. **Establishment of Protection Zone**. Protection zones shall be established in the two ethnographical Muslim cemeteries that are within the 50-m zone (Table 83). Being Muslim cemeteries, they are not to be excavated.

Table 83: Physical cultural resources and heritage sites within 50m of the road project that requires the establishment of protection zone.

SN	Location		Distance from the Road	Description
	Road KM	UTM Coordinates		
A9	166+840 - 166+940	42°17.967'N; 77°50.551'E	30 to 73m North	An ethnographical Muslim cemetery, which includes the remaining objects that are not excavated as they are either outside the 50-m zone and/or they are Muslim burial mounds.
A12	183+130 - 183+190	42°21.198'N; 78°1.400'E	9 to 24 m North	Ethnographical Muslim cemetery

866. The six modern cemeteries and one sculptural monument that are within 50-m of the road, will be outside the road expansion boundaries. (i.e., expansion will be done on the side of the road opposite the cemeteries). Also, the boundaries of these cemeteries and sculptural monument are already defined (Figure 182).

Figure 182: Fencing provided around the memorial monument to Sart Ake and Tilekmat Ake (Site A4)

c) Archaeological site outside the 50-meter zone

867. Six (6) cultural heritage sites located outside the 50-meter zone from the road were identified, which include (Figure 119 and Table 59):

(i) Three (3) burial grounds of the early Iron Age;

(ii) Two (2) ethnographical cemeteries; and

(iii) One (1) - is a modern memorial complex (sculptural monument).

868. Archaeological sites outside the 50-m zone of the project site are not expected to be directly affected by the construction activities. Protection zone shall be established in these sites.

d) Accidental Archaeological Finds

869. Although an extensive archeological survey was carried out, it is based on a comprehensive assessment of physical evidence on the ground's surface. As such, there it may still be possible that during construction works, archaeological objects may be found. In case of any signs of objects of historical and cultural heritage (human and animal bones, fragments of ceramics, etc.), is found, construction activities will be stopped. The Ministry of Culture, Information, Sports and Youth Policy of the Kyrgyz Republic will be informed by the construction contractor through MOTC. The instruction on what actions need to be done (e.g., excavation) of the Ministry of Culture will be implemented before construction activities at the specific site will be resumed.

7. Waste Generation and Management

a) *Construction Wastes*

870. As discussed in Chapter 3 (Project Description), materials from demolition, dismantling and disassembly will be either be trucked/transported to the Department of Road Facilities (DRF) of the MOTC or to dump sites. Materials that will be sent to DRF will be recycled/reprocessed for reuse (e.g., paving of village roads).

b) *Asphalt pavement*

871. Most of the asphalt pavement that will be removed from the existing road (82.3% or 58,629 m^3) will be milled and reused onsite to strengthen road shoulders, with the remaining 17.7% (12,603.6 m^3) to be trucked to nearby dump sites (within 30 kms of the project). The location of the dump site will be identified during the construction phase.

c) *Asbestos Cement Pipes*

872. Existing asbestos-cement (A/C) water pipes will be removed as part of the earthworks. A total of 15.21 linear meter ((625.13 kg) of A/C pipe will be removed. This quantity is relatively small with a volume of less than 1 m^3 (A/C density ~ 1,700 kg/m^3). However, as this asbestos is considered hazardous special management of this waste shall be implemented.

873. A site-specific Asbestos Containing Materials (ACM) Management Plan shall be developed in line with the ADB Good Practice Guidance for the Management and Control of Asbestos[121]. The Management Plan shall include the following elements:

- (i) The duties of employers, workers/subcontractors, asbestos contractors and vendors;
- (ii) Training requirements for working with asbestos;
- (iii) Identification of asbestos;
- (iv) Managing long term risks of asbestos;
- (v) Safety in the use of asbestos;
- (vi) Managing incidents where asbestos is found;
- (vii) Managing the risks of asbestos removal;
- (viii) Managing asbestos waste; and
- (ix) Managing asbestos waste generated through disasters.

d) *Domestic and Hazardous Wastes*

874. Domestic wastes will be generated at worker's camps and site offices during construction. The wastes will consist mainly of packaging wastes, plastic and glass bottles, food wastes (left overs), papers and other domestic wastes. The volume of waste will mainly depend on the number of workers and employees that will be mobilized on site. At this point this information is not available and as such the volume that will be generated cannot be estimated.

[121] ADB. Good Practice Guidance for the Management and Control of Asbestos, Protecting Workplaces and Communities from Asbestos Exposure Risks. March 2022. https://www.adb.org/sites/default/files/publication/783636/good-practice-management-control-asbestos.pdf

875. However, with proper management, the impact of the waste can be minimized as listed Table 84.

Table 84: Recommended waste management measures

Category	Management/ Control Measures
Waste segregation	Provide segregated waste bins (e.g., wood, metals, concrete/bricks and mixed waste) that would allow the proper recycling, reuse of disposal of construction waste.
	In offices and construction sites, segregated waste bins shall be provided for recyclables (e.g., plastic bottles, paper, aluminum cans, etc.), biodegradables (food wastes) and residual that would allow for the proper recycling, reuse or disposal of domestic wastes.
Waste storage	Provide segregated and safe temporary waste storage area onsite.
Waste transport	Regularly transport waste to offsite treatment (recycling, reuse, etc.) facilities or disposal site.
Hazardous waste	Provide safe area for hazardous waste storage, which shall be include impermeable surface, drainage (including adequate sump pit to collect spillage), roof, wall, proper ventilation, etc.
	Ensure that hazardous waste is properly stored in leak proof containers with proper markings.
	Regularly transport hazardous waste from the construction site to authorized treatment, storage or disposal facility.
	A hazardous waste data sheet shall be provided for each of the hazardous waste, which contains the physical and chemical characteristics and hazard, quantity, sources, etc.
Communication	Develop and implement waste management awareness/training program for all construction personnel that includes topics on waste segregation, reduction/minimization, reuse and recycling.
	Posters and other information materials shall be provided in appropriate location promoting waste segregation, reduction, reuse and recycling.
Monitoring	A construction waste record/log for all types of wastes (hazardous, domestic and construction) shall be kept onsite. The log shall include among others, the volume waste generated reused, recycled, sold, hauled to waste disposal facility, etc.

B. Operational Phase

1. Air Quality

876. During the operational phase, emissions to air arise from vehicles using the road. Emissions arise both from vehicle exhausts and from other sources including brake wear, tire wear, road abrasion and resuspension.

877. The proposed project will also increase the width of the road and result in some changes in alignment.

878. To assess the impacts of the proposed project on local air quality, detailed air quality modelling was undertaken. The dispersion of emissions from the rehabilitated road corridor was modelled using the latest version of the ADMS-Roads modelling package (version 5). ADMS-Roads is an internationally-recognized dispersion model which includes advanced features for the treatment of complex meteorological conditions, terrain, and street geometry.

879. The key inputs into the model included:

(i) Hourly meteorological data from the global ECMWF Reanalysis v5 (ERA5) dataset, published by the Copernicus Climate Change Service (C3S) at ECMFW.

(ii) Data relating to traffic flows and speeds for the existing and rehabilitated road.

(iii) Traffic speeds derived from average travel times using the Google TravelTime API and onsite surveys.

(iv) A representative vehicle fleet for the region has been derived from available information, including published studies and regional fuel use statistics.

(v) A road transport emissions inventory covering the rehabilitated (widened) road section, together with relevant connecting road links was compiled. The inventory includes oxides of nitrogen (NO_x/NO_2), sulfur dioxide (SO_2), ammonia (NH_3), fine particulate matter (PM_{10} and $PM_{2.5}$), and carbon monoxide (CO).

880. Details of the model inputs and model setup are provided in Annex 2.

881. Modelling was carried out for the following future scenarios:

(i) A Do-Nothing scenario, representing conditions without the implementation of the proposed project in 2027, the expected completion year;

(ii) A Do-Something scenario, representing conditions after the completion of the proposed project in 2027;

(iii) A Do-Nothing scenario, representing conditions without the implementation of the proposed project in 2047;

(iv) A Do-Something scenario, representing the condition with the implementation of the proposed project in 2047.

882. The model was used to predict concentrations in air for NO_2, PM_{10}, $PM_{2.5}$, SO_2, and CO at the locations of sensitive receptors within 250m of the road corridor and along transects extending 500 m on each side of the road in settlements. NO_x and NH_3 concentrations were also predicted at ecological receptors. The impacts of the traffic generated by the project were assessed against National limit values and the WHO guideline levels in accordance with the IFC Guideline.

a) Air quality standards and guidelines

883. **Human health**. Concentrations in air at relevant sensitive receptors were assessed against relevant national standards, and the World Health Organization (WHO) guidelines as referenced in the IFC Guideline on air quality.[122] The standards used in this study are presented in Table 85.

884. The WHO air quality guidelines provide background information and guidance to support policy development and project assessment and decision-making. The guidelines identify pollutant levels below which exposure would not constitute a significant public health risk, based on current scientific understanding. The guidelines are adopted by ADB in its Safeguarding Policy Statement as a basis for assessment of projects supported by the bank through its adoption of the IFC Guideline on air quality.[122] Updated guidelines were published by WHO in 2021. Along with other agencies and jurisdictions, ADB is currently considering how these shall be incorporated into policy. The previous (2005) guidelines referenced in the IFC Guideline on ambient air quality were used in this assessment.

885. Interim targets are proposed by the WHO as incremental steps in progressive improvements in air quality, and are intended for use in areas where pollution is high. These targets aim to promote a shift from high air pollutant concentrations, which have acute and serious health consequences, to lower air pollutant concentrations. Progressively achieving these targets will deliver improvements in environmental quality and health risks for exposed populations. The

[122] International Finance Corporation, General EHS Guidelines: Environmental, “Air Emissions and Ambient Air Quality,” 2007

WHO considers that countries should seek to achieve the guideline values rather than treating the interim targets as objectives.

Table 85: Air Quality Standards and Guidelines, µg.m^{-3}

Pollutant	Averaging Period	National legislation	WHO Guideline
NO_2	Annual	-	40
	24 hours	40	-
	Maximum	85	200 (18 hours per year)
PM_{10}	Annual	40	70 (Interim target 1)
			50 (Interim target 2)
			30 (Interim target 3)
			20 (guideline)
	24 hours	60	150 (Interim target 1)
			100 (Interim target 2)
			75 (Interim target 3)
			50 (guideline)
	Maximum	300	-
$PM_{2.5}$	Annual	25	35 (Interim target 1)
			25 (Interim target 2)
			15 (Interim target 3)
			10 (guideline)
	24-hour	35	75 (Interim target 1)
			50 (Interim target 2)
			37.5 (Interim target 3)
			25 (guideline)
	Maximum	160	-
SO_2	Maximum	500	-
	10 minutes	-	500 (guideline)
	24 hour	40	125 (Interim target 1)
			50 (Interim target 2)
			20 (guideline)
CO	15 minutes		100000
	24 hours	5000	

886. **Habitats**. The project contribution and total predicted environmental concentration of relevant pollutants at sensitive ecological sites was assessed against the Critical Levels adopted by the United Nations Economic Commission for Europe (UNECE). These critical levels are provided for different averaging times, reflecting the differing sensitivities of sensitive habitats to long-term and short-term exposure. The Critical Levels are presented in Table 86.

Table 86: UNECE Critical Levels

Pollutant	Averaging period	Critical Level (µg.m^{-3})
Oxides of nitrogen (NO_x)	24 hours	75
	Annual average	30
SO_2	Annual	10
Ammonia (NH_3)	Annual	1

Source: Mapping Critical Levels for Vegetation, UNECE, 2017

b) *Significance Assessment*

887. In accordance with the IFC Guidance on air emissions and ambient air quality, the impact of the project was assessed on the basis of the following criteria:

(i) For pollutants where the airshed can be considered as "not degraded" (i.e., national standards and international guidelines are achieved), emissions from the road should not contribute more than 25% of the applicable air quality standards

(ii) For pollutants where the airshed can be considered as "degraded" (i.e., national standards and international guidelines are not achieved), any increase in pollution levels should be as small as feasible, and should amount to no more than a fraction of the applicable air quality guidelines or standards. For the purposes of this assessment, and consistent with other assessments carried out on behalf of ADB, this was interpreted as an increase of no more than 5% of the applicable air quality guidelines or standards.

c) *Limitations and assumptions*

888. The assessment is based on the best available information at the time of writing, and follows the IFC guideline, and the ADMS-Roads modelling guidance published by the model developer CERC. However, some limitations remain, particularly with regards to predictions of traffic emissions in future years. A summary of the limitations and assumptions in this assessment is presented in Table 87.

Table 87: Principal limitations and assumptions in this assessment

Limitation	Uncertainty	Approach to reducing impacts
Model setup		
Long-term monitoring of pollutant concentrations is not available in the area	Estimates of background concentrations are uncertain.	Background concentrations have been taken from short-term monitoring in the Karakol. As this is the area with the highest population, it is expected that the city will experience high background concentrations relative to the rest of the region, and as a result using this data should provide a worst-case estimate of background levels.
	It is not possible to verify the model against monitoring data.	The emissions inventory has been compiled using best practice approaches to minimize this risk.
Uncertainties in the dispersion model process.	Models are not perfect representations of reality, and as a result even with the use of best practice in all elements of a study, there will inevitably remain some differences between modelled concentrations and the levels that would be measured in practice.	These are accounted for as far as possible through the use of a well-validated and internationally-recognized dispersion model.
Emissions inventory		
Detailed vehicle fleet information in the Kyrgyz Republic is limited.	Predictions of exhaust emissions are subject to uncertainty.	The best available data on the vehicle fleet has been used. This data suggests that the vehicle fleet in the Kyrgyz Republic is older than in surrounding countries; as such, we

Limitation	Uncertainty	Approach to reducing impacts
		expect this approach to provide a conservative estimate of concentrations.
No detailed projections of the vehicle fleet composition in Kyrgyz Republic are available.	Predictions of concentrations in future years are subject to high uncertainty.	To provide a worst-case estimate of impacts from the proposed project in future years, no implementation of additional emissions standards beyond Euro 5, or transition to Low Emission Vehicles, has been assumed.
The speed of vehicles using the enhanced road corridor is uncertain	If the average speed of vehicles increases with the implementation of the project, emissions will be lower than predicted.	A worst-case approach was taken, whereby vehicle speeds were assumed to be unchanged by the project.

d) Impact on Human Health

889. This section presents the maximum Project Contributions (PCs) and total Predicted Environmental Concentrations (PECs) for each relevant pollutant and averaging time for each of the Air Quality Standards identified in Chapter 3 of this EIA Report. Where appropriate, this section also discusses the PC resulting from the project minus the PC resulting from existing road traffic. This is referred to as the "Net PC".

890. Maximum predicted concentrations at set distances from the kerb were modelled in 2023 without the road rehabilitation project, and in 2027 (the opening year) and 2047 with and without the proposed project. The impact of the proposed project was also calculated at the sensitive receptors identified in Chapter 4.

891. Full results for the modelled scenarios at sensitive receptors are presented in Annex 16, and detailed modelled results along the modelled transects are provided in Annex 17. Contour plots for pollutants and averaging times where the PC from the road is greater than 5% of the relevant WHO air quality guideline or national level are presented in Annex 18.

892. **Sensitive receptors**. The impact of the proposed project on air pollutant concentrations at sensitive receptors varies depending on a combination of the following factors:

(i) The predicted increase in vehicular traffic flows will increase exhaust emissions along the road.

(ii) Changes to the road alignment which bring the kerb closer to or further away from a receptor. The road alignment is brought closer to receptors by 10m in Shalba, and is moved away from receptors by 10m in Jele Tobe. As a result, concentrations at Shalba Mosque (km 198+970) increase with the proposed project.

(iii) The widening of the road will spread out emissions from vehicles, reducing the impact of the corridor on kerb-side concentrations. However, the widening of the road will also bring the road closer to some receptors.

893. Increases in annual mean, 24-hour mean and maximum PM_{10} concentrations may be large enough to potentially require mitigation at five receptors where the road widening and realignment results in the kerb being brought closer to the receptor. Increases in annual mean, 24-hour mean and maximum $PM_{2.5}$ concentrations may also be large enough to potentially require mitigation at one receptor, Shalba Mosque (km 198+970). These receptors are shown in Table 88.

Table 88: PECs at sensitive receptors where impacts from the project are classified as "potentially requiring mitigation"

ID	Type	Settlement	Location, km	Total PEC, µg/m³				Change as % of WHO guideline	
				2027 no project	2027 project	2047 no project	2047 project	2027	2047
Annual mean PM_{10} concentrations									
10	Mosque	Chychkan	163+550	37.9	39.3	37.2	38.4	7.2%	6.2%
25	Gment	Kyzyl Suu	182+980	37.3	39.0	36.7	38.2	8.8%	7.5%
31	School	Kyzyl Suu	185+020	36.6	37.9	36.1	37.2	6.3%	5.4%
40	Mosque	Shalba	198+970	38.5	40.9	37.7	39.8	12.2%	10.5%
42	Residential	Saruu	176+250	41.4	42.4	40.1	41.0	5.2%	4.5%
99th percentile of 24-hour mean PM_{10} concentrations									
10	Mosque	Chychkan	163+550	79.4	83.3	77.5	80.8	7.8%	6.5%
25	Gment	Kyzyl Suu	182+980	77.9	82.7	76.1	80.2	9.5%	8.3%
31	School	Kyzyl Suu	185+020	76.0	79.2	74.5	77.3	6.4%	5.7%
40	Mosque	Shalba	198+970	80.4	86.5	78.2	83.3	12.2%	10.2%
Maximum 1-hour mean PM_{10} concentrations									
10	Mosque	Chychkan	163+550	141.7	166.5	128.3	150.5	8.3%	7.4%
25	Gment	Kyzyl Suu	182+980	133.5	162.8	122.4	147.8	9.8%	8.5%
31	School	Kyzyl Suu	185+020	127.3	151.3	118.0	139.3	8.0%	7.1%
40	Mosque	Shalba	198+970	147.1	183.6	133.6	164.5	12.2%	10.3%
Annual mean $PM_{2.5}$ concentrations									
40	Mosque	Shalba	198+970	28.9	29.5	28.6	29.0	5.7%	4.4%
99th percentile of 24-hour mean $PM_{2.5}$ concentrations									
40	Mosque	Shalba	198+970	58.6	60.0	57.8	58.9	5.7%	4.3%
Maximum 1-hour mean $PM_{2.5}$ concentrations									
40	Mosque	Shalba	198+970	74.5	83.0	69.6	76.1	5.4%	4.1%

894. Predicted impacts at these receptors are close to being classified as acceptable. In view of the uncertainties in the model inputs and results, it is recommended that confirmation of the findings of the study through long-term monitoring at these locations be carried out. The recommended approach is discussed in subsection F below.

895. All other impacts at sensitive receptors can be classified as “acceptable”.

896. **Transects in settlements: NO_2.**Table 89, Table 90 and Table 91 present the maximum contribution from the road corridor to annual mean, 24-hour mean, and maximum NO_2 concentrations respectively in transects in settlements along the road. As the airshed has been categorized as “not degraded” for NO_2, an increase of more than 25% of the relevant WHO air quality guideline or MPC would be classed as “potentially requires mitigation”.

897. The Net PC from the proposed project is less than 25% of the relevant WHO air quality guidelines and national levels at all distances from the road, and no exceedances are predicted to occur 5m from the kerb. The air quality impact of the project can therefore be classified as “acceptable”.

Table 89: Road corridor contribution to annual mean NO_2 concentrations with and without proposed project, µg/m^3

	Concentration at distance from kerb, µg/m^3					
	5m	10m	20m	50m	100m	200m
WHO guideline	40					
Background	11.2					
2023 PC without project	8.1	6.5	4.8	2.6	1.5	0.8
2027 PC without project	7.8	6.3	4.6	2.5	1.5	0.8
2027 PC with project	8.3	6.6	4.8	2.6	1.5	0.8
Net PC as % of guideline in 2027	1.1%	0.7%	0.4%	0.2%	0.1%	0.1%
2027 PC with project as % of guideline	49%	44%	40%	35%	32%	30%
2047 PC without project	11.5	9.2	6.8	3.7	2.1	1.2
2047 PC with project	12.0	9.5	6.9	3.8	2.2	1.2
Net PC as % of guideline in 2047	1.6%	1.1%	0.7%	0.5%	0.3%	0.2%
2047 PEC with project as % of guideline	58%	52%	45%	38%	34%	31%

Table 90: Road corridor contribution to 24-hour mean NO_2 concentrations with and without proposed project, µg/m^3

	Concentration at distance from kerb, µg/m^3					
	5m	10m	20m	50m	100m	200m
WHO guideline	40					
Background	22.4					
2023 PC without project	9.6	8.0	6.1	3.6	2.2	1.4
2027 PC without project	9.3	7.7	5.9	3.5	2.2	1.4
2027 PC with project	9.6	8.0	6.0	3.7	2.4	1.5
Net PC as % of guideline in 2027	1.8%	1.3%	0.9%	0.7%	0.5%	0.4%
2027 PC with project as % of guideline	80%	76%	71%	65%	62%	60%
2047 PC without project	13.4	11.2	8.6	5.1	3.2	2.0
2047 PC with project	13.8	11.4	8.7	5.3	3.5	2.2
Net PC as % of guideline in 2047	2.3%	1.7%	1.1%	1.0%	0.8%	0.6%
2047 PEC with project as % of guideline	90%	84%	78%	69%	65%	62%

Table 91: Road corridor contribution to maximum 1-hour NO_2 concentrations with and without proposed project, µg.m^{-3}

	Concentration at distance from kerb, µg/m^3					
	5m	10m	20m	50m	100m	200m
National standard	85					
Background	22.4					
2023 PC without project	37.6	32.4	25.9	17.0	11.4	7.6

	Concentration at distance from kerb, μg/m³					
	5m	10m	20m	50m	100m	200m
2027 PC without project	36.6	31.5	25.1	16.5	11.1	7.3
2027 PC with project	41.3	35.6	28.8	19.5	13.1	8.5
Net PC as % of guideline in 2027	2.3%	2.1%	1.8%	1.5%	1.0%	0.7%
2027 PC with project as % of guideline	75%	68%	60%	49%	42%	36%
2047 PC without project	53.0	46.0	36.9	23.9	16.4	10.8
2047 PC with project	57.9	50.5	41.1	28.5	19.3	12.4
Net PC as % of guideline in 2047	3.4%	3.1%	2.7%	2.3%	1.5%	1.0%
2047 PEC with project as % of guideline	94%	86%	75%	60%	49%	41%

898. **Transects in settlements: PM_{10}.** Table 92 presents the Net PC from the project to annual mean PM_{10} concentrations at set distances from the kerb in settlements in all modelled scenarios.

899. Table 93 presents detailed results across transects in settlements with and without the project in 2027. As the airshed has been categorized as "degraded" for PM_{10}, an increase of more than 5% of the relevant WHO air quality guideline or MPC would be classed as "requiring mitigation".

900. The Net PC to annual mean PM_{10} concentrations is greater than the 5% threshold within 20m of the kerb in Kyzyl Suu, and within 10m of the kerb in many other settlements along the project road. There are sensitive receptors within 20m of the kerb in Kyzyl Suu, and as a result the overall impact of the project is classified as "potentially requiring mitigation" for annual mean PM_{10} concentrations. The recommended mitigation approach is detailed in Chapter 9.

Table 92: Road corridor contribution to annual mean PM_{10} concentrations with and without proposed project, μg/m³

	Concentration at distance from kerb, μg/m³					
	5m	10m	20m	50m	100m	200m
WHO guideline	20					
Background	33					
2023 PC without project	11.6	9.3	6.8	3.8	2.2	1.2
2027 PC without project	13.9	11.2	8.2	4.6	2.6	1.4
2027 PC with project	15.3	12.2	8.9	4.9	2.9	1.6
Net PC as % of guideline in 2027	7.4%	5.6%	3.9%	2.4%	1.5%	1.0%
2027 PC with project as % of guideline	242%	226%	209%	190%	179%	173%
2047 PC without project	11.9	9.6	7.0	3.9	2.3	1.2
2047 PC with project	13.1	10.4	7.6	4.2	2.5	1.4
Net PC as % of guideline in 2047	6.4%	4.9%	3.4%	2.1%	1.3%	0.9%
2047 PEC with project as % of guideline	230%	217%	203%	186%	177%	172%

Table 93: Road PC to annual mean PM_{10} concentrations with and without proposed project, 2027, µg/m^3

Transect	2027 without project						2027 with project						Change as % of WHO guideline					
	5	10	20	50	100	200	5	10	20	50	100	200	5	10	20	50	100	200
Kichi Jargylchak	10.1	8.3	6.0	3.5	2.1	1.3	11.2	9.2	6.7	3.9	2.4	1.5	**5.5%**	4.5%	3.4%	2.2%	1.5%	0.9%
Ak Terek	8.8	7.1	5.2	3.0	1.8	1.1	9.8	7.9	5.7	3.3	2.0	1.2	**5.1%**	3.8%	2.7%	1.7%	1.0%	0.6%
Chychkan	10.8	8.8	6.4	3.6	2.1	1.2	12.0	9.5	7.0	3.9	2.4	1.4	**5.7%**	3.4%	2.8%	1.6%	1.1%	0.7%
Darkhan	10.7	8.8	6.3	3.6	2.1	1.2	11.9	9.4	6.9	3.9	2.3	1.4	**5.8%**	3.4%	2.7%	1.5%	1.0%	0.7%
Kyzyl Suu	12.2	9.8	7.1	4.0	2.3	1.3	13.7	11.0	7.9	4.5	2.7	1.5	**7.4%**	**5.6%**	3.9%	2.4%	1.5%	1.0%
Shalba	11.7	9.5	6.9	3.9	2.4	1.4	12.5	10.1	7.3	4.1	2.5	1.4	3.7%	3.3%	2.0%	0.9%	0.6%	0.3%
Jele Tobe	12.3	9.9	7.3	4.1	2.4	1.4	12.8	10.2	7.4	4.1	2.5	1.4	2.5%	1.5%	0.7%	0.4%	0.3%	0.2%
Karakol	13.9	11.2	8.2	4.6	2.6	1.4	15.3	12.2	8.9	4.9	2.9	1.6	**7.0%**	4.9%	3.2%	1.8%	1.1%	0.8%
Maximum	13.9	11.2	8.2	4.6	2.6	1.4	15.3	12.2	8.9	4.9	2.9	1.6	**7.4%**	**5.6%**	3.9%	2.4%	1.5%	1.0%

901. Table 94 presents the Net PC from the project to 24-hour mean PM_{10} concentrations at set distances from the kerb in the modelled scenarios; Table 95 presents detailed results across transects in settlements with and without the project in 2027. As the airshed has been categorized as "degraded" for PM_{10}, an increase of more than 5% of the relevant WHO air quality guideline of 50 µg.m-3 would be classed as "requiring mitigation".

902. The Net PC to annual mean PM_{10} concentrations is greater than the 5% threshold within 20m of the kerb in Kyzyl Suu, and within 10m of the kerb in other settlements along the project road. There are sensitive receptors within 20m of the kerb in Kyzyl Suu, and as a result the overall impact of the project is classified as "potentially requiring mitigation" for 24-hour mean PM_{10} concentrations.

Table 94: Road corridor contribution to the 99th percentile of 24-hour mean PM_{10} concentrations with and without the proposed project, µg/m^3

	Concentration at distance from kerb, µg.m^{-3}					
	5m	10m	20m	50m	100m	200m
WHO guideline	50					
Background	66					
2023 PC without project	25.7	21.6	16.4	9.9	5.9	3.5
2027 PC without project	30.9	26.0	19.7	11.9	7.1	4.1
2027 PC with project	34.0	28.0	21.1	12.4	8.0	4.9
Net PC as % of guideline in 2027	7.7%	6.1%	3.6%	2.6%	2.3%	1.7%
2027 PC with project as % of guideline	200%	188%	174%	157%	148%	142%
2047 PC without project	26.4	21.9	16.6	10.0	6.0	3.6
2047 PC with project	28.7	23.7	17.9	10.6	6.8	4.2
Net PC as % of guideline in 2047	6.4%	5.2%	3.6%	2.3%	2.0%	1.5%
2047 PEC with project as % of guideline	189%	179%	168%	153%	146%	140%

Table 95: Road PC to the 99th percentile of 24-hour mean PM_{10} concentrations with and without proposed project, 2027, µg/m³

Transect	2027 without project						2027 with project						Change as % of WHO guideline					
	5	10	20	50	100	200	5	10	20	50	100	200	5	10	20	50	100	200
Kichi Jargylchak	24.5	20.2	15.2	9.0	5.7	3.7	26.7	22.2	16.6	10.1	6.4	4.3	4.9%	4.5%	3.1%	2.4%	1.5%	1.5%
Ak Terek	23.8	19.7	14.9	8.9	5.7	3.4	26.9	22.1	16.6	9.9	6.2	4.0	7.0%	5.4%	3.6%	2.3%	1.2%	1.1%
Chychkan	25.8	21.6	16.2	9.6	6.0	3.7	28.0	23.0	17.4	10.3	6.6	4.0	5.0%	3.2%	2.5%	1.5%	1.2%	0.8%
Darkhan	25.3	21.3	15.8	9.5	5.9	3.5	27.6	22.7	17.0	10.1	6.4	3.9	5.1%	3.1%	2.6%	1.4%	1.0%	0.7%
Kyzyl Suu	30.0	25.0	18.9	11.3	6.9	4.1	33.5	27.7	20.5	12.4	8.0	4.9	7.7%	6.1%	3.6%	2.6%	2.3%	1.7%
Shalba	29.5	24.5	18.5	11.0	6.9	4.1	31.0	25.8	19.5	11.7	7.2	4.3	3.2%	2.9%	2.1%	1.5%	0.9%	0.4%
Jele Tobe	30.6	25.4	19.2	11.1	6.8	4.1	31.4	25.9	19.4	11.3	7.1	4.3	1.8%	1.1%	0.6%	0.5%	0.5%	0.4%
Karakol	30.9	26.0	19.7	11.9	7.1	4.1	34.0	28.0	21.1	12.3	7.7	4.6	7.0%	4.5%	3.1%	0.9%	1.3%	1.1%
Maximum	30.9	26.0	19.7	11.9	7.1	4.1	34.0	28.0	21.1	12.4	8.0	4.9	7.7%	6.1%	3.6%	2.6%	2.3%	1.7%

903. Table 96 presents the maximum contribution from the road corridor to maximum PM_{10} concentrations across all modelled transects. No exceedances of the national limit of 300 µg.m^{-3} are predicted within the vicinity of the road in any modelled scenarios, and as a result, the impact on maximum PM_{10} concentrations can be categorized as "acceptable".

Table 96: Road corridor contribution to maximum 1-hour mean PM_{10} concentrations with and without the proposed project, µg/m³

	Concentration at distance from kerb, µg/m³					
	5m	10m	20m	50m	100m	200m
National standard	300					
Background	66					
2023 PC without project	108	93	74	49	33	22
2027 PC without project	130	112	90	59	40	26
2027 PC with project	153	133	108	74	50	33
Net PC as % of guideline in 2027	7.6%	7.1%	6.0%	5.4%	4.7%	3.7%
2027 PC with project as % of guideline	73%	66%	58%	47%	39%	33%
2047 PC without project	109	95	76	50	34	23
2047 PC with project	127	111	91	63	44	29
Net PC as % of guideline in 2047	7.1%	6.3%	5.6%	4.9%	4.3%	3.2%
2047 PEC with project as % of guideline	64%	59%	52%	43%	37%	32%

904. **Transects in settlements: $PM_{2.5}$**. Table 97, Table 98 and Table 99 present the process contribution from the road corridor to annual mean, 24-hour mean, and maximum $PM_{2.5}$ concentrations respectively. As the airshed has been categorized as "degraded" for $PM_{2.5}$, an increase of more than 5% of the relevant WHO air quality guideline or MPC would be classed as "requiring mitigation".

905. The predicted change in concentrations is below 5% of the relevant WHO air quality guidelines and MPCs for all relevant averaging times, so the impact from the proposed project is categorized as "acceptable".

Table 97: Road corridor contribution to annual mean $PM_{2.5}$ concentrations with and without proposed project, µg/m^3

	Concentration at distance from kerb, µg/m^3					
	5m	10m	20m	50m	100m	200m
WHO guideline	10					
Background	27.6					
2023 PC without project	2.8	2.3	1.7	0.9	0.5	0.3
2027 PC without project	3.3	2.7	2.0	1.1	0.6	0.3
2027 PC with project	3.6	2.9	2.1	1.2	0.7	0.4
Net PC as % of guideline in 2027	3.4%	2.6%	1.8%	1.1%	0.7%	0.5%
2027 PC with project as % of guideline	312%	305%	297%	288%	283%	280%
2047 PC without project	2.5	2.0	1.5	0.8	0.5	0.3
2047 PC with project	2.8	2.2	1.6	0.9	0.5	0.3
Net PC as % of guideline in 2047	2.7%	2.0%	1.4%	0.9%	0.6%	0.4%
2047 PEC with project as % of guideline	304%	298%	292%	285%	281%	279%

Table 98: Road corridor contribution to the 99th percentile of 24-hour mean $PM_{2.5}$ concentrations with and without the proposed project, µg.m^{-3}

	Concentration at distance from kerb, µg.m^{-3}					
	5m	10m	20m	50m	100m	200m
WHO guideline	25					
Background	55.2					
2023 PC without project	6.3	5.3	4.0	2.4	1.4	0.8
2027 PC without project	7.3	6.2	4.7	2.8	1.7	1.0
2027 PC with project	8.1	6.6	5.0	2.9	1.9	1.2
Net PC as % of guideline in 2027	4.0%	3.1%	1.9%	1.3%	1.2%	0.9%
2027 PC with project as % of guideline	253%	247%	241%	233%	228%	225%
2047 PC without project	5.6	4.6	3.5	2.1	1.3	0.8
2047 PC with project	6.1	5.0	3.8	2.2	1.4	0.9
Net PC as % of guideline in 2047	3.0%	2.4%	1.7%	1.1%	0.9%	0.7%
2047 PEC with project as % of guideline	245%	241%	236%	230%	227%	224%

Table 99: Road corridor contribution to maximum 1-hour mean $PM_{2.5}$ concentrations with and without the proposed project, µg.m^{-3}

	Concentration at distance from kerb, µg.m^{-3}					
	5m	10m	20m	50m	100m	200m

National standard	160					
Background	55.2					
2023 PC without project	26.3	22.7	18.1	11.9	8.1	5.3
2027 PC without project	31.0	26.7	21.3	14.0	9.5	6.2
2027 PC with project	36.3	31.5	25.5	17.4	11.8	7.8
Net PC as % of guideline in 2027	3.3%	3.0%	2.6%	2.3%	2.0%	1.6%
2027 PC with project as % of guideline	57%	54%	50%	45%	42%	39%
2047 PC without project	23.2	20.1	16.2	10.6	7.3	4.8
2047 PC with project	26.9	23.5	19.3	13.4	9.2	6.1
Net PC as % of guideline in 2047	2.8%	2.5%	2.2%	1.9%	1.7%	1.3%
2047 PEC with project as % of guideline	51%	49%	47%	43%	40%	38%

906. **Transects in settlements: SO_2.** Table 100, Table 101, and Table 102 present the process contribution from the road corridor to 24-hour mean, 1-hour mean, and maximum 10-minute mean SO_2 concentrations respectively.

907. The Net PC to SO_2 concentrations resulting from the implementation of the project across all modelled transects is below 25% of the relevant guideline for all relevant averaging times, so the impact from the proposed project is classified as “acceptable”.

Table 100: Road corridor contribution to the 99th percentile of 24-hour mean 24-hour mean SO_2 concentrations with and without proposed project, μg.m^{-3}

	Concentration at distance from kerb, μg.m^{-3}					
	5m	10m	20m	50m	100m	200m
WHO guideline	20					
Background	3.8					
2023 PC without project	0.5	0.4	0.3	0.2	0.1	0.1
2027 PC without project	0.6	0.5	0.4	0.2	0.1	0.1
2027 PC with project	0.6	0.5	0.4	0.2	0.1	0.1
Net PC as % of guideline in 2027	0.3%	0.2%	0.1%	0.1%	0.1%	0.1%
2027 PC with project as % of guideline	22%	21%	21%	20%	20%	19%
2047 PC without project	1.2	1.0	0.8	0.5	0.3	0.2
2047 PC with project	1.3	1.1	0.8	0.5	0.3	0.2
Net PC as % of guideline in 2047	0.6%	0.5%	0.4%	0.2%	0.2%	0.1%
2047 PEC with project as % of guideline	25%	24%	23%	21%	20%	20%

Table 101: Road corridor contribution to maximum 1-hour mean SO_2 concentrations with and without the proposed project, $\mu g.m^{-3}$

	Concentration at distance from kerb, $\mu g.m^{-3}$					
	5m	10m	20m	50m	100m	200m
National standard	500					
Background	3.8					
2023 PC without project	2.0	1.7	1.3	0.9	0.6	0.4
2027 PC without project	2.4	2.0	1.6	1.1	0.7	0.5
2027 PC with project	2.8	2.4	1.9	1.3	0.9	0.6
Net PC as % of guideline in 2027	0.1%	0.1%	0.1%	0.1%	0.1%	0.0%
2027 PC with project as % of guideline	1%	1%	1%	1%	1%	1%
2047 PC without project	5.0	4.3	3.5	2.3	1.6	1.0
2047 PC with project	5.8	5.0	4.1	2.9	2.0	1.3
Net PC as % of guideline in 2047	0.2%	0.2%	0.2%	0.1%	0.1%	0.1%
2047 PEC with project as % of guideline	*2%*	*2%*	*2%*	*1%*	*1%*	*1%*

Table 102: Road corridor contribution to maximum 10-minute mean SO_2 concentrations with and without the proposed project, $\mu g.m^{-3}$

	Concentration at distance from kerb, $\mu g.m^{-3}$					
	5m	10m	20m	50m	100m	200m
WHO guideline	500					
Background	3.8					
2023 PC without project	2.2	1.9	1.6	1.1	0.8	0.5
2027 PC without project	2.6	2.3	1.9	1.3	0.9	0.7
2027 PC with project	3.3	2.9	2.4	1.8	1.3	0.8
Net PC as % of guideline in 2027	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
2027 PC with project as % of guideline	1.4%	1.3%	1.2%	1.1%	1.0%	0.9%
2047 PC without project	5.4	4.7	3.9	2.8	2.0	1.4
2047 PC with project	6.8	6.1	5.2	3.9	2.8	1.8
Net PC as % of guideline in 2047	0.3%	0.3%	0.3%	0.2%	0.2%	0.1%
2047 PEC with project as % of guideline	2.1%	2.0%	1.8%	1.5%	1.3%	1.1%

908. **Transects in settlements: CO**. Table 103 and Table 104 present the maximum road corridor contributions to 24-hour mean and 15-minute mean CO concentrations with and without the proposed project respectively across all modelled transect locations. As the Net PC to concentrations is below 25% of the relevant guidelines for both averaging times, the impact from the proposed project is classified as “acceptable”.

Table 103: Road corridor contribution to maximum 24-hour mean CO concentrations with and without the proposed project, $\mu g.m^{-3}$

	Concentration at distance from kerb, $\mu g.m^{-3}$

	5m	10m	20m	50m	100m	200m
National standard	5000					
Background	800					
2023 PC without project	75	63	48	28	17	10
2027 PC without project	56	47	35	21	12	7
2027 PC with project	61	51	38	23	14	9
Net PC as % of guideline in 2027	0.1%	0.1%	0.1%	0.1%	0.0%	0.0%
2027 PC with project as % of guideline	17.2%	17.0%	16.8%	16.5%	16.3%	16.2%
2047 PC without project	18	15	12	7	4	2
2047 PC with project	19	15	12	7	4	3
Net PC as % of guideline in 2047	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
2047 PEC with project as % of guideline	16.4%	16.3%	16.2%	16.1%	16.1%	16.1%

Table 104: Road corridor contribution to maximum 15-minute mean CO concentrations with and without the proposed project, μg.m^{-3}

	Concentration at distance from kerb, μg.m^{-3}					
	5m	10m	20m	50m	100m	200m
WHO guideline	100000					
Background	800					
2023 PC without project	336	292	236	161	113	70
2027 PC without project	251	218	177	120	84	53
2027 PC with project	310	272	226	161	114	69
Net PC as % of guideline in 2027	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%
2027 PC with project as % of guideline	1.1%	1.1%	1.0%	1.0%	0.9%	0.9%
2047 PC without project	80	70	58	41	29	20
2047 PC with project	94	84	71	52	38	24
Net PC as % of guideline in 2047	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
2047 PEC with project as % of guideline	0.9%	0.9%	0.9%	0.9%	0.8%	0.8%

e) Ecological sites

909. The predicted process contribution from the road corridor to NO_x, SO_2 and NH_3 concentrations at the core zone in each modelled scenario is presented in Table 105. The maximum Net PC to concentrations at Lake Issyk-Kul is predicted to occur near Chon Jargylchak, where the proposed road passes closest to the lake.

910. Table 106 presents the maximum PEC at the core zone and across Lake Issyk-Kul in each modelled scenario as a percentage of the relevant Critical Levels.

Table 105: Predicted roadway contribution to concentrations at the ecological receptors, μg/m³

Site	Pollutant	Averaging period	Critical Level (μg.m⁻³)	Process Contribution (μg/m³)				
				2023	2027 without project	2027 with project	2047 without project	2047 with project
Core Zone	NO_x	24 hours	75	1.9	1.9	2.2	2.7	3.1
		Annual	30	0.40	0.39	0.43	0.56	0.61
	SO_2	Annual	10	0.01	0.01	0.01	0.03	0.03
	NH_3	Annual	1	0.03	0.03	0.04	0.04	0.04
Lake Issyk-Kul	NO_x	24 hours	75	19.5	18.9	19.4	27.3	27.5
		Annual	30	7.1	6.9	7.3	9.9	10.3
	SO_2	Annual	10	0.18	0.21	0.23	0.46	0.50
	NH_3	Annual	1	0.53	0.54	0.61	0.62	0.69

Table 106: Maximum PEC at the ecological receptors as % of relevant Critical Levels

Site	Pollutant	Averaging period	Critical Level (μg/m³)	Predicted Environmental Concentration, % of Critical Level				
				2023	2027 without project	2027 with project	2047 without project	2047 with project
Core Zone	NO_x	24 hours	75	19%	19%	19%	20%	21%
		Annual	30	22%	22%	22%	23%	23%
	SO_2	Annual	10	19%	19%	19%	19%	19%
	NH_3	Annual	1	3%	3%	4%	4%	4%
Lake Issyk-Kul	NO_x	24 hours	75	43%	42%	42%	53%	53%
		Annual	30	44%	44%	45%	54%	55%
	SO_2	Annual	10	21%	21%	21%	23%	24%
	NH_3	Annual	1	53%	54%	61%	62%	69%

911. The rehabilitation of the road is not predicted to lead to any exceedances of the relevant Critical Levels at either the Core Zone or at other parts of Lake Issyk-Kul. As such, the impact from the proposed project can be classed as "acceptable".

f) Mitigation

912. The air dispersion modelling and impact assessment is subject to uncertainty in relation to the calculation of emissions, dispersion processes over relatively short distances. Furthermore, a number of worst-case assumptions have been made in this assessment in order to ensure a worst-case estimate of potential impacts from the proposed project. These include:

(i) Traffic speeds have been assumed to remain constant with the implementation of the project. However, it is likely that improvements to road quality and capacity will lead to an increase in speeds, which will reduce emissions along the road corridor.

(ii) The fleet data used in the assessment is highly uncertain due to limitations in available fleet statistics.

(iii) Emissions factors for resuspension used in this assessment were designed for use in North America. Recent studies including Padoan et. al (2018)[123] indicate that these factors may over-predict emissions from resuspension in typical urban environments.

(iv) Background data used to assess the significance of impacts for PM_{10} and $PM_{2.5}$ is from settlements; the data may overestimate background concentrations in rural areas.

913. In view of these sources of uncertainty, and the fact that the maximum predicted impacts from the proposed project at sensitive receptors are close to the screening threshold, a program of environmental monitoring is recommended following the opening of the road to assess the need for mitigation. The following procedure for monitoring and mitigation of impacts on adjacent receptors is therefore recommended:

(i) **Step 1**: Before the new road opens, measure baseline levels of nitrogen dioxide and dust deposition at proposed locations (Figure 183). The outcomes of the modelling have been used to provide recommendations regarding monitoring sites.

(ii) **Step 2**: Review the findings of this assessment to update the assessment in the light of improved data on baseline air quality, and identify whether mitigation may potentially be required.

(iii) **Step 3**: Once the new road is operational, repeat the measurements of levels of NO_2, PM_{10}, $PM_{2.5}$ and SO_2 at the same locations.

(iv) **Step 4**: Confirm whether mitigation is required.

(v) **Step 5**: If necessary, implement appropriate mitigation.

[123] Padoan E, Ajmone-Marsan F, Querol X, Amato F. An empirical model to predict road dust emissions based on pavement and traffic characteristics. Environmental Pollution. 2018;237:713-720. doi:10.1016/j.envpol.2017.10.115

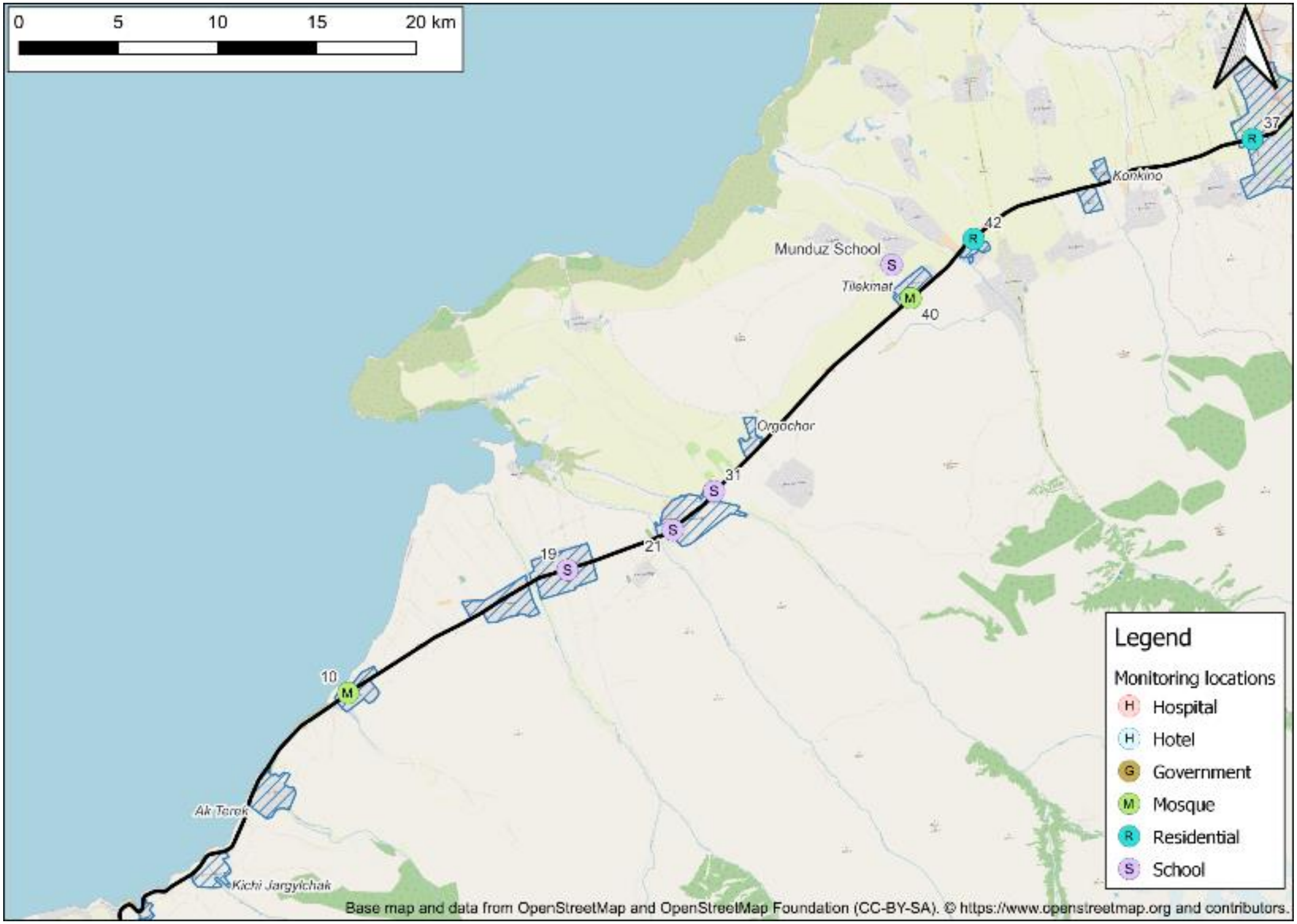


Figure 183: Proposed air quality monitoring locations

914. **Monitoring Program**. The recommended monitoring program is outlined in Table 107. All monitoring must be carried out by qualified external experts. Costs will be dependent on the rates of the consultants used.

Table 107:Recommended air quality monitoring plan

Pollutant	Sites	Method	Frequency
NO_2, SO_2	At least 8 sites, as shown in Figure 183	Diffusion tubes	Monthly, up to 12 months. Tubes to be left out for 2-4 weeks.
PM_{10}, $PM_{2.5}$	At least 8 sites, as shown in Figure 183, including Shalba Mosque	Sampling using portable sensors, at least 60 minutes	Once per month, up to 12 months
	1 receptor in Kyzyl Suu (Site 37)	Continuous monitoring	Continuous, up to 12 months

915. Following the first year of monitoring post-construction, the need for additional monitoring will be assessed. If exceedances of relevant AQO guideline values or national MPCs are observed, additional monitoring may be required.

916. Sites for potential monitoring using portable sensors and diffusion tubes are shown in Figure 183 detailed locations are shown in Table 108. The locations given are approximate; in practice sites shall be selected in the vicinity of these locations based on practical sampling requirements such as the availability of suitable surfaces to affix equipment to. At each location, both passive diffusion tube monitoring of NO_2 and SO_2, and short-term sampling of PM_{10} and $PM_{2.5}$ using portable sensors shall be carried out. Diffusion tube sampling shall be carried out using 3 tubes in each location. The average of the three tubes shall be used as the basis of the mitigation analysis.

917. The sites selected represent highly sensitive receptors (i.e., schools, hospitals, and dwellings) and have been selected to allow compliance with the relevant WHO air quality guidelines and national legislation to be assessed along the proposed roadway. An addition site has been suggested in Munduz, to allow assessment of conditions outside the road corridor to accurate determine baseline concentrations in the region.

Table 108: Proposed monitoring locations

Site ID	Type	Location	Location Coordinates			
			x	y	Lat	Long
10	Mosque	Chychkan	1224500	4718056	42.242	77.724
19	School	Saruu	1235621	4724296	42.322	77.924
21	School	Kyzyl Suu	1240956	4726323	42.335	77.991
31	School	Kyzyl Suu	1243047	4728289	42.351	78.018
37	Residential	Karakol	1270333	4746144	42.483	78.369
40	Mosque	Shalba	1253011	4738068	42.428	78.151
42	Residential	Saruu	1256204	4741072	42.452	78.193
Munduz School	School	Munduz	1252052	4739752	42.444	78.141

918. **Reporting**. Following conclusion of the monitoring programme, an air quality survey report will be produced including:

(i) Maps shows the monitoring locations;

(ii) Photographs of the locations;

(iii) Tables summarising results including summary statistics;

(iv) Laboratory certificates for diffusion tube testing; and

(v) For dust survey results, time of sampling and weather conditions during the sampling.

919. **Potential mitigation approaches**. Potential mitigation approaches are summarized in Table 109. Should the need for mitigation be identified, the costs and most effective approach will heavily depend on the degree of mitigation required.

920. In view of the limited extent of potentially affected areas, it is considered that regular road sweeping or planting of vegetation barriers in these areas would be the most cost-effective means of mitigation, if this should be required.

Table 109: Potential mitigation options should the need for mitigation be identified

Mitigation approach	Cost	Ease of implementation	Duration
Road sweeping	Low for short sections of road.	High	Ongoing costs.
Planting of vegetation barriers along roadside in settlements	Low for short sections of road.	High	Periodic maintenance of vegetation barriers required during operational phase, but effectiveness is not reliant on continuous implementation.
Implementation of lower speed limits in settlements	Low; signage required.	Moderate; speed limits can be difficult to enforce	Ongoing enforcement may be required.
Realignment of road to avoid sensitive receptors	High	Extremely low; unlikely to be possible	

2. Noise

a) Calculation of Road Traffic Noise

921. Road traffic noise levels from the existing and rehabilitated road have been calculated using the Noisemap 5.2 computer model incorporating the method set out in the ‘Calculation of Road Traffic Noise’ (CRTN)[124]. This method takes into account factors including the speed and number of vehicles, the traffic mix (i.e., the percentage of heavy goods vehicles), the distance between the road and houses, and local topographical features.

922. Road traffic noise at dwellings and community facilities within the villages alongside the road have been calculated for both the year of opening (2027), both with and without the project, and for fifteen years after opening (2042), again, both with and without the project. This has enabled the assessment of both short and long-term effects arising from the project, and follows procedure set out in the UK Design Manual for Roads and Bridges[125].

[124] Calculation of Road Traffic Noise, Department of Transport, 1988Terms of Reference.
[125] Design Manual for Roads and Bridges

(1) Assumptions: Road traffic noise calculations

923. **Road traffic flows**. The following road traffic data for day, evening and night time periods has been derived from hourly weekday traffic flows provided by JOC:

(i) Baseline (2023) 24-hour 2 way road traffic flows by vehicle for each section of the road;

(ii) Forecast traffic flows for the year of opening (2027) both with and without the project;

(iii) Forecast traffic flows for the period 15 years after opening (2042) both with and without the project; and

(iv) Proposed speeds though villages by lane and for open sections of the road.

924. The day, evening and night time road flows on each route section for the years 2023, 2027 and 2042 which have been used as the basis of the noise calculations are set out in Table 110. The flows for each scheme are per carriageway and hence for a dual carriage way the figures in the Table represent half the total flow.

925. The road traffic speeds have been assumed to be 60 km/h in residential areas and 120km/h outside these areas.

926. The approach to the assessment constitutes a worst case. No correction has been in the noise modelling to account for the improved road surface in 2027 following opening of the project. However, this is no longer a worst case assumption in 2042 as no commitments have been made regarding the maintenance regime in the intervening period. Also, no account has been taken for the future introduction of electric cars, which is likely to reduce road traffic noise levels by the year 2042, particularly in urban areas where road traffic speeds are lower.

Table 110: Road Traffic Flows

Year and Scenario	Route Section	Day	Evening	Night
2023 baseline	Barskoon-Kyzyl Suu	3429	784	278
	Kyzyl Suu-Karakol	3699	1017	633
2027 do nothing	Barskoon-Kyzyl Suu	4152	949	337
	Kyzyl Suu-Karakol	4479	1232	767
2027 with project	Barskoon-Kyzyl Suu	2246	513	182
	Kyzyl Suu-Karakol	2393	658	410
2042 do nothing	Barskoon-Kyzyl Suu	7736	1768	627
	Kyzyl Suu-Karakol	8351	2297	1430
2042 with project	Barskoon-Kyzyl Suu	4189	957	340
	Kyzyl Suu-Karakol	4466	1228	764

(2) Mapping

927. Digital mapping of the existing and proposed road project has been supplied by JOC and has been discussed in Chapter 5.

b) Assessment of Operational Noise

928. The Kyrgyz National Noise Standards and IFC Guidelines have been discussed in detail in Chapter 3 and hence only specific comments relating to road traffic noise will be included in this Chapter.

929. The assessment of community response to change in road traffic noise will be assessed by considering the change in noise levels ($L_{pAeq,T}$) during the day and night time periods. In agreement with IFC Guidelines, a noise change of 3dB is used to identify a significant operational noise impact, which is then rated using the semantic descriptors in Table 111.

Table 111: Description of long term road traffic noise impact.

Noise change (dB)	Description of Impact	Effect
Decrease of 3 dB or more	Significant decrease	Positive Effect
Increase of 0.1-2.9 dB	Negligible	No Effect
Increase of 3.0-4.9 dB	Minor	Negative Effect
Increase of 5.0-9.9 dB	Moderate	
Increase of 10 dB or more	Major	

930. In addition, a significant risk of sleep disturbance will be identified for residents of dwellings at which night time (2300H-0700H) road traffic noise levels are greater than or equal to 55 dB $L_{pAeq,8hr}$ (outdoors). This is the Interim Target set out in the WHO Night Noise Guidelines for Europe[126] and is based on the assessment of internal noise levels with windows assumed to be open.

931. The assessment took into account the IFC day and night time residential limits set out earlier in Table 11 (in Chapter 3 of this EIA Report). In the case of non-residential buildings, the internal noise criteria proposed in Chapter 3 of this EIA Report will be used. However, for permanent noise effects, i.e., road traffic noise from the project, windows should be assumed to be open. Typically, for single glazed windows, there will be a reduction of 15dB between external and internal noise levels when windows are open. External noise criteria for specific building types can therefore be derived for operational noise and these are included in Table 112.

Table 112: Internal and External Noise Levels for Community Facilities

Receptor	Noise Level $L_{pAeq,T}$ (dBA)	
	Internal	External (windows open)
School Classroom	40	55
Shop	55	70
Cafe	45	60
Village Administration Building	50	65
Mosque	35	50

(1) Summary of Operational Noise Assessment Criteria

932. In summary, the criteria by which operational noise have been assessed are as follows:

(i) **Dwellings**. A significant noise impact has been identified where there is an increase in day or night time noise level of 3dB or more and the terms in Table 111 have been used to describe the noise impact. In addition, a significant noise impact associated with sleep disturbance at residential receptors has been identified where there will be an increase in $L_{pAeq,8hr}$ of greater than or equal to 1dB and night time road traffic noise levels are greater than or equal to 55 dB $L_{pAeq,8hr}$. Compliance with the noise limits set

[126] WHO. 2007. Night Noise Guidelines (NNGL) for Europe.

out in the IFC Guideline day and night time noise levels in Table 11 will also be addressed.

(ii) **Community Facilities**. A significant noise impact has been identified where there is an increase in noise levels of 3dB or more and/or internal noise levels exceed those set out in Table 112.

c) *Results of Operational Noise Assessment*

933. The results of operational noise calculations are presented in Tabular form in Annex 19. The left hand side of the Table is in a similar format to the construction noise results Table, with the first column giving the receptor number followed by, in column 2, the type of receptor e.g., shop or house. Day and night time noise levels and changes in road traffic noise level are presented for the short term (post project, 2027) and long term (post project, 2042) assessments, and are presented to an accuracy of 0.1 dB

934. Details of operational noise effects are discussed below for noise sensitive receptors alongside the road where is passes through or nearby to the villages of Chon Jargylchak, Kichi Jargylchak, Ak Terek, Chychkan, Darkhan, Saruu, Dzhang, Uryuk, Kyzyl Suu, Orgochor, Shalba, Jele Tobe, Baltabay, Konkino and the outskirts of the city of Karakol.

935. The changes in noise levels (the resulting effects) are uniform over the project and therefore detailed discussion has been limited to those areas where noise effects differ.

936. At many of the villages, existing road traffic noise levels at houses alongside the road already exceed noise levels set out in the IFC Guidelines for the day and night time periods. Thus, noise effects will be largely assessed on the basis of noise change rather than exceedance the IFC threshold levels.

(1) <u>Comparison of Noise Calculations with Baseline Monitoring Results</u>

937. A comparison between the results of road traffic noise calculations and the baseline noise monitoring is shown in Table 113. There is generally good agreement between the results (daytime) where monitoring has been carried out at the roadside and road traffic noise is the dominant source, .e.g., noise monitoring locations (NMLs) 1, 3, 8, 12, 16, 20. There are some exceptions however, on examination these have obvious causes. At the monitoring locations away from the road where other sources (e.g., domestic activities and traffic on local roads) make a greater contribution to ambient noise levels, the results of monitoring are as to be expected, higher than the calculated road traffic noise levels.

Table 113: Comparison between Noise Calculations and Measured Baseline

Location	NML No.	Rec. No.	Approx. Duration	L_{Aeq} dB		Output from noise model	
				Day	Night	Day	Night
Kichi Jargylchak	1	127	6hr	58.6	-	57.7	n/a
Kichi Jargylchak	2	128	24 hr	49.8	48.7	47.5	38.4
Ak Terek_	3	145	6hr	51.6	-	52.8	n/a
Ak Terek_	4	143	24 hr	48.6	46.4	45.4	36.3
Chychkan	5	216	6hr	43.8	-	41.4	n/a
Chychkan	6	214	24 hr	60.5	52.8	54.0	45.2
Darkhan	7	318	6hr	50.4	-	41.9	n/a
Darkhan	8	314	24 hr	55.1	48.8	56.2	47.4
Jalgyz_Oruk	9	n/a	6hr	39.5	-	-	-

Location	NML No.	Rec. No.	Approx. Duration	L_{Aeq} dB		Output from noise model	
				Day	Night	Day	Night
Saruu	10	414	24 hr	62.4	55.8	58.3	49.5
Kyzyl Suu	11	513	6hr	42.9	-	41.1	n/a
Kyzyl Suu	12	515	24 hr	58.3	53.6	56.8	51.1
Orogochor	13	607	6hr	48.7	-	41.7	n/a
Orogochor	14	602	24 hr	60.2	54.5	53.9	48.2
Shalba	15	654	6hr	49.6	-	40.5	n/a
Shalba	16	656	24 hr	53.6	51.5	50.2	44.5
Jele Tobe	17	706	6hr	44.6	-	40.0	n/a
Jele Tobe	18	705	24 hr	62.8	55.7	55.8	50.1
Baltabay	19	803	6hr	53.5	-	42.6	0.0
Baltabay	20	802	24 hr	57.7	48.7	56.5	50.8
Konkino	21	852	6hr	62.2	-	56.0	n/a
Karakol	22	909	6hr	48.1	-	43.3	n/a
Karakol	23	901	24 hr	61.0	58.2	57.7	52.0

(2) Effect of the Project in Year of opening 2027

938. The change in day and night time road traffic levels with and without the project (see Annex 19) in the year of opening is for the most part negligible with noise changes ranging from approximately +0.2dB to -0.3dB. An exception occurs at properties on the outskirts of Barskoon where noise levels are reduced by up to approximately 1.7 dB as a result of the movement of the road alignment away from the buildings.

(3) Effect of Project in Year 2042

939. The change in day and night time road traffic levels with and without the project in 2042 is for the most part negligible with noise changes ranging from approximately +0.5dB to -0.2dB. An exception occurs at properties on the outskirts of Barskoon where noise levels are reduced by up to 1.5 dB , again as a result of the movement of the road alignment away from the building

(4) Overall Effect from Year 2027 (without project) to 2042 (with project)

940. The change in day and night time road traffic levels form the year of opening without the project to 2042, with the project in 2042 is at most properties along the route an increase of between 2.4 and 2.9dB, which is considered to be a negligible noise impact . Exceptions occur at the following locations:

(i) Outskirts of Barskoon, (rec nos.102-104) where the increase is limited to approximately 2.3 dB as a result of the movement of the alignment away from the house.

(ii) Minor noise impacts are calculated to occur at:

 (a) Chon Jarglychak, (residential rec no. 109): an increase of 3.5dB where the road alignment moves slightly closer to the receptor;

 (b) Kichi Jargylchak (residential rec. no. 129): an increase of 3.0 dB;

 (c) Saru, (residential receptor no. 409): an increase of 3.0 dB;

 (d) Jele Tobe (residential receptor no. 701): an increase of 3.0dB; and

(e) Baltabay (residential receptor no. 800): an increase of 3.0dB.

941. However, it should be noted that the change in noise levels between the year of opening without the project to 2042 and with the project in 2042 is dominated by the intensification in road traffic unrelated to the project itself. This can clearly be seen by comparing the do nothing 2027 noise levels with the do nothing 2042, which show noise increases range typically between 2.5-2.6dB.

d) Mitigation of Operational Noise

942. The noise increases arising from the project itself both in the years 2027 and 2042 are negligible and no mitigation is necessary.

943. The noise increases arising from the combination of the project and the intensification of road traffic are negligible, with some exceptions where calculated future road traffic levels (2042) have been found to increase by up to 3dB, and are considered minor impacts. However, even in these circumstances it would not normally be considered necessary to offer noise mitigation as:

(i) the increases are a result of intensification rather than the project itself;

(ii) there are likely be changes between the forecast and actual road traffic flows and vehicle types between the year of opening and 2047; and

(iii) for the most part the required criterion has only been met by 0.1dB which is much less than potential effect of the worst case assumptions.

944. In practice, a reasonable course of action would be to carry out a review of the working assumptions underpinning the noise calculations (road traffic flows, vehicle type, road condition etc.) at a future date (e.g., 10 years after scheme opening) and assess the requirement for mitigation at that time.

3. Vibration

945. In the case of potential ground-borne vibration from the operation of the upgraded road, it is considered that an operational vibration assessment is unnecessary. Specifically, the UK Design Manual for Roads and Bridges[127] states that peak particle velocities (ppv's) in the structure of buildings close to heavily trafficked roads rarely exceed 2 mm/s and typically are below 1 mm/s.

946. The results of the vibration survey showed this to be the case at the locations at which monitoring was carried out. No evidence was found of abnormal ground conditions likely to give rise to higher levels of vibration than might otherwise be expected.

947. Normal use of a building such as closing doors, walking on suspended wooden floors and operating domestic appliances can generate similar levels of vibration to those from road traffic. Based on this statement, vibration arising from future operation of the road would be unlikely to give rise to cosmetic or structural damage.

4. Water

948. During operation, long-term environmental benefits from the project are expected, due to the improvement of the technical characteristics of the road and the culverts. As designed, runoff from the road will be allowed to percolate into the soil in area where there are no settlements.

[127] State Agency of Anti-Seismic Construction and Engineering Design. Seismologic Report. Trenching Method. Chapter 3. 2017

949. In settlement areas, runoff will be directed into canals. During rain events or snow melt road runoff can be washed directly into canals and waterways and ultimately into rivers and Lake Issyk-Kul. The runoff will contain soil, particles from tires and pavement, hydrocarbons fuel fuel/oil spills.

950. There are no available data on the characteristics of the pollutants that will be carried by the runoff. However, taking into consideration that the road will be paved, the amount of soil is not expected to be significant.

5. Biodiversity

951. Biodiversity conservation during the operation phase shall focus on maintenance of trees along the road, the development and implementation of a biodiversity conservation and management plan, training and awareness, and partnership and capacity building.

952. The control measures aimed at conserving the biodiversity near and around the project site shall be implemented:

(i) Regular inspection and maintenance of trees along the road, including replanting of trees that had died and pruning of trees.

(ii) Development of an integrated biodiversity management plan for the conservation of critical habitats and priority biodiversity sites (swamps, shallow water bodies, forests, shrublands and steppe) of Lake Issyk-Kul, Issyk-Kul National Nature Reserve, BTIK and Teskei Geopark. This plan at the minimum shall include actions listed below.

(iii) Identify and develop criteria and methods for biodiversity monitoring using indicator species.

(iv) Carry out activities to regulate the number of harmful predators (wolves, jackals).

(v) `Study factors affecting migratory bird species in protected areas and develop recommendations to improve migration conditions.

(vi) Develop maps of geology, biodiversity, sacred sites, cultural monuments for the conservation of natural resources and ecotourism as part of the development of the Teskei Geopark.

(vii) Installation of billboard in areas where waterfowl congregate, with information about birds, their numbers and conservation measures.

(viii) Conduct annual study of ecologically important species and communities (economically important for agrobiodiversity) and develop recommendations for their conservation and sustainable use.

(ix) Prepare and implement memorandums of cooperation between the Directorate of BTIK and the Institute of Biology of the National Academy of Sciences of the Kyrgyz Republic and stakeholders in the field of assistance and capacity building for biodiversity conservation. The memorandums shall include mechanisms for consultations, participation on annual bird counts, and expeditions to study biodiversity.

(x) Annual meetings to strengthen cooperation and interaction with local government agencies, local communities and other stakeholders. The meeting should focus on "Prospects, problems of the biosphere territory of Issyk-Kul" and ways to solve them".

(xi) Regularly conduct scientific expeditions-surveys on biodiversity every season.

(xii) Assistance from international organizations for funds to purchase monitoring equipment for BTIK: GPS, tablets, spyglass, motor boats, binoculars, desk top computers and laptops.

(xiii) Development of training guides and modules on biodiversity conservation. Five to eight modules will be developed.

(xiv) Implementation of training guides and modules on biodiversity conservation. Training will be carried out two to three times per year for five years

(xv) Development of special training programs on biodiversity monitoring methods. Six to nine modules will be developed.

(xvi) Implementation of special training programs on biodiversity monitoring methods . Train and involve specialists such as ornithologist, ichthyologist, entomologist, glaciologist, soil scientist, etc. Training will be carried out four times a year for a period of three years.

(xvii) Training in monitoring the use of near-settlement grazing lands of the BTIK, revival of traditional grazing methods through public outreach work. Training to be conducted once a year for five (5) years.

(xviii) Training on use of GIS as a biodiversity data assessment tool. Two training sessions (approx. 3 days each). Funding can be sourced from international organizations.

(xix) Carry out environmental education activities for the local population aimed at fostering a culture of respect for nature in BTIK. To be conducted two to four times a year and may involve meetings, round-table discussions, action lectures, conversations and discussions of problems.

(xx) Organize information campaigns among young people and the local population "Let's preserve the natural filter of Issyk-Kul". Conduct information campaigns and holding events dedicated to the Day of Birds, the Day of Biodiversity, etc. Carry out environmental actions to increase knowledge and change behavior in the direction of sustainability.

(xxi) Develop informational materials on biodiversity conservation and disseminating them widely among stakeholders and local residents.

(xxii) Preparation and publication of scientific articles on the importance of preserving biodiversity and natural ecosystems, and on monitoring the biodiversity of Lake Issyk-Kul and BTIK

6. Archaeology

953. The operation of the road will not directly affect archaeological sites. However, with the expected influx of tourists with the rehabilitation of the road, there is a risk of damage to archaeological sites. However, the protection that will be built around these sites, if properly maintained, could provide safeguard.

7. Waste Generation and Management

954. Domestic wastes will be generated by the users of the road, especially at bus stops. Table 114 lists waste management measures that would ensure that impacts from waste generation are minimized.

Table 114: Waste management measures

Category	Management/ Control Measures
Waste segregation	Provide segregated bins for wastes (e.g., bottles, plastics, food waste, etc.) at appropriate locations such as bus stops that would allow the proper recycling and reuse of wastes.

Category	Management/ Control Measures
Waste transport	Regularly collect and transport waste to offsite treatment (recycling, reuse, etc.) facilities or disposal site.
Communication	Posters and other information materials shall be provided in appropriate location promoting waste segregation, reduction, reuse and recycling.

C. Climate Risk and Vulnerability Assessment

1. Climate Risks

955. A separate climate and vulnerability assessment (CRVA) was carried out for the project (Annex 20), and assessed the risk of climate change on the project as Medium Risk. The discussions below were taken from the CVRA Report prepared for the project.

956. The assessment considered the following risks:

(i) higher atmospheric temperatures;

(ii) increased range of temperatures: hotter to freezing;

(ii) extreme rainfall events;

(iv) higher precipitation as rain or snow;

(v) increased wind strengths; and

(vi) earthquakes (Earthquakes are not climate change induced but can pose a threat to the project roads).

957. Each of the following project components were assessed against the abovementioned risks:

(i) **Road pavement surface.** Impacts of risks (i), (ii) and (iii) on the pavement layers could damage the surface material causing it to prematurely disintegrate. The freeze-thaw cycle can damage the underlying road structure. Heavy rain can damage the wearing course.

(ii) **Flooding.** Some culverts under the road may be overwhelmed by risk (iii) with short term heavy rain. This may cause localized flooding.

(iii) **Drainage.** Increased impermeable surfaces such as road pavements cause larger runoff which could be exacerbated by (iii) and (iv). If the runoff is into farmers' fields damage to crops may result.

(iv) **Water courses under bridges.** Risks (iii) and (iv) may increase velocity of water flow in water courses lead to scouring of bridge abutments and possible collapse.

(vi) **Mud flows.** Risks (i) and (iv) may cause snows to melt at different times of the year and these have in the past lead to mud flows in the water courses. These can damage bridges and the road.

(vii) **Water Transport.** Risk (v) with stronger winds can pose a hazard for vessels on the lake particularly tourism boats which carry a large number of passengers.

(viii) **Tourism Facilities & Buildings.** Seismic events (vi) can damage buildings. However, The Ministry of Emergency Situations of the Kyrgyz Republic has published predictive studies on "Identification of the most dangerous areas of expected earthquakes in the territory of Kyrgyz Republic" which show that the project road is located in an area of low earthquake activity.

(ix) **Landslides.** Risks (iii) and (iv) with increased precipitation can cause landslides on unstable slopes which can block roads.

(x) **Avalanches.** Risks (i) and (iv) with chance of snow melt can lead to avalanches. However, the project road section is not in an area vulnerable to avalanches.

2. Climate Projections

958. In the Kyrgyz Republic, increasing temperatures are leading to more frequent and intense extreme events, such as drought, unpredictable seasonal weather, and an increasing number of natural disasters such as landslides, mudflows, and avalanches. The latest GCM (global climate model) projections indicate that under the median range of simulations for RCP 4.5 and RCP 8.5, future climate projections are:

(i) A warming trend across the country with an annual average temperature rise of 2.0-2.5°C by 2050 in comparison with a reference period of 1986-2005. This increases the risks of heatwaves, glacial melting and drought in the country.

(ii) A 1.6–2.6mm increase in monthly precipitation by 2050, mainly in winter and spring. This increases the risks of floods, landslides and mudflows, especially in the mountainous regions. A projected decrease in precipitation during the summer season, on the other hand, may lead to droughts.

3. Climate Change Adaptation

959. Possible adaptation measures are:

(i) **Flooding Protection**: In general, the project area is a Low Risk area for flooding. However, in one small section prone to flooding (near Yrdyk) the road embankment will be raised above the flood level. Additional cross drainage will be incorporated to prevent the road acting as a dam.

(ii) **Drainage**. In the past the road has been over topped and flooded due to culverts being overwhelmed by water flows. The number of culverts crossing the road will be increased to facilitate the flow of water (snowmelt and rainwater).The number of culverts will be increased from 148 to 175, with corresponding increase in cross sectional area from 203 m^2 to 371 m^2 (83% increase). To account for potential increase in quantities of rainfall and snowmelt due to climate change an additional 26 culverts will be constructed with an additional flow area of 154 m^2 (41% increase).

(iii) **Bridges**. Four bridges will be replaced or repaired and one new bridge will be constructed. The maximum water level is based on observation and local knowledge. In the current design process, there is no allowance made for increased flow in the future due to climate change. However due to the steep sided sections of the water course there is typically 4-5 meters freeboard between the maximum water level and the underside of the soffit of the bridge. This is more than sufficient to cope with increased water flows which may be of the order 15% to 20% increased.

960. Table 115 lists the built-in climate adaptation in the project.

Table 115: Climate adaptation plans within the project

Adaptation Activity	Target Climate Risk
Earthworks: embankments raised and vegetated.	▪ Extreme short term rainfall ▪ Flash flooding ▪ Road overtopping ▪ Erosion of embankment side slopes.
Drainage: 45% increase in culvert capacity by increasing diameter of culverts and adding new drains	▪ Extreme short term rainfall ▪ Flash flooding ▪ Road overtopping.
Pavement: compaction of materials for subbase, shoulders to withstand heavier rain impacts.	▪ Higher temperatures in summer ▪ Increased freeze thaw cycle
Bridges; four bridges will be replaced or repaired and one new bridge will be constructed.	▪ Heavy rain ▪ Flash floods ▪ Glacial melt ▪ Mud flows.

4. Climate Change Mitigation

961. Table 116 lists climate mitigation measures that are built-in in the project. The contributor to the reduction is the replanting of trees and reuse of asphalt that will be removed from the existing road.

Table 116: Climate mitigation plans within the project

Mitigation Measure	Estimated GHG Emissions Reduction (tCO_2e/year)
Tree Planting. Trees will be planted to replace the estimated more than 5,200 trees that will be cut down in road widening.	Total 392 tonnes (19.6 tonnes/year)
Traffic Management. CCTV cameras may be added to control traffic flow and reduce congestion. 3,363 LED street lights will be provided (1 LED light saves 5kg CO_{2e}).	16.8 tonnes/year
Electric Vehicles Charging stations. Charging stations will be provided at two rest areas.	23,000 tonnes/year[128]
Recycling. Reuse of 48,138 m^3 milled pavement for shoulders thus saving transport of raw materials.	160 tonnes

D. Cumulative Impacts

962. Cumulative environmental impacts are changes to the environment caused by the combined impacts current and future activities and projects in an area and natural phenomenon. The impacts of different activities may be additive or synergistic.

963. At the project site, there are currently no on-going projects that can contribute to cumulative impacts. It should be noted that the additional impacts or environmental stresses to the environment have been considered in the impact assessment discussed in Sections 5.1 and 5.2. On the other hand, the cumulative impact from climate change is discussed in Section 5.3.

[128] Each 1,000 EVs requires 6MW, which will be most likely source from hydropower, so there will be no CO_2 emissions. Assume 5,000 cars per year switch to EV. Gasoline car emits 4.6T CO_2/yr so saving is 23 KiloTonnes/yr.

E. Induced Impacts

964. The main potential induced impact of the project is the increase in tourist visits with the corresponding increase in vehicular traffic (Table 117). This will result to the development and expansion of support activities and facilities to accommodate the increase. Economically, this will have a positive impact on the livelihood and income of the local population.

965. On the other hand, the increase in tourists visits will result to higher air pollution from vehicles. It may also increase the risk of degradation and damage to biodiversity in the area, without a biodiversity management plan in place.

Table 117: Mitigation of induced impact of the project

Impact	Enhancement/Mitigation
Expansion of livelihood related to tourism (accommodation, tour guides, etc.)	Tourism development plan should be developed.
Increase in vehicular traffic and consequently higher air pollution level.	Traffic management plan to reduce congestion and efficient maintenance of road network.
Higher risk of degradation/ destruction of biodiversity	Development and implementation of a biodiversity management plan (see Section B.5)

F. Unanticipated Impacts

966. During the EIA, a vibration screening study was carried out that identified potential houses and structures that maybe affected by vibration from road compaction. This study however is mainly based on modelling and available literature data, taking into consideration only the material of construction of these houses and structures. The screening study did not include verification or assessment of the actual structural conditions of the house, which is very important in predicting which houses will actually be affected during the construction of the road.

967. To be able to more accurately identify which houses and structures might be affected by the vibration from construction activities it is necessary to carry out a Baseline Condition Survey/Structural Assessment Report.

968. Before the start of construction works, the contractor, with the presence of CSC Vibration Expert and PIU, will carry out baseline condition/structural survey of all buildings within 25 meters of the road alignment that in the opinion of the contractor might be affected by vibration resulting from the construction activities. The surveys shall be conducted in the presence of and with the permission of the property owners. The findings of the building condition surveys shall be recorded in the report that shall contain the following information:

(i) Building address and location;

(ii) A description of the building condition and any existing cosmetic and/or structural damage;

(iii) Sketches and photographs showing the location and extent of any damage; and

(iv) High resolution video recordings of the surveyed buildings.

969. The CSC Vibration Expert shall review the baseline condition survey and structural assessment report of the Contractor and send to ADB for approval. The Vibration Expert shall approve the construction methodology based on the assessment of vibration impacts (to be conducted by the contractor). He will also inform the Social Safeguards team if structural damage is expected and to identify if there is a need to relocate the residents temporarily/permanently.

VI. Analysis of Alternatives

A. Introduction

970. Analysis of alternatives involves the assessment of the different options available to meet the objectives and requirements that the project aims to fulfill. For environmental aspects it involves looking at alternatives that would result to pollution prevention and/or control and gives protection to the environment while achieving the project's purpose.

971. Alternatives may include any of the following; (i) Road alignment and route alternatives – a different location for the project and/or project component; and (ii) Design/Operational aspects – technology options, operational parameters and conditions.

B. The 'No project' Alternative

972. The 'no project' alternative considers the scenario where the project will not be implemented. Under this scenario, the existing 2-lane road from Barskoon to Karakol will continue to be used without any improvement. As can be seen from Figure 184 to Figure 186, the road is degraded with most of the asphalt already washed out. Most of the sections of the road are in this condition, with some area being worse. Without rehabilitation, the road condition will likely further deteriorate. This road condition result to unpleasant and tiring travel for people who live and need to go to the settlements along road.

Figure 184 – Existing road condition near Shalba

Figure 185– Existing road condition in Darkhan

Figure 186– Existing road condition in Jele Tobe

973. As discussed below, the "no project" alternative is not a good alternative as the existing bad condition of the road leads to the following adverse consequences:

(1) Environmental

974. A road in bad condition is bad for the environment as it will result to:

(i) **Vehicles running less efficiently** - requiring more fuel and as such, emitting more air pollutants and greenhouse gases per kilometer travelled.

(ii) **Higher wear and tear of tires** - requiring more frequent tire change and higher particulate emissions due to tire particles that could get airborne. In addition, these particles will be carried by runoff (from snow melt and rain) into rivers and ultimately into Lake Issyk-Kul or into agricultural lands. Frequent tire change will also result to higher GHG emissions.

(iii) **Higher noise level** – higher vibration of the vehicles and the contact of the tire to uneven road generates higher noise level causing nuisance and inconvenience to passengers of the vehicle and to nearby residential areas and sensitive receptors.

(iv) **Higher safety risk** – higher traffic accident risk that could lead to fatality, injury and damage to property.

(2) Socio-economic

975. Tourist who would like to enjoy Lake Issyk-Kul avoids going to the southern shores because of the bad road conditions. The difference in tourist visits in the southern and northern shores of Lake Issyk-Kul is quite significant and one reason maybe the inconvenience of travelling to the southern shores due to bad road condition. This, despite scenic spots in the southern shores, including Jeti-Oguz (Figure 187), nature reserves (Figure 188) and Lake Issyk-Kul itself (Figure 189). The lack of good road deprives the local economy of potential income from tourists.

Figure 187: The Jeti-Oguz Rocks

Figure 188: A bird at the Kokuy-Kol Core Zone of the Issyk-Kul Nature Reserve

Figure 189: The southern shores of Lake Issyk-Kul.

(3) Disaster Risks – Flooding

976. Some of the existing culverts and water channels crossing the existing road is not sufficient to handle the quantities of water during snow melt and rain events. During the site visit of the EIA team, this was highlighted by the engineers of the Road Operations Company (ROC), Ministry of

Transportation and Communications (MOTC), Jeti-Oguz (Engr. Chyngyshev Mirsen and Mr. Altynbek Omurov, Engineer and Head of the Road Operations Company of MOTC in Jeti-Oguz District, respectively). They explained to the Team that one of the reasons for the temporary flooding is the inadequate (small) diameter of the culverts and pipes for water flow (Figure 190). The flooding causes the traffic to stop for a few hours until the flood subsides.

Figure 190: Road section recently affected by flooding near the village of Kichi Zhargylchak (KM 151+70) due to inadequately-sized water pipe/culvert (10 April 2023)

C. Road Alignment and Route

977. The project only considered the upgrade of the existing road and did not explore other alternatives in terms of new route/alignment as this option provides a number of environmental and socio-economic advantages, compared to moving the road to a new route. The advantages include the following:

(1) <u>Environmental advantages</u>

978. Environmental benefits include the following:

(i) **Minimal additional land take**. Using the existing road alignment will mean lesser land take. The existing road will be widened from a two-lane road to a four-lane road and therefore will be using the same land with some expansion on both sides.

(ii) **Avoidance of destruction of fertile agricultural lands**. The surround areas are fertile agricultural land (Figure 191). Rerouting the road means that the new road will need to traverse productive farms that are planted with various crops including wheat, potato, barley and orchards planted with fruit trees such as apricot.

(2) Socio-economic advantage

979. The main socio-economic advantage is lower costs to acquire lands, as the total area for the road project will be much lesser.

Figure 191: Agricultural lands near and in the general area of the road

D. Design Alternatives

980. Due diligence of the project design was carried out JOC. The JOC evaluated different design options. The design options that were selected considered environmental, safety, socio-economic and cost aspects. These discussed below.

1. Pavement

981. Pavement cost represents about 38% of the total cost of the road rehabilitation project and as such it is important to assess all available alternatives to optimize the design. Three options were evaluated as shown in Figure 192, which included the following:

(i) Original design

(ii) Option 1 – change the thickness of all road layers; and

(iii) Option 2 – change the thickness of base course layers only (base course thickness reduced by 5 cm and the subbase course by 5 cm).

982. The original design was chosen as it's better in addressing frost heaving, although it costs more. Frost heaving of pavement is a phenomenon where the ground freezes and thaws, causing the upward movement or displacement of pavement or road surfaces. It occurs in cold regions where the ground experiences freezing temperatures. Frost heaving of pavement can result in uneven surfaces, cracks, potholes, and damage to the road infrastructure.

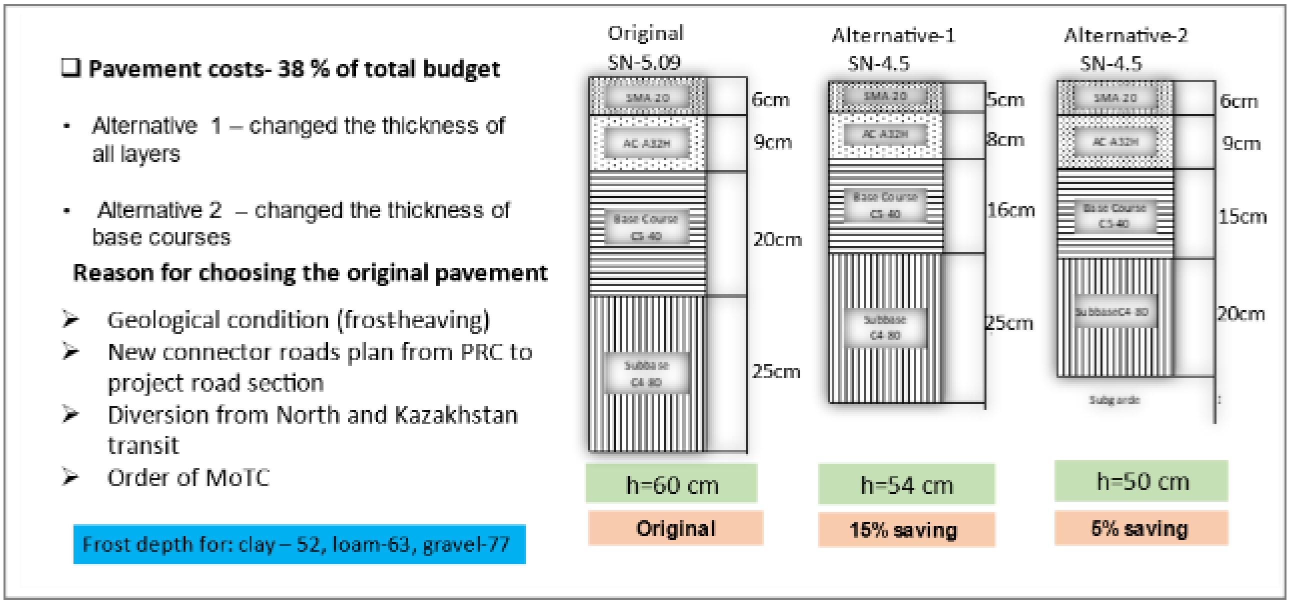
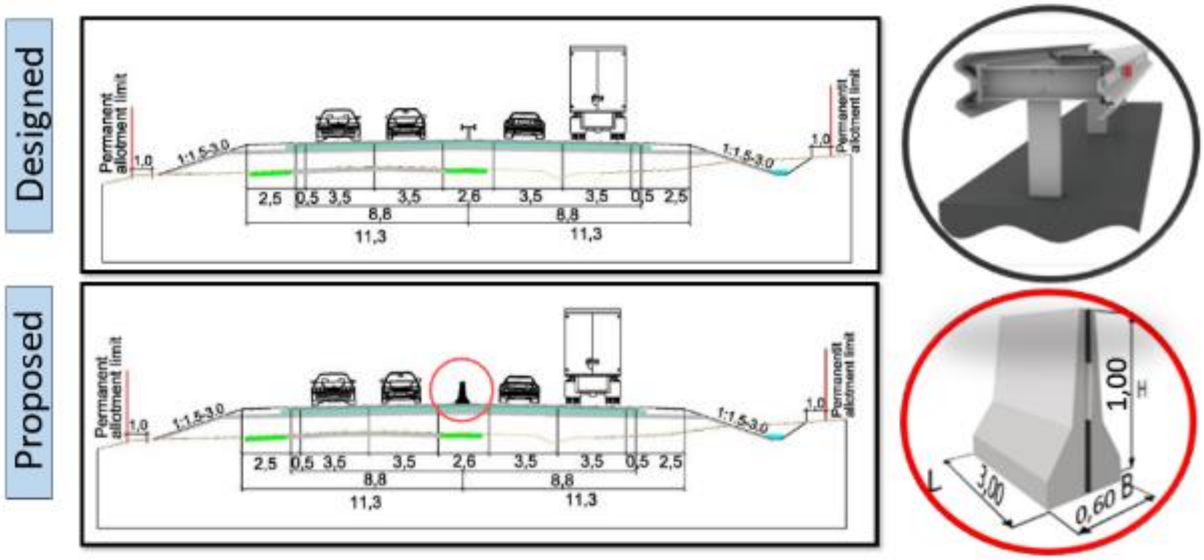
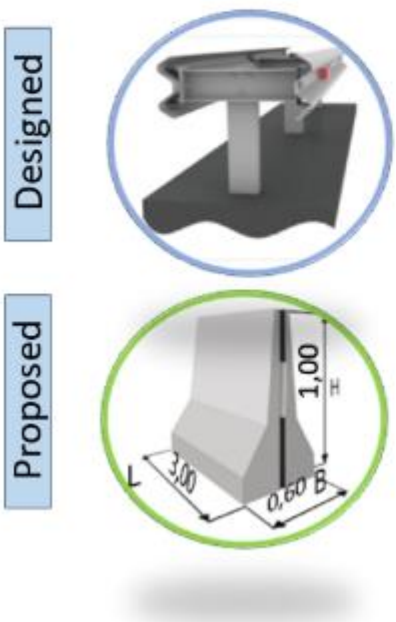


Figure 192: Options considered for road pavement

2. Median Barriers

983. Two options were considered in the design of median road barriers as shown below (Figure 193). The original design is a metal barrier while the proposed design is reinforced concrete barrier. Comparison of the two options using a number of relevant parameters – energy absorption, source, cost and bending width. The reinforced concrete barrier is more advantageous based on the parameters considered. The JOC estimates that the reinforced barrier, being locally sourced at a lower cost will result to savings of US$1.6 million.





Criteria	Value
Energy absorption	300 kJ
Hight	75 cm
Material	Steel
Source	Import
Cost	$88.8 USD / m
Bending width (BW)	1.14

Criteria	Value
Energy absorption	400 kJ
Hight	85 cm
Material	Reinforced Concrete
Source	Local
Cost	$75.4 (65.9) USD / m
Bending width (BW)	I 0 I

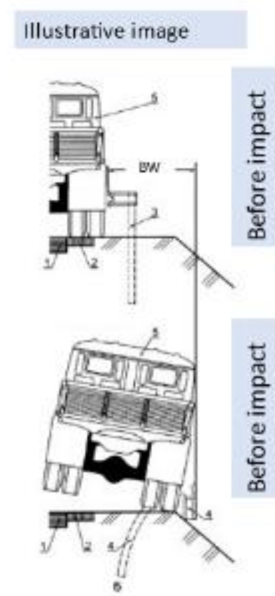


Figure 193: Two options for the road barrier

3. Refuge (Safety) Island

984. Safety islands accommodates pedestrians at pedestrian crossings across multi-lane roads (Figure 194) and serve refuge islands for pedestrians crossing the road.

985. The proposed design of safety island is shown in Figure 195 and Figure 196). Safety island will be installed at appropriate locations.

Figure 194: Safety Islands

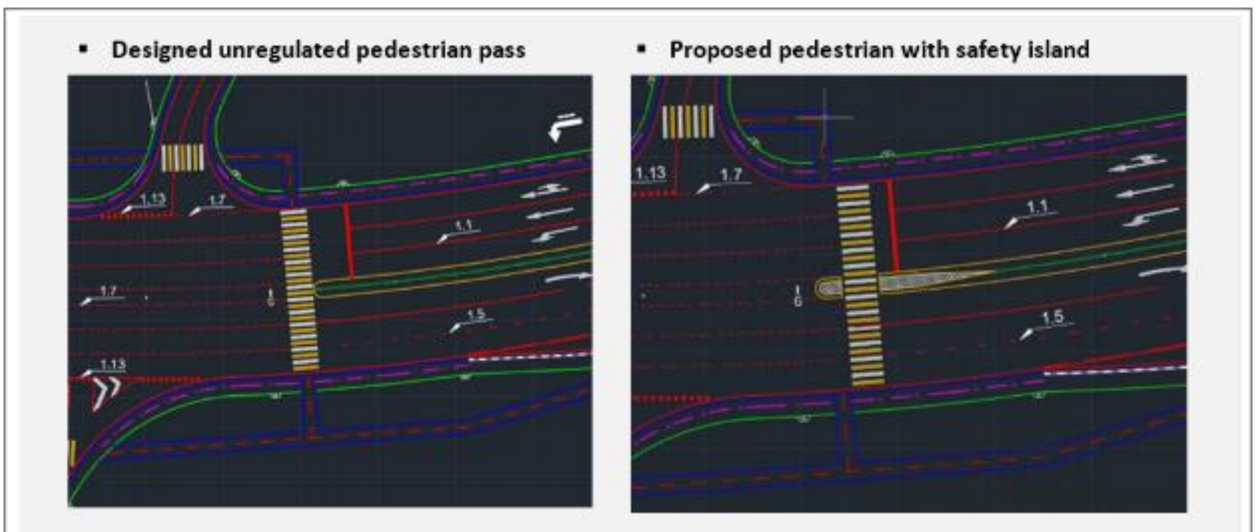


Figure 195: Proposed pedestrian crossing with safety island

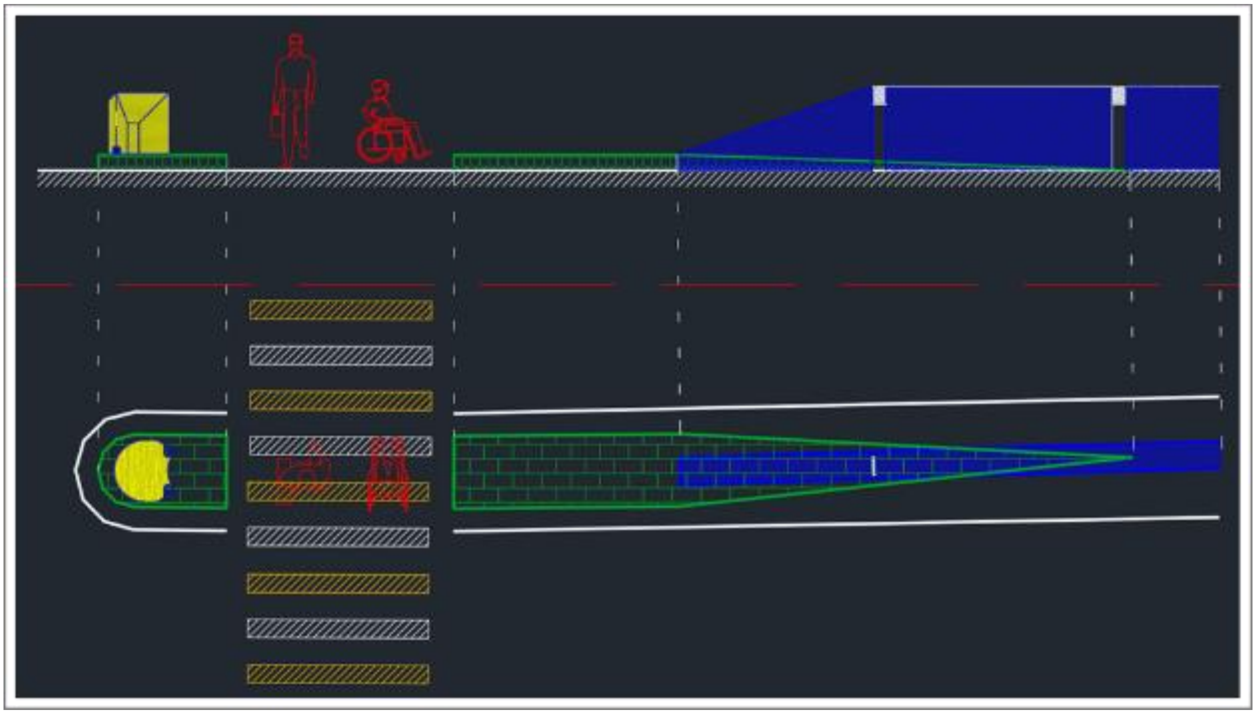


Figure 196: Proposed safety island typical drawing

4. Rest areas

986. Two rest areas will be built as part of the project. The number has been reduced from initially seven (7) rest areas, or almost one every ten kilometers. Environmentally, the reduction of the number of rest areas will be more favorable to the environment, as this reduces the number of areas where there will be environmental risk, e.g., improper disposal of wastes, risk of soil and groundwater pollution from improper discharge of wastes.

5. Number of Culverts

987. The number of culverts (Figure 197) crossing the road will be increased to facilitate the normal flow of water (snowmelt and rainwater). As shown in Table 118, the number of culverts were increased from 148 to 175, with corresponding increase in cross sectional area from 203 m^2 to 371 m^2 (83% increase). To account for potential increase in quantities of rainfall and snowmelt due to climate change an additional 26 culverts will be constructed with an additional flow area of 154 m^2 (41% increase).

Figure 197: Existing culvert

Table 118: Number of culverts

Items	Existing road	Upgraded Road
Number of culverts	148	175
Cross sectional area	203m^2	371m^2
Percentage increase	-	82%
Number of new culverts for climate change	-	26
Cross sectional area of new drainage for climate change	-	154m^2
Percentage of new drainage for climate change	-	41%

6. Recycling of existing pavement materials

988. The existing pavement materials, rather than totally to being disposed in landfill, will be partially recycled. Approximately 58,629 m^3 (82.31%) of existing pavement materials will be recycled and reused onsite to strengthen road shoulder.

7. No vibration compaction

989. Vibration resulting from the compaction of the road may potentially result to cosmetic damages to 105 adobe houses and 30 non-residential adobe buildings. In addition, occupants of 390 brick built buildings would likely experience moderate vibration impact.

990. Options to mitigate vibration impacts include road compaction using compaction roller that have zero vibration near areas where structures are susceptible to cosmetic damage. Other options include: low vibration roller setting, use of alternative compaction equipment, and trenching. To limit nuisance from vibration, compaction can be scheduled outside of prayer hours and other community activities and awareness campaigns to explain to residents vibration impacts from compacting.

991. There are a number of equipment (roller) for road compaction are available in the market. An example is SEM 520, as described in Figure 173. This equipment is a typical large vibrating roller used in road construction projects, which has both high and low vibration operating modes and can also operate with no vibration. A similar model of roller, the SEM 522, is currently being used on the upgrade of the Ring Road on the North side of Lake Issyk-Kul, to the east of Balykchy. Another example is the XS 203 which was used in the Bishkek-Osh project, Phase 4 (Figure 198).

Figure 198: Roller for compaction (model XS 203)

992. Based on model calculations, there is a clear reduction in vibration resulting from the use of a lower vibration setting on the roller. However, more passes of the roller may be required to achieve the same level of ground compaction, resulting to higher costs. Alternative means of compaction of the sidewalk sub-base and the sides of embankment could be adopted such as using a non-vibratory rubber tire roller.

993. In populated areas the design of the road incorporates a drainage channel or culvert proposed to run alongside the road. The depth of the channel could be temporarily increased during the construction of the road. his would enable it to function as a trench providing vibration isolation to properties alongside the road from operation of the roller. It would be possible to achieve an attenuation in levels of ground-borne vibration of the order of 50% using a trench alongside the road. The depth of the trench would be likely to be between 1.5-3m. However, this approach may prove impractical in this application. It may be that there is insufficient space to construct the over-excavated drainage ditch, service utilities may lie in the areas in which the trench could be constructed, or there may be a risk of the trench collapsing during rolling near its edge.

994. The use of no vibration roller would provide the most effective form of mitigation and would eliminate cosmetic damage resulting from vibration in the high risk buildings (within the measurement range).

995. The final choice of what mitigation measure should be implemented to mitigate vibration and the consequent impacts will however be left to the winning bidder, as the choice will have cost implications and the contractor is in the best position to assess which measure is optimal. The contractor shall ensure that potential vibration damage to structures and houses located close to the road alignment is avoided and/or minimized through the implementation of control and mitigation measures that may include the use of “no vibration” roller for compaction or any other means. The contractor shall ensure that any complaint on vibration damage on structure or house is properly investigated and that recommendation of the investigation implemented, including indemnification. The contractor shall be liable for any proven damage to structure or house after proper investigation.

VII. Information Disclosure, Consultation and Participation

A. Introduction

996. This report documents the public consultation, meetings and consultations carried out by the EIA Team with various organizations, including the relevant regional (Oblast of Issyk-Kul), district (Rayon of Jeti-Oguz) and city (Karakol City) government agencies and departments, environmental non-governmental organizations (NGOs), and the Directorate of the Biosphere Territory of Issyk-Kul.

997. During the meetings/consultations the EIA Team presented to the attendees the Issyk-Kul Ring Road Improvement Project (IRRIP) and the objectives of the meetings/consultation in connection with the preparation of the EIA for the project, as an important part of the approval process in obtaining financing for the project. The team also solicited comments and concerns regarding the project and also asked the support of the organization for data and information that are necessary in the preparation of the EIA of the project.

B. Public Consultation

998. A public consultation was conducted on 7th July 2023, at the Kyzyl-Suu House of Culture, Kyzyl Suu, Jeti-Oguz, Issyk-Kul Oblast to discuss the proposed project, its design and engineering solutions, resettlement and social aspects as well as findings of the EIA. The Jety-Oguz district administration supported the organization of this meeting, which was attended by 68 participants (Annex 21). The invitation letters sent by the MOTC to stakeholders is also included in Annex 7-1.

999. Representatives from the MOTC, the Jety-Oguz District administration, local people from villages along the road from Barskoon to Karakol City participated in the meeting. Representative of the ADB observed the public consultation.

1000. The MOTC PIU delivered presentations on the proposed Issyk-Kul Ring Road Project and presented the preliminary EIA findings. The MOTC PIU staff delivered five presentations (Table 119). The power point presentations are attached to this document as Annex 22.

1001. This public consultation served as an opportunity to engage stakeholders, inform them about the proposed project, and gather their feedback and concerns, including on the environmental impacts of the project. The active participation of government officials and the local community in these consultations demonstrates a commitment to transparency and inclusive decision-making processes in the project preparation.

Table 119: Public Consultation Agenda

Time	Activity
15:30 - 15:50	Mr. Sanjar Asanaliev – MOTC PIU ADB Projects Coordinator Presentation: Information of Issyk-Kul Ring Road Improvement Project (IRRIP)
15:55 - 16:20	Mr. Ulanbek Sultanov – Project Designer Kyrgyzdortransproekt (KDTP) Presentation: Road Reconstruction Project Design
16:20 - 17:00	Mr. Ryskulov Atai – MOTC PIU Resettlement Specialist Presentation: Resettlement (LARP) and Gender Issues
17:00 - 17:25	Mr. Asylbek Abdygulov – MOTC PIU Environment Specialist Presentation: Environmental Impact Assessment
17:25 - 18:00	Questions & Answers

1002. There were 68 (60 men and 8 women) participants at the stakeholders' meeting, including 6 from Barskoon village, 14 from Kyzyl Suu Village, 3 from Saruu Village, 3 from Tilekmat Village, 2 from Ak-Terek Village, 4 from Jeti-Oguz village, 4 from Jele Tobe Village, 3 from Alkym Village, 1 from Kokuy-Kol Village, 1 from Zhalgyz Oruk, 2 from Lesnoe Village, 1 from Svetlaya Polyana Village, 1 from - Ananyevo Village, 5 from Karakol City, 1 from Balykchy, 1 from Chyrak, 1 from Isanov Village and 10 from Bishkek City (Figure 199 and Figure 200).

1003. Among the issues raised during the consultation were: concerns about dust, project financing, tree cutting, bicycle road, resettlement compensation, domestic animal corridors, road safety issues, project timetable, and other potential benefits of the project. Details of the discussions on these issues are summarized in Table 120.

1004. During the meeting, no objections were made against the project.

Figure 199: Participants to the public consultation held on 7th July 2023 in Kyzyl Suu

Figure 200: Question and answer portion of the public consultation: (a) Ms. Banura Abdieva NGO Leader (Karakol); (b) Mr. Jugaziev Jumabai, Leading Huntsman of Issyk-Kul Natural Reserve, Jenish section; (c) Mr. Kamchigaliev Jety-Oguz administration, and (d) MoTC PIU Team

Table 120: Issues and concerns and discussed during the public consultation

No.	Question / Comment	Answer	Actions in EIA
1	Ms. Banur Abdieva NGO Lider Karakol: **Question # 1:** Could you provide information regarding the project cost and loan amount? **Question # 2:** Since 2017-2018 and in 2020, there has been a discussion about the development of tourism in the coastal area near the lake, from the village of Ton to Darkhan, which attracts tourists. Considering the frequent use of the road by cyclists traveling to Kochkor and Naryn, has the inclusion of a bicycle lane been considered as part of the project? **Question # 3:** What specific measures has been taken to address road safety concerns, particularly regarding the presence of animals on the carriageway, in the design of the project road?	Mr. Sanjar Asanaliev MOTC PIU ADB Projects Coordinator: The total project cost, including all infrastructure and non-infrastructure components, is estimated to be around $120M USD, of which ADB will provide $80M concessional loan, $20M grant and $20M would be Government co-financing. It was clarified that since it is a loan, there is no need to be concerned, as this type of financing for infrastructural development is not only financially repayable but also contributes to the overall future development of the region. The speaker emphasized that numerous projects funded by loans have yielded positive outputs and outcomes. Furthermore, it was mentioned that the interest rate for this particular loan is 1%. Ulanbek Sultanov Project Designer Kyrgyzdortransproekt (KDTP): While the future plans for the southern ring road may include a bicycle track, the current project does not encompass it. Regarding cattle passages, one passage has been designed strategically in areas where there is a high concentration of cattle. This passage includes rumble strips on the pavement to alert drivers and fencing at the entrance to guide the cattle towards the underground passage in Barskoon Village. In other villages, at the beginning and at the end of the village, signs indicating the passage of livestock will be installed based on research of social safeguards team. In response, **Ms. Abdieva** reiterated that the section in question is a popular tourist destination and suggested that landscaping could be a valuable addition to attract tourists if a cycle track is constructed simultaneously. She expressed skepticism about the possibility of the cycle track being built at a later stage, as she had personally held discussions with three different Prime Ministers, all of whom had made promises regarding its construction, yet no progress has been made thus far.	Information on cattle passages is included in the EIA.

No.	Question / Comment	Answer	Actions in EIA
		In response, **Mr. Ulanbek** explained that the inclusion of the bicycle route and other additional features ultimately depends on the availability of financing from the government. He mentioned that the Prime Minister has expressed a desire to have a bicycle route encircling the lake. However, currently, the main priority is focused on the construction of the road itself. A bicycle lane will be constructed in the second phase of the project	
2	Mr. Samakeev A. Ozgochor Ayil Okmotu, Land Specialist **Question #1:** The road will be widened to 36 meters and how it would impact the surrounding land, structures, and fields. Additionally, he asked if there would be compensation provided for those affected by these changes. Question #2: Is it necessary to install concrete Jersey barriers in the Darkhan to Karakol section? There is a lot of snowfall, and snowdrifts reach Karakol City. This creates black ice, which is dangerous for vehicles. Please inform if road median dividing fence will be installed, he provided an example of the Bishkek Manas airport road, where he believes a safety median is preferable over concrete barriers that were initially designed for that road. He sought information regarding the inclusion of a median strip in the project. **Question #3** Mr. Samakeev specifically requested information about the trees lining both sides of the road. Acknowledging that these trees are quite old, possibly over 100 years, he agreed that they may need to be cut.	Mr. Azamat Omorbekov: Compensations will be paid to Affected Persons based on the ADB Safeguards Policy Statement requirements. The PIU has provided an update stating that the LARP (Land Acquisition and Resettlement Plan) is nearly completed and encompasses all the necessary measures to minimize the project's impact. **Mr. Azamat Omorbekov** further clarified that compensation for affected individuals will be provided. The amount of compensation was determined by an independent evaluator, utilizing a matrix that takes various factors into account during the calculation process. To minimize the impact, the project opted for an optimal alignment designed by DI KDTP (Design Institute KyrgyzDortransproekt). Regarding the choice between steel or concrete medians, **Mr. Ulanbek Sultanov** stated that concrete medians were chosen for safety considerations. The ends of the barriers would be flared, and bright coloring would be used to attract drivers' attention and enhance safety.	N/A

No.	Question / Comment	Answer	Actions in EIA
	However, he proposed that the cut trees should be distributed among the poor households within the affected villages.		
3	The **Ayil Aymak** representatives made a request for the distribution of old culvert pipes to the locals. They also emphasized the importance of planting trees that do not create excessive shade but also do not have a bush-like appearance.	In response, the **PIU** assured them that many of these requests would be addressed once the project begins in 2024.	Concern about trees will be included in the EIA report.
4	**Madnbekov Salamat NGO Bai Too, Kysyl Suu**, Plastic recycling factory founder extended his best wishes for the success of the project and posed two questions. **Question #1:** Please inform the future maintenance of parking spaces along the road, which were previously maintained either by the Ministry of Transport and Communications (MOTC) or the Ayil Aymak. **Question #2:** How the project is planning to use old asphalt and where it would be applied/stored? Our factory is ready to recycle plastic wastes.	Ulanbek Sultanov Project Designer Kyrgyzdortransproekt (KDTP): Informed that there is a Road Fund under MOTC, who are the owners of all the infrastructure along the road and will make an agreement with Private sector to rent it out. Regarding the recycled asphalt it will be milled and re-used for the road shoulder construction. Excess asphalt might be used for paving secondary roads in villages upon agreement with Ayil Okmotu.	Old asphalt utilization is discussed in the EIA.
5	Jjety Oguz Ayil Aimak resident Temirbekov Kanybek **Question #1:** If the roundabout at Jeti-Oguz intersection will be constructed? **Question #2:** When will the road reconstruction project between Barskoon and Karakol begin?	**Ulanbek Sultanov Project Designer Kyrgyzdortransproekt (KDTP)** has clarified that during the planning phase, a roundabout was indeed considered for the intersection. However, after discussions with the Road Police, it was determined that both roads at that intersection have an equivalent right to pass. As a result, the decision was made to construct a signalized conventional intersection without a roundabout. Traffic management plans will be prepared by Contractor to limit traffic related impacts. According to the plan, the road reconstruction project is scheduled to begin in 2024.	N/A

No.	Question / Comment	Answer	Actions in EIA
6	Several attendees inquired about the period of the construction	**Ulanbek Sultanov Project Designer Kyrgyzdortransproekt (KDTP)** clarified that the project is scheduled to be implemented in 2024-2027.	N/A
7	Alliance of Mountain Communities of Central Asia (AGOCA) Abakirova Bermet **Question:** Project sustainability, how long will the road construction take?	Mr. Sanjar Asanaliev MOTC PIU ADB Projects Coordinator: The road will not be a long-term construction project; it will be built on schedule.	N/A
8	A question regarding the potential occurrence of unexpected issues during the construction phase and how they would be addressed.	Mr. Asylbek Abdygulov MOTC PIU Environment Specialist: In response to the concern raised by the member of the crowd, the PIU representative reassured them that contingencies have been considered to address any unexpected issues that may arise during the construction phase of the project. Measures to reduce dust will be implemented. The project will develop EIA, EMP and contractor will prepare a site-specific EMP where all mitigation measures will be provided as well as budget allocated.	N/A
9	There are periods of very high flow in the river, this should be carefully considered during the detailed design to ensure that flooding does not occur.	During detailed design hydrological studies will be undertaken to ensure that all bridges, culverts, etc., are designed and constructed to the correct specification.	Discussion is included in the EIA.
10	Will there be any delays with project implementation.	Mr. Sanjar Asanaliev MOTC PIU ADB Projects Coordinator addressed the participants' concerns by pointing out that all Asian Development Bank (ADB) projects have been completed on time since 1996. However, he also emphasized that the Ministry of Transport and Communications (MOTC) would require assistance from all stakeholders, including villagers, to fulfill the project's scope of work. Additionally, **Mr. Sanjar** assured the participants that since the project is financed by the ADB, there would be no financing issues as compared to projects funded by other sources. He expressed hope that the project would be completed on time.	Project schedule is include in the EIA.
11	**Mr. Jugaziev Jumabay leading huntsman of Issyk-Kul Nature Reserve, section Jenish** raised concerns regarding the issue of dust on the first two sections of the ongoing reconstruction works for the southern ring road. He specifically highlighted that buckthorn and	Mr. Asylbek Abdygulov MOTC PIU Environment Specialist provided information that an Environmental Impact Assessment (EIA) and an Environmental Management Plan (EMP) are being prepared. These documents will include specific measures for dust suppression, and multiple parties, such as the supervision consultant, environmental agency, and ecology protection	This concern is addressed and discussed in the EIA.

No.	Question / Comment	Answer	Actions in EIA
	barberry bushes, which serve as the main food source for many birds, have been affected along the roadside. He inquired about the measures taken to provide food for the avian fauna if similar effects were to occur on the berry bushes during the construction of new sections. Additionally, **Mr. Jugaziev** pointed out the presence of telegraph poles along the road and expressed concern that if the road is widened, the poles would need to be relocated. This, in turn, could potentially impact the fauna in the area.	agency, will oversee the implementation of necessary mitigation activities to ensure their effectiveness. Furthermore, **Mr. Sanjar** confirmed that the road design has taken into account various elements along the road, including the telegraph poles. Additionally, he mentioned that other features such as shoulders, sidewalks, and lighting have also been considered during the design process.	
12	**Mr. Toytukov Kanatbek deputy director of Jeti Oguz forestry department** raised a question regarding the type of replacement trees that would be planted, specifically inquiring if they would be local or foreign species. He emphasized the significance of trees along the road for nesting birds, highlighting the importance for migrating birds that may not return if the trees are cut down.	Mr. Asylbek Abdygulov MOTC PIU Environment Specialist responded by stating that the selection of tree species would be a collaborative process between the consultant and local forestry representatives. Their aim would be to identify the most suitable tree species for the region, taking into consideration factors such as the local fauna and climate. He also mentioned that the planting procedure would be explained, and there would be plans for the future maintenance of the trees. **Ornithologist Sagynbaev Seitkasy** responded that it is necessary to plant local varieties of trees and shrubs that do not require intensive care. The plants should be low-maintenance and not require frequent watering. Some examples of such plants include wild apricot, wild cherry, narrow-leaved willow, silver poplar, and caragana.	This comment is addressed and discussed in the EIA.
13	**Village Jargylchak, Mr. Bakchiev A.** has proposed supporting the project as the new road will provide opportunities for tourism development on the southern shore. It is important for us to support this initiative for road reconstruction.		Noted and included in the EIA.

No.	Question / Comment	Answer	Actions in EIA
14	**Mr. Kamchigaliev Jety-Oguz administration** expressed a desire for support of the project, stating that local residents will not hinder road construction.		

C. Other Meetings and Consultations

1. Ms. Zhyldyz Asanakunova, Environmental NGO in Issyk-Kul Lake

1005. Date and Place: 09 April 2023, Amaluu Yurt Camp in Bokonbayevo.

1006. The EIA Team met with Ms. Zhyldyz Asanakunova (Figure 201), who is working with an environmental NGO in the southern shores of Issyk-Kul Lake. The NGO promotes sustainable tourism, including ethno-cultural tourist destinations, campaigning for the creation of a geopark and the preservation of natural and cultural heritage in the Issyk-Kul Region.

Figure 201: Ms. Zhyldyz Asanakunova, an NGO worker, explains to the EIA Team their work on sustainable tourism in the Issyk-Kul Region during the meeting held on 09th April 2023 at Amaluu Yurt Camp, Bokonbayevo (10 April 2023).

2. Road Operations Company (ROC), Ministry of Transportation and Communications (MOTC), Jeti-Oguz

1007. Date and Place: 10 April 2023, Barskoon-Karakol Road, Jeti-Oguz Rayon and Karakol City.

1008. Engr. Chyngyshev Mirsen and Mr. Altynbek Omurov, Engineer and Head of the Road Operations Company of MOTC in Jeti-Oguz District (Figure 202), respectively, accompanied the EIA Team in visiting various locations along the Barskoon-Karakol Road that had been affected by flooding, landslides, and mudslides (Figure 203). These events lead to traffic stoppages. They explained to the Team that one of the reasons for the flooding is the inadequate (small) diameter of the culverts and pipes for water flow.

Figure 202: Mr. Altynbek Omurov and Mr. Chyngyshev Mirsen of the Road Operations Company of MOTC in Jeti-Oguz District discussing with the EIA Team member, the problem of flooding in the project area (10 April 2023).

Figure 203``: Road section recently affected by flooding (KM 151+70, 42°12'45.57"N; 77°42'6.94"E) near the village of Kichi Zhargylchak due to inadequately-sized water pipe/culvert (10 April 2023).

3. Ministry of Emergency Situations, Jety-Oguz Rayon.

1009. Date and Place: 10 April 2023. Jeti-Oguz Rayon Administration Building, Kyzyl Suu Village.

1010. Meeting participants included the following:

(i) Shambetaliev Niyimbek, Deputy Head, Ministry of Emergency Situations, Jeti-Oguz District;

(ii) Danshin Alexander Nikolaevich, Head of the Hydromet Department, Jeti-Oguz District;

(iii) Donato dela Cruz, EIA Team Leader and Environment Expert;

(iv) Mark Attree, Deputy EIA Team Leader and Air Quality Expert;

(v) Chinara Sadykova, Biodiversity Expert; and

(vi) Venera Zhunusbaeva, Water Quality Expert.

1011. During the meeting, the Deputy Head of the Ministry of Emergency Situations, discussed problematic areas of the road, including the Zhargylchak Village (Figure 204), where mudflows with stones occur once every five (5) years, floods in three areas Chon Zhargylchak, Kichi Zhargylchak and Ak-Terek Villages. He also mentioned that the Zhuku River normally overflows from the middle of June to end of September every year.

1012. The Team also requested for meteorological and hydrological (surface and groundwater) data from the Ministry.

1013. The Team visited the hydrometeorological station in Jeti-Oguz to review available hydrometeorological data in Jeti-Oguz. Mr. Danshin Alexander Nikolaevich, Head of the Hydrometeorological Department (Figure 205), explained that the hydrometeorological station conducts year-round monitoring and that all data can be obtained from the Hydrometeorological Service in Bishkek. Monitoring of river flow is under the responsibility of the meteorological station in Karakol City.

Figure 204: Project EIA Team with the Deputy Head of the Ministry of Emergency Situations and the Head of Hydrometeorology Station, Jeti-Oguz Rayon held on 10 April 2023 at the Jeti-Oguz Rayon Administration Building (10 April 2023).

Figure 205: (a) Danshin Alexander Nikolaevich, Head of the Hydrometeorological Department, Jeti-Oguz District discussing the hydrometeorological monitoring system is Jeti-Oguz; (b) the meteorological station in Jeti-Oguz (10 April 2023).

4. Meeting with the “Kyrgyz Autozhol” Enterprise, Ministry of Transportation and Communications, Issyk-Kul Oblast

1014. Date and Place: 11 April 2023, Kyrgyz Autozhol” Enterprise, Ministry of Transportation and Communications, Issyk-Kul Oblast.

1015. The EIA Team met with Mr. Beishebaev Taalaybek Yksanovich, the Director of “Kyrgyz Autozhol” Enterprise of the Ministry of Transportation and Communications of Issyk-Kul Oblast and his staff (Figure 206). During the meeting the director mentioned the problem of mudflows in some sections of the road.

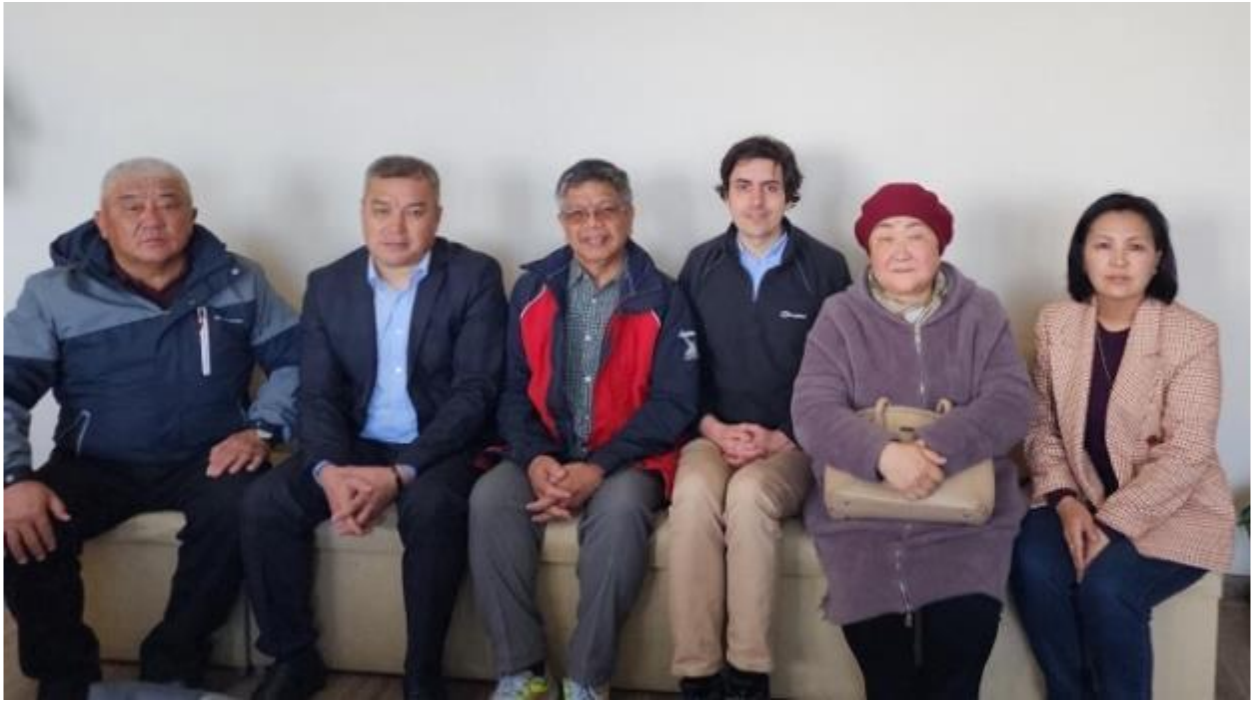


Figure 206: The Project EIA Team with Mr. Beishebaev Taalaybek Yksanovich, the Director of "Kyrgyz Autozhol" Enterprise of the Ministry of Transportation and Communications of Issyk-Kul Oblast and his staff (11 April 2023).

5. Ministry of Mineral Resources, Ecology and Technical Supervision, Issyk-Kul Oblast

1016. Date and Place: 11 April 2023, Office of the Ministry of Mineral Resources, Ecology and Technical Supervision, Issyk-Kul Oblast, Karakol City.

1017. The EIA Team met with Salmaev Beishenbek, Chief Inspector of the Ministry of Mineral Resources, Ecology and Technical Supervision of Issyk-Kul Oblast to discuss monitoring data of rivers in the areas from Barskoon to Karakol City and Issyk-Kul Lake (Figure 207). Mr. Beishenbek mentioned that here is no monitoring data available at their office but data is available in their office in Cholpon-Ata.

Figure 207: Project EIA Team met with Salmaev Beishenbek, Chief Inspector of the Ministry of Mineral Resources, Ecology and Technical Supervision of Issyk-Kul Oblast (11 April 2023).

6. Hydrometeorology Center in Issyk-Kul Oblast

1018. Date and Place: 11 April 2023 Hydrometeorology Center of Issyk-Kul Oblast, Karakol City.

1019. The EIA Team met with the Hydrometeorology Center's meteorologist, Ms. Baibolotova Guljan Jakjylykovna (Figure 208). Ms. Jakjylykovna mentioned that all river flow data are submitted to the Kyrgyz Hydromet in Bishkek. But this data can be accessed only for a fee.

Figure 208: Project EIA Team member with the Ms. Baibolotova Guljan Jakjylykovna, meteorologist of Hydrometeorology Center of Issyk-Kul Oblast (11 April 2023).

7. Ak-Suu Forest Experimental Station (named after V.P. Fatunov) and the Research and Production Center for Forest Research of the ,

1020. Date: 10 April 2023.

1021. The EIA Team visited the Ak-Suu Forest Experimental Station and the Research and Production Center for Forest Research of the Institute of Biology, National Academy of Sciences in Ak-Suu District[129] (Figure 209). The main objective of the visit is to identify possible sources of seedlings of trees and shrubs that need to be planted along the road and discuss with forestry experts what types of plants can be planted along the Barskoon-Karakol Road, including the methods of planting.

1022. The EIA Team met with the Director of the Center, Dr. Candidate Razhapbaev Muslim Kudusovich and Senior Researcher, Dr Canditate Nursultan Chyngojoev (Figure 210). During the meeting Mr. Nursultan and Dr. Razhapbaev, the following points were discussed:

(i) The type of plants to be planted on the road depends on soil condition, rainfall and other parameters.

(ii) For the Barskoon-Karakol Road, elm and poplar trees are appropriate. Other trees that can be planted are willow and birch. Bushes (rybina) can also be planted.

(iii) Newly planted trees shall be cared for (monitored and maintained) for a least five (5) years.

129 www.forest.kg

(iv) The Center can provide seedling and manpower for planting trees along the Barskoon-Karakol Road but needs advance notice of two to three years to enable them to prepare the seedlings (i.e., the seedlings need to be at least two years old before transplanting on road).

Figure 209: Nursery of the Ak-Suu Forest Experimental Station

Figure 210: Meeting with the Director (Dr. Razhapbaev Muslim Kudusovich) and Senior Researcher (Mr. Nursultan Chyngojoev) of the Research and Production Center for Forest Research of the Institute of Biology, National Academy of Sciences, Kyrgyz Republic (11 April 2023).

8. Karakol City Forestry Service, Issyk-Kul Oblast, Ministry of Agriculture

1023. Date and Place: 11 April 2023, Office of the Director, Karakol City Forest Service, Karakol City.

1024. The EIA Team met with Mr. Dabaev Kanatbek Kubanychbekovich, Director of Karakol City Forestry Service, Issyk-Kul Oblast, Ministry of Agriculture (Figure 211). During the meeting he discussed what type of trees and shrubs (seedlings), as well as the methodology of planting of trees/shrubs along the road.

1025. During the meeting he emphasized the following:

(i) The type of plants to be planted on the location.

(ii) For the Barskoon-Karakol Road, elm, poplar and wild apricot, cherry and apple are appropriate. Other trees that can be planted are willow and birch. Poplar, however may not grow in some areas.

(iii) Newly planted trees should be cared for (monitored and maintained) for a least two to three years.

(iv) Newly planted trees should be protected from animals, humans and vehicles by fencing them.

(v) The Karakol City Forest Service can provide seedlings but not the manpower to plant and maintain the trees. The seeds should be ordered in advance (i.e., 1 to 2 years for poplar and 3 to years for elm)

(vi) Fir trees are not recommended as they are very expensive.

(vii) Planting of wild apricot, cherry and apple along the road can attract more tourist.

(viii) It is not recommended to plant in the northside of the Barskoon-Karakol Road as the shade from trees planted on this side of the road will prevent sunlight hitting the road and subsequently the quick melting of snow.

(ix) There are no regulations with regards to replacement of trees that are cut (i.e., no regulation on how many trees should be planted to replace a tree that is cut).


Figure 211: EIA Team with Mr. Dabaev Kanatbek Kubanychbekovich, Director of the Karakol City Forestry Service, Issyk-Kul Oblast, Ministry of Agriculture (11 April 2023).

9. Youth Volunteer Organization "Leadership"

1026. Date and Place: 11 April 2023, Karakol City.

1027. The EIA Team met with a representative of the Youth Volunteer Organization "Leadership"[130] based in Karakol City, Ms. Anastasiia Stysenko (Figure 212). The organization is active in the Issyk-Kul Oblast and the whole country, in general. It is a non-profit organization bringing together young volunteers with the mission of involving youth in civil society through volunteerism, project design and cooperation, both locally and internationally. During the meeting, Ms. Stysenko discussed their air quality monitoring program in Issyk-Kul. They monitor PM_{10} and $PM_{2.5}$ at 7 locations around the Issyk-Kul Lake, with three stations located in Karakol City[131]. She also mentioned that one sensor is located along the Barskoon-Karakol Road, at the Kyzyl Suu Administration Building (Figure 213).

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[130] http://www.leadership.kg/index.php/en/about-us.html
[131] https://aq.kg/

Figure 212: EIA Team meeting with the representative of the Volunteer Organization “Leadership”, Ms. Anastasiia Stysenko (11 April 2022).

Figure 213: Air quality monitor (sensor) of the Volunteer Organization “Leadership”, installed at the administrative building of the Kyzyl Suu Rayon.

10. Ministry of Mineral Resources, Ecology and Technical Supervision, Issyk-Kul Regional Department in Cholpon-Ata

1028. Date and Place: 11 April 2023, Ministry of Mineral Resources, Ecology and Technical Supervision, Issyk-Kul Regional Department in Cholpon-Ata.

1029. The EIA Team met with Mr. Termeev Ruslan, Department Head and Ms. Japarova Gulnaz, Head of Laboratory of the Issyk-Kul Regional Department of the Ministry of Mineral Resources, Ecology and Technical Supervision. The Department have 20 monitoring points in Issyk-Kul Lake. Analysis of water quality at these locations are being carried out 2 to 3 times per year.

11. Meeting with the Issyk-Kul Biosphere Territory

1030. Date and Place: 11 April 2023, Directorate of the Biosphere Territory of Issyk-Kul, Balykchy.

1031. The EIA Team met with Kenenbaeva Anipa, Head of the Biodiversity Department of the Directorate. Ms. Anipa mentioned that they are not responsible for monitoring of Issyk-Kul Lake water quality. However, in the previous years, they did some monitoring and also as part of one project. She provided water quality data for 2016-2018.

12. Deputy Akim (Head), Jeti-Oguz Rayon Administration

1032. Date and Place: 12 April 2023, Office of the Deputy Akim, Jeti-Oguz Rayon Administration Building, Kyzyl Suu.

1033. The EIA Team met with the Deputy Head for Social Services of Jeti-Oguz Rayon, Ms. Beishenbaeva Venera Mukambetovna (Figure 214). Ms. Mukambetovna provided the EIA Team with socioeconomic data of the Jeti-Oguz Rayon, which the Team needs in the preparation of the Project EIA. She mentioned that the main industries in the Rayon include: milk factory, tailoring and brick making.

1034. She also expressed the full support of the Jeti-Oguz Rayon Administration to the project. She also mentioned that there is no opposition to the rehabilitation of the Barskoon-Karakol Road. The Deputy Akim mentioned that she attended a meeting regarding the project during the ADB mission in 2022.

Figure 214: EIA Team with the Deputy Head of Jeti-Oguz Rayon, Ms. Beishenbaeva Venera Mukambetovna (11 April 2022).

13. Jeti-Oguz District Forestry Service, Issyk-Kul Oblast, Ministry of Agriculture

1035. Date and Place: 12 April 2023, Jeti-Oguz Rayon Administration Building, Kyzyl Suu.

1036. The EIA Team met with Mr. Kanatbek Toitukov, Deputy Director, Jeti-Oguz Forest Service, Issyk-Kul Oblast, Ministry of Agriculture. Deputy Director Kanatbek Toitukov, showed the EIA Team the District Forestry Service nursery (Figure 215). During the meeting Deputy Director Toitukov mentioned the following:

(i) The Jeti-Oguz District Forestry Service has the capacity to prepare seedlings for trees needed in the road project. Seedlings of elm karagach, poplar, wild apricot and wild cherry should be planted immediately as by the time road rehabilitation is started, the seedlings will be 2-3 years old. Tree seedlings can be grown in the nursery by pre-order.

(ii) Trees that could be planted along the road, include: wild cherry, wild olive, and vinegar tree requiring minimal care and water. Planting of silver poplar and elm are also recommended.

(iii) Protection of the trees from animals eating them should be provided after planting.

(iv) Local plant species should be planted. When selecting trees for planting, it is necessary to take into account soil conditions, i.e., there are trees that grow well in alkaline soils and others in saline soils.

(v) It is very good to plant a wild cherry, and a wild apricot, oleaster Elaeagnus angustifolia, which are not fastidious in care and do not need frequent watering. It is good for tourism as tourist can pick the apricot fruit for drying and eating.

(vi) Spruce or Fir tree is not suitable to plant, as its expensive (the cost of 1-meter spruce or fir tree is approximately 1000 Soms), very slowly growing, requires care for the first 5 years after planting, and constant watering.

(vii) The first 5 years after planting the trees requires good care and watering, so that the trees take root and become stable.

(viii) An ecologist/ forester should be hired to manage the planting and maintenance of the trees.

Figure 215: EIA Team meeting with Mr. Kanatbek Toitukov, Deputy Director, Jeti-Oguz Forest Service, Issyk-Kul Oblast, Ministry of Agriculture (12 April 2022).

14. Baitoo Public Foundation, Saruu Village

1037. Date and Place: 12 April 2023, Saruu Village

1038. The EIA Team visited the waste plastic recycling facility of the Baitoo Public Foundation in Saruu Village (Figure 216 (b)). The manager of the facility, Mr. Madanbekov Salamat explained to the Team the recycling process from segregation of the plastic to the conversion of the plastic to pellet form (Figure 216(a)), which is sold to manufacturers of plastic products. The waste plastic is collected from various parts of the country.

1039. The Nature Development Fund financed the purchase of equipment for a plastic recycling facility. The plastic recycling facility in addition to recycling plastics provides jobs for the local population of the village. Saruu.

1040. Plastic recycling from wastes bins along the road project, particularly from the bus stops and the view deck can be segregated and sent to recycling to this facility.

1041. The Baitoo Public Foundation is registered with the Issyk-Kul Oblast Department of Justice on January 29, 2003. Its main purpose is to protect the environment and natural resources of the biosphere of the Issyk-Kul Oblast, and promotion of environmentally safe socio-economic development.

Figure 216: EIA Teamvisited the plastic recycling facility of Baitoo Public Foundation in Saruu Village. (a) Recycled plastic pellet ready for sale. (b) The EIA Team with Mr. Madanbekov Salamat manager of Baitoo Public Foundation's plastic recycling facility in Saruu Village. (12 April 2022).

15. Mr. Bapaev Chyngyz Arstanovich, First Vice Mayor, Karakol City

1042. Date and place: 12 April 2023, Office of the First Vice Mayor, Karakol City.

1043. The EIA Team met with First Vice Mayor of Karakol City, Mr. Bapayev Chyngyz Arstanovich and Chief of Staff Sagynbaev Ryskul Jumakadyrovich (Figure 217). The First Vice Mayor have already met with the ADB Mission in 2022. Karakol City Hall is ready to provide full support and cooperation to the project. He expressed that he will support the preparation for and conduct of the public hearing (provide a place, lists of participants and other support).

Figure 217:The EIA Team with First Vice Mayor of Karakol City, Mr. Bapayev Chyngyz Arstanovich at his office (12 April 2022).

16. Public Foundation "El-Too"

1044. Date and Place: 12 April 2023, El-Too Yurt Camp, Bokonbaevo

1045. The EIA Team met with Mr. Choitonovbaev Bakyt (Figure 218), the founder of the Public Foundation El-Too[132]. The Foundation, which was established in 2001 and has 19 years of experience in promoting and developing community-based ecotourism, raising awareness of local population in sustainable use of natural resources, introduction of energy-efficient technologies, community initiated micro-bioreserves, permaculture practices, sustainable livelihood and food security in South of Issyk-Kul Region. The foundation unites voluntarily 3 community initiative groups, 50 members and cooperates with 15 schools on the south of Issyk-Kul Lake. 14 organizations from Kyrgyz Republic are members of the Alliance of Central Asian Mountain Communities (AGOCA) is an association of mountain villages of Kazakhstan, Kyrgyz Republic and Tajikistan founded in 2003. Association of mountain organization activities in the area of environment protection, gender, food security and rural development.

1046. The foundation unites voluntarily three (3) community initiative groups, 50 members and cooperates with 15 schools on the south of Issyk-Kul Lake. It is a member of the Alliance of Central Asian Mountain Communities (AGOCA), an association of mountain villages of Kazakhstan, Kyrgyz Republic and Tajikistan founded in 2003 engaged in environment protection, gender, food security and rural development

[132] www.el-too.com

Figure 218: The EIA Team with Mr. Choitonovbaev Bakyt, the founder of the Public Foundation El-Too (12 April 2022).

17. Directorate of the Biosphere Territory of Issyk-Kul

1047. Date and Place: 12 April 2023, Directorate of the Biosphere Territory of Issyk-Kul Office, Balykchy.

1048. The EIA Team met with the Directorate of the Biosphere Territory of Issyk-Kul, Deputy Director Mr. Suiundukov Kanatbek, Head of Department Kenenbaeva Anipa Tolonovna, Head of Department of Biodiversity Kojokeev Turatbek Rakhimberdievich (Figure 219).

1049. During the meeting the Directorate provided the EIA Team with maps (with UTM coordinates) of the two core zones nearest to the project site. The Deputy Director committed to provide the Team with map of the two zones in GIS format. The Directorate also expressed the need for specialists to conduct monitoring of the biodiversity of Issyk-Kul. The Directorate also reiterated that the project should be Category A as the site is within the Issyk-Kul Biosphere Territory, which is a legislated biosphere territory, a Ramsar Sit and included in the “World Network of Biosphere Reserves” (Figure 220).

Figure 219: The EIA Team meeting with the Directorate of the Biosphere Territory of Issyk-Kul (12 April 2022).

Figure 220: Certificate of inclusion of the Issyk-Kul Biosphere Territory to the "World Network of Biosphere Reserves" under UNESCO's "Man and the Biosphere Programme.

VIII. Grievance Redress Mechanism

A. Introduction

1050. The Grievance Redress Mechanism (GRM) is a system established to ensure grievances on environmental performance during the road project's life cycle, particularly during the construction and possibly during operational phases, are addressed by the PIU) Project activities like site preparation, building and operation of construction camps, land acquirement (if required), environmental (e.g., dust, noise, vibration), health and safety incidents etc. may become a source of community grievances, which will be address according to the procedure established in this Chapter of the EIA Report.

1051. Affected people have the right to file complaints and/or queries on any aspect of the project, including environmental safeguard issues. Under the GRM, people can appeal any decision, practice or activity related to the project. All possible avenues will be made available to affected people and local authorities to voice their grievances. The project/PIU will ensure that grievances and complaints on any aspect of the project are addressed in a timely and effective manner.

1052. The GRM for environmental and social issues are aligned and similar with the GRM for the Land Acquisition and Resettlement Plan (LARP) for the project.

1053. **ADB Policy (SPS, 2009) Requirements**. ADB SPS (June 2009) specifies the following requirements on GRM[133]:

1054. "The borrower/client will establish a mechanism to receive and facilitate resolution of affected peoples' concerns, complaints, and grievances about the project's environmental performance. The grievance mechanism should be scaled to the risks and adverse impacts of the project. It should address affected people's concerns and complaints promptly, using an understandable and transparent process that is gender responsive, culturally appropriate, and readily accessible to all segments of the affected people at no costs and without retribution. The mechanism should not impede access to the country's judicial or administrative remedies. The affected people will be appropriately informed about the mechanism."

B. Objectives

1055. The GRM is a process that provides a trusted venue through which affected people can voice and resolve concerns about the project and through which the project implementor also finds an effective way to address the affected people's concerns.

1056. The objectives of the GRM are:

(i) To reach mutually agreed solutions satisfactory to both the project and the affected people, and to resolve any grievances in consultation with the aggrieved party;

(ii) To facilitate the smooth implementation of the project, particularly avoid or minimize lengthy litigation processes and prevent delays in project implementation; and

(iii) To facilitate the consultation at the local level, while maintaining transparency as well as to establish accountability to the affected people.

[133] ADB. Safeguard Policy Statement. June 2009.

C. Specific Project GRM

1. Legal Framework

1057. The project's GRM was approved by the Minister of MOTC through the issuance of MOTC Order No.127 (on Grievance Redress Group) dated 26 April 2023 (Annex 23). This order aims to ensure transparency and objectivity of decisions made and interaction of the MOTC with local authorities and civil society in the process of implementing the project.

1058. The mechanism consists of grievance resolution at two levels: the local and central government levels. At each level, grievance redress groups (GRGs) are established. The role and responsibility of the GRGs is to accept claims and complaints, assess its validity, determine the scope of eventual impacts, and timely resolve the issue, including the claims regarding the compensation and maintain GRM as flexible and efficient to address and resolve the claims during project implementation.

1059. The GRM covers issues related to social, environmental and other safeguard issues under the ADB SPS and Kyrgyz laws.

2. Grievance Redress Groups

1060. As established by MOTC Order No. 127 (April 2023), the local and central level GRGs will function for the duration of the project. The local GRG is set in Jeti-Oguz Rayon and the central GRG is set at MOTC in Bishkek. Table 121 shows the composition of the local level GRG.

Table 121: Local GRG Composition

Member	Position
Deputy Head of State Administration of the Jeti-Oguz Rayon (by agreement)	Chairperson
Deputy Head of State Administration of the Ak-Suu Rayon (by agreement)	Member
Heads of ayil aimaks* (also as LFPs)	Members
Heads of DEP** No.3 and DEP No.35	Members
Social Safeguard Specialist, ADB PIU of MOTC	Member
Environment Safeguard Specialist, ADB PIU of MOTC	Member
Representative affected people	Members
Representatives from NGOs (by agreement)	Members
Representative of Issyk-Kul Oblast (by agreement)	Member
Representative of Public Supervision Board of MOTC (by agreement)	Member
Observers	Observers

*Ayil Aimaks – rural districts; DEP – local maintenance unit

Table 122lists the composition of the central level GRG:

Table 122: Central GRG Composition

Member	Position held
Coordinator, ADB PIU of MOTC	Chairperson
Heads of RMD No.3 and No.35	Members
Social Safeguard Specialist, ADB PIU of MOTC	Member
Environment Safeguard Specialist, ADB PIU of MOTC	Member

Architectural and Land Solutions Specialist, ADB PIU of MOTC	Member
Representative of Issyk-Kul Oblast (by agreement)	Observer
Representative of Public Supervision Board of MOTC (by agreement)	Observer
Representatives of NGOs (by agreement)	Observers

1061. At each level of appeal, the GRG will be assisted as needed by the professional capacity to solve specific cases. They include:

(i) Representatives of Rayon Administration

(ii) Representatives of the Rayon Branch of the State Agency for Architecture and Construction

(iii) Gosregister (State Registration Services) of the Rayon

(iv) Ministry of Agriculture

(v) Ministry of Natural Resources, Ecology and Technical Supervision

(vi) Ministry of State Property

(vii) Ministry of Emergency Situations

(vii) Technical experts - professional engineers, and consultants with relevant experience in social safeguards and resettlement.

3. Grievance Resolution Process

1062. Complaints and grievances from the affected people will be addressed through the procedure illustrated in Figure 221 and detailed in Table 123.

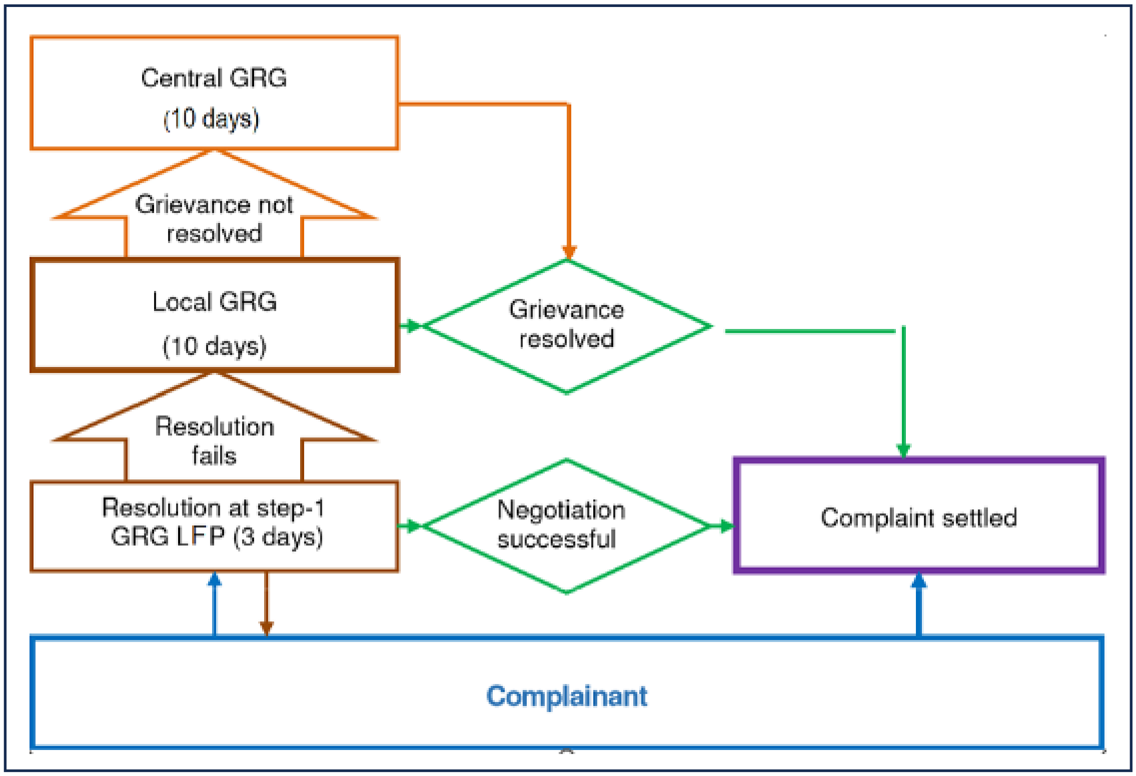

Figure 221: Grievance Redress Procedure

Table 123: Grievance Redress Procedure

Step	Action Level	Process	Timeline
1	Resolution by local focal point (LFP) at ayil aimak level	At the initial stage, the LFP (head of ayil aimak) will give hearing to the aggrieved person and try to give an acceptable solution. If an aggrieved person is not satisfied with the solution, then she/he will lodge grievances in writing to the rayon or local level GRG within 3 days.	3 days
2	Resolution at local level	After receiving a written complaint, the chairperson will review and prepare a Case File for GRG hearing and resolution. A formal hearing will be held with the GRG on a date fixed by the chairperson in consultation with the aggrieved person. On the date of hearing, the aggrieved person will appear before the GRG and present proofs in support of his/her claim. The GRG will note down the statements of the complainant and document all proofs. The decision from the majority of the members will be considered final from the GRG and will be issued by the chairperson and signed by other members of the GRG. The case record will be updated and the decision will be communicated to the aggrieved person by the chairperson within 10 days. If an aggrieved person is not satisfied with the solution, the chairperson will lodge a grievance in written to the central GRG at MOTC with conclusion and supporting documents prepared at local level.	10 days
3	Resolution at central level	After receiving a written complaint, the central GRG chairperson will review and prepare a Case File for GRG hearing and resolution. A formal hearing will be held on a date fixed by the	10 days

Step	Action Level	Process	Timeline
		GRG chairperson and the aggrieved person. GRG members will contact the complainant and visit his/her village. The Environment Officer of PIU will note down the statements of the complainant and document all proofs. The decisions from the majority of the members will be considered final from the central GRG and will be issued by the chairperson and signed by other members. The case record will be updated and the decision will be communicated to the aggrieved person by the environment officer of PIU within 10 days of submission.	

4. Additional Mechanisms

1063. Any physical and legal person, any appellant can communicate his/her concern to the court at any stage of grievance redress. The GRGs will not restrict or influence people from applying to court for legal remedies. If the complaint is found invalid, the GRG will formulate a response and send a written letter to the complainant, explaining the reasons for rejection.

1064. In addition, ADB has its Accountability Mechanism Policy (2012)[134], “a forum where people adversely affected by ADB-assisted projects can voice and seek solutions to their problems and report alleged noncompliance with ADB's operational policies and procedures”. The complainant, if not satisfied with GRGs’ decision or even the court’s decision, can appeal the case to the Office of the Special Office Facilitator of ADB. The GRGs will not in any way impede affected people’s access to the ADB Accountability Mechanism.

5. Complaint Documentation

1065. The PIU of the MOTC will document all grievances in both written and electronic forms.

134 ADB. Accountability Mechanisms. https://www.adb.org/who-we-are/accountability-mechanism/main

IX. Environmental Management Plan

A. Objectives

1066. This Environmental Management Plan (EMP) presents measures that shall be undertaken during the different phases of the road project implementation. The EMP's key objective is to prevent and where prevention is not possible, to minimize, mitigate and/or offset adverse environmental impacts of the project. This EMP includes mitigation and management measures identified in the EIA that need to be implemented, including cost estimates, institutional arrangement (i.e., organizational setup), monitoring program and reporting, and timeframe for implementation of the plan.

1067. The main objective of this EMP is to ensure that the implementation of the project in undertaken in a responsible manner that ensures protection of the environment and the welfare of the stakeholders. The EMP provides the following:

(i) A proactive, feasible, and practical working tool to enable the measurement and monitoring of the project's environmental performance;

(ii) Detailed guidance and requirements to ensure the proper implementation of the findings and the recommendations of the project's EIA;

(iii) Specific actions necessary to avoid or mitigate the environmental impacts of the project and ensure the safety of workers and the community where the project is located.

1068. The EIA Report, including the EMP, will be included in the bidding and contract documents, so by accepting the contract, the Contractor will be legally obliged to implement all specified mitigation measures, including the allocation of budget to implement all mitigation measures and monitoring activities required in the EMP, and provisional sum that will ensure funding for any budget shortfall or for addressing any unanticipated impacts during the construction phase and DNP of the project.

1069. The EMP sets out the mitigation measures that the Contractor is required to provide and implement during construction and defect notification period (DNP) and the manner in which the PIU requires the mitigation to be provided. The methods to be used for site preparation and construction, as well as associated arrangements to ensure sound environmental management and safety at all times, are already defined in the bid documents. The Contractor shall prepare a site-specific EMP (SSEMP) based on the EMP and the project's EIA Report to make it relevant to the particular condition and setting during the project's construction and DNP phases.

1070. The Contractor shall prepare the SSEMP describing specific design features that will ensure environmental protection and set out the work methods, management, and mitigation measures and monitoring that will be put in place, for each of the various activities, during the implementation of the project. The scope of the SSEMP shall address all of the issues itemized in the EMP in this EIA Report. The SSEMP shall have the same level or stricter set of measures than those included in the EMP of this EIA Report. The SSEMP shall consider relevant ISO standards (e.g., ISO 14001) when detailing the project's environmental management system. The Contractor shall submit the SSEMP to PIU. PIU shall submit a copy of the SSEMP to ADB for review and disclosure.

1071. If there will be significant changes in the final detailed design of the project compared to the preliminary design used in the EIA, the Contractor shall accordingly update the EIA Report and the EMP, including budget that will cover implementation of any additional mitigation measures and monitoring activities. The Contractor shall submit the updated EIA Report including the EMP to PIU, and the PIU shall submit the EIA Report and other relevant documents to ADB for final review and disclosure.

1072. The Contractor is required to (i) establish an operational system for managing environmental impacts; (ii) implement mitigation measures and monitoring requirements set forth in the EIA Report, EMP and SSEMP; (iii) implement any corrective or preventive actions set out in safeguards monitoring reports that PIU will prepare from time to time to monitor implementation of the project's EIA and EMP; and (iv) allocate budget for compliance with these EMP requirements, monitoring activities and actions, including provisional sum where to draw budget for any shortfall in the initial budget estimates and for addressing any unanticipated impacts during construction and DNP phase of the project.

B. Institutional Arrangement

1. Implementation Arrangements

1073. The executing agency is the Ministry of Transport and Communications (MOTC) of the Kyrgyz Republic. The project steering committee chaired by the Minister, through the MOTC, will provide overall guidance and strategic directions to the project. The MOTC will establish the Project Implementation Unit (PIU) composed of officials and staff from the MOTC. The PIU will be continuously strengthened with external experts, as may be required, throughout the implementation of the project. The PIU will be supported by Construction Supervision Consultant (CSC), a professional engineering and management consulting firm. The CSC will assist in the delivery of the different project components, which include the construction and NDP, including capacity building of MOTC and PIU in monitoring road construction and operations. The CSC will act as MOTC's representative during the construction and NDP. The CSC will have national and international environmental safeguards specialist/consultant responsible for overseeing implementation of environmental safeguards on behalf of MOTC and PIU. The terms of reference for CSC is attached as Annex 24. The Contractor will be responsible for the implementation of the project, and other responsibilities as indicated in the contract documents. In compliance with the requirement of ADB SPS, the project, as a Category A undertaking with significant impacts and risks, shall retain an external environmental monitoring expert consultant who will verify monitoring information.

1074. **MOTC**. As the executing agency, MOTC shall:

(i) Serve as focal point for communication with ADB on project related matters, and signatory to contract agreements for civil works, consulting and non-consulting services, withdrawal applications, and audit reports;

(ii) Ensure timely completion of the project;

(iii) Ensure that PIU is fully staffed and functional during the entire period of implementation;

(iv) Supervise all consultancy and works contracts (including instructing the supervision consultant, approving contract variations, suspending, and terminating contracts); and

(v) Ensure compliance with financing covenants, ADB's guidelines, procedures, and policies.

1075. **Project Implementing Unit (PIU)**. As the project's implementing unit will have the following functions during the pre-construction phase and construction phases:

(i) Pre-construction phase:

(a) Advise MOTC on procurement of goods, works, consulting and non-consulting services;

(b) Design learning and development program;

(c) Review and verify documents submitted by contractors, consultants, suppliers, and service providers; and

(c) Obtain ADB approvals.

(ii) Construction phase:

(a) Monitor and evaluate project activities and outputs;

(b) Administer contracts and ensure minimal variations and deviations from original prices and schedules;

(c) Ensure compliance with ADB's Safeguards Policy Statement 2009 (as amended from time to time);

(d) Ensure compliance with ADB's financial management guidelines;

(e) Report the project's progress to MOTC and ADB;

(f) Assist ADB project review missions; and

(g) Consult with the public and disclose project information, in consultation with ADB.

1076. **ADB**. The ADB will monitor and review overall project implementation in consultation with MOTC/PIU, including:

(i) the project implementation schedule;

(ii) actions required in terms of environmental and resettlement impacts;

(ii) approvals of project implementation and procurement documents;

(iv) timeliness of budgetary allocations and counterpart funding;

(v) project expenditures, progress with procurement and disbursement, and SOE;

(vi) compliance with particular loan covenants;

(vii) disclosure of relevant project information and documents and knowledge sharing; and

(viii) the likelihood of attaining the project's immediate development objective.

2. Environmental Management Roles and Responsibilities

1077. Environmental management roles and responsibilities with respect to the project area discussed below.

a) Contractor

1078. The Contractor will have primary responsibility for implementing the EMP during the construction stage and will:

(i) Appoint a qualified full-time environmental health and safety (EHS) manager to manage implementation of the EMP and monitoring plan;

(ii) Ensure that sufficient number of engineers/staffs are trained effectively on the implementation of the EMP and SSEMP who will assist the EHS manager, subject to internal manpower arrangements but at the minimum shall include the following: (1) Environmental Specialist; (ii) Road Safety Engineer; and (iii) Health and Safety Engineer.

(iii) Ensure that all shift schedules shall include the EHS manager or at least one trained engineer/staff on EMP and SSEMP implementation;

(iv) Obtain necessary environmental license(s), permits, etc. from relevant agencies as prior to commencement of civil works contracts;

(v) Undertake all necessary studies required in this EIA report, such as vibration study, among others as may be deemed necessary;

(vi) Prepare all work program and pre-approved project plans required for implementing the EMP during construction phase as follows:

(a) Waste Management Plan;

(b) Occupational Health and Safety Plan following international best practices on occupational health and safety such as those in Section 4.2 of IFC EHS Guidelines on Construction and Decommissioning Activities;

(c) Construction Camp Development and Management Plan;

(d) Spill Control and Containment Plan;

(e) Traffic Management Plan around the construction site to ensure easy access and passage vehicles;

(f) Dust Management Plan;

(g) Asbestos Containing Materials (ACM) Management Plan;

(h) Construction Logistics Plan;

(i) Vibration Management Plan;

(j) Water, Wastewater and Drainage Management Plan;

(k) Stakeholders Communication Plan;

(l) Tree Planting Management Plan; and

(j) Biodiversity Management Plan.

(vii) Implement all mitigation measures in the EMP and activities in the Monitoring Plan, including allocation of budget to implement the EMP/SSEMP, monitoring program and measures for any unanticipated impacts during the construction and DNP phases of the project;

(viii) Ensure that all workers, site agents, including site supervisors and management participate in training sessions delivered by the project proponent;

(ix) Ensure compliance with environmental statutory requirements and contractual obligations;

(x) Participate in resolving issues as a member of the Grievance Redress Committee;

(xi) Respond promptly to grievances raised by the local community or any stakeholder and implement time-bound environmental corrective actions or additional environmental mitigation measures as necessary;

(xii) Based on the results of EMP monitoring, cooperate with the PIU to prepare and implement time-bound corrective action plans, as necessary; and

(xiii) Provide necessary support to the external environment expert consultant who will be retained under the project (see below description of external environment expert).

1079. **Terms of Reference for PIU Environment Officer**. Key tasks and responsibilities of the PIU Environment Officer are as follows:

(i) Ensure that EIA Report with the EMP is updated based on final detailed designs, in coordination with the Contractor;

(ii) Ensure that EIA Report with the EMP is included in bidding and contract documents;

(iii) Ensure that costs for implementing the EMP, including those special cost indicated in Table 128 are included in the BOQ (or equivalent) of the bidding and contract documents;

(iv) Ensure that the Contractor's SSEMP is consistent with the EMP. The SSEMP shall have the same level of detail or stricter mitigation measures than the EMP;

(v) Provide oversight on environmental management aspects of the project and ensure EMP and SSEMP are implemented by the Contractor;

(vi) Establish a system to monitor environmental safeguards of the project, including monitoring the indicators set out in the monitoring plan of the EMP;

(vii) Confirm compliance of Contractor with obtaining statutory clearances or permits required under the project, including environmental clearances as applicable;

(viii) Review, monitor, and evaluate the effectiveness with which the EMPs are implemented, and recommend necessary corrective actions to be taken as necessary;

(ix) Consolidate monthly environmental monitoring reports from Contractor and submit quarterly monitoring reports to ADB and required reports to government ministries;

(x) Ensure timely disclosure of final EIA report in locations and form accessible to the public;

(xi) Address any grievances brought about through the grievance redress mechanism in a timely manner;

(xii) Provide assistance to Contractor's EHS Manager (as may be needed) on delivering orientation to Contractor's personnel regarding environmental management arrangements for the project;

(xiii) Visit worksites during construction phase and the road corridor during operation phase, and provide guidance relating to supervision and compliance monitoring;

(xiv) Provide necessary support to the external environment expert consultant who will be retained under the project (see below description of external environment expert); and

(xv) Provide inputs to progress reports and the project completion report.

b) CSC Safeguards Specialists.

1080. The CSC shall employ the following specialists (refer to Annex 25, for the specific terms of reference):

(i) One (1) National Environmental Specialist;

(iii) One (1) National Health and Safety Specialist; and

(iv) One (1) International Environment Specialist.

1081. These team of safeguard specialists will have the following responsibilities, shared among them:

(i) Assist PIU in meeting requirements of ADB SPS and the government on environment, occupational health and safety, and labor standards;

(ii) Assist PIU in obtaining all necessary permissions and complying with statutory requirements;

(iii) Ensure Contractor submits requirements per EMP and government clearances/permits;

(iv) Provide support to Contractor in preparing the site-specific EMP (SSEMP) to ensure ADB SPS and conditions in government clearances are incorporated accordingly;

(v) Assist PIU in updating the EIA for any change in scope, design, location, or unanticipated impacts that are not reported in the EIA;

(vi) Review any changes in the Contractor's design and support PIU in ensuring environmental assessment, impacts avoidance and mitigation measures are reflected in the SSEMP and updated EIA;

(vii) Assist the Contractor and the PIU in all project related environmental clearances, and ADB's no-objection, and monitor and control construction compliance against the updated EIA, ADB SPS, and SSEMP;

(viii) Monitor the contractors' compliance with all safety requirements as stated in contract and SSEMP, during and prior to any construction activity;

(ix) Assist in preparation of accident report and keeping accident records on-site as required;

(x) Monitor the implementation of the SSEMP during construction and pre/post construction phases;

(xi) Assist PIU in continuing stakeholders' engagement, consultations, information disclosure and addressing complaints/grievances;

(xii) Develop public awareness program and materials to support wider understanding of the project, potential impacts and measures to ensure impacts are avoided, mitigated and affected people, if any, are compensated;

(xiii) Assist PIU in preparation of environmental monitoring reports;

(xiv) Coordinate with external environment experts on results of independent monitoring and support PIU to prepare corrective actions, if required;

(xv) Provide and organize trainings/workshops/seminars on environmental safeguards, occupational health and safety, and labor standards

(xvi) Assist PIU in review of contractor's health and safety program and in monitoring its implementation;

(xvii) Support PIU during ADB review missions;

(xviii) Support PIU in developing data management system on environmental safeguards; and

(xix) Other tasks related to environmental safeguards, occupational health and safety, and labor standards.

c) External Environment Experts

1082. In compliance with the requirement of ADB SPS, the project, as a Category A undertaking with significant impacts and risks, shall retain external environment expert consultants that at the minimum will include: (i) one (1) international environment expert; and one (i) local environment expert. These experts shall have expertise on road project construction and operation and experience in management and monitoring of environmental impacts of such kind of infrastructure projects. The environment experts shall be hired on an intermittent basis. During the 3-year construction period: twice during the 6 months where there are civil works and once to prepare the annual external monitoring report or the environmental audit report. During the 5-year DNP: once a year. . The environment experts will coordinate and work closely with PIU and the Contractor when planning or fielding monitoring activities, including requests for information or documents that will facilitate the task. Per ADB SPS, the environment experts shall not be involved in day-to-day project implementation or supervision of the project and will report directly to ADB. The terms of reference of the external environment experts is attached as Annex 25.

C. Environmental Management Plan Matrix

1083. Table 124 shows the Environment Management Plan (stage-wise) summarizing the potential adverse environmental impacts, proposed mitigation measures, responsible parties, and cost of implementation. This EMP will be included in the bidding and contract documents.

1084. Table 125 shows the proposed Environmental Monitoring Plan (EMOP) for the project. It includes all suggested environmental parameters, description of sampling stations, frequency of monitoring, applicable standards, and responsible parties.

Table 124: Environmental Management Plan Matrix

No.	Field or Activity	Potential Impact/ Issue	Mitigating Measure	Compliance Evidence	Monitoring Frequency	Implementing Agency	Monitoring Agency	Estimated Cost (USD)
	Pre-Construction							
1	Invitation for bids	Bidding documents are issued without the project's EMP and/or the EIA	No bidding documents shall be issued without having the mitigation measures and monitoring requirements in the project's EIA/EMP report included in the safeguard clauses of technical specifications in bidding and contract documents.	Bidding and contract documents include safeguard provisions and the projects EIA Report and EMP	▪ During drafting of bidding and contract documents ▪ Before the issuance of bidding documents for IFB ▪ Before awarding of contracts	MOTC/PIU	MOTC	No cost
2	Consents, permits, clearances, no objection certificate (NOC), etc.	Stoppage of activities due to lack of permits or clearances from the local and national governments.	▪ Prepare and submit the project's OVOS and obtain environmental permit from the MNERTS ▪ Obtain all necessary consents, permits, clearance, NOCs, prior to start of civil works.	Permits, clearances and approvals	Once prior to start of construction	MOTC/PIU	MOTC	20,000
Construction Phase								
3	Overall project site management	Poor environmental management by Contractor	▪ Designate one full time and qualified EHS) Manager who will be in charge of the overall EMP/SSEMP implementation and other tasks as required in the EIA report. He/ She shall be in place from the day of mobilization of contractor. ▪ In addition to the EHS Manager, designate qualified trained engineers/staff on EHs (an Environmental Specialist, a Road Safety Engineer, and a Health and Safety Specialist) who will ensure EMP/SSEMP implementation for every work shift during construction stage who will assist the EHS Manager (either in his/her presence or absence) at all times. ▪ Coordinate with the PIU on additional studies/ surveys identified during the EIA that need to be conducted once the Contractor is selected and complete these studies as required with support of external experts.	▪ Included in manpower requirements as indicated in bidding documents and final contract documents. ▪ Hired EHS Manager and EHS engineers/staff.	One-off during mobilization and continuously throughout the contract period	Contractor	PIU//CSC	Part of Contractor's contract
4	Sources of raw materials - quarries and burrow pits	Extraction of raw materials for construction (e.g., sand, gravel and crushed stone) in quarries and burrow pits will cause changes in topography and/or river morphology and hydrology.	▪ As much as possible, utilize existing quarries or borrow pits as listed in the EIA Report. ▪ Before applying for a quarry permit, an environmental study shall be carried out to assess potential impacts and control measures to minimize environmental impacts of quarrying (this is especially relevant for extraction from near or in rivers or lakes). ▪ Obtain permit from relevant agency prior to quarrying. ▪ Coordinate with local authorities. ▪	▪ Permit from relevant agency ▪ Location of quarry and burrow pits ▪ Record of sources of raw materials. ▪ Regular site inspection of quarries and burrow pits.	Monthly or as required	Contractor	PIU/CSC	Part of Contractor's contract

No.	Field or Activity	Potential Impact/ Issue	Mitigating Measure	Compliance Evidence	Monitoring Frequency	Implementing Agency	Monitoring Agency	Estimated Cost (USD)
			▪ Areas that could impact Issyk-Kul Lake shall be avoided. ▪ Site specific borrow management plans should be developed and approved by relevant authorities. ▪ A map of all borrow sites /quarries will be developed and maintained. ▪ Safety measures, if required, will be implemented to prevent access to borrow sites /quarries by members of the public and livestock. ▪ Measures for control of dust during extraction, handling and transport of materials will be applied. ▪ Measures to rehabilitate borrow sites shall include contouring slopes within each site and reseeding / planting native species. ▪ Quarries in the Biosphere Territory of Issyk-Kul should be avoided to prevent unnecessary environmental impacts. Consultations shall be held with the Directorate of the Biosphere Territory of Issyk-Kul to obtain expert opinion. ▪ Borrow sites /quarries sites must be at least 500m from Lake Issyk.					
5	Air quality – dust emissions	The most significant impact of construction activities is the generation of airborne dust. The predicted magnitude of dust impacts is high, and there are large numbers of high sensitivity receptors close to the construction works; as a result, the risk in terms of both dust soiling and human health is categorized as "High" for demolition, earthworks, construction and track out activities.	▪ Prepare a detailed Dust Management Plan (DMP) as part of the SSEMP, which at the minimum shall include the control measures listed below. ▪ Regular dust suppression (watering) along roads and the earthwork sites and ensure that adequate water supply for dust suppression is available. ▪ Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible. Crusher site and mixing plants shall be located at least 500m to 1km downwind of sensitive receptors and settlement areas. ▪ Avoid (or suspend) dust-generating activities during windy periods such soil stripping/ earthworks. ▪ Minimize drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment, when appropriate. ▪ Limit the speed of all construction vehicles at <20km/h. ▪ Cover earth material (e.g., sand) transporting trucks and ensure vehicles entering and leaving sites are covered to prevent escape of particulate materials during transport. ▪ Wet/spray with water stockpiles during loading operations in dry or windy conditions.	▪ DMP document. ▪ Records of watering (no. of water lorry trips) ▪ Location of stockpiles and dust causing activities. ▪ Speed limit signs at strategic locations. ▪ Regular site inspection report that verifies implementation of control measures. ▪ Number of complaints from sensitive receptors. ▪ Attendance to training on dust management techniques for machine operator, including copy of module.	▪Daily or as required for inspection and monitoring report.	Contractor	PIU/CSC	Part of Contractor's contract

No.	Field or Activity	Potential Impact/ Issue	Mitigating Measure	Compliance Evidence	Monitoring Frequency	Implementing Agency	Monitoring Agency	Estimated Cost (USD)
			▪ Cover particulate materials stockpiles. ▪ Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and if possible, stored in silos with suitable systems to prevent escape of material and overfilling during delivery ▪ For smaller supplies of fine power materials, ensure bags are sealed after use and stored appropriately to prevent dust. ▪ Fully enclose or install dust screens or barriers on or around site or specific operations where there is a high potential for dust production and the site is active for an extended period. ▪ Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. Cover if they are being re-used on-site. ▪ Cover stockpiles of particulate construction materials. ▪ Use enclosed chutes and conveyors and covered bins. ▪ Regularly clean crusher site to remove fine dust. Keep site fencing, barriers and scaffolding clean using wet methods. Avoid dry sweeping of large areas. ▪ Avoid site runoff of water or mud from site compounds by providing appropriate temporary drainage. ▪ Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate control measures are in place. ▪ Rehabilitate disturbed areas as soon as practicable. Re-vegetate earthworks and exposed areas/soil to stabilize surfaces as soon as practicable. ▪ Limit soil disturbance area, i.e., only remove soil cover in small areas during work. Demarcate construction areas within which construction activities shall be done. ▪ Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods. ▪ Machine operators shall be trained on good practice dust management techniques.					
6	Air quality – emissions from construction vehicles and equipment	Gaseous emissions from construction vehicles and equipment	▪ Parked construction vehicles and equipment shall not be located in proximity to sensitive receptors (e.g., health centers, schools). ▪ Ensure all vehicles and construction equipment are switched off when stationary - no idling vehicles/equipment.	▪ Regular site inspection report that verifies implementation of control measures.	▪ Daily or as required for inspection and monitoring report.	Contractor	PIU/CSC	Part of Contractor's contract

No.	Field or Activity	Potential Impact/ Issue	Mitigating Measure	Compliance Evidence	Monitoring Frequency	Implementing Agency	Monitoring Agency	Estimated Cost (USD)
			▪ Avoid bonfires and prohibit burning of waste materials. ▪ Regular inspection and maintenance of construction vehicles and equipment to ensure that their emissions are minimized. ▪ Develop a Construction Logistics Plan to manage the sustainable delivery of goods and materials.	▪ Inspection and maintenance record of construction vehicles and equipment. ▪ Construction Logistics Plan document.				
7	Noise	Temporary increaser in noise due to construction activities, equipment and vehicles.	▪ Develop and implement a Construction Noise Management Plan that includes among other community consultation process and including the control measures listed below. ▪ Keep local residents informed of the progress of the works, including when and where the noisiest activities will be taking place and how long they are expected to last. ▪ Avoid noisy activities during night time and weekend. ▪ Avoid noisy activities near mosques during prayer time. ▪ Carry out works near schools during holiday periods. ▪ Use modern, low noise and well-maintained plant and construction equipment. ▪ Fit all vehicles and equipment with effective exhaust silencers which shall be maintained in good and efficient working order. ▪ Fitted acoustic covers shall be kept in a good state of repair and shall be kept closed when equipment is in use. ▪ Vehicles shall not wait or queue on the road with engines running and equipment in intermittent use shall be shut down when not in use or where this is impracticable, throttled down to a minimum. ▪ If a site compound, or materials storage area is to be used, both it and any static plant within it shall be sited as far as is practicable from noise sensitive buildings. ▪ Where activities, including delivery of material to site, cannot take place during normal working hours they shall be carried out as close to normal working hours as is reasonably practicable. ▪ Concrete mixers shall not be cleaned by hammering the drums. ▪ When handling materials, care shall be taken not to drop materials from excessive heights. ▪ Noisy activities will be scheduled for less sensitive times - operations will be scheduled to coincide with periods when people would least likely be affected; work hours and workdays will be limited to less noise-sensitive times. Since the evening periods are important for community rest and	▪ Construction Noise Management Plan document. ▪ Location of stockpiles and noise causing activities. ▪ Regular site inspection report that verifies implementation of control measures. ▪ Number of complaints from stakeholders. ▪ Inspection and maintenance record of construction vehicles and equipment. ▪ Communication record with local communities. ▪ Meetings with local communities.	▪ Daily or as required for inspection and monitoring report.	Contractor	PIU/CSC	Part of Contractor's contract

No.	Field or Activity	Potential Impact/ Issue	Mitigating Measure	Compliance Evidence	Monitoring Frequency	Implementing Agency	Monitoring Agency	Estimated Cost (USD)
			recreation and provide respite when noisy work has been conducted throughout the week - work will not be scheduled during these times. ▪ Notice as early as possible will be given to the local residence for periods of noisier works such as excavation. ▪ No horn policy (unless vitally necessary) will be enforced. ▪ Excessive noise within the camp areas will not be allowed, in particular in night hours. ▪ Construction vehicle speeds will not 40 km/hr when driving through communities, and not exceeded 80 km/hr when driving on highways; ▪ Account will be taken of the needs of residents in choice of working hours and where possible these shall be chosen to avoid night time and weekend working; avoid working near mosques during prayer time; and to carry out works near schools during holiday period. ▪ Whilst of temporary noise barriers are generally not used for transient construction work, while working in juxtaposition to particularly sensitive facilities the installation of temporary hoardings may be a practicable form of noise control.					
8	Vibration	Temporary vibration due to construction activities, particularly during compaction of the road.	Before the start of construction works, the contractor with the presence of CSC Vibration Expert and PIU will carry out baseline condition/structural survey of all buildings within 25 meters of the road alignment that in the opinion of the contractor might be affected by vibration resulting from the construction activities. The surveys shall be conducted in the presence of and with the permission of the property owners. The findings of the building condition surveys shall be recorded in the report that shall contain the following information: (i) Building address and location; (ii) A description of the building condition and any existing cosmetic and/or structural damage; (iii) Sketches and photographs showing the location and extent of any damage; and (iv) High resolution video recordings of the surveyed buildings. ▪ The CSC Vibration Expert shall review the baseline condition survey and structural assessment report of the Contractor submit to ADB for approval. The Vibration Expert shall approve the construction methodology based on the assessment of vibration impacts (to be conducted by the contractor). He will also inform the Social Safeguards team if structural damage is expected and to identify if there is a need to relocate the residents temporarily/permanently.	▪ Condition Survey Report/Findings ▪ Construction Vibration Management Plan Document ▪ Regular site inspection report that verifies implementation of control measures. ▪ Number of complaints from stakeholders. ▪ Communication record with local communities.	▪ Once for condition survey and construction vibration management plan. ▪ Daily or as required for inspection and monitoring report.	Contractor	PIU/CSC	Part of Contractor's contract

No.	Field or Activity	Potential Impact/ Issue	Mitigating Measure	Compliance Evidence	Monitoring Frequency	Implementing Agency	Monitoring Agency	Estimated Cost (USD)
9	Rivers and Lake Issyk-Kul water quality	Earthworks and construction work in rivers and water channels and near Lake Issyk-Kul can cause sediments and soils from construction activities to enter water bodies and increase their turbidity during period of heavy rains or snowmelt.	▪ Prepare and implement a detailed Wastewater, Water and Drainage Management Plan (WWDMP) includes runoff management measures and water conservation. The plan shall contain, at the minimum, the control measures listed below ▪ Use of sediment trap and/or other measures to settle out soil/ sediments in runoff and prevent them entering the river or the lake; ▪ Preserve existing water channel, restore all altered water channels, repair damaged water channel and remove sediment that accumulated due to construction activities. ▪ Minimize activities and time spent in the water channel. ▪ Carry out construction work near rivers and Lake Issyk-Kul during the "drier" months of the year to minimize runoff. ▪ Provide temporary canal or pipes to divert water flow when working in rivers or water channel to prevent obstruction of water flow.	▪ Water, Wastewater and Drainage Management Plan document. ▪ Sediment trap or other measures installed as necessary. ▪ Regular site inspection report that verifies implementation of control measures. ▪ Construction schedule	▪ Once for water, wastewater and drainage management plan. Daily or as required for inspection and monitoring report.	Contractor	PIU/CSC	Part of Contractor's contract
10	Rivers and Lake Issyk-Kul water quality	Risk of contamination of surface water and groundwater as a result of accidental oil or chemical spills	▪ Develop and implement a Spill Prevention and Response Plan, which shall include control measures listed below. ▪ Store hazardous chemical such as fuels, oils, lubricants and chemicals as well as hazardous wastes in appropriate containers provided with proper labels and placed in an area with impermeable surface and provided with containment with volume that can accommodate 110% of the volume of the largest container. ▪ Locate fuel and chemical storage areas at least 500 m away from any surface water, including dry rivers. ▪ Make available Safety Data Sheet (SDS) of hazardous chemicals at storage areas and where they are used. ▪ Refuel vehicles in an area that is at least 100 m away from any surface water. ▪ Provide spill kits in accessible areas at all times. ▪ Train personnel handling fuel and chemicals in the use of spill response kits in accordance with the emergency preparedness and response plan. ▪ Stop construction in the event that previously undetected contamination is discovered during construction work until appropriate measures to reduce the impact or an appropriate removal and disposal process is determined implemented. ▪ Schedule works near rivers during low flow periods i.e., avoiding snow melt periods when rivers often have higher velocities.	▪ Spill Prevention and Response Plan document. ▪ Chemical and fuel and storage facilities. ▪ SDS. ▪ Spill kits ▪ Training records.	▪ Once spill prevention and response plan. ▪ Daily or as required for inspection and monitoring report.	Contractor	PIU/CSC	Part of Contractor's contract

No.	Field or Activity	Potential Impact/ Issue	Mitigating Measure	Compliance Evidence	Monitoring Frequency	Implementing Agency	Monitoring Agency	Estimated Cost (USD)
11	Water intake for use in construction	Water abstraction may affect existing water use for the specific source.	▪Conduct a more detailed assessment of water and water supply needs, including potential sources. ▪Obtain permit for from relevant authority for use of surface or groundwater. ▪Train workers on water saving measures at construction site and workers' camp. ▪Provide construction workers with potable water from approves sources.	▪Water use record ▪Water permit	▪ Daily or as required for inspection and monitoring report.	Contractor	PIU/CSC	Part of Contractor's contract
12	Biodiversity	There is risk to disturbance and destruction of critical habitats due to illegal hunting or poaching of wildlife and gathering of wild plants.	▪Use of sites designated for waste disposal to avoid polluting ecologically important aquatic habitat of Issyk-Kul Lake. This will also prevent contamination of the aquatic food chain. ▪Prohibit and prevent hunting and poaching of wild life to protect species of conservation importance and minimize loss of wildlife. ▪Consult with the MNRETS to confirm when works in rivers should be suspended in order to limit impacts to fish spawning periods. ▪Launch awareness campaign on the importance of preserving red-listed species.	▪Awareness campaign	▪ Daily or as required for inspection and monitoring report.	Contractor	PIU/CSC	Part of Contractor's contract
13	Flora/ Tree Cutting	One of the main impacts of construction activities is the cutting of more than 5,200 trees along the road. Every tree cut for road widening shall be replaced with two (2) new trees	▪Tree cutting permit shall be obtained from the MNERTS. ▪ Replace every tree with two (2) new trees that will be cut due to the road project. Trees shall be planted along the road or if additional areas are required, consult with MNRETS or the local authorities for appropriate location. ▪ The project shall develop a Tree Management Plan (TMP) to ensure newly planted trees are monitored and managed and to ensure important co-benefits are realized (soil protection, habitat provision, etc). The TMP, including the replanting schedule shall be submitted to PIU/CSC/ADB for review and approval. Once reviewed, a memorandum of cooperation will be developed between key stakeholders to ensure the successful implementation and management of the TMP. At a minimum, the TMP will include the following: (i) Surveys, mapping, planning; (ii) Justification for suitability of soil type; (iii) Justification of selection of native species; (iv) Water availability; (iv) Requirements of seedlings; (v) Land preparation requirements; (vi) Planting method and density; (vii) Pest and disease control (if necessary); (ix) Measures and capacity building for 'buy-in' from local communities; (x) Timeframes and budgets to ensure chosen species become established; (xi) Confirmation of key stakeholders, roles and responsibilities; and (xii) Indicative budgets. ▪For planting new trees: (i) Plant local varieties of trees and shrubs that do not require high level of maintenance and watering. Recommended tree	▪Development and implementation of Tree Management Plan. ▪Planted trees	▪ Tree planting to be done once road section is completed. ▪ Daily or as required for inspection and monitoring report.	Contactor	PIU/CSC	186,000 for tree cutting and tree replacement

No.	Field or Activity	Potential Impact/ Issue	Mitigating Measure	Compliance Evidence	Monitoring Frequency	Implementing Agency	Monitoring Agency	Estimated Cost (USD)
			species tree for planting: wild apricot, wild cherry, narrow-leaved elk, elm tree, fruits and flowers of these trees are food for birds. (ii) Establish partnership with Jeti-Oguz Forestry Department, sign a memorandum of cooperation, in order to get plant and to plant trees according to Forestry instruction. (iii) Planting trees, caring for trees, watering until the end of the DNP. ▪ No trees will be cut or cleared until inspection by an ecologist, ornithologist, or equivalent specialist to ensure that nest or nesting birds are removed (as required) and recorded. ▪ Confirmation of tree cutting program should be submitted to CSC taking into consideration nesting seasons and staged tree cutting works. ▪ Consultation shall be conducted with relevant avian authorities / NGOs to confirm appropriate seasons for tree felling to avoid nesting birds.					
14	Cultural heritage and archaeological sites	Cultural and heritage sites maybe damaged or destroyed during construction of the road.	▪Prepare and implement a detailed Archaeological Site Management Plan. The plan at the minimum shall include the control measures as listed below. ▪Excavate cultural and historical heritage sites (14 burial mounds at 5 locations and 1 recent burial), found within 50-meter from the road, before the start of the construction work on the nearby road section (refer to the EIA Report for the location of these sites). The excavation shall be coordinated with the Ministry of Culture, Information, Sports and Youth Politics of the Kyrgyz Republic by the MOTC. ▪Establish protection zone for two Ethnographical Muslim cemeteries found within 50-meter from the road before the start of construction work on the nearby road section (refer to EIA Report for the location of these sites). Protection shall be coordinated with the Ministry of Culture, Information, Sports and Youth Politics of the Kyrgyz Republic by the MOTC. ▪Establish protective zones for archaeological and cultural heritage sites outside of 50m of the road. This shall be done by state research restoration Institute and approved by Ministry of Culture, Information, Sports and Youth Policy at the request of contractor or/and MOTC. Fencing and/or of information boards shall be erected at identified nine (9) locations (Refer to EIA Report) ▪In case of finding any historical and cultural heritage object (e.g., human and animal bones, fragments of ceramics, etc.), stop construction work at the location where the object is found and inform the Ministry of Culture, Information, Sports and Youth Policy of the Kyrgyz Republic. Follow	▪Excavation Report. ▪Established protection zone ▪Accidental find report	▪ Daily or as required for inspection and monitoring report.	Contractor	PIU/CSC	Part of Contractor's contract

No.	Field or Activity	Potential Impact/ Issue	Mitigating Measure	Compliance Evidence	Monitoring Frequency	Implementing Agency	Monitoring Agency	Estimated Cost (USD)
			instructions from the Ministry of Culture on how to manage the change find.					
15	Cultural heritage and archaeological sites – chance find	There is a good chance that there will be chance find of cultural and archaeological artefacts as the project site is believed to be once part of the Silk Road.	▪Prepare a detailed chance find procedure following ADB's SPS (2009). ▪When. any physical cultural resource is found during construction the contractor will be required to stop work at the specific site and the Ministry of Culture, Information, Sports and Youth Policy of the Kyrgyz Republic will be informed through the MOTC. ▪The contractor will be required to carry out and shoulder the expenses for the excavation, including documentation and any actions required by the Ministry of Culture to ensure proper preservation of cultural and archaeological artefacts. ▪The PIU will assist in coordinating work with local authorities, which are responsible for developing the "project protection zones. ▪Budget has been allocated for excavation of chance find, if required by the Ministry of Culture.	▪Report ot Ministry of Culture ▪Implementation of the requirements of the Ministry of Culture.	▪ Daily or as required.	Contractor	PIU/CSC	20,000
16	Demolition wastes	Improper management of demolition wastes (existing asphalt pavement, structures, etc.) will result to nuisance and	▪ Materials from demolition, dismantling and disassembly of structures will be either be trucked/transported to the Department of Road Facilities (DRF) of the MOTC or to dump sites. Materials that will be sent to DRF will be recycled/reprocessed for reuse (e.g., paving of village roads). ▪ Most of the asphalt pavement that will be removed from the existing road (82.3% or 58,629 m^3) will be milled and reused onsite to strengthen road shoulders, with the remaining 17.7% (12,603.6 m^3) to be trucked to nearby dump sites (within 30 kms of the project). The location of the dump site will be identified during the construction phase. ▪ Third-party waste disposal shall be undertaken by legitimate, qualified enterprises that have all the necessary regulatory approvals and/or licenses. ▪ The location the final disposal of the waste by the third party shall be approved by PIU/SCS. ▪ Ensure that the final disposal facility is licensed by the relevant regulatory agencies. ▪	▪Record of demolition waste recycling, reuse or disposal (waste manifest) ▪Indentification and inspection of final disposal site ▪Licensed third party service provide for waste transport and disposal	▪ Daily or as required for inspection and monitoring report.	Contractor	PIU/CSC	Part of Contractor's contract
17	Demolition waste – asbestos/cement (A/C) pipe	Improper disposal of A/C pipe that will be dismantled, although limited in volume, can result to health impacts to nearby population if not properly done.	▪Develop and implement an Asbestos Containing Materials (ACM) Management Plan in line with the ADB Good Practice Guidance for the Management and Control of Asbestos. The Management Plan shall include the following elements: (i) The duties of employers, workers/subcontractors, asbestos contractors and vendors; (ii) Training requirements for working	▪Asbestos Containing Materials (ACM) Management Plan document ▪Disposal site for A/C pipes and report	▪ Daily during dismantling and disposal.	Contractor	PIU/CSC	Part of Contractor's contract

No.	Field or Activity	Potential Impact/ Issue	Mitigating Measure	Compliance Evidence	Monitoring Frequency	Implementing Agency	Monitoring Agency	Estimated Cost (USD)
			with asbestos; (iii) Identification of asbestos; (iv) Managing long term risks of asbestos; (v) Safety in the use of asbestos; (vi) Managing incidents where asbestos is found; (vii) Managing the risks of asbestos removal; (viii) Managing asbestos waste; and (ix) Managing asbestos waste generated through disasters.					
18	Labor camps, laydown area and site offices	Risk of contamination of soil, rivers and Lake Issyk-Kul from discharge of untreated wastes and sewage from construction sites, laydown areas and workers' camp.	▪Wash vehicles and equipment in designated areas where all wastewater can be collected and treated prior to disposal. ▪No discharge of untreated wastewater/sewage into surface water is permitted. ▪Locate temporary camps for workers, laydown areas, and site offices at least 500 m from any river or Lake Issyk-Kul with their location carefully chosen under the direction of the local environmental authority. ▪Toilet facilities (latrines) shall be constructed in accordance with the instructions of the local environmental authorities, and they shall be at least 500 m from any river or Lake Issyk-Kul. ▪Treat sewage and wastewater in workers' camp and construction site offices prior to final disposal. Effluents shall be treated appropriately, in particular for the removal of sludge and, if necessary and obtain necessary discharge permit prior to disposal. Sewage and wastewater will not be discharged into the lake. Sewage and wastewater should be stored on site and periodically sent to a licensed facility, authorized by the government, to be processed and safely disposed of. ▪Prohibit throwing of waste or debris into bodies of water (rivers, water channels and Lake Issyk-Kul). ▪Remove any construction debris from rivers, water channel and Lake Issyk-Kul. ▪Provide segregated waste bins for recyclables (e.g., plastic bottles, paper, aluminum cans, etc.), biodegradables (food wastes) and residual wastes (wood, metals, concrete/bricks, etc.) that would allow for the proper recycling, reuse or disposal of domestic wastes. ▪Provide segregated and safe temporary waste storage area onsite. ▪Regularly transport waste to offsite treatment (recycling, reuse, etc.) facilities or disposal site authorized by the government. ▪Provide safe area for hazardous waste storage, which shall be include impermeable surface, drainage (including adequate sump pit to collect spillage), roof, wall, proper ventilation, etc. Ensure that hazardous waste is properly stored in leak proof containers with proper markings. Regularly	▪Construction Camp Development and Management Plan ▪Location of workers' camp, laydown areas, site offices. ▪Waste record ▪Segregated waste bins ▪Training record ▪Awareness posters	▪ Daily or as required for inspection and monitoring report.	Contractor	PIU/CSC	Part of Contractor's contract

No.	Field or Activity	Potential Impact/ Issue	Mitigating Measure	Compliance Evidence	Monitoring Frequency	Implementing Agency	Monitoring Agency	Estimated Cost (USD)
			transport hazardous waste from the construction site to authorized treatment, storage or disposal facility. A hazardous waste data sheet shall be provided for each of the hazardous waste, which contains the physical and chemical characteristics and hazard, quantity, sources, etc. ▪Develop and implement waste management awareness/training program for all construction personnel that includes topics on waste segregation, reduction/minimization, reuse and recycling. ▪Provide posters and other information materials in appropriate locations promoting waste segregation, reduction, reuse and recycling. ▪Keep onsite waste record/log for all types of wastes (hazardous, domestic and construction). The log shall include among others, the volume waste generated reused, recycled, sold, hauled to waste disposal facility, etc. ▪Consider available best practice guidance workers accommodation, such as the IFC / EBRD (2009) Workers Accommodation: Processes and Guidance[135].					
19	Workers Health and Safety	Workers are exposed to various occupational health and safety risks that could result to death or injury such as fall from height, vehicular accident, etc.	▪Comply with labor laws of Kyrgyz Republic and relevant ILO standards. ▪Develop and implement Occupational Health and Safety Plan, which shall follow all relevant occupational health and safety requirements of Kyrgyz Republic and ILO and shall include at the minimum the requirements listed below. ▪Provide compulsory health and safety orientation training to all new workers to ensure that they are apprised of Occupational Health and Safety Plan including rules of work, use of personal protective equipment (PPE), preventing injury to fellow workers, etc. ▪Restrict public access to worksites. ▪Provide PPE to workers and ensure their effective usage. For example, require workers to wear high visibility clothes or reflectorized vests at all times at construction sites. PPE and safety equipment shall include adequate equipment for working near water bodies. ▪Document procedures to be followed for site activities with respect to occupational health and safety. ▪Maintain accident reports and records. ▪Maintain hygienic accommodation in work camps.	▪Number of accidents ▪Records of supply ▪of uncontaminated ▪water ▪Condition of eating areas of workers ▪Record of orientation training ▪Availability of PPE at construction site ▪Percentage of moving equipment outfitted with audible back-up alarms ▪Signage for storage and disposal areas ▪Condition of sanitation facilities for workers ▪Report summary on daily toolbox talks for workers.	▪ Daily or as required for inspection and monitoring report.	Contractor	PIU/CSC	Part of Contractor's contract

[135] IFC/EBRD. 2009. Workers' accommodation: processes and standards, A guidance note by IFC and the EBRD. https://www.ifc.org/content/dam/ifc/doc/mgrt/workers-accomodation.pdf

No.	Field or Activity	Potential Impact/ Issue	Mitigating Measure	Compliance Evidence	Monitoring Frequency	Implementing Agency	Monitoring Agency	Estimated Cost (USD)
			▪Ensure uncontaminated water for drinking, cooking and washing. ▪Ensure clean eating areas. ▪Ensure sanitation facilities are readily available. ▪Provide medical insurance coverage for workers. Provide HSE orientation for guest and visitors. ▪Ensure that visitors do not enter hazard areas unescorted. ▪Ensure moving equipment is outfitted with audible backup alarms. ▪Chemical and material storage areas need to be marked clearly. Display SDS, train staff on storage and handling. ▪Hearing protection equipment enforced in noisy environment. ▪Conduct of daily toolbox talks to reiterate all the above measures and prioritize safety briefings; leanings from incidents, their causes and risks, and other safety procedures as may be identified. ▪Conduct periodic safety audit, identify and remove potential hazards. ▪Provide medical aid facilities (first aid, doctor on call etc.,) and ensure that qualified first aid is provided at all times; equipped first-aid stations shall be easily accessible throughout the work sites and camps. ▪Provide caution & information boards (traffic, safety, information etc.,) ▪Ensure proper maintenance and cleanliness of the site and facilities. ▪Demarcate assembly area for emergencies					
20	Community health and safety and socioeconomic condition	Construction works will impede the access of residents and business in limited cases. Construction works will raise danger to people in the settlements.	▪Identify location of labor camps, site offices and laydown areas in consultation with local administration. ▪Obtain permission from owners, if work on private land/ property is required. ▪Develop and implement a Stakeholders Communication Plan that includes community engagement before work commences on site. ▪Inform local people through continuous consultations of the nature, duration and possible impacts of construction activities. ▪Inform occupiers of houses/buildings of the nature, duration and potential vibration effects prior to the works. Generally, the main concern relating to construction vibration is of damage to property and if this is not likely to occur, then this point shall be made clear to residents. ▪Prohibit alcohol and drugs on site. ▪Prevent excessive noise. ▪Code of conduct for workers includes restricting workers in designated areas, no open defecation,	▪Traffic Management Plan document. ▪Stakeholders Communication Plan document. ▪Number of complaints from stakeholders. ▪Agreement between ▪contractor and private property owners in case of using the latter's land for storage or other use.	▪ Daily or as required for inspection and monitoring report.	Contractor	PIU/CSC	Part of Contractor's contract

No.	Field or Activity	Potential Impact/ Issue	Mitigating Measure	Compliance Evidence	Monitoring Frequency	Implementing Agency	Monitoring Agency	Estimated Cost (USD)
			no littering, no firewood collection, no fire except designated places, no trespassing, no residence at construction sites, and no obligation to potentially dangerous work. ▪Follow international best practices on community health and safety such as those in Section 4.3 of IFC Environmental Health and Safety (EHS) Guidelines on Construction and Decommissioning Activities. ▪Maintain a complaint logbook in workers camp and take action promptly on complaints from stakeholders. ▪Promptly relocate construction materials and equipment if found to be obstructing or disturbing free movement of local people. ▪Develop and implement a detailed Traffic Management Plan to minimize inconvenience and disruption of normal community activities that takes into consideration safe passage for vehicles and pedestrians, temporary road diversions, erection and maintenance of traffic signs, barricades as required, etc. ▪Erect display boards at strategic locations about the nature, duration of construction and contact for complaints and/or issues about the project. ▪Complete quickly any work that is near adjacent establishments. ▪Restore immediately damaged properties and utilities to pre-construction work conditions.					
Operation Phase								
21	Waste generation	Domestic wastes will be generated by the users of the road, especially at bus stops, rests area and the view deck. Improper disposal will result to nuisance and health risks (garbage will attack flies and other insects)/	▪Provide segregated bins for wastes (e.g., bottles, plastics, food waste, etc.) at appropriate locations such as bus stops that would allow the proper recycling and reuse of wastes. ▪Regularly collect and transport waste to offsite treatment (recycling, reuse, etc.) facilities or disposal site. ▪Provide posters and other information materials in appropriate locations promoting waste segregation, reduction, reuse and recycling.	▪Segregated waste bins ▪Cleanliness of the road ▪Posters and other awareness materials	▪ Daily	Local administration	Local administration	Existing budget of local administration on waste management
22	Water Quality	The main concern is runoff during rain events or snow melt, which can flow into water canals and waterways and ultimately into rivers and Lake Issyk-Kul. The runoff will	▪Regularly inspect and maintain (de-clogging and cleaning of debris) drainage system and sediment and erosion controls. ▪Regular water quality monitoring and based on the results of the monitoring, mitigation measures will be recommended (Note: The MNERTS is currently conducting water quality monitoring of major rivers in the project area, including in Lake Issyk-Kul).	▪Well-maintained canals and water channels (no debris or sediment accumulation) ▪Water quality monitoring report	▪ Monthly or quarterly	▪MNERTS	▪MNERTS	Included in regular budget of MNERTS

No.	Field or Activity	Potential Impact/ Issue	Mitigating Measure	Compliance Evidence	Monitoring Frequency	Implementing Agency	Monitoring Agency	Estimated Cost (USD)
		contain soil, particles from tires and pavement, hydrocarbons fuel fuel/oil spills.						
23	Noise	The increase in road traffic flows in the period following opening of the project, combined with the effect (minimal) of the road widening, is considered to be a negligible noise impact. At a small number of locations increases in road traffic noise is a minor noise impact.	It is not recommended that mitigation be provided. A reasonable course of action would be to carry out a review of the working assumptions underpinning the noise calculations (road traffic flows, vehicle type, road condition etc) at a future date (e.g., 10 years after project opening) and assess the requirement for mitigation at that time.	▪Noise study report.	▪ Once, 10 years after project opening.	▪MNERTS	▪MNERTS	Cannot be estimated at this point in time.
24	Biodiversity – planted trees along the road	Without proper maintenance of trees along the road, some of these trees may die. Trees that died need to be replaced.	▪Regular inspection and maintenance of trees along the road, including replanting of trees that had died and pruning of trees.	▪Healthy trees	▪ Monthly	MOTC	MOTC	Included in the regular budget of the MOTC for road maintenance.
25	Biodiversity – protection of BTIK, Lake Issyk-Kul Ramsar site, Issyk-Kul Nature Reserve and other nearby natural reserves	Increased in tourist visits will result to increased risk of degradation and damage to biodiversity in the area without strategic	▪Development of an Integrated Biodiversity management plan for the conservation of critical habitats and priority biodiversity sites (swamps, shallow water bodies, forests, shrublands and steppe) of Lake Issyk-Kul, Issyk-Kul National Nature Reserve, BTIK and Teskei Geopark. This plan at the minimum shall include actions listed below. ▪Identify and develop criteria and methods for biodiversity monitoring using indicator species. ▪Carry out activities to regulate the number of harmful predators (wolves, jackals). ▪Study factors affecting migratory bird species in protected areas and develop recommendations to improve migration conditions. ▪Develop maps of geology, biodiversity, sacred sites, cultural monuments for the conservation of natural resources and ecotourism as part of the development of the Teskei Geopark. ▪Install information boards/ billboards in areas where waterfowl congregate, with information about birds, their numbers and conservation measures. ▪Conduct annual study of ecologically important species and communities (economically important	▪Integrated Biodiversity Management Plan document ▪Research, survey and study reports and publications ▪Training modules and training records ▪Brochures, posters, billboards and other awareness materials	▪ Monthly, quarterly and/or annually	Directorate of the BTIK, Institute of Biology, National Academy of Sciences, Kyrgyz Republic, MNERTS, local administration, NGOs.	Directorate of the BTIK	

No.	Field or Activity	Potential Impact/ Issue	Mitigating Measure	Compliance Evidence	Monitoring Frequency	Implementing Agency	Monitoring Agency	Estimated Cost (USD)
			for agrobiodiversity) and develop recommendations for their conservation and sustainable use. ▪Prepare and implement memorandums of cooperation between the Directorate of BTIK and the Institute of Biology of the National Academy of Sciences of the Kyrgyz Republic and stakeholders in the field of assistance and capacity building for biodiversity conservation. The memorandums shall include mechanisms for consultations, participation on annual bird counts, and expeditions to study biodiversity. ▪Organize annual meetings to strengthen cooperation and interaction with local government agencies, local communities and other stakeholders. The meeting shall focus on "Prospects, problems of the biosphere territory of Issyk-Kul" and ways to solve them". ▪Regularly conduct scientific expeditions-surveys on biodiversity every season. ▪Seek assistance from international organizations for funds to purchase monitoring equipment for BTIK: GPS, tablets, spyglass, motor boats, binoculars, desk top computers and laptops. ▪Develop of training guides and modules on biodiversity conservation. Five to eight modules will be developed. ▪Implement training guides and modules on biodiversity conservation. Training will be carried out two to three times per year for five years ▪Develop special training programs on biodiversity monitoring methods. Six to nine modules will be developed. ▪Implement special training programs on biodiversity monitoring methods. Train and involve specialists such as ornithologist, ichthyologist, entomologist, glaciologist, soil scientist, etc. Training will be carried out four times a year for a period of three years. ▪Provide training in monitoring the use of near-settlement grazing lands of the BTIK, revival of traditional grazing methods through public outreach work. Training to be conducted once a year for five (5) years. ▪Provide training on use of GIS as a biodiversity data assessment tool. Two training sessions (approx. 3 days each). Funding can be sourced from international organizations. ▪Carry out environmental education activities for the local population aimed at fostering a culture of respect for nature in BTIK. To be conducted two to four times a year and may involve meetings,					

No.	Field or Activity	Potential Impact/ Issue	Mitigating Measure	Compliance Evidence	Monitoring Frequency	Implementing Agency	Monitoring Agency	Estimated Cost (USD)
			round-table discussions, action lectures, conversations and discussions of problems. ▪Organize information campaigns among young people and the local population "Let's preserve the natural filter of Issyk-Kul". Conduct information campaigns and holding events dedicated to the Day of Birds, the Day of Biodiversity, etc. Carry out environmental actions to increase knowledge and change behavior in the direction of sustainability. ▪Develop informational materials on biodiversity conservation and disseminating them widely among stakeholders and local residents. ▪Prepare and publish scientific articles on the importance of preserving biodiversity and natural ecosystems, and on monitoring the biodiversity of Lake Issyk-Kul and BTIK					
26	Air Quality	Concentrations PM10 along the rehabilitated road may potentially be slightly above the significance criterion of 5% of the WHO air quality guideline for annual mean, and 24-hour mean PM10 at a small number of receptors within 20m of the kerb in Kyzyl Suu and within 10m of the kerb in other settlements. Impacts for all other pollutants are not significant and therefore considered “acceptable”.	▪It is recommended that a program of air quality monitoring be implemented in the vicinity of the new road. This will identify if mitigation is required during the operational phase. If needed, the following options may be considered: (a) road sweeping; (b) planting of vegetation barriers along roadside in settlements; (c) implementation of lower speed limits in settlements.	▪Air quality monitoring results ▪Air quality management plan	▪ Monthly, up to 12 months (at 8 locations) ▪ Continuous, up to 12 months for Kyzyl Suu	MNERTS	MNERTS	Cannot be estimated at this point in time

D. Environmental Monitoring Plan (EMOP)

1085. Monitoring is the systematic collection of information and involves measuring and recording of environmental parameters and indicators associated with project activities and impacts. The objectives of monitoring are to:

(i) Compare predicted and actual impacts;

(ii) Assess the implementation and effectiveness of mitigation measures;

(iii) Ensure that the project complies with relevant local and international regulations and standards;

(iv) To monitor changes to baseline conditions during construction;

(v) To implement corrective/ remedial actions, if necessary, if the proposed mitigation measures are not effective in eliminating or reducing environmental impacts of activities.

(vi) Gather information on responses of receptors to impacts;

(vii) Make future assessments more efficient and minimize errors in future assessments and impact predictions;

(viii) Provide information for environmentally responsible project management; and

(ix) Improve the EIA and monitoring process.

1086. Environmental monitoring shall cover all construction areas and sites, field offices, laydown areas and workers' camps. The minimum monitoring requirements are presented in Table 125. Monitoring requirements set out under relevant permits shall be added to this plan.

Table 125: Construction Phase Environmental Monitoring Action Plan

SN	Aspect		Parameter/ Objective	Location	Methodology	Frequency/ Duration	Responsible
Construction Phase							
1	General	Environmental site inspection and monitoring of EMP implementation	Mitigation and control measures specified in the EMP/SSEMP	Construction sites, workers camp, laydown area and site offices	Site Inspection/ walkthrough (see Section IX,D,1 below)	Daily	Contractor to carry out monitoring and PIU to verify
2	Biodiversity	Monitor tree planting activities to ensure that planted trees are growing.	No. of planted trees, No. of dead trees that requires replacement	Sections of the road where trees have been planted	Site Inspection	Monthly	Contractor to carry out monitoring and PIU to verify
3	Biodiversity	Seasonal surveys of migrating and nesting birds, including monitoring of rare and endangered faunal species included in the Red Book of Kyrgyz Republic	Bird and faunal species and numbers	Project area	Bird counts and visual monitoring.	Twice a year: at the start of winter and in spring for 3 years	Third party consultant hired by contractor
4	Air Quality	Dust soiling checks of surfaces such as cars and window sills within 100m of the site boundary.	Dust on surfaces (visual)	Nearby receptors (within 100m) in active construction areas	Site Inspection/ walkthrough	Daily	Contractor to carry out monitoring and PIU to verify
5	Water Quality	Water quality monitoring	TSS, oil and grease,	Downstream of the river where there are construction activities	Grab sampling and laboratory analysis	Once during construction works	Third party consultant hired by contractor
6	Archaeology	Monitoring of archaeological sites	Visual appearance	Archaeological sites within the 50-m zone identified in the archaeological survey	Site Inspection	Monthly	Contractor to carry out monitoring and PIU to verify
7	Vibration	Vibration Monitoring	Vibration level and damage to structures	Selected houses and areas near residential areas	See below (Section IX, D, 2)	As required during construction	Third party consultant hired by Contractor

SN	Aspect		Parameter/ Objective	Location	Methodology	Frequency/ Duration	Responsible
8	Waste Management	Waste segregation and storage	Cleanliness of projects site	All project sites	Site inspection	Daily	Contractor to carry out monitoring and PIU to verify
9	External Environmental Monitoring	Environmental Monitoring	See below (Section IX, D, 3)	Project areas, laydown areas, site offices, workers' camp, etc.	Records and reports review, site inspection	Twice a year for the duration of construction and DNP	External Environment Experts
Post Construction							
10	Air Quality	Post construction monitoring of gaseous emissions	NO_2, SO_2	At least 7 sites (Table 126 and Figure 222)	Diffusion tubes	Monthly, up to 12 months. Tubes to be left out for 2-4 weeks.	Third party consultant hired by contractor
11	Air Quality	Post construction monitoring of dust and aerosols	PM_{10}, $PM_{2.5}$	At least 8 sites, as shown in including Shalba Mosque (Table 126 and Figure 222))	Sampling using portable sensors, at least 60 minutes	Once per month, up to 12 months	Third party consultant hired by contractor
12	Air Quality	Post construction monitoring of dust and aerosols	PM_{10}, $PM_{2.5}$	1 receptor in Kyzyl Suu (Table 126 and Figure 222))	Continuous monitoring	Continuous, up to 12 months	Third party consultant hired by contractor
13	Water Quality	Water quality monitoring	TSS, oil and grease,	Upstream and downstream of the road project	Grab sampling and laboratory analysis	Once	Third party consultant hired by contractor
14	Site Condition	Site restoration	Condition of trees replanted, restoration of construction sites, wastes and debris onsite, etc.	Road corridor, site offices, laydown areas, quarry and borrow pit, Workers' camp	Visual inspection	Continuing until complete demobilization and restoration of project site	Contractor to carry out monitoring and PIU to verify

SN	Aspect		Parameter/ Objective	Location	Methodology	Frequency/ Duration	Responsible
Operation Phase							
15	General	Monitoring of road	Monitoring of trees condition, oil spill, wastes	Entire road section	Visual inspections	Monthly	MOTC
16	Biodiversity	Monitoring of indicator species.	Indicator species (refer to OB4)	(a)	Survey	Annually	Directorate of BTIK [(b)]
17	Biodiversity	Seasonal surveys of migrating and nesting birds	Bird species and numbers	(a)	Bird counts and visual monitoring.	Twice a year: at the start of winter and in spring (March to May, June)	Directorate of BTIK [(b)]
18	Biodiversity	Expanding the network of photo traps in appropriate locations.	Number of traps set up and operated	(a)	Photo traps	Annually	Directorate of BTIK [(b)]
19	Biodiversity	Monitoring of rare and endangered species included in the Red Book of Kyrgyz Republic,	Rare and endangered species included in the Red Book of Kyrgyz Republic	(a)	Survey	Annually	Directorate of BTIK [(b)]
20	Biodiversity	Annual inventory of flora and fauna	Number of flora and fauna	(a)	Inventory /survey	Annually	Directorate of BTIK [(b)]

1. Environmental Site Inspections

1087. Site inspection shall be carried out regularly (daily, weekly or monthly) using an appropriate checklist and taking into account the EMP/SSEMP and the EMOP. Site inspection will help in ensuring that environmental controls are in place and if not, rectification actions will be immediately taken. Any environmentally harmful activities and non-conformances observed during the site inspection will immediately be stopped and reported to the Project/Construction Manager for further action. All non-conformances will be recorded and its close out by the Site Supervisor will be monitored. The site inspection records will be summarized in the Monthly Environment Report.

2. Methodology: Vibration Monitoring During Construction

1088. The contractor will be required employ a qualified/experienced vibration consultant to carry out vibration monitoring (including the provision of vibration threshold exceedance alarms) on selected dwellings during construction, with locations and vibration thresholds to be agreed with the Construction Supervision Consultant. The equipment selected shall use remote notification of exceedances via GPRS network and shall be capable of continuous monitoring of peak particle velocity ppv and dominant frequency. This will limit the possibility of cosmetic/ structural damage to buildings and provide a means of monitoring contractor working practices.

1089. The locations shall include the nearest vibration sensitive buildings to the road and could typically number up to 4-5 locations per village depending on village size and the extent of construction operations. The procedures for accelerometer mounting and reporting shall follow those set out in BS ISO 4866:2010 [11] and BS 5228 Pt 2[136].

1090. The Construction Supervision Consultant shall be notified of any exceedances of agreed vibration threshold levels within a 24 hour period and an explanation given of the cause, outcome and remedial action. The results of monitoring and threshold exceedances shall also be reported to the Construction Supervision Consultant by means of a quarterly report, including details of equipment used and monitoring locations.

3. External Environmental Monitoring

1091. External environmental monitoring is an integral part of EMP implementation. It provides feedback on the effectiveness of control measures in preventing and/or minimizing the environmental impacts of project activities. External environmental monitoring is an independent, systematic and documented process of objectively obtaining and evaluating verifiable evidence to determine that the EMP is properly implemented, consistent with regulatory requirements, standards and the EIA. The results of the monitoring are documented through a monitoring report where the findings are recorded and prioritized. The report also details corrective actions, including action parties and targeted completion dates using an action tracking matrix.

1092. External environmental monitoring shall be carried out once every three months (quarterly) for the duration of the project (i.e., construction phase and until project turnover).

1093. An external environmental monitoring’s main objective is to determine the effectiveness of the CEMP in preventing or mitigating impact of construction activities through checking the project’s compliance with relevant standard and regulations and reviewing the implementation of prevention and control measures specified in the EMP.

1094. The monitoring normally involves the following process:

[136] British Standard BS 5228- 2. Code of Practice for noise and vibration control on construction and open sites. Part 2. Vibration. 2009.

(i) **Monitoring Scoping**. Scoping shall include:

a) Issue or issues to be monitored;

b) Monitoring objectives;

c) Timing and duration of monitoring;

d) Composition of the monitoring team, the International Monitoring Expert shall be the Monitoring Team Leader

e) Monitoring methodology, including an monitoring checklist (if required).

(ii) **Monitoring Preparation**. Prior to conducting monitoring, it may be necessary for the External Monitoring Expert to contact the Project Manager to discuss the details of the monitoring and to make the necessary arrangements. Issues to be covered may include:

a) Date and time for the monitoring;

b) Briefing material required;

c) List of documents and records to be reviewed;

d) Interviews to be conducted;

e) Site access and safety requirements (including personal protective equipment); and

f) Travel and accommodation arrangements.

(iii) **On-Site Briefing**. On arrival at the site, the monitoring team shall be briefed on the work going on at the site. The team shall also get an HSE Induction from the National Environmental Specialist/H&S Engineer, highlighting any precautions they shall take. In turn, the monitoring team shall brief the staff at the site, on the aims and program for the visit.

(iv) **Conduct of the Monitoring**. The monitoring may be supported by the use of a checklist and detailed interviews with construction contractor’s personnel, along with review of documents and records. The monitoring checklist shall be completed by the Monitoring Team Leader following completion of interviews and at the end of each monitoring day. Completion of the checklist shall be supported by the monitoring team who shall provide feedback on interviews conducted.

(v) **Interviews**. Interviews are necessary to gather information and verify information provided in the documents and records. Interview of site personnel is important as they are the one who are implementing the project at the site level.

(vi) **Monitoring Close Out Meeting**. The close out meeting, which shall be led by the Monitoring Team Leader, shall highlight the good points and the deficiencies (non-compliances) that can be immediately remedies by the site personnel themselves. Deficiencies that require higher level action shall be taken up with higher management, if they are not present in the close out meeting.

(vii) **Reporting**. The Monitoring Team Leader shall prepare the monitoring report. The report shall be distributed to all concerned parties. The monitoring report must include the following at the minimum:

a) Conformities/compliances;

b) Non-conformities (non-compliances), including close out actions and tracking mechanism;

c) Effectiveness of implementation of control measures

d) Implementation and effectiveness of any corrective actions in previous monitoring; and

e) Conclusion and recommendations.

(viii) **Follow up and Close Out Actions**. The Construction Manager shall assign the National Environmental Specialist who shall ensure timely completion of actions items. The National Environmental Specialist will develop an monitoring tracking system where the status and progress on monitoring follow up actions are recorded. The tracking system shall identify the action parties and target completion dates for all recommended monitoring actions. The Construction Manger shall prepare the budget for approval of the Project Manager if the actions to close out the monitoring finding has some costs associated with it.

4. Air Quality Monitoring

1095. Due to existing poor air quality in the airshed with regards to PM_{10} and $PM_{2.5}$, receptors in the area are highly sensitive to potential PM_{10} and $PM_{2.5}$ impacts from the corridor enhancement. Impacts that may potentially require mitigation for PM_{10} concentrations have been identified within 20m of the enhanced road corridor in Kyzyl Suu, and within 10m of the enhanced road corridor in other settlements along the proposed road.

1096. At these locations, the impacts from the enhanced road corridor are slightly above the significance criterion of 5% of the WHO air quality guideline for annual mean and 24-hour mean PM_{10} concentrations. To ensure that adverse impacts are not observed in practice, it is recommended that a program of air quality monitoring shall be implemented in the vicinity of the new road. If needed, options would be available to enable mitigation of impacts. The proposed monitoring plan is presented in Table 124.

1097. The recommended monitoring program, post project construction, is outlined below. All monitoring must be carried out by qualified external experts. Costs will be dependent on the rates of the consultants used. Following the first year of monitoring post-construction, the need for additional monitoring will be assessed. If exceedances of relevant AQO guideline values or national MPCs are observed, additional monitoring may be required.

1098. Sites for potential monitoring using portable sensors or diffusion tubes are shown in Table 126 and Figure 222. The locations given are approximate; in practice, sites shall be selected in the vicinity of these locations based on practical sampling requirements such as the availability of suitable surfaces to affix equipment to. At each location, either: (a) a combination of passive diffusion tube monitoring of NO_2 and SO_2, and short-term sampling of PM_{10} and $PM_{2.5}$ using portable sensors or (b) continuous monitoring of PM_{10}, $PM_{2.5}$ and NO_2 using portable sensors shall be carried out. Additional sites may be added following detailed design and liaison with stakeholders.

1099. The sites selected represent highly sensitive receptors (i.e., schools, hospitals, and dwellings) and have been selected to allow compliance with the relevant WHO air quality guidelines and national legislation to be assessed along the proposed roadway. An addition site has been suggested in Munduz, to allow assessment of conditions outside the road corridor to accurately determine baseline concentrations in the region.

1100. Diffusion tube sampling shall be carried out using 3 tubes in each location. The average of the three tubes shall be used as the basis of the mitigation analysis.

Table 126: Proposed air quality monitoring locations.

Site ID	Type	Location	x	y	Lat	Long
10	Mosque	Chychkan	1224500	4718056	42.242	77.724
19	School	Saruu	1235621	4724296	42.322	77.924
21	School	Kyzyl Suu	1240956	4726323	42.335	77.991
31	School	Kyzyl Suu	1243047	4728289	42.351	78.018
37	Residential	Karakol	1270333	4746144	42.483	78.369

40	Mosque	Shalba	1253011	4738068	42.428	78.151
42	Residential	Saruu	1256204	4741072	42.452	78.193
Munduz School	School	Munduz	1252052	4739752	42.444	78.141

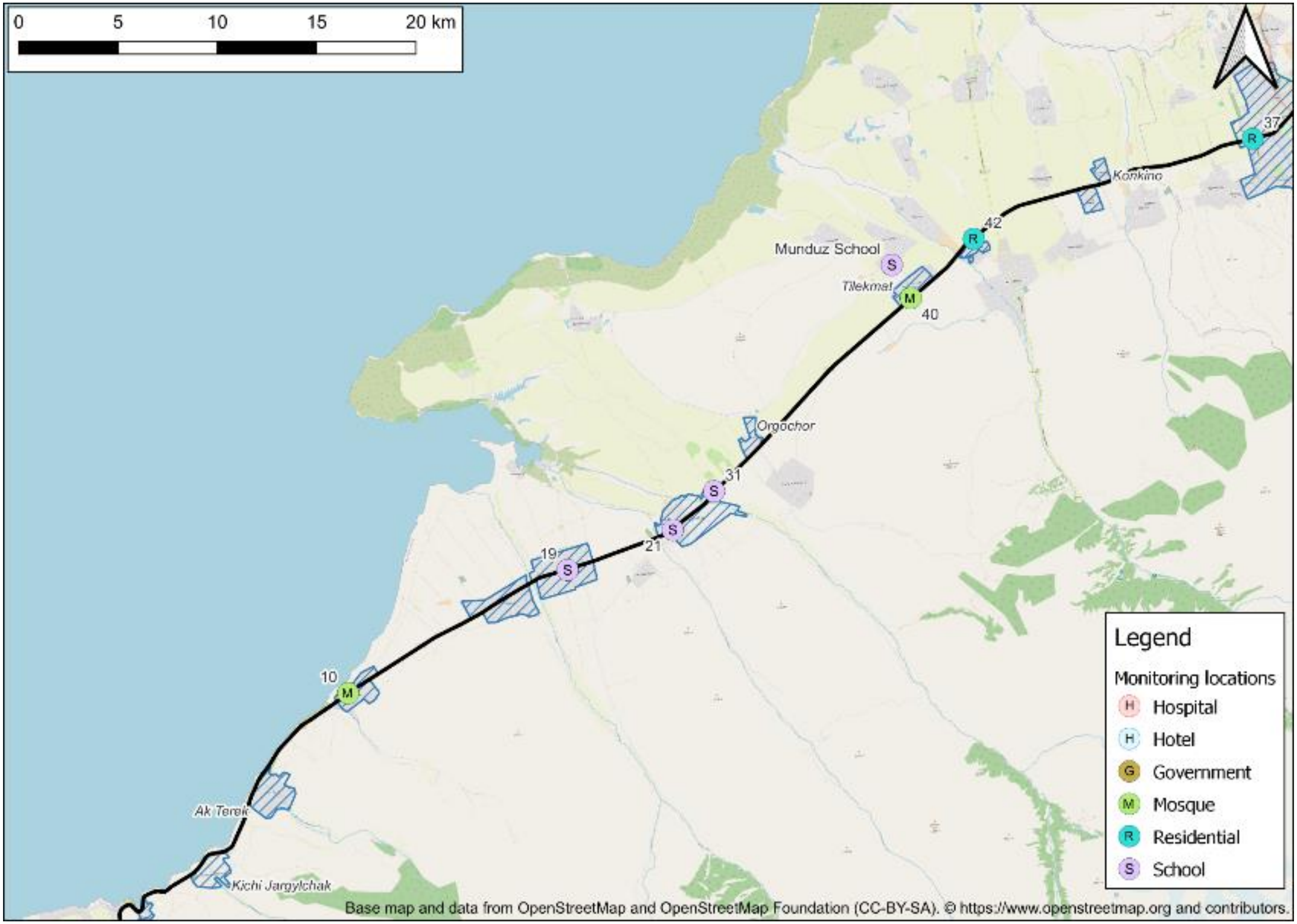

Figure 222: Proposed monitoring locations

E. Reporting

Table 127 list the required reports, including the required frequency of submission.

1101. **Monthly Monitoring Report**. The Contractor will be required to submit monthly monitoring reports to CSC/PIU during the implementation phase of the project. CSC/PIU may require the Contractor to submit additional information and reports that will be needed to fulfill the reporting obligation of MOTC to ADB and government ministries, such as but not limited to Quarterly Monitoring Report. The report format will be developed by the contractor and approved by the Supervision Consultant and the PIU. At the minimum, the following information shall be provided:

- (i) The number of complaints received by the construction contractor directly from the general public;
- (ii) The number of site inspections conducted by the Environmental Specialists;
- (iii) The number of non-conformances and corrective action requests issued from internal and external sources;
- (iv) The number of environmental incidents on site;
- (v) The number of non-conformances and environmental incidents closed out;
- (vi) The latest revision number of the EMP, and whether any changes have been made;
- (vii) The number of staff that underwent environmental trainings;
- (viii) Waste management data;
- (ix) Results of environmental monitoring; and
- (x) Other environmental performance data as may be required.

1102. **Quarterly Monitoring Report**. PIU will prepare and submit reports to ADB on a quarterly basis during construction phase and semiannual basis post construction until ADB issues a project completion report. The suggested outline of quarterly environmental monitoring reports is attached as Annex 26. In addition, to facilitate monitoring and enable responses to emerging issues, monthly reports may be required to prepared by PIU and submitted to ADB.

1103. **Semi-Annual External Environmental Monitoring Report**. The Monitoring Team Leader shall prepare the monitoring report. The report shall be distributed to all concerned parties. The monitoring report must include the following at the minimum: (i) Conformities/compliances; (ii) Non-conformities (non-compliances), including close out actions and tracking mechanism; (iii) Effectiveness of implementation of control measures; (iv) Implementation and effectiveness of any corrective actions in previous monitoring; and (v) Conclusion and recommendations.

Table 127: Environmental Reporting Requirements

SN	Report	Prepared by	Submitted to	Frequency
1	Monthly Monitoring Report	Contractor	Supervision Consultant/ PIU/ MOTC/ ADB	Monthly
2	Quarterly Monitoring Report	PIU	ADB	Quarterly
3	External Environmental Monitoring Report	External Environment Experts	ADB	Semi-annually

F. Cost of EMP Implementation

1104. Table 128 shows that the EMP costs include activities that are standard practice in most modern construction sites such as preparing management plans (e.g., waste management plan, etc.) and monitoring, including environmental sampling and hiring of personnel and expert to ensure that the project is implemented in a sustainable manner that prevents or minimizes the impact on the environment.

1105. Most of the mitigation and control measures specified by this EMP are considered standard good practices and are consistent with normal standards that an experienced international contractor implements in any project. The costs of these mitigation measures will therefore be covered by the Contractor's normal budget estimates for project design, construction and operation. Indicative cost estimated for EMP implementation and monitoring activities are included in the EIA report and bid documents. The exact and more specific budget for EMP implementation, monitoring, capacity development, and other safeguards requirements will be determined once the contractor is on board and will be included in the Final EIA report.

1106. However, there are some measures that contractors would not normally budget for, and these are the measures that are required because of the unique aspects of this project site. Costs that are particular for this project include vibration monitoring and mitigation, archaeological site excavation and protection zone and replanting a substantial number of trees. The estimated costs of these activities is shown in Table 128, based on the cost of similar exercises on other projects in the Kyrgyz Republic and in the region. These costs would be included in bidding documents, and the Contractor can provide budget and quote in the budget as per the requirement of EMP in bidding document.

Table 128: EMP Cost

SN	Activity	Total Cost (USD)
	EMP	
1	Development of specific environment management plans: Wastewater, Water and Drainage Management Plan; Accidental Spill Prevention and Management Plan; Archaeological Management Plan; Noise Management Plan; etc.	Included in the Contractor's Scope of Works and contractor's staff for environment and health and safety
2	Training and Awareness Programs (Training on water conservation, accidental spill management, waste management, etc. Communications materials (posters, brochures, etc.)	5,000.00
3	Management of the 15 archaeological sites (as identified in the EIA)	22,500.00
4	Establishment of Protection Zones per Ministry of Culture (15 May 2023, Annex 15 of this Report)	Coordination work cost for PIU and CSC
5	Chance Finds (all physical cultural resources as defined by ADB SPS and government laws)	20,000.00
6	Vibration Baseline Condition Survey including Structural Assessment, results, recommendations and report	Included in the Contractor's Scope of Works
7	Dust suppression	36,000.00
8	Tree planting (2 new tree planted for every tree cut) and care until end of DLP	150,145.30
9	Tree cutting	93,000.00

SN	Activity	Total Cost (USD)
10	PPE	Included in the Contractor's Scope of Work
11	Management of asbestos-containing material (ACM) pipes (identified in the EIA: 15 meters)	5,000.00
	Sub-Total	331,645.30
	Contingency (10%) including costs for unanticipated impacts	33,164.50
A	**Total**	**364,809.80**
	Environmental Monitoring	
12	Biodiversity (Season survey + red list)	15,000
13	Air Quality Monitoring	25,000
14	Water Quality Monitoring	25,000
15	Noise Monitoring (under IFC Environment, Health and Safety Guidelines)	50,000
	Sub-Total	305,000.00
	Contingency (10%)	30,500.00
B	**Total**	**335,500.00**
C	External Environment Expert	**To be finalized**
D	Construction Supervision Consultant (Environment)	**To be finalized**
	Total (A + B + C + D)	**To be finalized**

G. Future Review and Revision of Documents

1107. The EIA report and EMP will be regularly revisited throughout the project and will be updated to reflect any changes in major design and to amend the impact assessment and mitigation and monitoring requirements as may be necessary. This process will also allow any unforeseen impacts to be documented, mitigated and monitored. The EIA report will be reviewed and updated, if necessary, by the CSC/PIU.

1108. The review and revision process will be conducted by the CSC/PIU with the assistance of the external environment expert hired under the project, and to be reviewed and approved by the MOTC. It should be emphasized that it is only necessary to revise the document to address significant deviations from what is presented in this EIA report or its latest version in the future. The PIU shall submit the updated EIA report to ADB for final review and disclosure.

X. Findings (Conclusion) and Recommendations

1109. The EIA for the proposed project was carried out using best practices and following the ADB Environmental Safeguard requirements. It included screening, scoping, description of the baseline environmental conditions, impact identification and assessment, identification of mitigation measures, and development of environmental management plan including monitoring. The EIA considered all phases of the project. The overall findings of the project are:

(ii) During construction, the project will have significant adverse impacts on nearby receptors, including the people in settlements, on cultural and archaeological sites, and on biodiversity and ecological receptors, particularly in Lake Issy Kul. Impact will be from dust (airborne and in runoff), noise and vibration. Most of these impacts, which are intermittent and short-term, can be mitigated with the control measures listed in the EMP.

(iii) During operation, the operation of the improved road will have no significant adverse impacts on receptors.

(v) Socio-economically, the project can also potentially increase tourist visits in the project area with the consequent increase in economic incomes of the local people. The better connectivity as a result of the improved road can also potentially help in increasing the local economy and the economy of the Kyrgyz Republic in general.

1110. Based on the results of the EIA, specific recommendations have been provided and these are discussed and listed in the Chapter V (Anticipated Environmental Impacts and Mitigation Measures) and reiterated in Chapter IX (Environmental Management Plan). Most of the recommendations are typical of this type of project (e.g., dust control using watering, proper siting, etc.) In general, to prevent or minimize project impact and to protect the environment, the contractor shall develop and implement a SSEMP that include the mitigation and control measures identified in the EIA report and the EMP and for any unforeseen impacts of the project and for any significant impact resulting from the change in project design. Corollary to this is for the contractor to implement the environmental monitoring plan presented in the EIA Report.

1111. Major recommendations that are specific to this particular project are reiterated below:

(i) Engage external expert(s) for verification of environmental monitoring reports and EMP implementation. External expert(s) shall not be involved in day-to-day project implementation or supervision;

(ii) Excavate heritage and archaeological sites near the road corridor as identified in the survey conducted as part of the EIA and report to and follow the resolution of the Ministry of Culture, Information, Sports and Youth Politics of the Kyrgyz Republic with regards to handling chance archaeological finds during the construction phase. The PIU will assist in coordinating work with local authorities, which are responsible for developing the “project protection zones”.

(iii) The Contractor shall carry out a vibration risk assessment based on the vibration modeling report and other EIA requirements. Based on the risk assessment, the contractor shall take into account all risks associated with construction work and develop a construction method that must be approved by CSC/PIU. The contractor must assess the condition of buildings and structures located along the project site before starting construction works. The Contractor shall bear the full responsibility for any possible impacts resulting from the construction work performed.

(iv) Carry out air quality monitoring, post construction, to identify any additional control measures that need to be implemented to minimize impacts from air pollution during the operation of the project.

(v) Replace all trees that will be cut at the ratio of one (1) tree planted for every tree that is cut. Replacement trees shall be native species that are suitable to local conditions.

(vi) Utilize existing quarries or borrow pits as source of gravel and stones for the road. Coordinate with local authorities and obtain permit from relevant agency prior to quarrying. Borrow areas and quarries comply with environmental requirements to control impacts.

(vii) Develop and implement an Asbestos Containing Materials (ACM) Management Plan in line with the ADB Good Practice Guidance for the Management and Control of Asbestos. Although limited volume of asbestos/cement (A/C) pipe will be dismantled, improper handling and disposal can result to health impacts to nearby workers and population if not properly done.

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