Initial Environmental Examination

Project Number: 49042-005
February 2018

TAJ: CAREC Corridors 2, 5, and 6 (Dushanbe–Kurgonteppa) Road Project–Additional Financing (Part 1 of 2: Main Report)

Prepared by the KOCKS Consult GmbH for the Asian Development Bank and the Ministry of Transport of Tajikistan.

ҶУМҲУРИИ ТОҶИКИСТОН
МАРКАЗИ ТАТБИҚИ ЛОИҲАҲОИ
ТАҶДИДИ РОҲҲО

РЕСПУБЛИКА ТАДЖИКИСТАН
ЦЕНТР РЕАЛИЗАЦИИ ПРОЕКТОВ
РЕАБИЛИТАЦИИ ДОРОГ

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Asian Development Bank

PNo.49042-005: CAREC Corridors 2, 5, and 6 (Dushanbe – Kurgonteppa) Road Project - Additional Financing

Subject: Disclose of Initial Environmental Examination (IEE) on ADB Web-site.

Dear Sir,

We are sending you the approved IEE under the above mentioned project for your no-objection to disclose on ADB's website.

Attachment: Initial Environmental Examination.

Sincerely,

Executive director Arabzoda N.S.

CONTENTS

Annexes

TABLES

FIGURES

ABBREVIATIONS

ADB	-	Asian Development Bank
AH	-	Asian Highway Standard
AIDS	-	Acquired immune deficiency syndrome
AP	-	Affected People
BOD		Biochemical Oxygen Demand
CAREC	-	Central Asia Regional Economic Cooperation
CIS		Commonwealth of Independent States
CS	-	Construction Supervision
CEP	-	Committee for Environmental Protection under the Government of Tajikistan
dB	-	Decibels
EA		Executive Agency
EMP	-	Environmental Management Plan
FS	-	Feasibility Study
GAI		Road Traffic Police
GHG		Green House Gas
GoT	-	Government of Tajikistan
HIV	-	Human Immune Deficiency Virus
HPP		Hydro Power Plant
IEE	-	Initial Environmental Examination
in/sec		inches per second
IMF		International Monetary Fund
IPPC		Intergovernmental Panel on Climate Change
KM	-	Kilometer
LAR	-	Land Acquisition and Resettlement
LARP		Land Acquisition and Resettlement Plan
LHS	-	Left Hand Side
LID		Light-Emitting Diode
M	-	meter
MAC		Maximum Allowable Concentration
masl		meter above sea level
MoT	-	Ministry of Transport
n.a.		not applicable
NGO	-	Non-Governmental Organization
h		hour
PAP	-	Project-Affected Person
PPTA	-	Project Preparatory Technical Assistance
PPV		Peak Particle Velocity
RAP	-	Resettlement Action Plan
RHS	-	Right Hand Side
RoW	-	Right-of-Way
RP	-	Resettlement Plan
SA	-	Social Assessment
SC	-	Supervision Consultant
SES		socio economic survey
SPS		Safeguard Policy Statement
STD	-	Sexually Transmitted Disease
SSEMP	-	Site Specific Environmental Management Plan
TA	-	Technical Assistance
TOR	-	Terms of Reference

UNFCCC		United Nations Framework Convention on Climate Change
USD	-	United States Dollar
VAT	-	Value Added Tax
VOC	-	Vehicle Operating Cost

EXECUTIVE SUMMARY

1. The road forms part of CAREC (Central Asia Regional Economic Cooperation) Corridors 2, 5 and 6. The 82 km long road section from Dushanbe to Kurgonteppa was divided into two phases. The Phase 2 starts at km 33+475 and ends at Kurgonteppa at km 82+095. The phase 2 project cover two road sections: ADB-financed section (km 33 to-km 73) and JICA-financed section (km 73-km 82).

2. This report is the Initial Environmental Examination (IEE) for the ADB financed section of the project Phase 2. It covers the ADB-financed section (in detail) and considers the JICA-financed section as an associated facility (less details). The construction works involves widening of the road from two to four lanes over the whole existing road.

3. This is the IEE for the Phase 2. For Phase 1 a separate IEE has been prepared as a stand alone document.

4. IEE is required for category B Projects in order to warrant compliance of the Project with the ADB Safeguard Policy Statement (June 2009). As such the IEE provides a road map to the environmental measures needed to prevent and/or mitigate negative environmental effects associated with the development project. The IEE also provides a detailed description of the direct and indirect environmental effects associated with the Project during key periods of work, namely the design, pre-construction, construction and operational phase.

5. Regarding its surface morphology the whole Project road can be divided from North to South into a rolling section (approximately 15 km), a mountainous section (approximately 13 km) and a flat section (54 km). Most of the phase 2 road section is located in flat terrain. Basically the highest altitude of the phase 2 is the starting point at 850 m from which it is continuously descending.

6. There are no specially protected natural areas (PAs) in the immediate vicinity of the project area. One strictly protected area – Tigrovaya Balka Natural Reserve is located at the distance of 45 km to the south of Kurgonteppa. The right-of-way of the project road sections in terms of natural zoning runs through two neighboring natural provinces: Hissar (from Dushanbe to pass Fahrobad) and Vakhsh (from pass Fahrobad to Kurgonteppa).

7. Phase 2 of the Project road crosses the Obikiik, Aksu and Vakhsh Rivers with their associated floodplain. Additional significant ecological structures are the tree rows that are stretching over many parts of the Project road. Among the planted species are pines and cypresses. Where drainage or irrigation channels are running parallel to the Project road, deciduous trees such as elms, planes, poplars and willows dominate.

8. The land use alongside the Project road can be divided into three broad main categories comprising urban environment and settlements, agricultural land, and grassland (steppe), which for most of its part is used as pasture land. Most prominent agricultural crops are apples, grapes, cherries, apricots, pistachio and cotton. The land under cultivation is irrigated.

9. Based on the conducted impact analysis, the environmental impacts of the Dushanbe – Kurgonteppa road rehabilitation are evaluated as site specific. Typically, projects upgrading a road to four lanes with separation cause community severance and create

obstacles for farmers and villagers in accessing their fields, etc. However, proper design and other mitigation measures will avoid or substantially minimize those impacts while improving road safety.

10. After Project implementation, during operational stage, there will be, however, only very low residual significant effects. This is because the reconstruction follows the existing alignment and no valuable or protected natural habitats or other valuable environmental structures are significantly impacted after finalization of construction period, neither in their structure nor function. Therefore, the Project is classified as B for environmental impacts, in line with the ADB SPS (2009). The few residual significant effects are due to the road widening and the higher traffic load in the future which will result in the gradual increase of noise and emission levels and potential community severance. These effects are managed by suitable measures which will avoid or substantially minimize these impacts. These measures have been incorporated into the design and consist of speed control signs, pedestrian crossings, livestock crossings, proper road markings, streetlights and other visual means.

11. An Environmental Management Plan (EMP) and Monitoring Programme have been elaborated as part of the IEE. The EMP considers the whole project cycle, namely the design- construction-, and operational- phase of the Project. Since the EMP is a contractual document it only covers the ADB-financed section of Phase 2.

INTRODUCTION

A. Project Background and Purpose of the Report

13. The project will support the government's program to progressively improve the road by (i) expanding its width from two to four lanes, to address the impending capacity constraints; (ii) improving its surface condition by structural overlays of the existing pavement and construction of new pavements, to address the condition constraints; and (iii) providing well-designed safety facilities to address the existing road safety deficiencies. The project will also serve to take stock, draw lessons and analyze the institutional gaps on road safety and road asset management with the view to incrementally strengthening MOT's capacities on these aspects. This approach will support a policy dialogue that will run parallel with the progressive improvement of the road and will be closely coordinated with other development partners active in the transport sector.

14. The 82 km long road section was divided into two phases according to priority. The second phase covers approximately 48+620 km of road section starting from km 33+475. The end point of this second phase is at km 82+095 in Kurgonteppa. The phase 2 project covers two road sections: ADB-financed section (km 33 to km 73) and JICA-financed section (km 73 to km 82).

15. ADB contracted the Kocks Consult GmbH; Germany in cooperation with State Unitary Enterprise "Research, Design and Survey Institute" Tajikistan in December 2015 as a consultant for the PPTA and consequently for preparation of all documents which are required according to the ToR.

16. This is the Initial Environmental Examination (IEE) report for the ADB financed section of the project Phase 2. It covers the ADB-financed section (in detail) and considers the JICA-financed section as an associated facility (less details). The IEE is required for category B Projects in order to warrant compliance of the Project with the ADB Safeguard Policy Statement (June 2009). As such the IEE provides a road map to the environmental measures needed to prevent and/or mitigate negative environmental effects associated with the development project. The IEE also provides a detailed description of the direct and indirect environmental effects associated with the Project during key periods of work, namely the design, pre-construction, construction and operational phases.

17. In detail the IEE (i) identifies and analyzes all significant impacts; (ii) describes their extent, duration and severity; (iii) formulates the required mitigation and monitoring measures and presents it all in the form of an Environmental Management Plan (EMP) and Monitoring Programme.

18. This IEE focuses on phase 2 only, with reference to the phase 1 where appropriate. This approach is based on the stipulations in the Safeguard Policy Statement (SPS) of ADB. Following appendix 1 Phase 1 needs to be interpreted as an associated facility to Phase 2 and there will be cumulative impacts.

19. Work on the IEE for phase 2 started in February 2017. In the following background information on the Republic of Tajikistan, the Project and the environmental baseline conditions within the Project's area of influence are given.

20. The Republic of Tajikistan (herein referred to as Tajikistan) is a landlocked, mountainous country with formidable geographic barriers that seriously constrain its ability to effectively participate in international trade. Its development efforts are further hampered by inadequate physical infrastructure, which is in need of investment and regular maintenance. Tajikistan is surrounded by China, the Kyrgyz Republic, Uzbekistan and Afghanistan. The population of Tajikistan has reached 8.161 million people in 2013. Population density is 57.2 persons / km².

21. Dushanbe, the capital of Tajikistan, is the country's political and economic hub with a population of 775,800 in 2013 which is about 9.5% share of the whole Tajikistan. Population density in Dushanbe is high and shows 7,758.0 persons / km².

22. Kurgonteppa, the southern endpoint of the Project road, is one of the largest cities in the province of Khatlon. The province borders with Afghanistan in the South and is susceptible to the influence of the current conditions in Afghanistan. It also has a high poverty rate.

23. The Project road forms the northern part of the Dushanbe-Nihzny Pyani road which by connecting Dushanbe and the province of Khatlon to Afghanistan, is one of the most significant international transport corridors in the country. Particularly since the opening of the Nihzny Pyani Bridge at the border with Afghanistan traffic volumes on the Project road have considerably increased and contributed much to its current state of deterioration of pavement conditions.

24. Taking the above described aspects of the Dushanbe to Kurgonteppa road together it becomes obvious that its rehabilitation/reconstruction is of urgent need.

25. The Project alignment is expected to follow the existing road alignment, with the possible exception of limited realignments to improve geometric characteristics, elimination of safety hazards and to avoid areas subject to severe soil erosion or unstable slopes. Based on the results of the conducted economic and traffic analysis it was decided that the road shall be designed to cater for 4 lanes over its whole length.

26. The existing RoW of phase 2 complies with 2 lanes only and widening of the RoW and the road's cross section is therefore required over the whole Project length.

27. For Obikiik village in Khuroson district 2 bypass options were considered and investigated. From environmental point of view also the bypass options are feasible. However, due to economic and technical constraints the existing alignment which traverses Obikiik was selected for reconstruction and widening. The environmental and social assessment of the investigated 3 options is shown in the chapter "alternatives".

28. The benefit of the proposed project will be improved connectivity and access to markets. The outcome of the project will be efficient movement of freight and passenger traffic along the Dushanbe – Kurgonteppa road. After implementation of both phases the project outputs will be: (i) 82 km of reconstructed road from Dushanbe to Kurgonteppa, (ii) strengthened road asset management system, and (iii) improved road safety.

B. Study Area and Project Categorization

29. For purposes of establishing the environmental conditions, the overview of regional data is followed by the description at the project level if data is available. For purposes of the

impact assessment it needs to be distinguished in between the core impact area and the wider zone of influence.

30. The core impact area is subject to direct physical encroachment which usually results in the physical loss of structures, such as human properties (kiosks, fences, crops etc.) or natural structures such as topsoil, trees, shrubs and biotopes. Other impacts refer to negative interferences which do not cause the loss of structures but nevertheless cause the reduction of environmental quality. Examples are the negative effects of noise emissions, the effects of emissions of pollutants or the occurrence of increased erosion due to malfunctioning of culverts, lack of retention basins or other. A detailed description of the impacts is given in the chapter on impacts and mitigation measures.

31. An envelope of 200 meters wide on each side of the project road over its entire length is identified as the core impact area. The road sections where sensitive receptors are present, such as schools, hospitals, residential houses or other places where people congregate are given particular attention so that ample mitigation is formulated.

32. The ADB section of Phase 2 of the Project road traverses several towns and villages such as Obikiik, Uyali and Kyzylkala. In all these settlements the sensitive receptors such as schools, hospitals, medical places, bazars, mosques and many residential houses were identified and localized in order to assess any possible impacts due to noise emissions and pollutant emissions during construction phase. The information about sensitive points of public interest near the road alignment was collected during public consultations and specially organized visits to the Project road area. In total 36 sensitive receptors of public interest (schools, kindergartens, mosques and medical places) were identified within the phase 2 of the project. Only few of them are located closer than 50 m to the future Project road.

33. A detailed list of all identified sensitive receptors of public interest including photographs is given in the annex. In addition the many residential houses that are located close to the project road were classified as sensitive receptors. The table in annex 7 shows the buildings within the Project corridor. For road sections that cross rivers, the impact assessment is expanded to cover the identified continuous extent of any ecologically important habitats / features along the Project Corridor. In addition the core impact area needs to be widened at certain locations to consider all ancillary facilities occurring outside the 200 m corridor such as borrow pits and quarries.

34. In contrast the wider zone of influence includes the wider geographical area that is influenced by the project due to better access and more efficient transport connections. This wider zone of influence is subject to indirect and positive impacts.

35. The magnitude of environmental impacts of the Dushanbe – Kurgonteppa road rehabilitation is evaluated as site specific. Typically projects upgrading road to Category 1 road with separation cause split communities, and create obstacles for farmers and villagers in accessing their fields, etc. However, proper design and other mitigation measures allow avoiding or minimizing those impacts, and improve road safety.

36. After Project implementation, during operational stage, there will be however only very low remaining impacts, mainly because the reconstruction follows the existing alignment and no valuable or protected natural habitats or other valuable environmental structures are significantly impacted after finalization of construction period, neither in their structure nor

function. Therefore the Project was classified as environmentally **category B**. This classification is in line with the ADB SPS in which a category B Project is defined as follows: "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."

C. Methodology

37. The project's environmental and social assessment needs to comply with both the legal requirements of Tajikistan and the ADB safeguard policies. Consequently, the methodology used for the preparation of this IEE report is based on the ADB Safeguard Policy Statement (2009) and the existing Tajikistan's environmental and social legislation and permitting procedure.

38. This IEE focuses in detail on the ADB section of Phase 2 whereas the JICA section is treated as an ancillary facility and hence in lesser detail. Reference is made to Phase 1 where appropriate. This approach is based on the stipulations in the ADB's Safeguard Policy Statement (SPS). Following Appendix 1 the connected road sections (JICA section and phase 1) needs to be interpreted as associated facilities to Phase 2 and there might be cumulative impacts from future development of the Project.

39. The Project area was visited for surveying of baseline data many times by the international and national consultants during the time period from March to May 2016, and again from February to May and in August 2017. In addition extensive consultation meetings were conducted on the basis of Jamoat level and in addition with Hukomats and city authorities. The purpose of the consultation was to inform people about the project, to receive their feedback and to incorporate their comments and concerns as far as technically feasible. Minutes of Meeting of the consultation process are incorporated in the annex. Data and information obtained during the consultations have been included where appropriate. Additional background data and information was obtained from published and unpublished sources, e.g., on: climate, topography, geology and soils, natural resources flora and fauna, agriculture, and socio-economic data.

40. During the consultation process, environmental issues were not raised by the local population. However, during consultation in the village of Mehnat people inquired about the possibility to receive compensation for anticipated impacts such as noise and air pollution during construction.

41. During construction period there will be a regular monitoring of noise and vibration, air and water quality as reflected in the Environmental Monitoring Programme, which is part of this IEE report. Baseline measurements for noise, vibration, air quality and water quality were conducted in September 2017.

42. Based on the results of the conducted surveys and consultation meetings noise modelling within Obikiik, Uyali and Kyzylkala were conducted. The results of the noise modelling are shown in the chapter on operational phase impacts and mitigation measures.

I. LEGAL, POLICY AND ADMINISTRATIVE FRAMEWORK

43. This section presents an overview of the policy/legislative framework as well as the environmental assessment guidelines of the Republic of Tajikistan that apply to the proposed project. The section also identifies relevant ADB Safeguard Policies that will be applied in the project.

A. Environmental Clearance Requirements

44. According to ADB's *Guidelines and Environmental Assessment Requirements of Infrastructure Projects*, an IEE will be presented to both the Government of Republic of Tajikistan and ADB. According to initial environmental assessment the project road has been qualified as category "B".

1. Government Environmental Laws, Regulations and Guidelines

Legislation

45. Tajikistan has a well-developed environmental legal and regulatory framework. Current environmental legislation in Tajikistan includes statutory acts and laws on the following topics: (i) Protection of the environment; (ii) ecological audit and monitoring; (iii) protection of flora and fauna; (iv) environmental information and education; (v) soil, water and air quality; (vi) biological safety; (vii) human health and safety; and (viii) waste and chemicals management. These laws, along with the regulations approved by the Government of Tajikistan (GoT) create a favorable legal framework for environmental protection and for the use and protection of the country's natural resources. They also enforce the rights of any citizen for environmental safety, organic products, eco-friendly environment, access to environmental information, possibility of investing (moral, material and financial) to improve the ecological situation in the country.

46. Environmental legislation in the Tajik Republic includes the Constitution, codes and laws on air quality, noise, mineral resources, land management, forests, health and safety, waste and chemicals management. The Tajikistan Framework Environment Law was adopted in 1993 it was enacted in 1994 and amended sequentially in 1996, 1997, 2002, 2004 and 2007. Then in 2011 it was replaced by new law. The Water Code was adopted in 2000 (amended in 2008, 2009, 2011 and 2012), the Land Code in 1996 (amended in 1999, 2001, 2004, 2006 and 2011, twice in 2008 and 2012) and the Forest Code in 1993 (amended twice in 1997 and 2008).

47. Other important environmental legal acts include:

- The Law on Hydro-meteorological Activity (No. 86 as of December 2, 2002);
- The Law on Production and Safe Handling of Pesticides (No. 1 as of April 22, 2003);
- The Law on Protection and Use of Flora (No. 31 as of May 17, 2004);
- The Law on Protection of the Population and Territories from Emergency Situations of Natural and Manmade Origin (No. 53 as of 15 July 2004);
- The Law on Biological Safety (No. 88 as of March 1, 2005);
- The Law on Animal World Conservation and Use (No. 354 as of January 5, 2008);
- The Law on Soils Conservation (No. 555 as of October 16, 2009);
- The Law on Subsoils (No. 983 as of July 20, 1994, wording as of RT Laws No. 120 as of November 4, 1995, No. 351 as of January 5, 2008, No. 471 as of December 31, 2008 and No. 663 as of December 29, 2010);

- The Law on Potable Water and Drinking Water Supply (No. 670 as of December 29, 2010);
- The Law on Environmental Education (No. 673 as of December 29, 2010);
- The Law on Environmental Information (No. 705 as of March 25, 2011);
- The Law on Environmental Monitoring (No. 707 as of March 25, 2011);
- The Law on Environmental Audit (No. 785 as of December 26, 2011);
- The Law on Specially Protected Natural Areas (No. 786 as of December 26, 2011);
- The Law on Use of Renewable Energy Sources (No. 857 as of January 12, 2012);
- The Law on Food Safety (No. 890 as of August 1, 2012);
- The Law on Atmospheric Air Protection (No. 915 as of December 28, 2012);
- The Law on Pastures (No. 951 as of March 19, 2013);
- The Law on Biological Management and Production (No. 1001 as of July 22, 2013);
- The Law on Radioactive Waste Management (No. 1002 as of July 22, 2013);
- The Law on Ensuring Sanitary and Epidemiologic Safety of Population (No. 49 as of December 8, 2003, wording as of RT Laws No. 441 as of October 6, 2008, No. 481 as of December 31, 2008, No. 793 as of December 26, 2011 and No. 1010 as of 22.07.2013);
- The Law on Energy Conservation and Efficiency (No. 1018 as of September 19, 2013);
- The Law on Fishing and Protection of Fishery Resources (No. 1021 as of September 19, 2013).
- The Law on Energy Saving (No. 524 as of February 6, 2002);
- The Law on Industrial and Domestic Waste (No. 44, as of May 10, 2002, wording of the Republic of Tajikistan Law No. 736 as of July 28, 2011); and
- The Law on Ensuring of Environmental Safety of the Road Transport (No. 1214 as of August 8, 2015).

International legal instruments

48. The Republic of Tajikistan is party to a number of international environmental treaties including:

- UN Convention to Combat Desertification (CCD), 1997.

- UN Convention on Biological Diversity (CBD), 1997; Related updates to CBD are:
  - Cartagena Protocol on Biosafety to the Convention on Biological Diversity, 2004.
  - Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity, signed in 2011 and ratified in 2013.

- Ramsar Convention (joined 2000);

- Bonn Convention on the Conservation of Migratory Species of Wild Animals (joined 2001); A related update is:
  - Bukhara Deer Memorandum, 2002.

- UN Framework Convention on Climate Change, 1998; A related update is:
  - Kyoto Protocol, accessed on December 29, 2008, and entered into force on March 29, 2009.

- Stockholm Convention on Persistent Organic Pollutants (ratified 2007); Related updates:
  - 2009 amendments listing 9 new POPs, August 26, 2010;

- 2011 amendment listing endosulfan, October 27, 2012; and
- 2013 amendment listing HBCD, November 26, 2014.

- Aarhus Convention (joined 2001); A related update is:
- Kiev Protocol on Pollutant Release and Transfer Registers to the Convention on Access to Information, on May 21, 2003.

- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), 2016.

- UNESCO Convention Concerning the Protection of the World Cultural and Natural Heritage (joined 1992).

Environmental Assessment

49. There are two laws in the country that stipulate all aspects of the EA: (a) Law on Environment Protection; and (b) Law on Ecological Expertise. The Chapter V, Articles 35-39 of the Law on Environment Protection (2011), introduces the concept of state ecological review (literally, state ecological expertise[1] – SEE) that seeks to examine the compliance of proposed activities and projects with the requirements of environmental legislation and standards and ecological security of the society. The mentioned laws stipulate the mandatory cross-sectoral nature of SEE, which shall be scientifically justified, comprehensive, and objective and which shall lead to conclusions in accordance with the law. SEE precedes decision-making about activities that may have a negative impact on the environment. Financing of programs and projects is allowed only after a positive SEE finding, or conclusion, has been issued.

50. The following activities and projects are subject to state ecological review:

    a. draft state programs, pre-planning, pre-project, and design documentation for economic development;
    b. regional and sectoral development programs;
    c. spatial and urban planning, development, and design;
    d. environmental programs and projects;
    e. construction and reconstruction of various types of facilities irrespective of their ownership;
    f. draft environmental quality standards and other normative, technology, and methodological documentation that regulates economic activities;
    g. existing enterprises and economic entities.

51. The laws stipulate that all types of economic and other activities shall be implemented in accordance with existing environmental standards and norms and shall have sufficient environmental protection and mitigation measures to prevent and avoid pollution and enhance environmental quality. The EA studies analyzing the short- and long-term environmental, genetic, economic, and demographic impacts and consequences shall be evaluated prior to making decisions on the allocation, construction, or reconstruction of facilities, irrespective of their ownership. If these requirements are violated, construction will be terminated until necessary improvements are made, as prescribed by the GoT

[1] State Ecological Expertise means both the department (institution) within the Committee for Environmental Protection and the process of review as well.

and/or other duly authorized control bodies, such as sanitary, geological, and public safety agencies.

52. An EIA is a component of the SEE, as set out in the 2011 Environmental Protection Law and in the 2012 Law on State Ecological Expertise, which comprises both the department within the Committee for Environmental and the process as well. Conducting the EIA is the responsibility of the project proponent. The State Ecological Review[2] - which comprises the process component only - for all investment projects is the responsibility of the GoT Committee for Environmental Protection (CEP) and its regional offices. Furthermore, according to the 2012 Law on State Ecological Expertise, all civil works, including rehabilitation ones, should be assessed for their environmental impacts and the proposed mitigation measures should be reviewed and monitored by the CEP.

53. According to the 2012 Law on Ecological Expertise, ecological expertise is intended to prevent negative impacts on the environment as a result of a proposed activity, forecast impacts from activities that are not considered as necessarily damaging to the environment and create databases on the state of the environment and knowledge about human impact on the environment.

54. This Law on Ecological Expertise and the Law on Environment Protection envisage two types of ecological expertise – State ecological expertise and public ecological expertise, which are not given equal importance. While State ecological expertise is a prerequisite for beginning any activity that may have an adverse environmental impact, public ecological expertise becomes binding only after its results have been approved by a State ecological expertise body.

55. The State Ecological Expertise is authorized to invite leading scientists and qualified outside specialists to participate in the review. Approval should be issued within 30 days, unless the project developer agrees to an extension, and remains valid for two years, if the decision is positive. For very complicated projects the term of consideration and approval can be extended till 60 days.

56. According to the Law on SEE the public ecological expertise of economic activities or other activities implementation of which can negatively impact the environment of population which live in relevant area can be carried out by any public organization and citizen. They have right to send the proposals to the responsible government bodies concerning environmental issues of implementation planned activities; to receive information on results of conducted state ecological expertise from relevant responsible bodies. The materials reflecting the public expertise delivered to the experts‘ commission should be taken into consideration under preparation of conclusion of state ecological expertise and decision making on realization of expertise object. The public ecological expertise is carried out under the state registration of application of public organization. The registration can be done by local executive authorities (during 7 days) in place where the expertise activities are planned. The public organizations which are organizing this expertise, should inform the population of initiation of expertise and then on its results.

57. The legal and regulatory system for the EIAs also include:

[2] State Ecological Review which is also commonly referred as State Environmental Review means the process only.

- Procedure of Environmental Impact Assessment (adopted by the Resolution of the Government of the Republic of Tajikistan No. 509 as of 01.08.2014).
- Procedure to implement State Ecological Expertise (approved by the Resolution of the Government of the Republic of Tajikistan No. 697 as of December 3, 2012).
- Guidelines on the composition and order of development of content and structure of the documentation to be submitted for review (SEE), as well as coordination and approval of all projected budget or investment estimations, design drawings or documentation that must be developed in coordination with the SEE3, buildings and structures and EIA chapters, Strategic Environmental Assessment SEA and feasibility documents; and
- List of objects and types of activity for which preparation of documentation on Environment Impact Assessment is mandatory (adopted by the Resolution of the Government of the Republic of Tajikistan No. 253 as of June 3, 2013).

58. The elaborated existing normative legal base is intended for determination of legal basis for implementation of projects and their compliance with state requirements for environmental protection and mitigation of environmental impact.

59. In the Republic of Tajikistan, the organizations with most responsibility for environmental monitoring and management currently are the Committee for Environmental Protection (CEP) under the Government of the Republic of Tajikistan (GoT), the Sanitary Inspectorate of the Ministry of Health, the Inspectorate for Industrial Safety and the Mining Inspectorate. An environmental licensing system exists in relation to handling hazardous waste and mineral extraction. An environmental permitting system regulates the use of natural resources.

60. The Environmental Protection Law states that a SEE should be conducted by the CEP, which is designated as a duly authorized state environmental protection body. The CEP has a comprehensive mandate that includes policy formulation and inspection duties. The CEP has divisions at oblast (region), city and rayon (district) level, in the form of Departments of Environmental Protection (DEPs), within the Hukumat (local administration) at each city or rayon.

Public Participation

61. Article 12 of the Environment Protection Law proclaims the right of citizens to live in a favorable environment and to be protected from negative environmental impacts. Citizens also have the right to environmental information (Article 13), as well as to participate in developing, adopting, and implementing decisions related to environmental impacts (Article 13). The latter is assured by public discussion of drafts of environmentally important decisions and public ecological reviews. Public representative bodies have an obligation to take into consideration citizens‘ comments and suggestions.

Licenses

62. Licenses are legal instruments to regulate certain potentially hazardous activities where minimal qualifications and strict adherence to rules are required to ensure that they are carried out efficiently, safely and do not result in potentially very significant and irreparable damage to the environment and human health .In particular, licenses are required for handling hazardous waste; for activities in industrial safety, sources of ionizing radiation,

[3] All projected budget or investment estimations, design drawings or documentation must be developed in coordination with the SEE.

production and handling of pesticides and other agrochemicals. They are issued by the relevant industry regulator (ministry or committee) or an entity to which it has delegated such right. Licensing is also used to ensure the most efficient and sustainable use of natural resources. For example, licenses are required for prospecting, collecting or extracting mineral resources (borrow areas), or for constructing underground facilities not related to mining.

Environmental Permits

63. Permits are meant to ensure the sustainable use of natural resources. There are two types of permits: (a) permits to use natural resources; and, (b) permits for emissions or discharges. The natural resources use permits allow their holders to take a certain number or amount of a particular natural resource within a defined territory and time period. They are issued both to individuals (e.g. to hunt a particular species of animal or harvest particular factories) and to organizations (e.g. permits to extract ground or surface water for a particular use). By law, permits are needed for any commercial use of any resource. The authority that issues the permit and the legislation (government resolution) that applies depend on the resource. Permits to discharge polluted matter are issued by the relevant inspectorate (e.g. previous State Water Inspectorate or State Air Inspectorate – now departments) of the local state environmental protection committees to industrial or agricultural enterprises and municipal utilities that release by-products into the environment. The permits allow releasing a certain amount of polluted matter (gases, liquids, solid waste) into the environment. The permits are normally granted for one year and indicate the maximum allowed concentration of the pollutants in the released matter, the maximum volume of the polluted matter and the pollutants allowed.

State Environmental Program 2009-2019

64. The Program, approved in 2009, obligates ministries and offices, heads of administrations and mayors of cities to improve environmental conditions and ensure sustainable development of the country during the period of economic transition. It calls for adoption of modern environmental standards for water, air, soil, solid waste, toxic wastes, and noise control, based on maximum permissible amounts. Standards are to be supplemented by discharge permits. The Program is accompanied by broad ecological zoning, dividing the country into ten zones (Syr-Darya, Northern Turkestan, Zeravshan, Gissar, Vaksh, Dangarin, Khulbak-Kulyak-Tchube, Karategin-Baldzhuan - Shurobad, Garm-Muksu-Balandkiik, and Badakshan).

2. ADB Safeguards

65. As noted previously the Dushanbe to Kurgonteppa road has been classified as category “B” for Environmental Assessment. The categorization was carried out based on ADB's Safeguard Policy Statement (2009). Because the Project is environmentally categorized as B, an IEE is required. An initial step in determining a project’s environmental category is to prepare a Rapid Environmental Assessment (REA) screening checklist, taking into account the type, size, and location of the proposed project. A preliminary REA for the Dushanbe to Kurgonteppa road had already been prepared in 2015 at the project's concept stage. Considering the new alignment considerations which among others included the new starting point (3.382 km North of Dushanbe gate) and the widening to 4 lanes over the whole Project length the REA was updated and resubmitted by the consultant to ADB on April 30. A project is classified as one of the following four environmental categories:

- Category A: Projects with potential for significant adverse environmental impacts. An environmental impact assessment and a summary EIA (SEIA) are required to address significant impacts.
- Category B: Projects judged to have some adverse environmental impacts, but of lesser degree and/or significance than those for category A projects. An initial environmental examination and a summary IEE are required to determine whether or not significant environmental impacts warranting an EIA are likely. If an EIA is not needed, the IEE is regarded as the final environmental assessment report.
- Category C: Projects unlikely to have adverse environmental impacts. No EIA or IEE is required, although environmental implications are still reviewed.
- Category FI: Projects are classified as category FI if they involve a credit line through a financial intermediary or an equity investment in a financial intermediary. The financial intermediary must apply an environmental management system, unless all subprojects will result in insignificant impacts.

66. Public consultation meetings on social and environmental issues were carried out as described in the chapter "Stakeholder Consultation and Information Disclosure". Minutes were taken during all conducted consultation meetings and are attached to this report.

67. The IEE report is to be submitted to the Committee for Environmental Protection under the Government of Tajikistan to obtain the SEE (State Ecological Expertise) for the Project.

B. Environmental Standards

68. Environmental quality standards in Tajikistan are based on GOST, SNiP and SanPiN. GOST (Tajiki: ГОСТ) refers to a set of technical standards maintained by the Euro-Asian Council for Standardization, Metrology and Certification (EASC), a regional standards organization operating under the auspices of the Commonwealth of Independent States (CIS). SNiP mean Technical Standards (Tajiki: СНИП) - a building code, a set of rules that specify the minimum standards for constructed objects such as buildings and nonbuilding structures. SanPiN (Tajiki: Коидахо ва меъёрхои санитари) are sanitary rules and norms (standards).

69. Environmental quality standards in Tajikistan ensure both MPC (Tajiki: ПДК) and MPE (Tajiki: ПДВ). The maximum permissible concentration (MPC) is approved by law hygienic standard. Under MPC refers to a concentration of chemical elements and their compounds in the environment, which in everyday impact for a long time on the human body does not lead to pathological changes or diseases established modern research methods in any time of life of present and future generations. The maximum permissible (or allowable) emissions (MPE) is standard of maximum permissible emissions of harmful substances (pollutants) into the air, which is set for a stationary source of air pollution in accordance with technical standards for emissions and background air pollution. It provides non-exceeding of the hygiene and environmental air quality standards, limits (critical) loads on ecological systems and other environmental regulations requirements.

70. The Table 1 gives an overview of the National Standards and regulations that are applicable to the Project.

Tab. 1 National standards and regulations applicable to the Project

#	Title - National Standards - GOSTs
1.	31431—2011. Protection of nature. Air. Set of Maximum Permissible Emissions (MPE). 29 November 2011
2.	31434—2011 Protection of nature. Air. Determination of parameters of efficiency of dust collection systems. 29 November 2011
3.	IEC 61241-0—2011 Electrical equipment used at areas containing flammable dust. Part 0. General requirements. 29 November 2011
4.	GOST 17.0.0.01-76 (ST SEV 1364-78) (in edition of 1987) System of standards for environmental protection and improvement of natural resources usage. General provisions
5.	General provisions GOST 17.0.0.04-80 (1998) Protection of nature. Environmental passport (certificate) of industrial facility. General provisions
6.	GOST R ISO14001-98 Environmental management systems. Requirements and guidelines.
7.	GOST 17.0.0.02-79 (1980) Protection of nature. Provision of metrological control of air, surface water and soils pollution.
8.	GOST 17.1.1.01-77 (ST SEV 3544-82) Usage and protection of water. General terms and definitions.
9.	GOST 17.2.1.01- 76 Classification of emissions (content).
10	GOST 12.1.014-84 (1996) SSBT. Air at workplace. Methodology of measuring of pollutants concentration using indication tubes.
11	GOST 12.1.005-88 (1991) SSBT. General sanitary and hygiene requirements to air at workplace.
12	GOST 17.2.2.05-97 Norms and methods of emissions measuring containing spent diesel gases, tractors and self-propelled agricultural machines.
13	GOST 21393-75 Diesel motorcars. Exhaust gas opacity. Norms and methods of measurement.
14	GOST 17.2.2.03-77 Concentration of carbon monoxide at exhaust gases of motorcars with gasoline engines. Norms and measurements methodology.
15	GOST 17.2.2.03-87 Norms and methods of measurements of carbon monoxide at exhaust gases of motorcars with gasoline engines.
16	GOST 17.4.2.01-81 Nomenclature of sanitary condition parameters
17	GOST 17.4.1.02-83 Classification of chemical substances for monitoring of contamination.
18	GOST 12.1.003-83 (1991) SSBT. Noise. General safety requirements
19	GOST 12.1.023-80 (1996) SSBT. Noise. Methods of threshold noise levels for stationary machinery.
20	GOST 12.1.029-80 (1996) SSBT. Means and methods of noise protection. Classification.
21	GOST 12.1.036-81 (1996) SSBT. Noise. Allowable levels of noise within residential and public buildings.
22	GOST 12.1.007-76 (1999) SSBT. Harmful substances. Classification and general safety requirements.

#	Title - National Standards - GOSTs
23	GOST 12.4.119-82 SSBT. Means of respiratory PPE. Methods of protective features assessment for aerosols.
24	GOST 12.4.125-83 (1985) SSBT. Means of collective protective equipment from mechanical factors. Classification.
Sanitary norms and regulations (SanPins)	
25	SanPiN 2.1.4.559-96 Drinking water. Hygienic requirements to the quality of water from centralised systems of drinking water supply. Quality control
26	CH 2.2.4/2.1.8.562-96 Noise at working places, indoors of residential and public buildings and the territories of residential areas

71. In the following tables a synopsis is given on the specific standards for air quality, water, waste and noise emissions in Tajikistan. In addition the standards are compared with international guidelines and standards. In general it can be concluded that the Tadjik system of environmental standards is well developed and for the purpose of the present Project it is in line with the requirements of IFIs. It was therefore decided to use the Tajik standards as the reference in the present Project.

Tab. 2 Environmental Standards for Emissions to the Atmosphere

	National Standards / Requirements	Adopted Project Standard			Rationale
Topic	**Tajikistan**	**IFC Environmental, Health, and Safety General Guidelines (or IFC PS)**	**IFC Environmental, Health, and Safety Guidelines for Onshore Oil and Gas Development**		
Emissions of Ozone Depleting Substances	No relevant numeric standard	No relevant numeric standard (*Although 'no new systems or processes should be installed using CFCs, halons, 1,1,1-trichloroethane, carbon tetrachloride, methyl bromide or HBFCs'*).	No relevant numeric standard.	Consistent with applicable international conventions apply the principle that the will be no utilisation of ozone depleting substances (halons, PCBs, CFCs, HCFCs) and IFC	Good practice
GHG emissions	No relevant numeric standard		No relevant numeric standard	Numeric standards do not apply. GHG will be quantified and reported annually if >25,000 tonnes CO_2 equivalent per year are expected (as per IFC PS3, 2012)	Most relevant

Tab. 3 Environmental Standards for Ambient Air

	National Standards / Requirements Tajikistan standards[4],	**IFC/World Bank Guidelines / Standards**	**General IFC Environmental, Health, and Safety Guidelines (Wastewater and ambient air quality)**	**Adopted Project Standard (mg/m^3)/ supplementary standards are marked blue**	**Rationale**
Air Quality - Human population protection (at receptors)	mg/m^3: PM 0.15 NO 0.06 NO_2 0.04 SO_2 0.05 Ammonia 0.06 Benzopyrene 0.1 Benzene 0.1 Acetone 0.35 Petrol 1.5 V_2O_5 0.002 Vinyl acetate 0.15 HCl 0.2 HF 0.005 Fe_2O_3 0.04 HNO_3 0.4 H_2SO_4 0.1 Xylol 0.2 Manganese and its oxides 0.001 Copper oxides 0.002 Magnesia 0.05	Where set, national air quality standards apply. If no national standards are set then apply WHO standards WHO guidelines, $\mu g/m^3$: $PM_{2.5}$ 10 (1 yr) $PM_{2.5}$ 25 (24 h) PM_{10} 20 (1 yr) PM_{10} 50 (24 h) Ozone 100 (8 h) NO_2 40 (1 yr) NO_2 200 (1 hr) SO_2 20 (24 h) SO_2 500 (10 min)	Emission concentrations as per General EHS Guidelines, and: H_2S: 5 mg/Nm^3	mg/m^3: PM 0.15 NO 0.06 NO_2 0.04 SO_2 0.05 CO 3.00 Ammonia 0.06 Benzopyrene 0.1 Benzene 0.1 Acetone 0.35 Petrol 1.5 V_2O_5 0.002 Vinyl acetate 0.15 HCl 0.2 HF 0.005 Fe_2O_3 0.04 HNO_3 0.4 H_2SO_4 0.1 Xylol 0.2 Manganese and its oxides 0.001 Copper oxides 0.002	Tajikstand and supplemented by WHO where necessary to achieve most comprehensive suite[5]

[4] Annex 3 to Procedure of Environmental Impact Assessment accepted by Resolution No 464 of the Government of the Republic of Tajikistan dated 3 October 2006
[5] The IFC cites WHO ambient air quality guidelines typically apply only in jurisdictions where there are no national standards in place.

	Nickel oxide 0.001 Inorganic dust (SiO_2 70 %) 0.05 SiO_2 = 70 % - 20 % 0.1 SiO_2 is less than 20 % 0.15 Lead and its compounds 0.0003 Lead sulfur 0.001 Hydrogen sulfide, H_2S 0.008 Turpentine 1 Ethyl alcohol (ethanol) 5.0 Butyl alcohol (butanol) 0.1 Propane alcohol (propanol) 0.3 Methyl alcohol (methanol) 0.5 Styrene 0.003 Soot 0.05 CO 3.0 Phenol 0.01 Formaldehyde 0.003 Fluoride (HF, SiF4) 0/05 Freon (all brands) 10 Chromium trioxide 0.0015 Chlorine 0.03 ZnO 0.05 Ethylene oxide 0.03			Magnesia 0.05 Nickel oxide 0.001 Inorganic dust (SiO_2 70 %) 0.05 SiO_2 = 70 % - 20 % 0.1 SiO_2 is less than 20 % 0.15 Lead and its compounds 0.0003 Lead sulfur 0.001 Hydrogen sulfide, H_2S 0.008 Turpentine 1 Ethyl alcohol (ethanol) 5.0 Butyl alcohol (butanol) 0.1 Propane alcohol (propanol) 0.3 Methyl alcohol (methanol) 0.5 Styrene 0.003 Soot 0.05 Phenol 0.01 Formaldehyde 0.003 Fluoride (HF, SiF4) 0/05 Freon (all brands) 10 Chromium trioxide 0.0015 Chlorine 0.03 ZnO 0.05 Ethylene oxide 0.03	

Tab. 4 Environmental Standards for Water Quality & Discharges to Water [6]

	National Standards / Requirements	**IFC/World Bank Guidelines / Standards**	**Adopted Project Standard**	**Rationale**
Topic	**Tajikistan**	**IFC Environmental, Health, and Safety General Guidelines**		
Discharge to surface water: **Effluent water**	List of MPC quality of water at surface water bodies (Requirements to water quality in fishery water bodies)[7] pH 6.5-8.5 Aluminium (Al) 0.04 Iron (Fe) 0.1 Cadmium (Cd) 0.005 Copper (Cu) 0.001 Nickel (Ni) 0.01 Lead (Pb) 0.006 Zinc (Zn) 0.01 Chromium (Cr^{+6}) 0.02 Chromium (Cr^{3+}) 0.07 Oil and petrochemicals 0.05 Arsenic (As) 0.05 Calcium (Ca) 180 Silicon (SiO_3^{2-}) 1.0	Temperature of wastewater prior to discharge does not result in an increase greater than 3°C of ambient temperature at the edge of a scientifically established mixing zone which takes into account ambient water quality, receiving water use and assimilative capacity among other considerations. For treated sanitary wastewater: pH 6-9 BOD 30 COD 125 Total nitrogen 10 Total Phosphorus 2 Oil and grease 10 TSS 50 Total coliform bacteria 400/100ml	pH 6.5-8.5 BOD 30 COD 125 Tital Nitrogen 10 Total Phosphorus 2 TSS 50 Total Coliform bacteria 400/100 ml Aluminium (Al) 0.04 Iron (Fe) 0.1 Cadmium (Cd) 0.005 Copper (Cu) 0.001 Nickel (Ni) 0.01 Lead (Pb) 0.006 Zinc (Zn) 0.01 Chromium (Cr^{+6}) 0.02 Chromium (Cr^{3+}) 0.07 Oil and petrochemicals 0.05 Arsenic (As) 0.05 Calcium (Ca) 180	Tajik MPC as most stringent standard supplemented by IFC where needed for comprehensive suite

[6] For drinking water see Tab. 5.
[7] Annex 3 to Procedure of Environmental Impact Assessment accepted by Resolution No 464 of the Government of the Republic of Tajikistan dated 3 October 2006
..

	National Standards / Requirements	IFC/World Bank Guidelines / Standards	Adopted Project Standard	Rationale
Topic	**Tajikistan**	**IFC Environmental, Health, and Safety General Guidelines**		
			Silicon (SiO_3^{2-}) 1.0	
Water quality - freshwater	List of MPC above (mg/l)	No numeric standards	Tajik MPC for surface water bodies	Tajik as only relevant

Tab. 5 Drinking Water Standards

The project has set numeric standards for the following waters:

DRINKING WATER GENERAL ANALYSIS CONTENT AND LIMITS						
Parameter	**Units**	**Tajikistan Standard[5)]**	**WHO Standard**	**EU Standard[3]**	**Project Standard [8] (mg/l unless stated otherwise)**	
Physical Quality						
pH	---	6-9	6–9	6.5-9.5	TS	6-9
Total Dissolved Solids	mg/l	1000	---		TS	1000
Hardness	Mg-eqv/l	7.0	---		TS	7.0
Turbidity	EMF (formasine) or mg/l (caoline)	1.5	---	Acceptable to consumers and no abnormal change	TS	1.5
Inorganic Chemical Quality						
Aluminium (Al)	mg/l	0.5	---	0.2	EU	0.2
Ammonium ion (NH_4)	mg/l		---	0.5	EU	0.5
Antimony (Sb)	mg/l	0.05	0.02	0.005	EU	0.005
Arsenic (As total)	mg/l	0.05	0.01	0.01	EU	0.01
Barium (Ba)	mg/l		0.7	---	TS	0.7
Beryllium (Be)	mg/l		---	---	TS	
Boron (B)	mg/l		0.5	1.0	WHO	0.5
Cadmium (Cd)	mg/l	0.001	0.003	0.005	TS	0.001
Chloride ion (Cl^-)	mg/l	350	---	250	EU	250
Chlorine (Cl)	mg/l	0.3-0.5 (free) 0.8-1.2 (bounded)	5	---	TS	0.3-0.5 (free) 0.8-1.2 (bounded)
Chromium (Cr^{+6}) (Cr^{+3})	mg/l	0.05 0.5	0.05	0.05	TS	0.05 0.5
Copper (Cu)	mg/l	1.0	2	2.0	TS	1.0
Cyanide (CN)	mg/l		0.07	0.05	EU	0.05

[8] Project standard represents most stringent for each parameter

DRINKING WATER GENERAL ANALYSIS CONTENT AND LIMITS						
Parameter	**Units**	**Tajikistan Standard[5)]**	**WHO Standard**	**EU Standard[3]**	**Project Standard [8] (mg/l unless stated otherwise)**	
Fluoride ion (F^-)	mg/l		1.5	1.5	EU	1.5
Hydrogen Sulphide (H_2S)	mg/l		---	---	TS	
Iron (Fe)	mg/l	0.3	---	0.2	EU	0.2
Lead (Pb total)	mg/l	0.03	0.02	0.01	EU	0.01
Manganese (Mn)	mg/l		0.4	0.05	EU	0.05
Mercury (Hg)	mg/l		0.001	0.001	EU	0.001
Molybdenum (Mo)	mg/l		0.07	---	WHO	0.07
Nickel (Ni)	mg/l	0.1	0.02	0.02	EU	0.02
Nitrate ion (as NO_3^-)	mg/l	45	50	50	TS	45
Nitrite ion (as NO_2^-)	mg/l		3 or 0.2	---	TS	3.0
Phosphate ion (PO_4^{2+})	mg/l	3.5	---	---	TS	3.5
Selenium (Se)	mg/l		0.01	0.01	TS	0.01
Silicon (Si)	mg/l	10	----	----	TS	10
Silver (Ag)	mg/l		---	---	TS	0.05
Sodium (Na)	mg/l		---	200	TS	200
Sulphate ion (SO_4^{2+})	mg/l	500	---	250	EU	250
Strontium (Sr)	mg/l		---	---	TS	---
Uranium (U)	mg/l		0.015	---	WHO	0.015
Vinyl Chloride (C_2H_3Cl / H_2C)	mg/l		0.0003	0.0005	WHO	0.0003
Zinc (Zn)	mg/l	5.0	---	---		5.0
Other quality parameters						
Petrochemicals	mg/l	0.1		0.1-5	TS	0.1
Sufactants (anionic)	mg/l	0.5		----	TS	0.5
COD	mg/l	----		150-400	EU	150-400
Permanganate oxizability	mg/l	5		----	TS	5
Specific electrical conductivity	$2x10^{-3}$			----	TS	$2x10^{-3}$

Note:

1. This table shows upper limit values, unless indicated otherwise as a range or lower limit value.
2. This table does not include organic chemicals, detergents, pesticides or disinfection by-products. Refer to WHO Guidelines for Drinking Water Quality for Chemical Lists and Guideline Values, the most stringent of which will also form the project standard.
3. EU Council Directive 98/83/EC of 3rd November 1998
4. EU Standard for radioactivity expressed as Tritium 100 Bq/l with a total indicative dose of 0.1 mSv/year
5. SanPin 2.1.4.1074-01.
6. **) – for climatic region III

Tab. 6 Environmental Standards for Waste

Topic	Tajikistan Standards / Requirements	IFC Environmental, Health, and Safety General Guidelines	Adopted Project Standard	Rationale
Waste treatment and disposal (onshore)	No numeric standards stated in the source documents. All waste produced must be handled and disposed of in accordance with national law on waste of production and consumption.	No relevant numeric standard.	No relevant numeric standard.	All waste produced must be handled and disposed of in accordance with national law on waste of production and consumption.
Secondary containment of liquid wastes	No numeric standards stated in the source documents. No numeric standards stated in Tajik legislation.	Secondary containment (SC) is included wherever liquid wastes are stored in volumes greater than 220 litres. The available volume of SC should be at least 110% of the largest storage container, or 25% of the total storage capacity (whichever is greater).	No relevant numeric standard.	IFC Environmental, Health, and Safety General Guidelines Secondary containment (SC) is included wherever liquid wastes are stored in volumes greater than 220 litres. The available volume of SC should be at least 110% of the largest storage container, or 25% of the total storage capacity (whichever is greater).

Tab. 7 Environmental Standards for Noise Emissions

	National Standards / Requirements	**International Guidelines / Standards**	**Adopted Project Standard**	**Rationale**
Topic	**Tajikistan[9]**	**IFC Environmental, Health, and Safety General Guidelines**		
Night time noise limits for human protection	Noise emissions at the night time (23:00-07:00) should not exceed the following levels (SanPin 2.2.4/2.1.8.562-96): • Inside residential and public buildings: – Hospital and sanatorium's wards, and operating rooms: 25 dB(A); – Residential rooms in apartments, rest houses, boarding houses, houses for the elderly and disabled, sleeping rooms in kindergartens, and residential schools: 30 dB(A); – Rooms in hotels and hostels: 35 dB(A); • In residential and other areas: – Recreational areas immediately adjoining hospital buildings and health centres: 35 dB(A) – Areas immediately adjoining residential buildings, policlinics, dispensary, rest houses, homes for the elderly and disabled, kindergartens, schools and other educational institutions, libraries; 45 dB(A); – Areas immediately adjoining hotel and dormitory's buildings: 50 dB (A)	Noise emissions should not exceed the following levels or result in a maximum increase in background levels of 3 dB at the nearest receptor location off-site: Outdoor: Residential; institutional, educational: Night time (22:00-07:00): 45 dB(A) Industrial, commercial: Night time (22:00-07:00): 70 dB(A)	Tajik standards apply with night time defined as 22:00 – 07:00 in line with IFC EHS General Guidelines. Exception 1: IFC standard will prevail from 22.00 to 23.00 Exception 2: areas adjoining hotels and dorms where IFC standard is more stringent 45 dB (A)	Most stringent and provides more comprehensive measurement criteria

[9] According to International Sanitary Norms adopted by CIS countries (SanPin 2.2.4/2.1.8.562-96)

	National Standards / Requirements	International Guidelines / Standards	Adopted Project Standard	Rationale
Topic	**Tajikistan[9]**	**IFC Environmental, Health, and Safety General Guidelines**		
Day time noise limits for human protection	Noise emissions at the day time (07:00-23.00) should not exceed the following levels (SanPin 2.2.4/2.1.8.562-96): • Inside residential and public buildings: – Hospital and sanatorium's wards, and operating rooms: 35 dB(A); – Consultation rooms of policlinics, ambulant clinics, dispensers, hospitals, and sanatoria 35 dB(A). – Classrooms, teachers' common room, school and other educational organization's auditoriums conference halls, and public reading rooms 40 dB(A). – Residential rooms in apartments, rest houses, boarding houses, houses for the elderly and disabled, sleeping rooms in kindergartens, and residential schools: 40 dB(A); – Rooms in hotels and hostels: 45 dB(A); – Halls of cafes, restaurants, eating rooms: 55 dB(A); – Shops trade halls, passenger halls in airports and stations, consumer services centres: 60 dB(A); • In residential and other areas: – Recreational areas immediately adjoining hospital buildings and health centres: 45 dB(A) – Areas immediately adjoining residential buildings, policlinics, dispensary, rest houses, homes for the elderly and disabled, kindergartens, schools and other educational institutions, libraries: 55 dB(A);	Noise emissions should not exceed the following levels or result in a maximum increase in background levels of 3 dB at the nearest receptor location off-site: Outdoor Residential.; institutional, educational.: Daytime (07:00-22:00): 55 dB(A) Industrial, commercial: Night time (22:00-07:00): 70 dB(A).	Tajik standards with daytime defined as 07:00 – 22:00 in line with IFC EHS General guidelines. Exception: areas adjoining hotels and dorms where IFC standard is more stringent 55 dB (A)	Most stringent and provides more comprehensive measurement criteria

	National Standards / Requirements	International Guidelines / Standards	Adopted Project Standard	Rationale
Topic	**Tajikistan[9]**	**IFC Environmental, Health, and Safety General Guidelines**		
	– Areas immediately adjoining hotel and dormitory's buildings: 60 dB (A) – Rest areas at the territory of hospitals and sanatoria 35 dB (A) – Recreation areas at the territory of micro-districts, and residential areas, rest houses, houses for the elderly and disabled, children's playgrounds in kindergartens, schools and other educational institutions: 45 dB (A)			

Vibration Standards

In Tajikistan, there are no state standards for vibration. However vibration levels will be monitored during construction phase within settlements. Baseline levels will be established before construction starts.

III. DESCRIPTION OF THE PROJECT

A. Overview

72. CAREC 2020 will seek to improve industrial competitiveness through transport connectivity, and development of economic corridors. Developing the economic corridors can help diversify the region's industries and make them competitive through technology, logistics, and other business support services. The project road is part of CAREC transport corridors. The impact of the project will be enhanced regional integration and inclusive economic growth in Tajikistan.

73. The government has requested ADB assistance to improve portions of CAREC corridors 2, 5, and 6 by upgrading the 82 km Dushanbe–Kurgonteppa road, for which ADB has programmed two projects (Phase 1 and Phase 2) in 2016 and 2018 as presented in the Tajikistan country operations business plan, 2016–2018.

74. The Phase 1 starts 3.382 km to the North of Dushanbe Gate and ends at village Chashmasoron at km 33+475. The Phase 2 covers the remaining road length until Kurgonteppa and ends at km 82+095. Phase 1 IEE was prepared for the whole section Dushanbe- Kurgonteppa, with focus on Phase 1. EMP was specific for Phase 1.

75. The Phase 2 was divided into 2 road sub-sections. Section 1 ranges from km 33+475 to km 73, section 2 covers the remaining road until Kurgonteppa (km 82+095). Section 1 will be financed by ADB and section 2 will be financed by JICA.

76. ADB and JICA agreed to adopt a single social and environmental assessment and planning process, as well as unified safeguard documentation, consultation, and disclosure requirements to satisfy both ADB's Safeguard Policy Statement (2009) and JICA's safeguards requirements as stipulated in the JICA's Guidelines for Environmental and Social Considerations (2010). During project implementation, ADB will be responsible for supervising and monitoring the environmental and social aspects of the ADB-financed section, while JICA will be responsible for reviewing and monitoring the environmental and social aspects of the JICA-financed section.

77. Consequently this IEE for the Phase 2 covers the ADB-financed section (in detail) and consider the JICA-financed section as an associated facility (less details). The EMP must only cover ADB-financed section since it's a contractual document.

78. The outcome of the project will be improved efficiency and safer movement of goods and people on the Dushanbe to Kurgonteppa road. The outputs of the project will be:

I. improved road conditions, facilities, and safety along and in the vicinity of the project road and
II. strengthened institutional capacity of MOT regarding financial management, road safety, and road asset management;

79. Output I is physical and will include 3 components:

    a. About 40 km of road designed to a 100 km/h standard whereas speed limits are aimed on 90 km / h in open area.

b. Adequate road safety feature installed and functional on the project road

c. The project will introduce clean energy technologies—such as solar street lighting and solar-based backup systems—to enhance power reliability and efficiency along the project road. This will contribute to improved living standards in the villages along the project road, and to reduced carbon dioxide emissions.. According to the current state of affairs the entire road will be equipped with solar LED lighting and solar-based backup systems (microgrids or individual sets) will be spread-out along the phase 1. It is subject to later confirmation whether this will also be implemented for the entire project road.

80. Conditions of the existing road can be described as follows. The main important damages and deficiencies of the existing Project road refer to the deteriorated pavement conditions and inadequate road markings and traffic signs. Guardrails on high embankments and alongside steep valleys in mountainous sections are lacking which is a serious safety issue. In addition drainage problems occur because of malfunctioning of the existing facilities. The JICA report dated November 2015 provides quantitative data on the existing road regarding pavement conditions, bridges, culverts and traffic safety facilities.

B. Type and Category of Project

81. The proposed Project, to which this IEE is addressed, will upgrade an approximately 48+620 kilometers road section between km 33+475 and km 82+095 in Kurgonteppa, improve facilities and road safety along this road, and strengthen institutional capacities of the Ministry of Transport (MOT) and relevant project stakeholders. The project is categorized as Category "B" for environment as it is described in the chapter "Introduction" under the head "Study Area and Project Categorization". Therefore an IEE was prepared.

C. Need for Project

82. The Dushanbe – Kurgonteppa road is the most important transport corridor from Dushanbe to the South and further to Afghanistan. Traffic, especially heavy traffic will significantly increase within the next decade. Considering the already described deficiencies of the Project road, especially with regard to traffic safety and by also considering the future increase of traffic the reconstruction of the Project road including its widening to four lanes is urgently needed.

D. Project's Costs

83. The project is estimated to cost between 87.486.502,99 and 92.222.072,07 USD based on the estimate below.

84. Cost Estimate (Source Consultant)

	By taking the average of the four low priced proposals	By taking the average price of all seven submitted proposals
Sub - Total without General Items	68.087.182,89	71.142.108,16
Sub - Total with General Items	72.138.942,89	76.043.761,76

Additional 5% for minor works items	3.606.947,14	3.802.188,09
GRAND TOTAL	**75.745.890,03**	**79.845.949,85**
Physical Contingencies (10%)	7.574.589,00	7.984.594,98
Price Contingencies (5%)	4.166.023,95	4.391.527,24
TOTAL AMOUNT in USD	**87.486.502,99**	**92.222.072,07**

E. Location

85. The Dushanbe – Kurgonteppa road starts in Dushanbe, 3.382 km North of Dushanbe gate. The road crosses the Kofarnigon River and runs south through the districts of Rudaki, Khuroson, A. Djami and Bukhtar. Before crossing the Vakhsh River the Project road bends to a southwestern direction until it reaches its endpoint in Kurgonteppa. The following map provides an overview.

Fig. 1: The Project road

86. The road section is part of the Central Asia Regional Economic Cooperation (CAREC) transport corridor as can be seen in the following map.

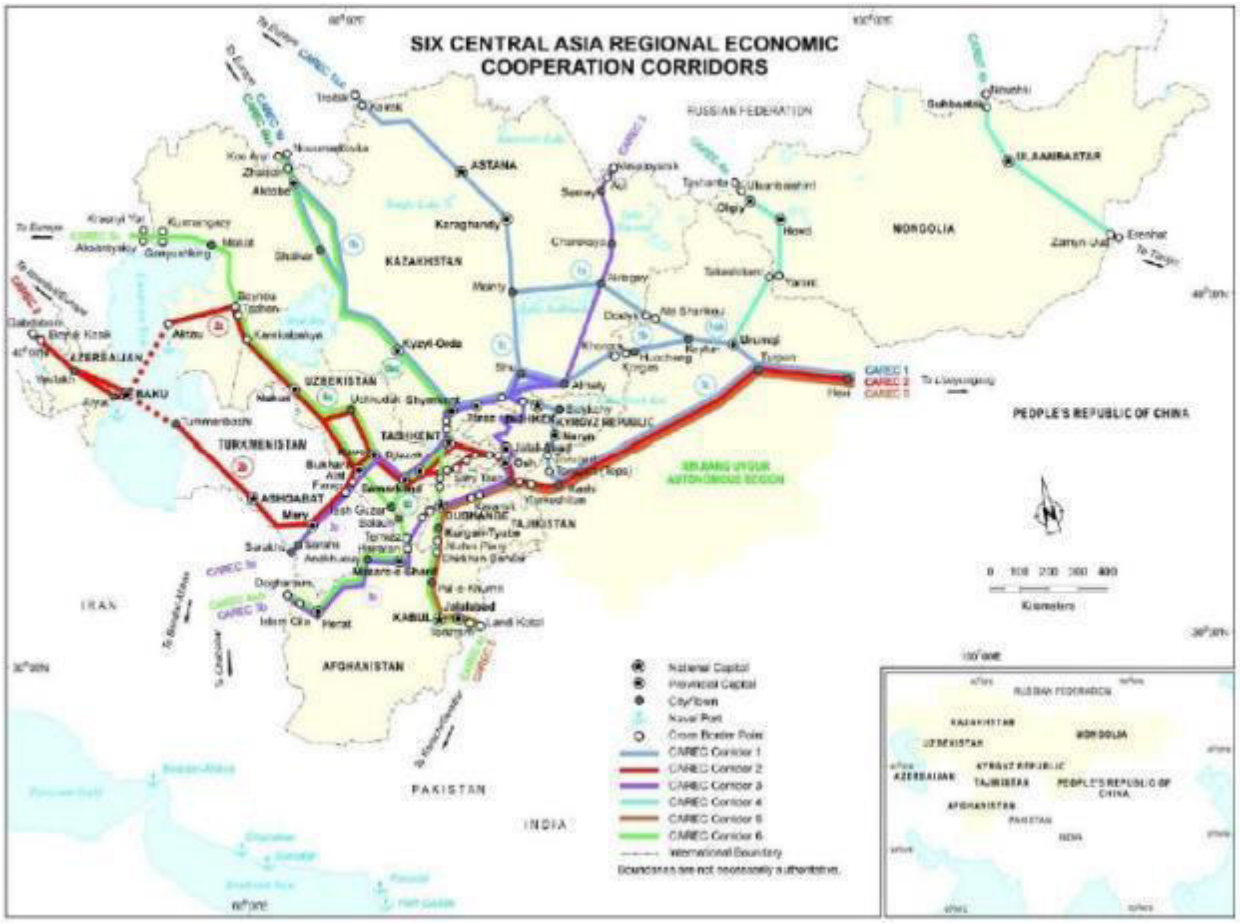
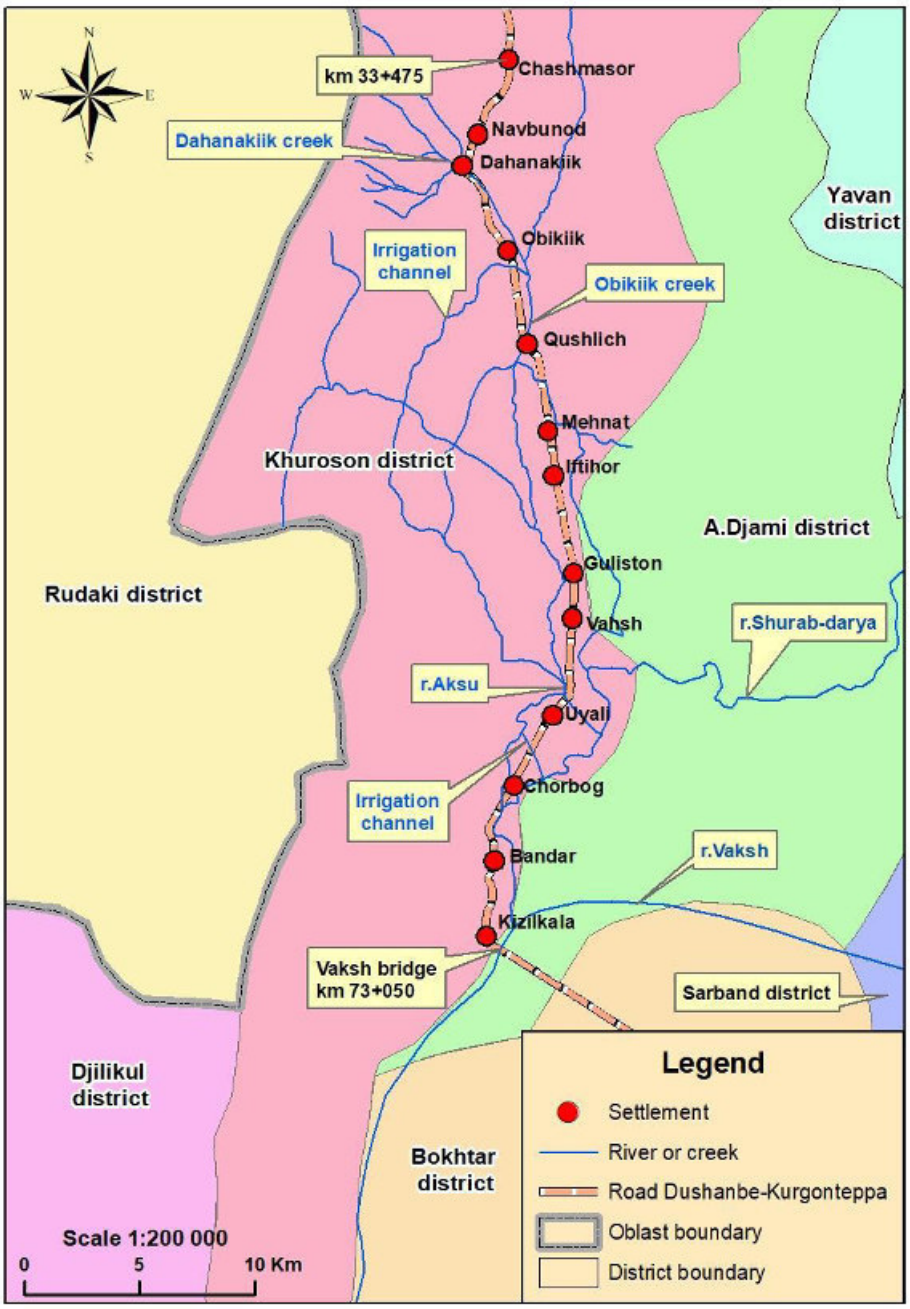


Fig. 2: The Central Asia Regional Economic Cooperation Corridors

87. The towns, villages and rivers along the Project road are shown in the following map.



F. Size or Magnitude of Operation

88. The Phase 2 of the Project involves the reconstruction and widening from 2 to 4 lanes of the 48+620 kilometers road section between Chashmasoron (km 33+475) and Kurgonteppa (km 82+095). The Project will involve a number of associated activities such as utilization of borrow areas, operation of asphalt plants and aggregate crusher, establishment of contractor's worker camps and storage sites, etc.

G. Traffic Volume

89. Traffic growth forecasts have been calculated based on the existing traffic volumes on the project road. The existing traffic volumes were determined by carrying out traffic surveys. For determining the future traffic development the anticipated national and regional economic development was considered..

90. The Phase 2 of the project road was further divided into 4 homogeneous sub-sections in terms of traffic volume and composition between significant settlements, terrain type and junctions (Table 8). For the purposes of geometric and structural design and the evaluation of economic benefits, the volume and composition of current and future traffic needs to be known. To achieve the objectives of the traffic study the data obtained by JICA in a former study[10] (were used, but supplemented and confirmed with manual counting done by Kocks Consult in March 2017.

Tab. 8 Observed Average Annual Daily Traffic

Section ID	***Name of the Section***	***AADT 2017***
7	Km 33+475 to 41+080	7.176
8	Km 41+080 to km 71+300	10.485
9	Km 71+300 to km 77+500	9.556
10	Km 77+500 to km 82+095	14.851

AADT = Annual Average Daily Traffic, ID = identification, km = kilometer
Source: JICA (2015) validated with additional manual traffic counts.

91. Future traffic was estimated for a 25 year period between 2017 and 2041. The growth rate for normal traffic was based on available GDP forecasts. Forecast AADT including generated Traffic

Section ID	**2020**	**2025**	**2030**	**2035**	**2040**
7	8.296	10.382	12.193	13.860	15.678
8	12.122	15.170	17.816	20.252	22.909
9	11.050	13.835	16.250	18.473	20.899
10	17.174	21.503	25.257	28.714	32.484

AADT = annual average daily traffic.
Source: JICA (2015) and Asian Development Bank estimates.

92. Based on the traffic forecasts, the Dushanbe – Kurgonteppa road section was designed as a Class 1 road according to Asian Highway Standards[11].

H. Proposed Schedule for Implementation

93. The schedule for the construction activities has not been decided at the time of preparation of this report.

[10] JICA 2015 “Data Collection Survey on a Road between Dushanbe and Kurgan-Tyube in Republic of Tajikistan, November 2015”
[11] Classification and Design Standards for the Asian Highway (1973); 5th revision Bangkok 1993.

I. Detail of the Project

94. The completed road will have two carriageways each with two traffic lanes 3.5m wide, separated by a median typically 2m wide in open areas and narrower where the road passes through villages and towns. In mountain cut and fill areas the median is narrowed to 60 cm. This complies with the Tajikistan standard for roads of this category, and with Asian Highway standards. Since the existing two lane road will reach capacity within five years, the proposed two carriageway four lane configuration is appropriate. The project road alignment will follow the existing road alignment, because of terrain considerations and also to minimize land acquisition, with some adjustments to horizontal and vertical alignments to meet the required standards. The design speed will typically be 100 km per hour, which is appropriate for a road of this class in the terrain through which it passes.

95. The completed road will have a flexible pavement with asphaltic concrete surfacing. The pavement structure has been designed using appropriate design methods based on the traffic projected to use the road over a 20-year period following project completion, from2021 to 2040, assuming two asphaltic concrete overlays during this period to provide the additional strength required for traffic loading for the latter part of the road's service life. The road design takes into account the severe weather conditions that the road will experience, which range from high temperatures in summer to below freezing with heavy snowfalls in winter. Relevant disaster risks and climate change adaptation and mitigation measures have also been factored into the design (drainage structures, slope stability, and solar street lighting).

96. The road design has taken into account road safety to international standards. The design will be subject to detailed road safety audits before construction commences, during construction and prior to final acceptance of the completed road. The road design also reflects consultations with communities living adjacent to the road, as a result of which several underpasses for people, livestock and agriculture, pedestrian crossings with appropriate warning devices, and other community-relevant facilities, will be provided.

J. Bridges and Culverts

97. The Phase 2 of the Project entails the reconstruction of 11 bridges. The most significant bridges are the bridges number B-14 (2-lane) and B14a (2-lane), which cross the Vakhsh River and exhibit a length of 331.60 m. B-14 refers to the rehabilitation of the existing bridge and B-14a refers to a new parallel bridge. In addition, numerous culverts are designed to support the functioning of the existing irrigation and drainage network.

98. There are three new pedestrian bridges foreseenin Obikiik, Uyali and Kurgonteppa. Additional underpasses are planned for animal and equipment crossing. The complete list of designed bridges and structures for pedestrian-, animal- and equipment crossing is shown in the table 9. The table also contains the information whether new structure will be constructed or whether there will be rehabilitation of the existing bridge.

Tab. 9 List of Bridges and Crossings

Bridge No.	Culvert No.	Location Km	Name of obstacles	Type of Work	Spans (m)	Type of Superstructure	Length (m)	Width (m)	Area (m^2)	Note
B-6		33+732	Animals Crossing	**N**[12]	1x6	Reinforced Concrete slab in-situ	26,0	7,6	197,6	Removal of existing bridge, replaced by a Under-pass 6,0x4,5 m as Animal and Equipment crossing
B-6a		34+290	Ravine	**N**	1x18	pre-cast segments	19,9	24,3	483,6	Removal of existing box culvert No.10 and replaced by a new Bridge 1x18 m
B-7		36+625	Across a Ravine	**N**	1x33	pre-cast segments	35,0	24,3	850,5	Removal of existing bridge, Half of new Bridge on the RHS
B-7a		40+380	Pedestrian Crossing	**N**	1x27	steel construction (RC in-situ)	27,0	3,40	91,8	New additional Pedestrian Bridge
B-8		41+653	Animals Crossing	**N**	1x6	pre-cast segments	27,0	7,6	205,2	Removal of existing bridge, new Underpass 6,0x4,5 m at the same place / center line
B-9		45+055	Mudflow	**N**	3x18	pre-cast segments	56,8	23,6	1.340,5	Removal of existing bridge, Half of new Bridge on the LHS
B-10		46+750	Channel	**N**	1x18	pre-cast segments	20,0	23,6	472,0	Removal of existing bridge, Half of new Bridge on the RHS

[12] N= New buildt structure

Bridge No.	Culvert No.	Location Km	Name of obstacles	Type of Work	Spans (m)	Type of Superstructure	Length (m)	Width (m)	Area (m^2)	Note
	25	49+980	Animals Crossing	**N**	2 x 4,5	Box Culvert	30,0	4,5		New additional Box culvert 2,0x4,5 m as Animal crossing
B-10a		50+780	Animals Crossing	**N**	1x6	RC slab in-situ	26,6	7,6	201,8	New additional Underpass 6,0x4,5 m as Animal and Equipment crossing
B-11		60+880	Channel	**N**	1x33	pre-cast segments	35,0	24,0	840,0	Removal of existing bridge, Half of new Bridge on the LHS
B-11a		61+940	Pedestrian Crossing	**N**	1x27	steel construction (RC in-situ)	27,0	3,40	91,8	New additional Pedestrian Bridge
B-12		66+140	Collector	**N**	1x18	pre-cast segments	20,0	23,6	472,0	Removal of existing bridge, Half of new Bridge on the LHS
B-13		67+310	Collector	**N**	1x18	pre-cast segments	20,0	23,6	472,0	Removal of existing bridge, Half of new Bridge on the LHS
B-14		72+860	Vaksh River	**R**[13]	10x33	steel girders	331,6	12,9	4.277,6	Rehabilitation of the existing bridge
B-14a		72+860	Vaksh River	**N**	10x33	pre-cast segments	331,6	12,65	4.194,7	New parallel bridge on the LHS
B-15		78+730	Collector	**N**	1x15	pre-cast segments	17,0	23,6	401,2	Removal of existing bridge, Half of new Bridge on the LHS
B-16		80+580	Collector	**N**	1x15	pre-cast segments	17,0	24,0	408,0	Removal of existing bridge, Half of new Bridge on the LHS
B-17		80+770	Pedestrian Crossing	**N**	1x27	steel construction (RC in-situ)	27,0	3,40	91,8	New additional Pedestrian Bridge

[13] R = Rehabilitation of existing structure

Bridge No.	Culvert No.	Location Km	Name of obstacles	Type of Work	Spans (m)	Type of Superstructure	Length (m)	Width (m)	Area (m^2)	Note
			= Road Bridge			= Underpass		= Pedestrian Crossing		

K. Quantities for the project

99. The quantities for cut and fill material are approximately:

a. Cut: 867,285 m^3
b. Fill: 982,087 m^3

100. Information on the type of the cut and fill material are given in the following table.

Tab. 10 Type of Quantities

CUT		
Common Excavation	*m^3*	*762,800*
Rock Excavation	*m^3*	*20.577*
Unsuitable Excavation	*m^3*	*83,908*
Fill		
Embankments	*m^3*	*707,188*
Selected fill	*m^3*	*274,899*

101. All common excavation and rock excavation (762,800 m^3 + 20.577 m^3 = 783,377 m^3) can be used as fill (cut to fill). The 83,908 m^3 of unsuitable excavation is spoil material (cut to spoil).

102. For embankments and structural layers 982,087 m^3 are required. 783,377 m^3 are taken from the excavation material and 198,710 m^3 (982,087 m^3 – 783,377 m^3) need to be imported (new fill material).

L. Disposal Sites

103. About 84,000.00 m^3 unsuitable excavation material will be generated by the Project which needs to be safely disposed. The identified potential areas for temporary and final deposition of surplus material are shown in figure 3 to figure 7. The identified sites have been agreed with the responsible authorithies of Khuroson district and are officially approved. Additional mitigation measures to be adhered by the contractor are described under the headline “Earthworks” in the chapter “Impacts and Mitigation Measures”.

104. Location of disposal site number 1 is shown in the below figure 3. It is located at the southern rim of Obikiik.

Fig. 3: Disposal Site 1. South of Obikiik on right side of Project Road

105. Disposal site number 2 is located close to the village of Mekhnat.

Fig. 4: Disposal site 2 between Mehnat village and Project road

106. Disposal site number 3 is located between km 59+060 and 59+300. It is in close vicinity to a cemetery. According to the Law on Conservation of Historical Monuments (2008) a minimum distance of 50 m is defined as protection zone. This is considered in the design.

Fig. 5: Disposal site 3. North of Uyali town on left side of Project road

107. Disposal site number 4 is located to the south of bridge number 13 and stretches on both sites of the project road. The disposal site number 4 is prone to water logging.

Fig. 6: Disposal site 4. Approximately 1.5 km south of Chorborg village on both sides of project road

108. Disposal site number 5 is located on the left bank of the Vaksh River and extends between km 73+200 and 73+620.

Fig. 7: Disposal site 5, approximately 300 m after Vaksh River crossing on left side of Project road

M. Proposed Camp Site Location

109. The final decision on site selection for the construction camp is up to the contractor. However a suitable site has already been identified by the PIU and agreed upon with local authorities. The site is shown as yellow signature in the below Google image. It is located in the South of the Project road, between Chorbog village and Kyzylkala, approximately 1 km to the South of Chorbog on the left side of the Project road.

Fig. 8: Proposed Camp Site Location

IV. ALTERNATIVES

110. The chosen alignment remains on the existing alignment over nearly its whole length. For reducing environmental and social impacts and also for better driving comfort and safety various alternatives were considered. Two possible type of alternatives were explored: widening options (left, right or both sides) and bypassing major towns and villages. The first one is spatially very small scale and refers to shifting of the centerline, either to the right or to the left side. This is in order to reduce impact on nearby social and environmental assets by extending from 2 to 4 lanes to the opposite side of the respective structures. This was done in cooperation with the design team and social and environmental planners as an iterative process aiming at avoiding and minimizing potential impacts as far as technically feasible.

111. The second type of alternatives refer to the village of Obikiik in Khuroson district. The need for investigating bypass options is determined by the upgrade of the existing road to a category 1 highway. Following the existing alignment will require either considerable reduction of traffic speed and change of status of this section, or when widening to 4 lanes, significant resettlement, removal of structures and additional construction works. In addition there is risk of mudflows.

112. Therefore to minimize the mudflow risk and keep the desired design parameter, several alignment alternatives were taken in consideration. The Consultant team developed conceptual alignments to explore alternative routes to bypass the town of Obikiik. Each alternative identified needed to balance a range of requirements including meeting the technical challenges, avoiding or minimizing resettlement of local communities, avoiding or minimizing impacts on areas of high biodiversity value, minimizing costs and maintaining an acceptable distance.

113. Three possible alternatives were investigated in more detail which include two bypass option and in addition the existing alignment which is traversing Obikiik. The three investigated options can be characterized as follows:

Tab. 11 Investigated three alignment options for Obikiik

Bypass No.	Start - Main Road	End - Main Road	Length Bypass (m)	Note
1	38+180	43+460	6,670	Option 1
2	39+640	43+460	4,250	Option 2
3	39+640	43+460	3,800 (no Bypass)	Option 3

114. The following map provides an overview of the three options.

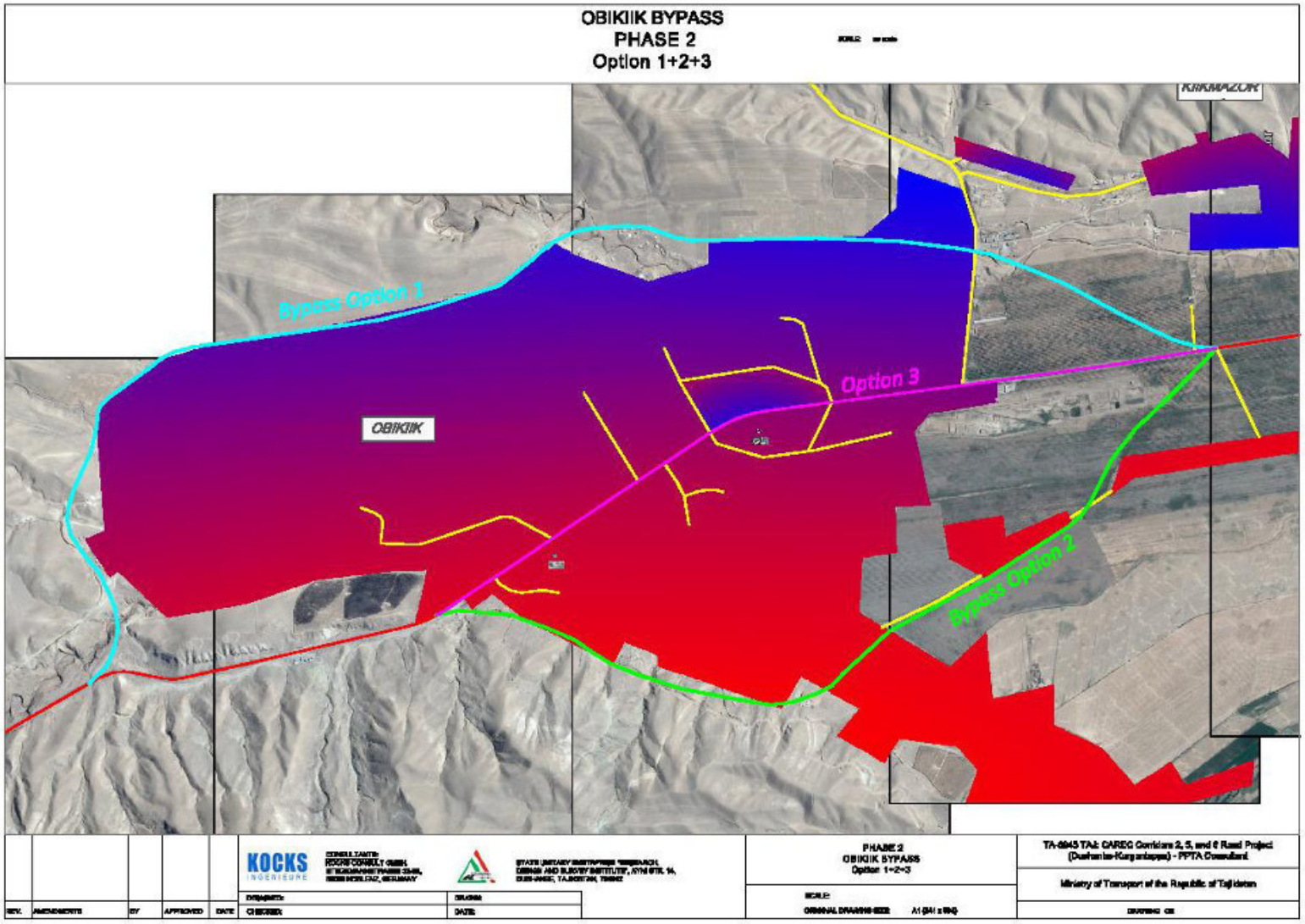


Fig. 9: Investigated three bypass alternatives in Obikiik

115. The environmental examination of the 2 proposed bypasses was performed by the International and Local Environmental Specialists during field visits in February, 2017. Most of the bypass sections were directly examined, part of the sections which were not easily accessible were observed from the distance of several hundred meters with additional studies of google images.

116. **Bypass 1** starts from km 38+180 and gradually turns to South-East, passing roughly parallel to the current route and then gently turns to the west for joining again the existing route at km 43+460. Most of the bypass 1 alignment runs through rolling terrain composed mainly of soft Quaternary deposits. The area is rugged and prone to erosion processes, which caused the formation of a network of intermittent streams draining from the slopes of the hills and numerous gullies.

117. At approximately 300 m after diverting from the existing alignment the proposed bypass route crosses the Obikiik River which is formed by the junction of Dahanikiik river with an unnamed eastern tributary. Further the alignment is following alongside foothills and crosses a number of northern tributaries to the Obikiik River. Land use in the area is mainly seasonal pasture for domestic cattle. No trees or valuable bushes were noticed along the route. Further, the road gently turns to south running between residential areas and rain-fed cultivated land mainly sowed by wheat. In the central part of the alignment the proposed bypass road turns to the southwest and runs between scattered houses and again crosses an Obikiik River tributary. Before it joins again the existent alignment at Km 43 +460 it encroaches into fruit plantations.

118. The encroachment into agricultural lands cannot be avoided however no resettlement is required for this option. The implementation of option 1 is complicated from engineering point of view due to unstable soil conditions and crossing of several ravines..

119. In its initial section the **bypass 2** traverses more stable terrain as compared to the initial section of bypass 1 and the alignment is not so much prone to erosion. However, after turning to the southwest the alignment encroaches in residential area and comes close to a cemetery before gradually turning to the southwest at km 39 +640. The proposed option 2 than runs alongside the lower slopes of hills which are also used as seasonal pastures. The road alignment crosses several natural drainages structures such as gullies and intermittent streams. The option than joins the main alignment at the same point as bypass 1 at km 43+460 after crossing fruit plantations.

120. Summarizing the above findings both options run through areas of only low ecological value. Bypass 1 crosses deeply incised drainage structures with steep soft slopes where birds such as wild pigeons prepared the holes for nesting. In the case of acceptance of bypass 1 option it is necessary to implement measures for avoiding the destruction of nesting sites.

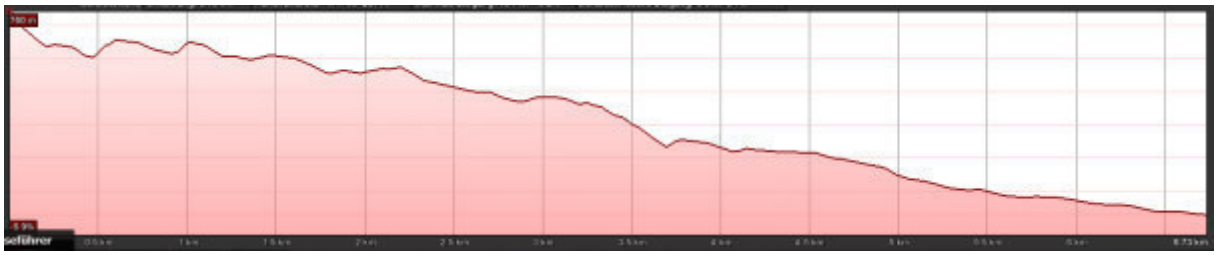
121. From social impact point of view the Bypass 2 doesn't encroach into any ecologically sensitive area. However, it requires much more attention due to significant resettlement issues. Sensitive points such as mosques, schools, kindergartens, hospitals were not identified by surveying the two bypass options. All sensitive points including 2 schools, medical center and a stadium are located along the existing alignment running through the centre of Obikiik. However, due to reduce of traffic speed within the town traffic noise is not expected to increase significant provided that protection measures will be implemented.

122. In conclusion environmental issues indifferent regarding the preferred options which therefore should be based on engineering, cost and/or social advantages of the project. As a result of the conducted comparison of all relevant aspects which included engineering, economic, social and environmental criteria the option three was selected as the preferred one. Below tables provide a visual impression of the investigated bypass options and show the result of the conducted evaluation.

Tab. 12 (Bypass 1)

Option 1
This alternative alignment is running mostly north of the village Obikiik. This is a complete new alignment starting at approximately 2 km before the entrance of the village Obikiik in northern direction. The proposed alignment alternative is avoiding settled areas and passing north of village.


Profil - Option 1



Tab. 13 Bypass 2

Option 2
This is a complete new alignment. Starting at the petrol station of the village Obikiik the proposed alignments runs south of the village. The main alternative passes along the foothill of the mountain range and runs then after the half through the settled area of Obikiik in a distance of about 1km until joining the existing road.


Profil - Option 2

Tab. 14 Comparison of the 3 Options

Evaluation Criteria	Comparison of Options			Preferred Option
	Option 1: east of Obikiik	Option 2: west of Obikiik	Option 3: Existing Alignment	
Geometric Features				
Road length	6,67 km	4,25 km	3,80 km	Option 3
Maximum gradient	5% - 7%	12%	4%	Option 3
Number of bridges	3	0	0	Option 2 + Option 3
Road length	6,67 km	4,25 km	3,80 km	Option 3
Construction Cost				
Construction Cost (USD)	16.5 Mill USD	10.5 Mill USD	7.5 Mill USD	Option 3
Environmental Impact				
Impact on landscape	• High cut sections	• High cut sections	• Widening of the existing road • lesser degree as the 2 bypass	Option 3
Noise, vibration and pollutant emissions.	• Increased background noise levels, vibration during operation and air pollutant emissions due to a new road alignment being introduced on a quiet area with currently no traffic • The increased noise levels will likely be significant due to introduction of traffic, including heavy vehicles, on a greenfield area • few sensitive receptors nearby the new alignment	• Increased background noise levels, vibration during operation and air pollutant emissions due to a new road alignment being introduced on a quiet area with currently no traffic • The increased noise levels will likely be significant due to introduction of traffic, including heavy vehicles, on a greenfield area • few sensitive receptors nearby the new alignment	• Increased background noise levels, vibration and air pollutant emissions due to expected increased traffic flow and volume. • Road passes through existing settlements that include a number of sensitive receptors	Option 1 + Option 2
LARP Impact				
Land acquisition and Impacts on land	• destroy about 15 hectare land	• destroy about 10 hectare land	• on agricultural areas • only marginal due to widening of the road	Option 3
Design and engineering				

Evaluation Criteria	Comparison of Options			Preferred Option
	Option 1: east of Obikiik	Option 2: west of Obikiik	Option 3: Existing Alignment	
Geotechnical risks, impact on existing landslide areas	The road alignment is located out of the landslide prone area	The road passes through a landslide prone area with high risks of future landslides	The road alignment is located out of the landslide prone area	Option 1 + Option 3
Use of existing road infrastructure	The existing road will be downgraded and used for local traffic	The existing road will be downgraded and used for local traffic	The existing road will be utilized, existing parameters will be in line with the desired standard.	Option 1 + Option 2

123. As result of the above cost-benefit analysis, it is recommended to consider Option 3 for implementation. After preliminary analysis and further to more detailed studies, this Option that follows the existing alignment will (i) have the lowest construction and maintenance costs; (ii) shows that while the noise and vibration are likely to increase along the settlements, they could be managed within acceptable limits during both the construction and operation phases. These studies, including air, water, noise, and vibration are presented in Section VIII (Environment Impacts and Mitigation Measures).

d

124. The “no Project” option implies that the existing road from Dushanbe to Kurgonteppa will not be improved and that the road would be left in its present state as characterized by the damages and deficiencies described under headline “III Project Description” which consist of deteriorated pavement conditions and inadequate road markings and traffic signs. In addition, guardrails on high embankments and alongside steep valleys in mountainous sections are lacking which is a serious safety issue. The main deficiency however refers to the present road category which is a two lane road and is not catered to the forecasted traffic development which only can be safely and efficiently handled by a Category 1 four lane road. Therefore, the “no project” alternative cannot be considered as a serious option.

V. DESCRIPTION OF THE ENVIRONMENT

125. Most of the phase 2 is flat. Basically the highest altitude of the phase 2 is the starting point at 850 m from which it is continuously descending. In terms of physical and biological environment there are only few environmentally significant structures located along the Project road.

126. The surface waters of phase 2 belong to the Vakhsh river sub-basin of the Amudarya basin. In addition to Vaksh River the Project road crosses several natural creeks and small rivers that drain from the slopes of Aktau and Karatau mountain ranges and numerous irrigation and collection drainage channels of the Vahsh river irrigation system.

127. Besides Vakhsh River there are two major natural water streams crossed by the Project road, the Obikiik and Aksu Rivers which are in more detail described in the chapter on “Water Resources”.

128. Additional significant structures are the tree rows that are stretching over many parts of the Project road. Among the planted species are pines and cypresses. Where drainage or irrigation channels are running parallel to the Project road deciduous trees such as elms, planes, poplars and willows dominate.

129. In terms of human environment an important concern which arose during initial consultation meetings are the cemeteries located along the Project road within Khurason District close to the village of Obikiik. Following initial consultations people are concerned about potential encroachment of the project road. As a mitigation measure any road widening is proposed to be carried out on the opposite side of the cemeteries. The design needs to consider this in order to avoid any impact on the cemeteries as far as it is technically feasible.

130. The land use alongside the Project road can be divided into three broad main categories comprising urban environment and settlements, agricultural land and grassland (steppe) which for most of its part is used as pasture land. Most prominent agricultural crops are apples, grapes, cherries, apricots, pistachio and cotton. The land under cultivation is irrigated. The following map which is taken from the JICA report (2015) provides a general overview of the land use characteristics in the vicinity of the Project area.

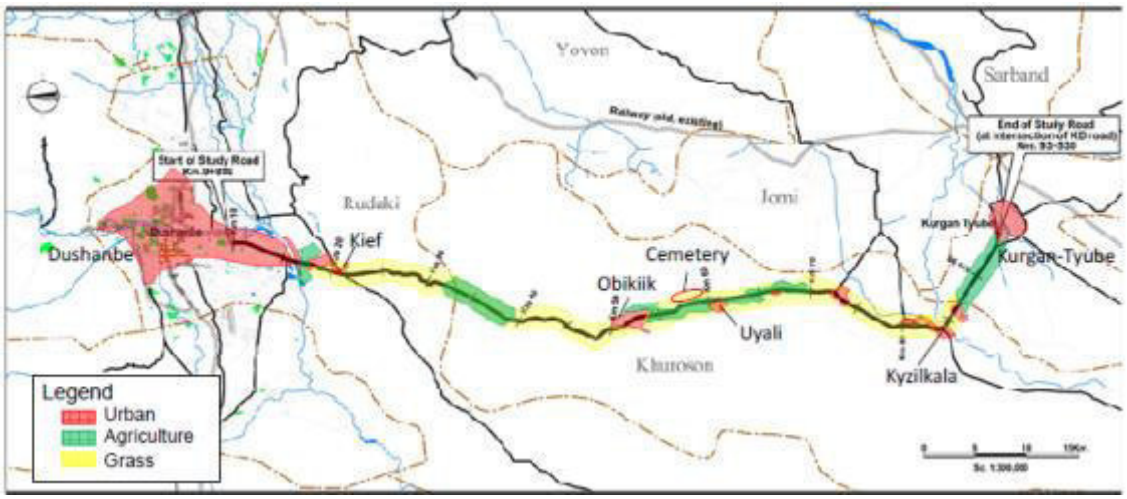


Fig. 10: Land use alongside the Project road

131. In the following an overview is given on the physical, biological and socioeconomic conditions in the project area.

A. Physical Resources in Project Area

1. Topography

132. The topography of Tajikistan is very diverse. Mountains occupy around 93% of Tajikistan. The main elements of Tajikistan's geography are the following: the Kuramin Mountain Range and the Mogoltau Mountains, Fergana Depression, Hissar-Alai Mountains (the South Tian Shan), the depressed area in southwestern Tajikistan (Tajik depression), and Pamir. Altitudes range from 300 to 7495 meters above sea level. The recent relief of Tajikistan is the result of activities of alpine tectonic movements of the earth surface as well as the denudation process. The majority plain territories of the country are the broad areas of river valleys or the vast depressions between the mountains. Most of the country's population is concentrated in these particular areas along with the main fields of industrial production and agricultural potential of the county.

133. The topography of the study area can broadly be divided from North to South into a rolling section which starts at km 0 and ends at km 14, a mountainous section which starts at km 14 and ends at km 21, a further rolling section from km 21 to km 27 and a second mountainous section from km 27 to km 39 and a flat section ranging from km 39 to the end of the Project (Phase 1 and Phase 2) in Kurgonteppa.

2. Geology and Seismicity

134. Geologically, the study area belongs to the Tadjik depression. Prevailing sediments are of late Mesozoic and early Cenozoic age. Within the river valleys of the Kofarnigon and Vakhsh Rivers alluvial deposits prevail. The prevailing sediments are soft and mostly unconsolidated. This makes the slopes susceptible to landslides, particularly in sections with high relief energy (mountainous part of the road). During consultation meeting in Obikiik it was reported by the Depute chairman of the Khurason District that only few years ago after heavy precipitation a serious mudflow destroyed a settlement

south of Obikiik. Houses were under mud and many cattle died. Houses of people needed to be removed and rebuilt at a save place.

135. For purpose of description of the geological characteristics of the study area the geological map of scale 1:500000 has been chosen (Fig. 3).

136. The alignment starts from the southern rim of Dushanbe in Upper Quaternary deposits made of sand, gravel and loams. Further on the road crosses river Kofarnigon and its floodplain which is of Holocene age and presented by fluvial deposits of sand, sandy loams, bench gravels and loams. Then the alignment crosses a rolling area of combined Palaeogene and Cretaceous deposits presented by clays, chalky clays, limestones, plasters, dolomite and conglomerates. Further crosses spurs of ridge Aktau combined also Cretaceous and Palaeogene breeds, places blocked Middle Quarternary deposits, presented loess-like loams, bench gravels, loess. Then the road line goes down on a terrace of the river Vakhsh, combined Upper Quarternary deposits presented by sand, bench gravels and loams. Further road crosses also a channel of the river Vakhsh combined by modern deposits by the presented sand, sandy loams, bench gravels and loams. The route line comes to an end at the northwest termination of Kurgonteppa located on terrace above flood-plain combined Upper Quarternary deposits by presented sand, bench gravels and loams.

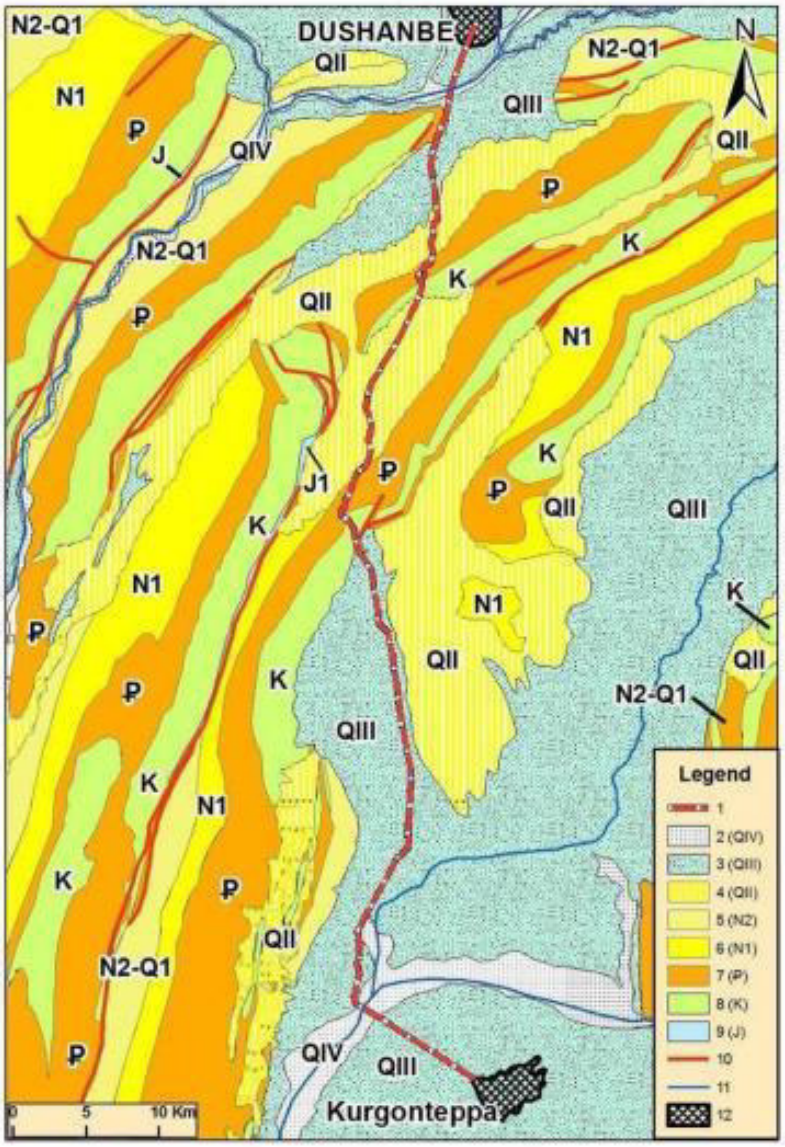


Fig. 11: Geology of the Study Area

137. Figure 11 above shows the Geology of the study area. The legend is as follows.

1) Project Road
2) Q(IV) – the upper Quaternary (Holocene) (almost modern) sediments or rocks
3) Q(III)- the upper Pleistocene sediments or rocks
4) (QII) -The middle Pleistocene sediments or rocks
5) (N2)- Upper Neogene sediments or rocks
6) (N1)- Lower Neogene sediments or rocks
7) (₽)- Paleogene sediments or rocks
8) (K)- Cretaceous rock
9) (J)- Jurassic rocks
10) Faults
11) Rivers

12) Cities

138. The Dushanbe to Kurgonteppa road is located within a seismic active zone. There are many active faults in Tajikistan and large scale earthquakes have occurred five times in the past, large one has not occurred after 1998. Earthquakes are the most dangerous and unpredictable hazards that can happen to the Project road. The initial part of the alignment crosses a zone of the Iljaksky deep fault, capable to generate earthquakes with magnitude to 7.5 and to cause concussions to 9 degree. The road most part passes in a zone possible 8 and 7 degree concussions (Fig. 6).

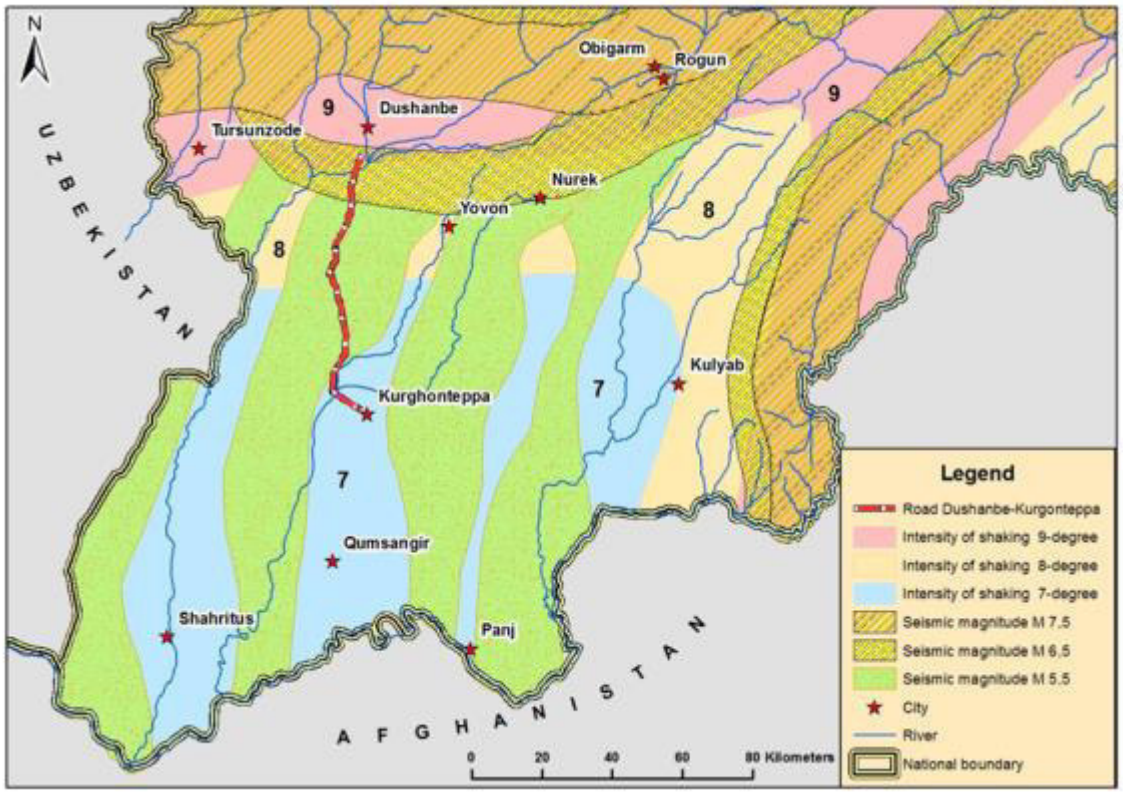


Fig. 12: Seismicity in the Study Area

3. Soils

139. Regarding the soils there is a distinguished gradient from the more humid northern part of the study area to the very dry southern part.

140. Within its initial stretch the Project road traverses light-grey soils (Fig. 7). Further to the south the alignment is crossing spurs of the Aktau ridge. There the grey soils are replaced by carbonate and mountain brown soils. Going down to the valley of the river Vakhsh the road line takes place again on grey soils from dark to light.

141. The soils of the study area are highly productive and much of the area is used for agricultural use. In the dry southern part of the Project area agricultural use is however only possible when soils are irrigated.

142. Soil erosion is a major environmental concern throughout the Republic of Tajikistan due to seismic activity, steep slopes, the fragility of the soils and human activities such as inappropriate livestock management, the removal of protective vegetative cover and poor water management practices.

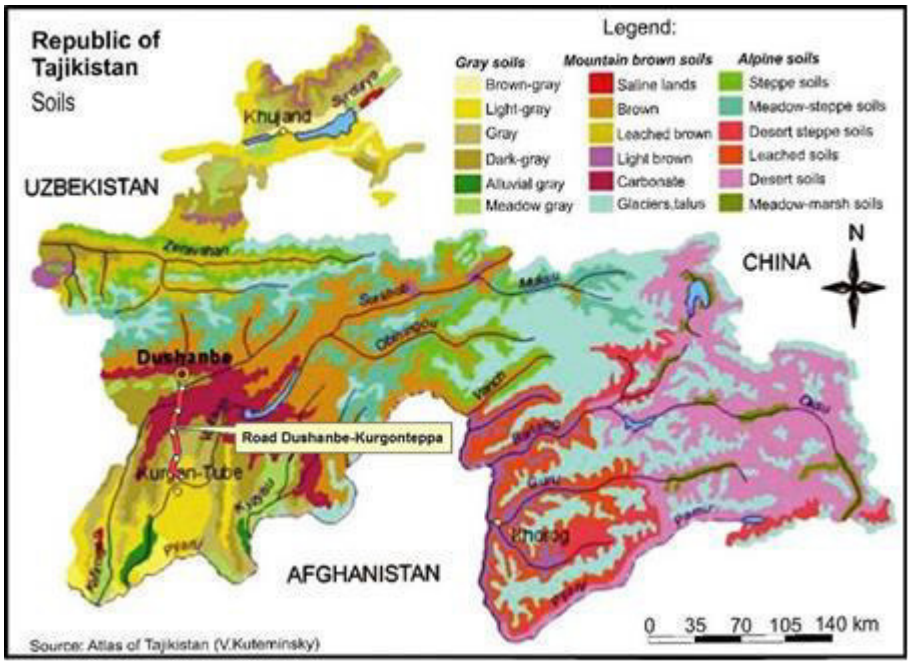


Fig. 13: Soils

143. As described in the Geotechnical Report most of the soils in the study area evolved from loess sediments. Loess consists of fine silty sand. Loess soils and sediments are firm and stable when dry, and can be stable even when cut vertical, but are readily collapsible and erodible when saturated with water.

144.

Mudflows and slope stability: Identification of locations that are prone to possible slope failure or occurrence of mudflows and erosion

145. Critical locations regarding soil instability were identified by the geologists and design engineers between the Km 48+580 and Km 60+760 within Obikiik valley. This section begins after the passing of bridge number 10. After completion of the last rehabilitation project for this road in 2006, the subsidence of the soil caused the distorting and destruction of the pavement in many locations and required much of efforts for the road maintenance. The figure below which is taken from Google Earth shows the vulnerable section.

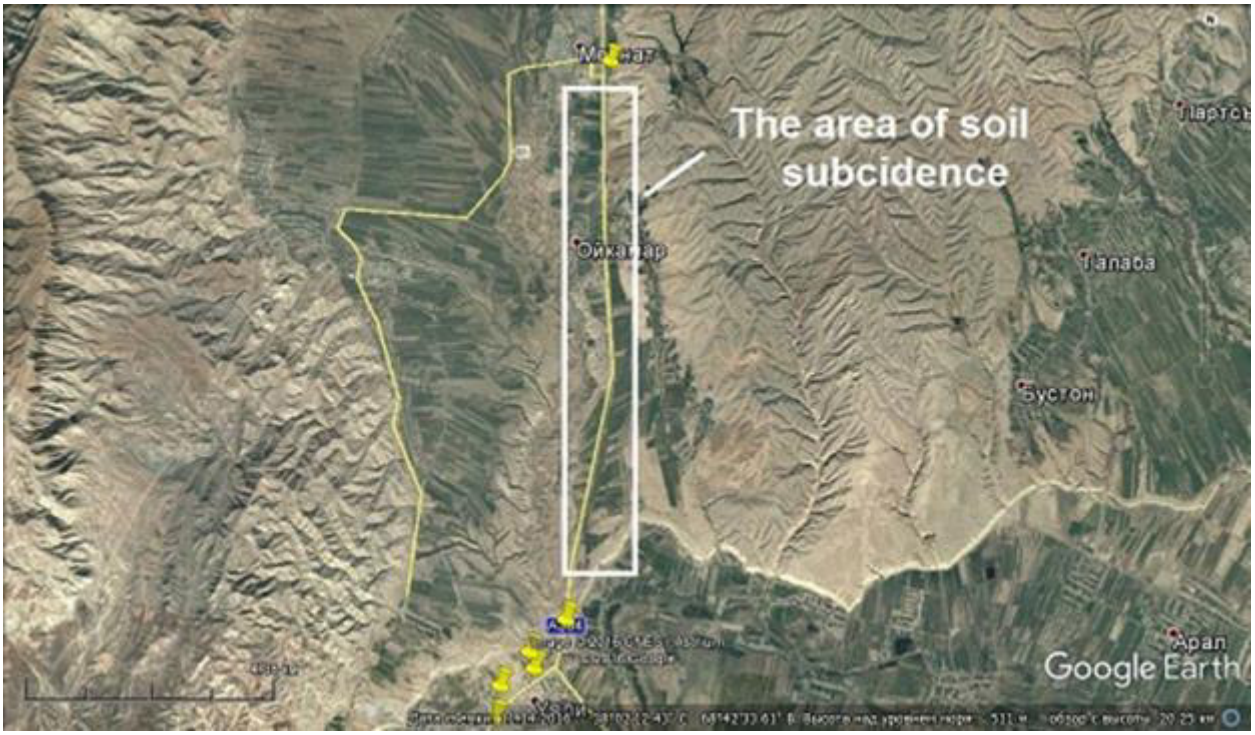


Fig. 14: Identified Section of Soil Subsidence

146. The main reason of soil instability is a combination of inadequate drainage of irrigation system and properties of soil which led to significant rise of groundwater level and can also result in floating soils.

147. Mudflows are anticipated at the crossing of intermittent drainages in the area of bridges 7, 8, 9 and 11. Mudflows may flow on the rivers (creeks) of Dahanakiik, Obikiik and Aksu in the case of outstanding rain events during the rainy season. The slope instability is also associated with the road sections running through Adyr zones. The following points of slope instability could be identified:

- at the hilly sections composed mainly by soft unconsolidated sediments from the starting point of phase 2 to approximately Chainage Km 38+000, mainly from the left side of the road.

- from the beginning to middle part of Bypass 2 on the right side of the road.

- at the interval from Km 59+300 to 60+800 before the entry to Uyaly the project road descends from the Obikiik valley to the main part of Vaksh river crossing the hilling section composed by loess like sediments. The cemetery occupies an area from the left side of the road, from right side the several locations are heavily eroded due to failure of drainage which was most likely built for existent road. In about 100m from the road it forms a steep wall descending to the Aksu river valley. Due to geotechnical properties and vulnerability of loess like-sediments to erosion, this section is also of special concern for slope and basement instability. The location is shown in the following aerial image.

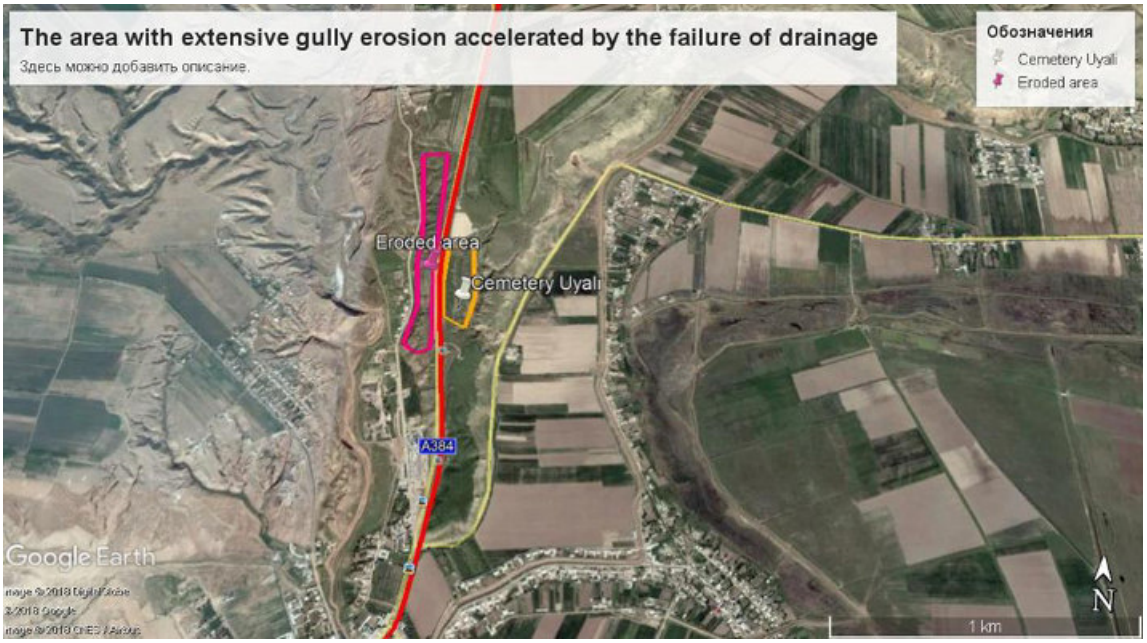


Fig. 15: The deep cave in loess-like sediments washed due to failure of drainage

Fig. 16: Rests of a former drainage channel

148. At the road section approximately from Km 66+000 to Km 67+500 from both sides of the road there are saturated, waterlogged areas. The water drained from the slopes of hills and water from irrigation collected in this area due to inadequate drainage system form significant areas of waterlogging from both sides of the road.

Fig. 17: Waterlogged area alongside Project road at km 66+000 – 67+500

4. Climate

149. Tajikistan's location in the middle of Eurasia, its remoteness from oceans and seas and vicinity to deserts predefine its climate which can be characterized as continental, with considerable seasonal and daily fluctuations in temperature and humidity. The country's very complicated relief structure, with huge variations in elevation, creates unique local climates with great temperature differences.

150. The climate in the central and south-west regions of Tajikistan where the Project is located is characterized by climate, with rather hot summers and warm winters. The cold period lasts 90-120 days, the warm period – 275-235 days. 75-85% of annual sum of precipitations happens from December to May. The climate might affect the construction season in the Project area which can be limited between February and December. Table 15 and Figure 8 indicate the average temperature and precipitation levels by districts.

Tab. 15 Temperature & Precipitation, by district

District	Month	Avg. High Temperature	Avg. Low Temperature	Avg. Annual Temperature	Annual Precipitation
Dushanbe	January	15-20^{0}C	–3,5^{0}C	14.6 ^{0}C	250-653 mm
	July	35-40^{0}C	12-17^{0}C		
Rudaki	January	20-22^{0}C	–3,3^{0}C	16.3 ^{0}C	175-541 mm
	July	35-40^{0}C	18-20^{0}C		
Khuroson	January	22-25^{0}C	–3,5^{0}C	16.5 ^{0}C	150-686 mm
	July	40-42^{0}C	18-20^{0}C		
A. Djami	January	22-25^{0}C	–2,2^{0}C	17,5 ^{0}C	50-193 mm
	July	40-45^{0}C	22-28^{0}C		
Bokhtar	January	22-25^{0}C	–2,0^{0}C	17,6 ^{0}C	50-194 mm
	July	40-45^{0}C	20-25^{0}C		
Kurgonteppa	January	22-25^{0}C	–2,0^{0}C	17,6 ^{0}C	50-194 mm
	July	40-45^{0}C	20-25^{0}C		

Source: Tajikistan National Agency for Hydrometeorology

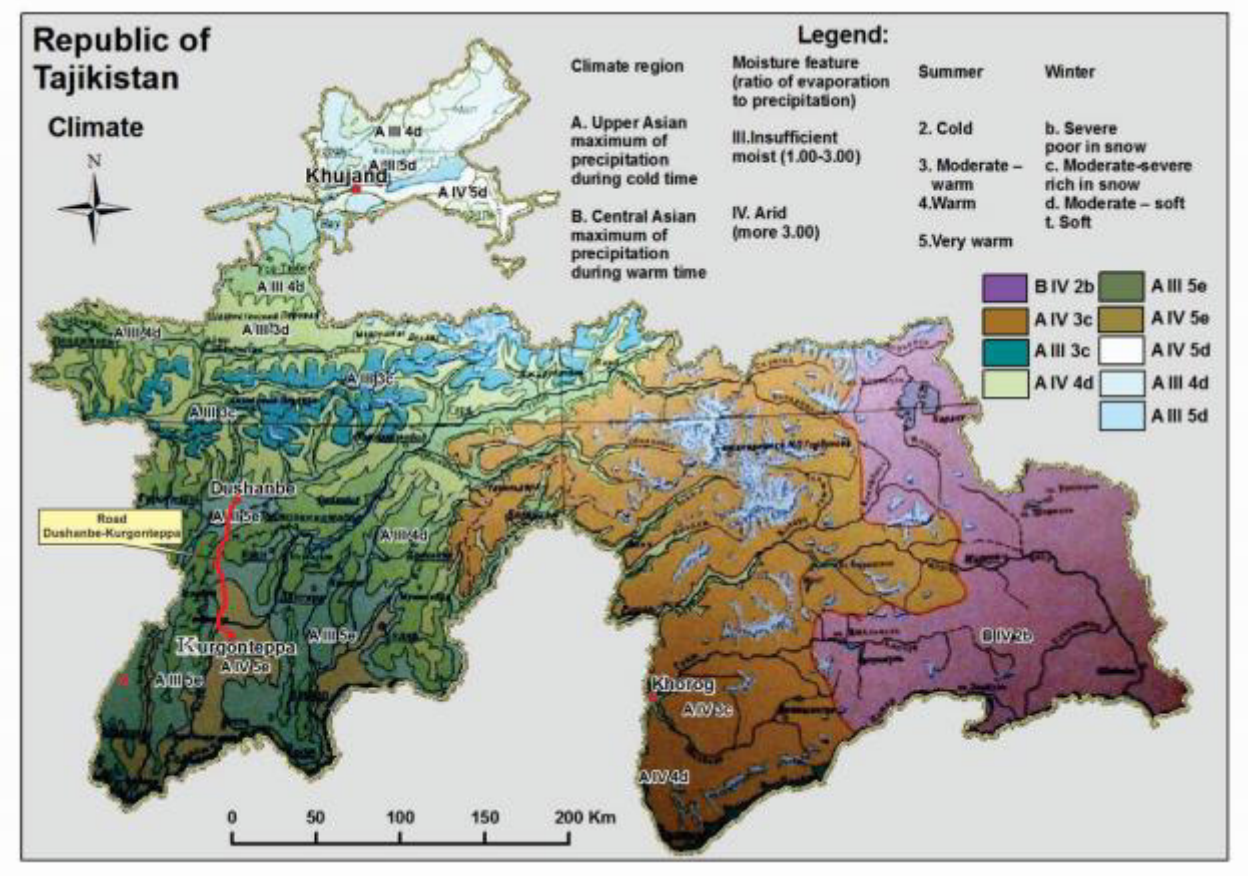


Fig. 18: Climate in Tajikistan

Climate Change

151. Climate change has been identified as an increasing threat to the environment in Tajikistan. The greatest concern has been an increase in air temperature, which has serious implications for its glaciers and water resources. Ground air temperatures are increasing in most districts and high altitude zones. The biggest increase of annual mean temperature has been at Dangara at 1.2°C and Dushanbe at 1.0°C over a 65- year period. In mountainous areas, 1.0-1.2°C was observed in Khovaling, Faizabad and Iskashim. However Figure 9 below indicates moderate changes in the area around the Project Road except its sections adjoining to Dushanbe. There has also been an increase of the number of days maximum temperatures have reached 40°C or over. There has been an increase in east and south - east (warm) winds, and a decrease in west and south - west (cold) winds. Thunderstorms and hailstorms, both associated with cold fronts, have decreased.

152. According to projections, climate change and its consequences like extreme temperatures, isolated anomalous rainfall and natural disasters will continue to have serious impacts on road infrastructure. However new road infrastructure such as tunnels, improved alignments and pavements will considerably reduce travel time and consequently fuel consumption, which in turn will lead to reduced emissions and increased road safety as well as improved transport communication between the regions and remote districts of the country.

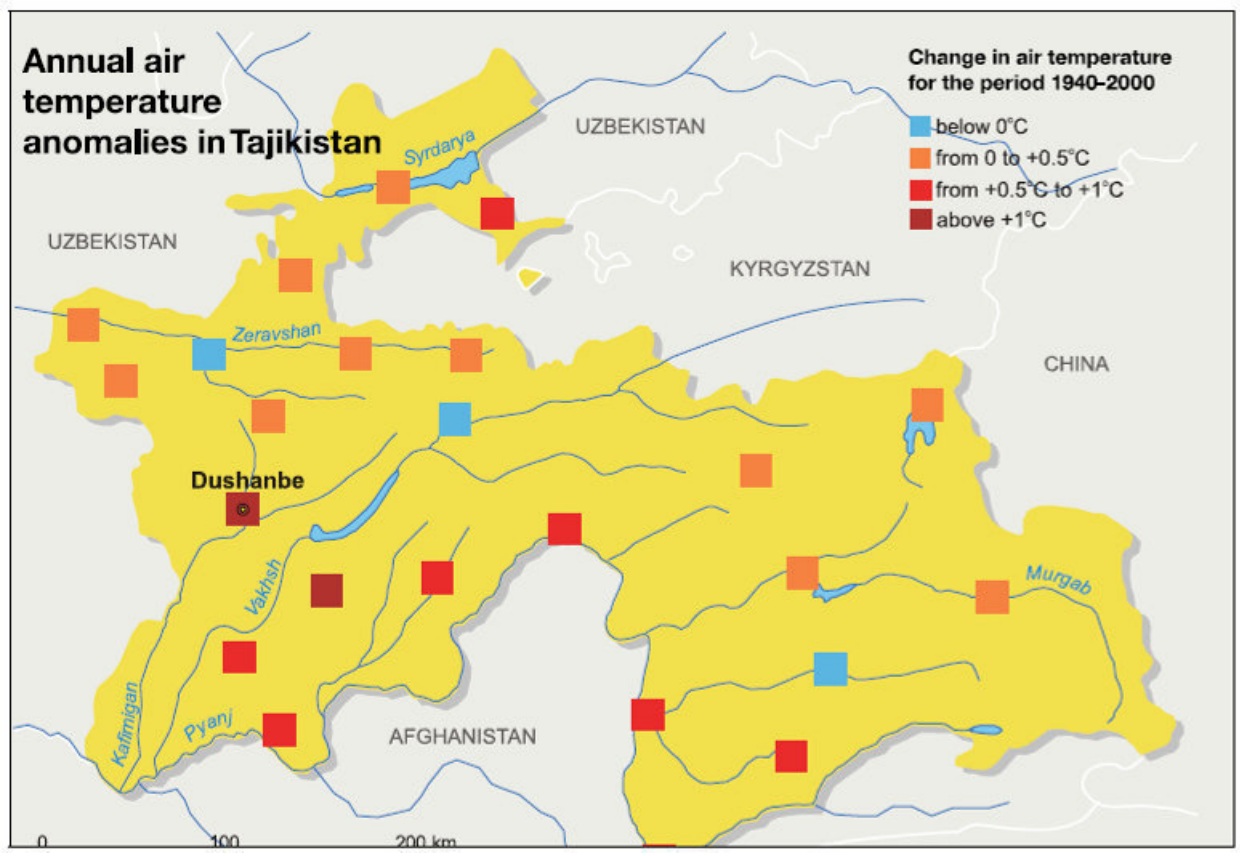


Fig. 19: Annual Air Temperature Anomalies in Tajikistan

Source: Reaching the Tipping Point: Climate Change in Tajikistan. Oxfam, 2009.

153. The main hazard future climate change poses to the Project refers to increased risk of flooding due to more severe single precipitation events in conjunction with temperature rise and snow melting. This refers to the Vaksh river and the associated irrgigation system and has been considered in the design of the bridges and culverts.

154. During dry periods in summer heat stress may emerge. In the mountainous section of the road, erosion on slopes and landslides are potential hazards, particularly at sites where quaternary loess sediments prevail.

155. A Climate Change Impact Assessment has been prepared for the Project as a separate document. In conclusion the climate risk assessment and management has identified and recommended the following climate change adaptation measures, which have been incorporated into the project engineering design:

- Extended drainage system with larger culvert sizes to reduce the risk of road over-flooding and water ponding along the roads;
- Provision of interceptor ditches above the top of vulnerable cut slopes including lining with geotextile filter and stone riprap protection, to reduce risk of slope failures and landslides and development of erosion gullies on slopes.
- Relocation of a creek as a mudflow protection measure between km 35+700 and km 36+200

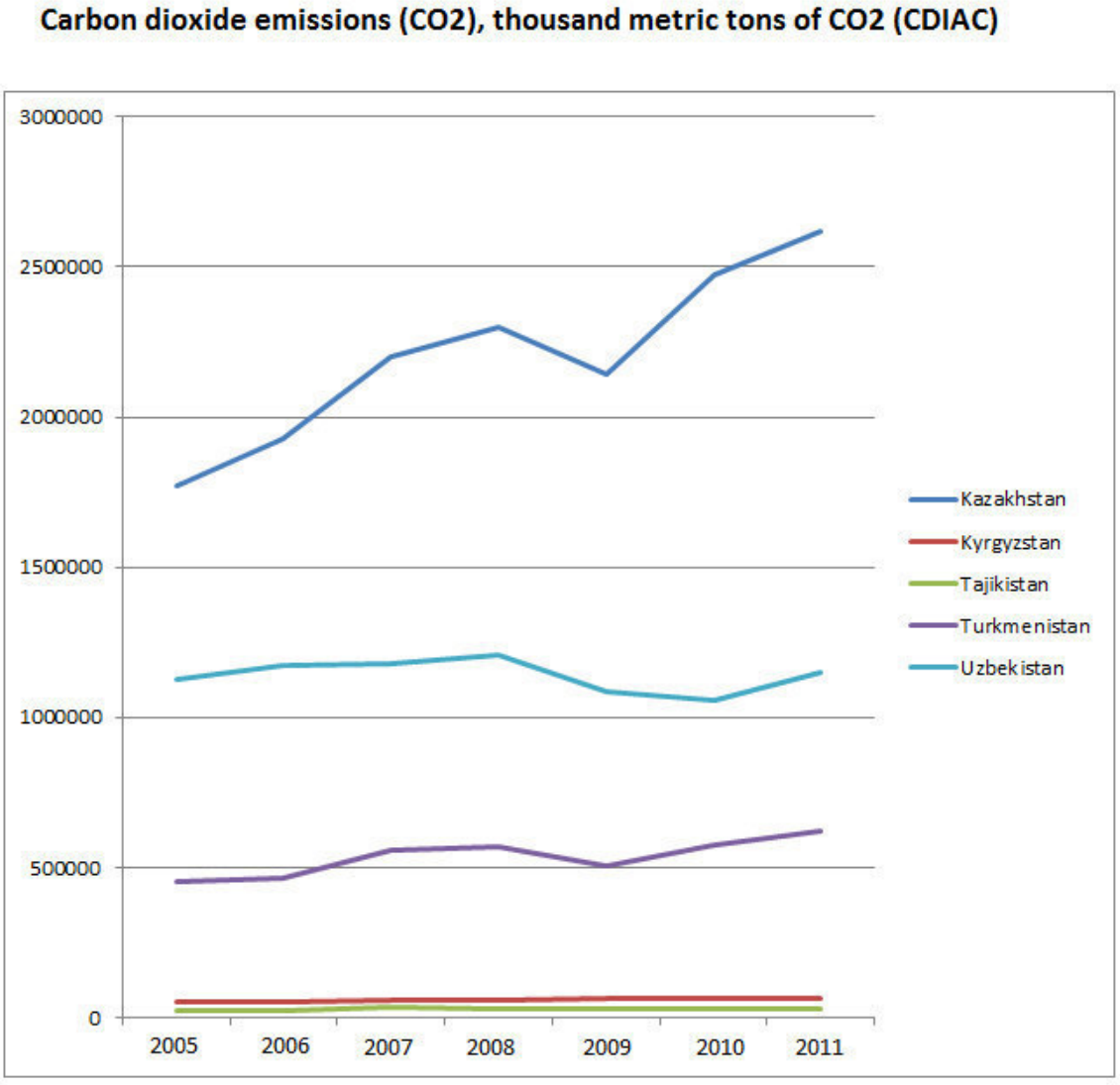
156. Droughts will likely be more intense and frequent in the future. One of the worst droughts was in 2001 where, in the lowland arid region of the Amu Darya River Basin (e.g. Karakalpakstan), access to water was halved. According to the IPCC (2007) - the projected decrease in mean precipitation in Central Asia will be accompanied by an increase in the frequency of very dry spring, summer and autumn seasons. Changes in seasonality and amount of water flows from river systems are likely to occur due to climate change.

157. In order to implement the UNFCCC commitments and strengthen climate protection and adaptation measures, to date Tajikistan has produced three National Communications on climate change. Tajikistan is one of the pioneers in the preparation of a National Action Plan for climate change mitigation (2003) within its territory. This plan includes adaptation measures many of which are being implemented and recommendations on updating the National Action Plan are currently being developed.

158. Currently Tajikistan's contribution to Carbon Dioxide emissions in Central Asia is negligible[14]. See Figure 8 below. Despite the fact that the country does not have quantitative UNFCCC commitments on the reduction of emissions, the current level of emissions as compared to 1990 have reduced by one third, mainly due to the collapse of the Soviet Union and structural changes resulting from the transition to a market economy

[14] According to the last inventory of GHG emissions (2004-2010) and as confirmed by international sources, the level of absolute and per capita emissions in Tajikistan remains the lowest in Central Asia. GHG emission was less than 28 thousand metric tons in 2011, i.e. twice less than Kyrgyzstan and almost 100 times less than Kazakhstan.

and independence. During the last decade, the level of carbon dioxide has remained quite stable, however in the current decade an increase of emissions is expected.



Source: Carbon Dioxide Information Analysis Center as cited at http://mdgs.un.org/

Fig. 20: CO_2 Emission in Central Asia

Air quality

159. The Project Road traverses relatively flat and low-mountainous landscape interspersed with small villages clinging to the ROW. As such there is relatively little industrial activity that may produce air quality impacts. One of the main sources of air pollution in the region relates to the burning of fossil fuels for heating, cooking and power within the urban areas, although this impact is being reduced as more portions of the

population become powered by hydroelectricity from Tajikistan's vast hydro resources. The other main source of emissions in the ROW is from vehicle movements which can be classified in two categories; emissions from the combustion engines, and dust related impacts from the movement of vehicles.

160. Emissions from the combustion of fuel, at present rates, are relatively low due to the low volume of traffic on the road. It can be noted, that Tajikistan's contribution to Carbon Dioxide emissions in Central Asia is negligible, thus indicating that any increase in emissions from vehicles operating on the rehabilitated road is unlikely to be a significant contributor to CO_2 emissions in the region.

161. Some sections of the road, have degraded to an extent that little asphalt remains on such places of the road, thereby vehicle movement create high volumes of dust, especially within the dry summer months. Tajikistan has a set of air quality standards; they are provided in the table "Environmental Standards for Ambient Air" in the chapter on Legal, Policy and Administrative Framework.

162. In September 2017 air quality baseline measurements were conducted at identified sensitive receptors alongside the Project road. The locations where measurements were taken are indicated in the map in annex 6. In total measuremens were taken at 18 locations for the following parameters: TSP, CO, NOx and SO2. The complete laboratory report is presented in annex 5 of the IEE.

163. In summary no exceedances of air quality standards were measured. The underlying standards were the MAC (Maximum Allowable Concentrations) of the Republic of Tajikistan for pollutants in the athmosphere of populated areas in mg/m³. The following summary table provides an overview of the air quality measurement results. There are no exceedances of the applied national standards.

No	Paramter / Standard in mg/m3 / Location	TSP / RT MAC = 0,150	CO/ RT MAC = 3,00	NOx / RT MAC = 0,085	SO2 / RT MAC = 0,050
		Measured Baseline Indices 13 – 14. 09. 2017 in mg/m³			
Obikiik					
1	Hospital Khuroson	0,0002	0,34	0,00	0,001
2	School / Lyseum	0,10	1,03	0,002	0,01
3	School	0,001	0,51	0,0002	0,002
4	Health Centre	0,09	1,0	0,001	0,01
5	Kindergarten	0,008	0,7	0,000	0,0004
6	Stadium Obikiik	0,09	2,02	0,003	0,006
7	Education Centre	0,09	2,02	0,003	0,006
8	School No 2	0,09	2,2	0,004	0,007

Uyali					
9	Mosque	0,08	2,04	0,002	0,005
10	Hospital	0,05	1,74	0,000	0,0008
11	Kindergarten Sitora	0,08	2,30	0,001	0,001
12	Big Mosque	0,10	2,65	0,004	0,009
Chorborg Village					
13	Health Centre	0,08	2,02	0,001	0,03
14	School	0,07	1,39	0,000	0,0001
Kyzylkala					
15	Mosque	0,09	2,50	0,003	0,008
16	Kindergarten	0,005	1,23	0,000	0,0006
17	Hospital and Medical Centre	0,11	2,93	0,003	0,008
18	School	0,09	2,76	0,0003	0,004

5. Water Resources

164. Tajikistan is rich in water resources. It is necessary to note that mountains of Central Asia occupying 20% of the total area of the Aral Sea basin (350 thousand sq. km) gives 90% of surface runoff. The rivers of Tajikistan are important sources of fresh water for the Aral Sea. The glaciers and permanent snow feed the rivers of the Aral Sea basin with over 115 km³ of water a year. The major rivers are the Syr Darya (total length 2,400 km), which flows for 195 km across the Fergana Valley in the north, the Zaravshan, which runs through central Tajikistan, and the Kofarnigon, Vakhsh and Panj rivers, all of which together all of which together drain more than three fourths of Tajikistan‘s territory and form Amu Darya. On average, 51.2 km³ of water is formed on the territory of Tajikistan which comprise around 44 % of annual water flow of the Aral Sea basin rivers: in the basin of Amu Darya River - 50.5 km³ and Syr Darya River - 0.7 km³. The total catchment area of these rivers (with tributaries) in Tajikistan is estimated being over 120,000 km².

Tab. 16 Transboundary Waters in the Basin of the Aral Sea[15]

Basin/sub-basin(s)	Catchment area (km²)	Recipient	Riparian countries
Amu Darya[16]	***612,000***	Aral Sea	AF, KG, TJ, UZ, TM
- Surkhan Darya	13,500	Amu Darya	TJ, UZ
- Kofarnigon	11,590	Amu Darya	TJ, UZ
- Vakhsh	39,100	Amu Darya	KG, TJ
- Pyanj	113,500	Amu Darya	AF, TJ
-- Pamir[17]	***10,000***	Panj	AF, TJ
-- Bartang[18]	***24,700***	Panj	AF, TJ

[15] Source: http://www.unece.org/fileadmin/DAM/env/water/blanks/assessment/aral.pdf
[16] Estimation: While some literature sources quote a basin area of up to 612,000 km², the water divide can only be correctly established in the mountainous part of the basin (309,000 km²); therefore many hydrologists refrain from giving figures for the total basin area.
[17] No exact figure. Some hydrologists give various figures from 5,000 km² to 10,000 km².
[18] https://ru.wikipedia.org/wiki/%D0%91%D0%B0%D1%80%D1%82%D0%B0%D0%BD%D0%B3

Syr Darya[19]	***782,600***	Aral Sea	KZ, KG, TJ, UZ
- Naryn[20]	***59,900***	Syr Darya	KG, UZ
- Kara Darya	28,630	Syr Darya	KG, UZ
- Chirchik	14,240	Syr Darya	KZ, KG, UZ
-- Chatkal	7,110	Chirchik	KG, UZ
Zaravshan[21]	***41,800***	Desert sink	TJ, UZ

165. Tajikistan's water resources mainly arise owing to glacier melting and precipitation. Total surface water reserves in Tajikistan's glaciers and snowfields are estimated at 550 km³. Many of them are located in the basins of high-mountain rivers (such as Obihingou, Gunt, and Muksu) as well as in other areas. Glaciers and snowfields occupy about 6% of country's territory. Over 1,300 lakes contain 44 km³ of water, including 20 km³ of surface fresh water and 24 km³ of saltwater. Their total area is about 705 km².

166. The Project Road is located within Kofarnigon and Vakhsh River basins. The following map shows the surface water resources with regard to the study area. The most prominent surface waters are the Rivers Kofarnigon and Vakhsh.

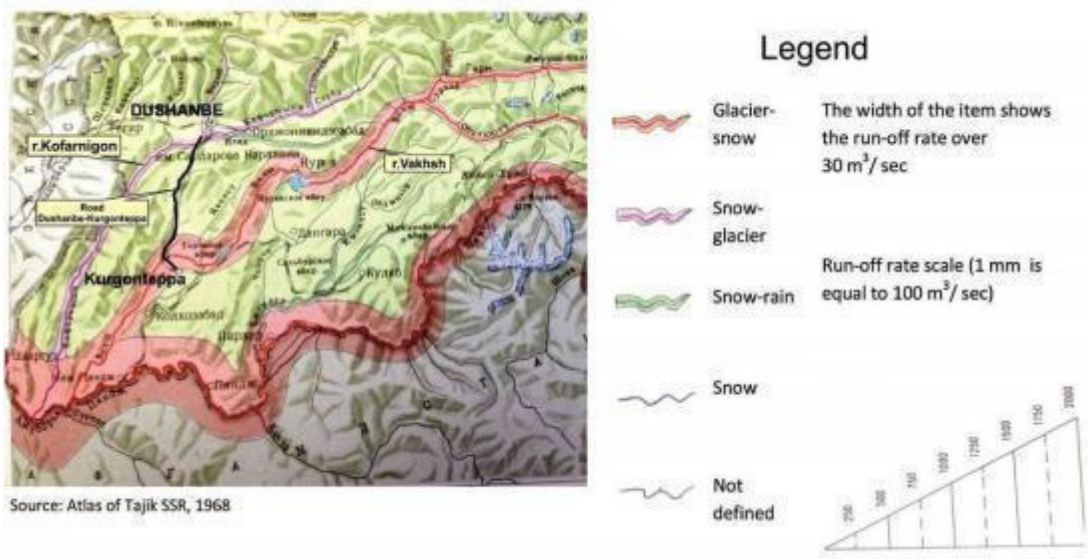


Fig. 21: Surface Water Resources in the Study Area

[19] Estimation: Some literature sources quote a basin area of up to 782,600 km². As with the Amu Darya, the water divide can only be correctly established in the mountainous part of the basin. Thus, many hydrologists do not give a figure for the total basin area but state that 142,200 km² of the basin area is upstream of the point where the river leaves the Fergana Valley.
[20] Estimation: The literature gives various figures for the size of the catchment area, from 58,370 km² to 59,900 km².
[21] Estimation: Due the sheer impossibility of determining the size of the catchment area, many hydrologists simply give a figure of 17,700 km² for the mountain part of the catchment area. https://www.unece.org/fileadmin/DAM/env/water/publications/assessment/Russian/G_PartIV_Chapter3_Ru.pdf

167. Both rivers have a hydrological regime that is particularly influenced by snow and glacier melting. The basic characteristics of the Kofarnigon and Vakhsh river are shown in the Table 17.

Tab. 17 Characteristics of the Kofarnigon and Vakhsh Rivers

№	River	Catchment area, km^2	Length, km	River fall, m	Average annual flow, m^3/s
1	Kofarnigon	11700	386	2270	155
2	Vakhsh	39100	691	4350	618

168. All surface waters of phase 2 relate to the Vakhsh river sub-basin of the Amu Darya basin.

169. In addition to crossing of Vaksh river at km 72+860 the Project road crosses several natural creeks and small rivers that drain from the slopes of Aktau and Karatau mountain ranges and numerous irrigation and drainage collecting channels of the Vaksh river irrigation system.

170. Besides Vakhsh River there are two major natural water streams crossed by the Project road, the Obikiik and Aksu Rivers.

171. Obikiik creek (river): Numerous intermittent drains descending from the slopes of Aktau and Karatau form the Obikiik creek. The creek is meandering through the valley and collects water from many intermittent tributaries that are descending from slopes of Aktau and Karatau ranges. it crosses the Project alignment at three locations. These locations are: bridge No 6 (upstream tributary), bridge No7 (Dahanakiik) and bridge No 9 (Obikiik creek) after junction with a number of tributaries drained from the Karatau slopes. The Obikiik is a shallow stream, which mainly holds water during the rainy season (winter-spring), and almost completely disappears at the mid of summer. However, some water remains around year. At the location of bridge No. 9 Obikiik creek is prone to mudflows which may have a flow rate for the estimated 100 years return period up to $190m^3$/sec. Nonetheless, the Obikiik valley was considered to be dry before construction of an irrigation system in the 1970s diverting water from the Vahsh river through a series of canals and tunnels. Obikiik creek is linked by geomorphology to the Aksu River. However its water does not reach Aksu River and gradually is disappearing downstream.

172. Aksu (creek) river drains from the Eastern slopes of Aktau range and crosses the Project road at the location of bridge No11 within Uyali village. Aksu is also prone to mudflows during the raining season and have very low water discharge during the dry season.

173. Vaksh valley has a very dense and diverse irrigation network consisting of 10 permanent irrigation systems, which turned it into the very important cotton growing region. Vaksh irrigation system is the largest in the country. The total length of the irrigation channels is 3,074km and 1,427km of collection/drainage channels. At the location of bridge N 10 the road crosses an irrigation channel diverted directly from the Vaksh River. All irrigated lands are located downstream from Nurek HPP (Hydro Power Plant).

174. The main three irrigation schemes along Vaksh River are shortly described in the following:

175. The Dangara tunnel with a capacity of 100 m^3/s was built to irrigate the land in Dangara area (70,000 ha) through a tunnel from the Nurek reservoir;

176. The Yavan-Obikiik irrigation scheme includes irrigation tunnels developed through the Jitimtau and Karatau ranges in length of 7,415 and 5,260m respectively. With a capacity of 75m^3/s it irrigates the land in the regions of Yavan, A. Jomi and Hurason. The water intake is connected to the Baipaza reservoir. At the location of bridge No 10 the road crosses an irrigation channel diverted from Baipaza reservoir by the Yavan-Obikiik irrigation scheme.

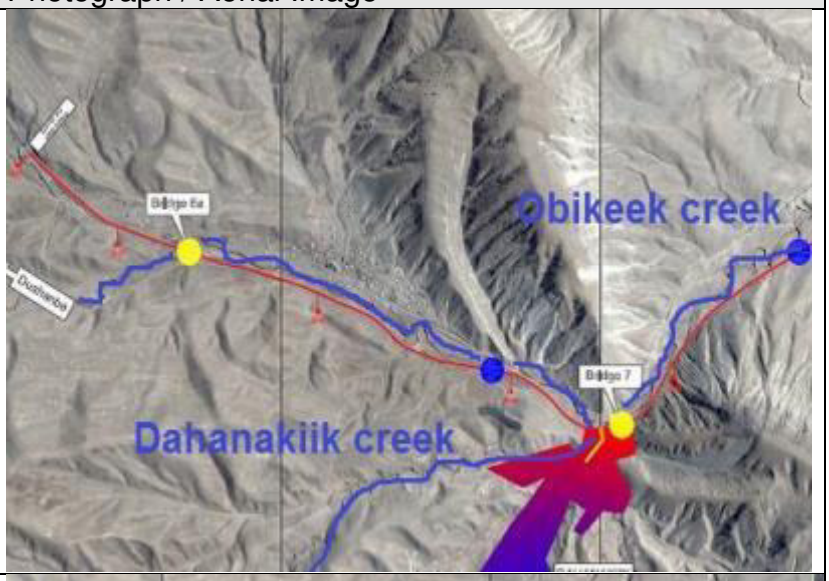
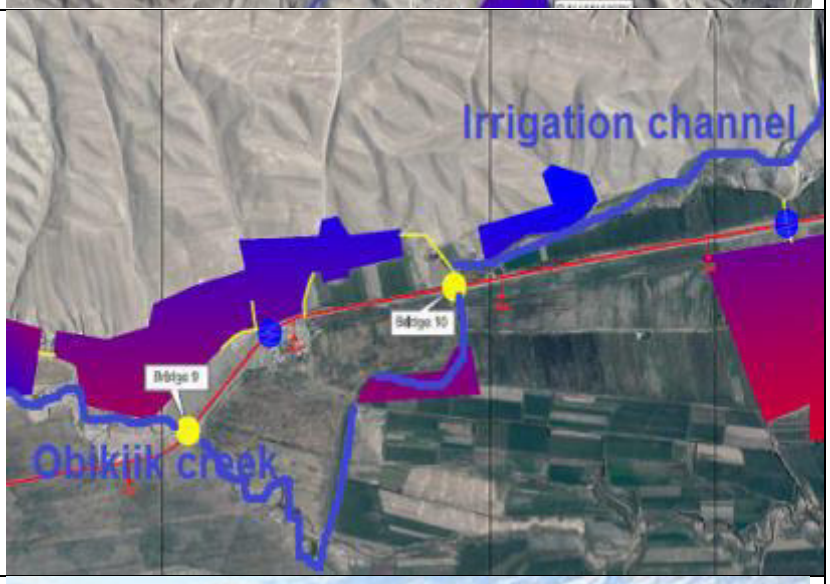
177. The Vakhsh main canal with a designed capacity of 180 m^3/s was built in the 1930-s and irrigates the land in the regions of Vakhsh, Bokhtar, Jilikul Kumasangir and Rumi at the left bank of Vaksh river. The water bodies crossing the Project road between the bridge over Vaksh and the end point of the Project in Kurgonteppa city are collection/drainage channels of the Vaksh main Canal.

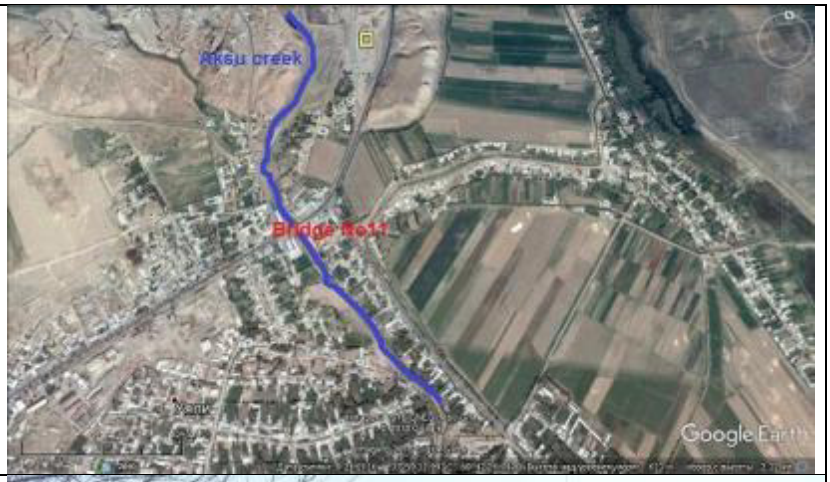
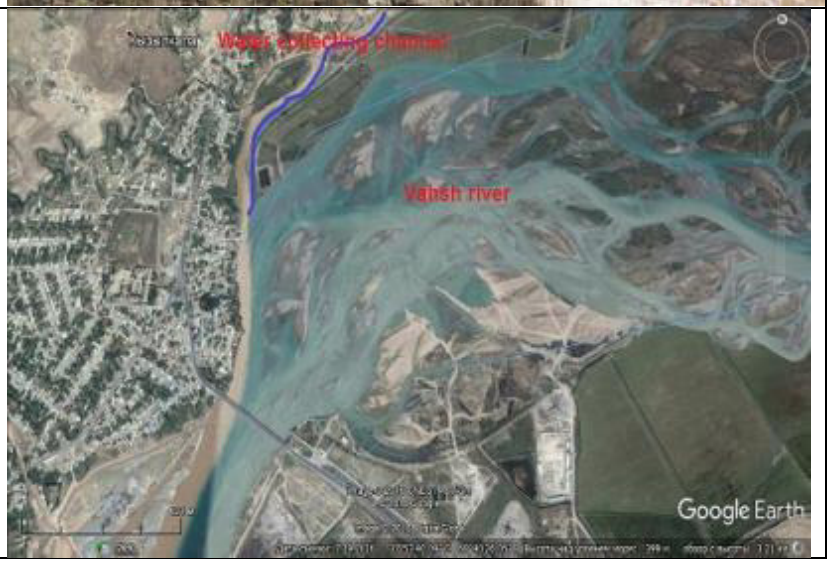
178. In addition to these major systems there are also several small size irrigation schemes that provide public and private farms with irrigated water; their abstraction capacity usually does not exceed 1 m^3/s (observations made on site along the Vakhsh river).

179. The water quality in natural bodies and irrigation network is mixed. The Shurabad darya (Yavansu) now receive not only Aksu River (water) but also numerous drainage channels before joining Vaksh River at about 750m from the Vaksh River bridge.

180. The below table provides an overview of the most significant surface waters in the Project area.

Tab. 18 Surface Waters

Description	Photograph / Aerial Image
Dahanakiik and Obikiik creeks crossed by bridges No 6a and 7. Water bodies are shown as blue lines	
Obikiik creek and irrigation channel diverting water from Vahsh river at the locations of bridges 9 and 10. Downstream from the bridge #9 the river intersects the irrigation channel crossed by the road at location of bridge No10.	
Obikiik creek at bridge No 9. The creek is prone to mudflows. During heavy rainfalls the flow increased by many times and filled the channel.	

Position of Aksu-creek at the location of bridge 11 in Uyali village. About 2.5 km downstream from the bridge the creek joins the drainage channel (Shurab-darya) which collects used irrigation water that enters Vakhsh river at about 750m upstream Vakhsh bridge.	
View to Aksu creek from the location of bridge No 11. The creek is prone to mud-flows. The historical data evidence extreme floods in 1992 and 1996	
The position of Vakhsh river and drainage channel collecting all irrigational and natural water. It enters into Vakhsh river at approximately 750m upstream from the bridge	

View from bridge to Vahsh river. The dirt water from collection/ drainage channel is mixing with clean water running flowing from Nurek&Baipaza reservoir	

5.1 Water quality

181. The Vakhsh River's feeding is snowfield/glacier melting and precipitation (snow-rain), flood - in period from February to June, maximum runoff is in June. Water mineralization is about 500-800 mg / L in the high water and 800-1000 mg / L in the low water period, the composition of water is calcium sulfate.

182. Water quality standards for Tajikistan are provided in the chapter on Legal, Policy and Administrative Framework.

183. According to the National Geoscience Database of Tajikistan, the Vakhsh River is subject to pollution from industry and settlements, including BOD, antimony and mercury.

184. In September 2017 water quality baseline measurements were conducted at the following 5 locations:

- 1 - Channel in Uyali village centre
- 2 - Vakhsh River at the right bank (merging with Aksu River)
- 3 - Vakhsh River (after merging with Aksu River)
- 4 - Vakhsh River Center
- 5 - Vakhsh River at left bank.

185. The following three figures shows the location of the sampling points.

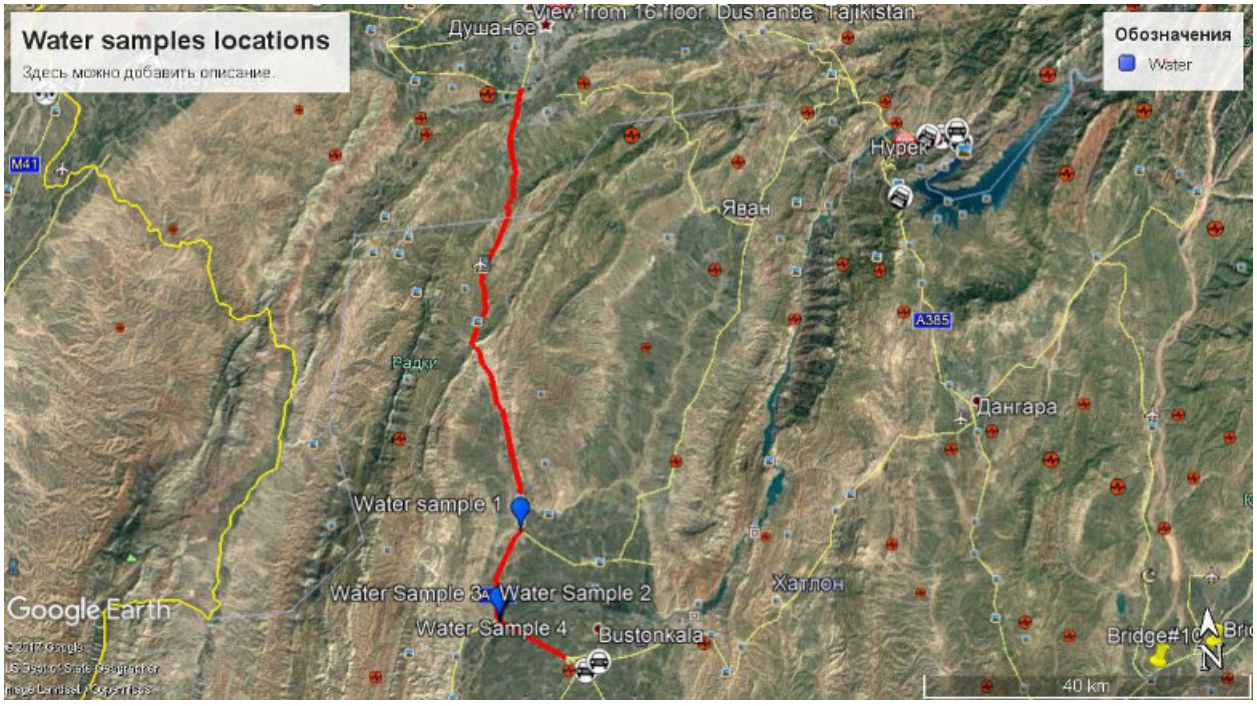


Fig. 22: Water sample locations alongside the Project road (blue dots)

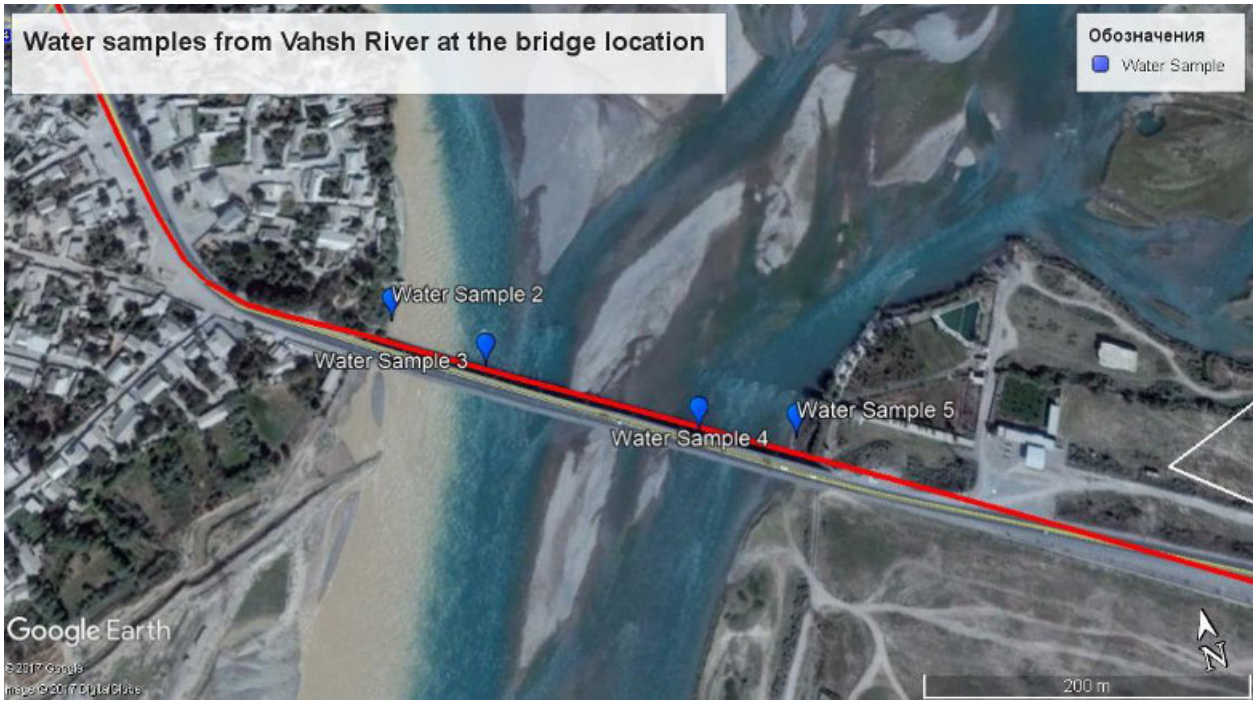


Fig. 23: Water sample locations in Vaksh River (blue dots)

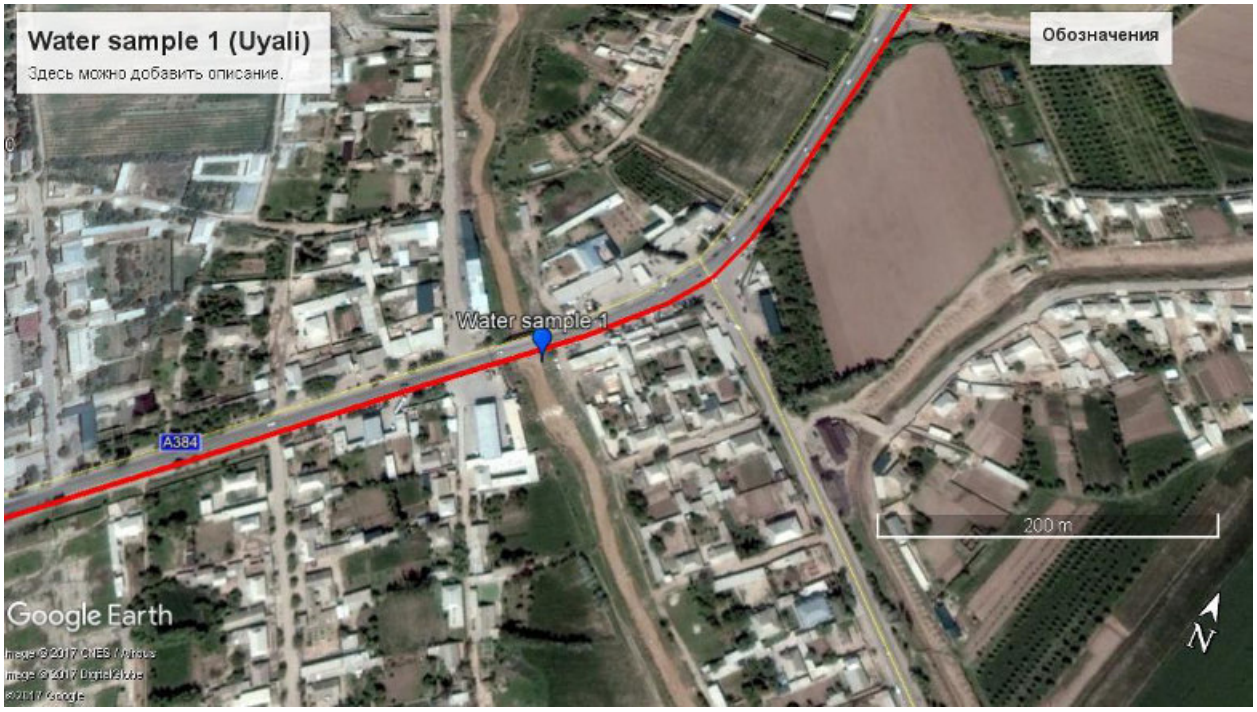


Fig. 24: Water sample location in irrigation channel in Uyali

186. The following table provides a synopsis of the measurement results for the different parameters:

Tab. 19 Water Quality Measurement Results

No	Ingredients Item	Maximum Allowable Concentrations (MAC) of Fishery Norms	Sampling Points				
			1	2	3	4	5
1	pH	6,5-8,5	9,2	8,2	7,4	7,3	7,6
2	Suspended solids in mg/l	75	620	416	43,5	33,4	57,6
3	BOD5 mg O/l	3,0	2,9	2,0	1,2	0,9	1,8
4	Dissolved oxygen in mg/l	Not less than 4	4,4	6,2	12,4	13,6	9,8
5	Salinity level mg/l	1000	1780	600	340	320	370
6	Oil products mg/l	0,05	0,01	0,01	отст	отст	0,01
7	Electrical conductivity ohm/cm	-	0,242	0,970	0,770	0,600	0,610

187. In summary the channel in Uyali village centre exceeds the MAC for suspended solids and salinity and at the right bank of Vaksh river the MAC for suspended solids is exceeded. In addition the channel in Uyali exceeds the MAC for pH. Probably the main reason is that the Geology of the area is composed mainly of carbonate rocks and soil and gypsum which reduce acidity when dissolved in water. Also the channel receives water flowing from the fields, enriched by compounds from fertilizers and pesticides which also affect the pH. All other baseline indices comply with the applied standards of the Republic of Tajikistan. The complete laboratory report is attached in annex 5.

5.2 Ground Water

188. Ground water level is varying from low levels within a range of 1 m to 5 m below ground in the river floodplain of Vaksh River to very deep levels of up to 20 m. There are no wells in the project area.

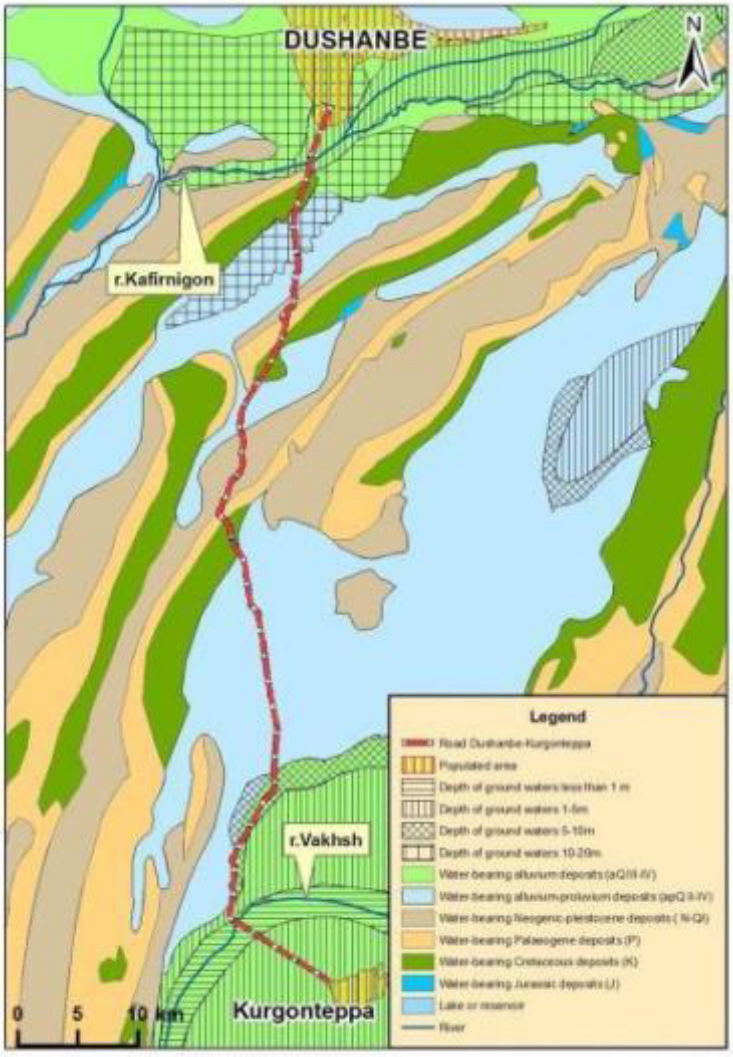


Fig. 25: Ground Water Resources in the Study Area

6. Noise

189. Existing ambient noise levels within the Project road corridor are attributable to vehicular traffic, construction and quarrying operations. Sensitive receptors of public interest concerning noise emissions are schools, hospitals mosques or other social infrastructure facilities. In addition there are many residential houses. They are located within the settlements alongside the Project road. The information about sensitive points of public interest was collected during public consultations and specially organized visits to the Project road area. Although only the public sensitive receptors located in distance of 200m or less to the Project road were targeted some of them located at the larger distance were also included into the list as the measurement of the accurate distances on the spot was complicated. The distances were clarified with the use of maps and google images.

190. The complete list of identified sensitive receptors of public interest is provided in the annex 3. The residential houses close to the Project road are shown in the annex 7.

191. Noise level standards in Tajikistan are shown in table 7 “Environmental Standards for Noise Emissions”.

192. Baseline noise measurements were carried out and are provided in chapter VII.C on noise measurements. During construction phase noise will be monitored as indicated in the Monitoring Programme. A summary of baseline noise measurements is in Table 35 and Table 36.

193. The vehicles responsible for the highest noise emissions on the Project road are trucks and agricultural machinery. Existing noise emissions are aggravated by the bad technical conditions of most of the vehicles and by the damaged and cracked road surface.

194.

Fig. 26: Impression of vehicle fleet

195. In the future the smooth surface of the reconstructed road will reduce noise emissions significantly as compared to the status quo. This will to a certain degree compensate the effects of higher traffic loads and road widening from 2 to 4 lanes.

7. Vibrations

196. In September 2017 baseline measurements for vibration were conducted at identified sensitive receptors alongside the Project road. The 18 locations where measurements have been taken are indicated in the map in annex 6. The locations are numbered from 1 to 18.

197. In summary no exceedances of the standards were measured. The underlying standard is the "Vibration Safety GOST 12.1.012-90 Interstate Standard, Moscow Standardinform, 2006" which is applied in Tajikistan because Tajikistan has no national standards for vibration emissions.

198. The measured parameter is the vibrational acceleration expressed in dB. The MAC is 107 dB (0,224 in/sec) for the Z axis (vertical axis) and 116 dB (0,63 in/sec) for the X and Y axis (horizontal axis) respectively. In summary no exceedances were measured. The measurement results are shown in the chapter "Baseline Measurements" and summarized in Table 37. The original laboratory report is attached in annex 5.

199. An assessment of the vibration impact during the construction phase is provided in the chapter on impacts and mitigation measures.

B. Ecological Resources in Project Area

200. Natural ecosystems are in general resilient systems. At the same time, the impact of anthropogenic activity on ecosystems is becoming the main reason for climate change, loss of biodiversity, and desertification/land degradation. Control of environmental risks requires a strong environmental policy, improved coordination of government structures, civil and business society representatives.

201. Changeable mountain climatic conditions and hard natural historical processes promoted formation of a unique biological diversity in Tajikistan. The annual average sunshine level varies from 2090 to 3160 hours, the average air temperature varying from +17°C and higher in the south of the country to -7°C and lower in the Pamirs. The highest temperature is in July, while the lowest is in January. The most severe climate is observed in the Eastern Pamirs, where the annual average temperature is from -1 to -6ºC. The absolute minimum is at the Bulunkul Lake -63°C. In hot deserts of southern Tajikistan and in cold high-mountain deserts of the Eastern Pamirs, the annual average precipitation level varies from 70 to 160 mm, the maximum being in Central Tajikistan, sometimes exceeding 2000 mm a year. The mountain landscapes of Tajikistan contain 0.66% of the animal world and 1.8% – plant diversity, including wild relatives of domestic animals and cultivated plants.

Tab. 20 Main Components of Biodiversity in Tajikistan[22]

Component	Importance
Ecosystems	12 types
Types of major biotypes	20 types
Flora	9 771 species
Wild relatives of cultivated plants	1 000 species
Plants, listed in the Red Data Book of Tajikistan	226 species
Agricultural crops	500 varieties
Fauna	13 531 species
Animals, listed in the Red Data Book of Tajikistan	162 species
Domestic animals	30 breeds

202. Forests only take up 3% (412,000 ha) of the land area of the country, however they still play an important role in the conservation of biodiversity and genetic resources as well as in atmospheric carbon absorption. In addition, the forests are a natural protection for human settlements against floods, avalanches, and soil erosion. They also regulate the water balance and microclimate.

203. Almost all forests in Tajikistan belong to the state and are considered to be Group 1 forests. Group 1 forests are defined in the forest code of Tajikistan and are forests that are not allowed to be cut for commercial use, only for reasons of sanitary protection.

204. Forest management activities are directed at conservation and the improvement of forest conditions. Primarily, there is an open juniper forest prevailing at 1,500-3,200 m. above sea level. Pistachio trees, well accustomed to the hot dry climate, are mostly found in southern Tajikistan at an elevation of 600-1,400 m. Walnut forests are characteristic of Central Tajikistan at 1,000-1,200 m. above sea level and are known by their specific requirements for soil and climatic conditions. Part of the forest belt consists in maple forests with fragmentary poplars, willows, birch trees, buckthorn, saxaul and various shrubs.

205. The environment of the project road sections is consisting mostly of agricultural land, grassland, pasture and settlements. There are no specially protected natural areas (PAs) in the immediate vicinity of the project area. One protected area – Tigrovaya Balka Natural Reserve is located at the distance of 45 km to the south of Kurgonteppa: that is why it can be concluded that no protected area is in the vicinity of the Project road. The right-of-way of the project road sections in terms of natural zoning runs through two neighboring natural provinces: Hissar (from Dushanbe to pass Fahrobad) and Vakhsh (from pass to Kurgonteppa).

1. Flora

206. Hissar province has quite rich vegetation and the area of the road falls under the belt of herbaceous plants. First of all, it is bluegrasses and sedges, the road also cross the habitat of Caucasian skeleton, pistachio, almond, and hawthorn. Over the past 50-60 years, these habitats are severely degraded and heavily modified by human. There is artificial planting of ash, poplar, willow, elm, plane tree, and so on, as well as farmland.

[22] First National Report on Biodiversity Conservation and National Biodiversity Strategy and Action Plan, 2003

Mulberry groves (*Morus alba*, White Mulberry) are common within the vicinity of the study area.

207. Regarding the vegetation Vakhsh Valley can be attributed to the desert and steppe (300-800 m above sea level) belt and the low-mountain (800-1300m) belt, as well as the river valley belt. Vakhsh River with its tributaries forms here three floodplain terraces. Surrounding hills and mountains are low and ranges on average reach heights of 1.000-1.500 masl (highest peak of Mundy-tau is 2.227 masl). The natural vegetation consists of short meadow grass and sedges as well as other herbaceous vegetation. At some places almonds and pistachios are growing. Natural vegetation now is severely destroyed or almost altered by the influence of anthropogenic factors. Vakhsh valley is the most significant region of Tajikistan for agricultural cultivation with its greatest share of cotton.

208. Based on literature review the most common species of the former natural vegetation within the study area are the following: bluegrass (*Poa bulbosa*), sedge (*Carex pachystilis*), astragalus (*Astrogalus*), wormwood (*Artemisia scotina*), calligonum (*Calligomm griseum*), Circassian (*Salsola richteri*), medusahead (*Thaeniatherum asperum*), maple (*Acer lactum*), Walnut (*Inglana regia*), wild almonds (*Amygdalus bucharica*), apple (*Pirus malus*), cherry (*Prunus divaricata*), plum (*Mahaleb*), willow (*Salix*), also found poplar, and juniper (Juniperus polycarpos) on the slopes.

209. Herbaceous vegetation occupies the foot of the Hissar and Turkestan ranges. They can be found mainly at autumn and winter pastures. The vegetation here is very low, its mass is small, but it is great eaten by all kinds of animals. More tall wheatgrass provide high mowing and used as hayfields or pastures. In this area also large plants of the family *Apiaceae* are common (Feruls, Prangos), rhubarb (*Rheum ribes*) and ram (*Polygonum polymorphum*) can be found.

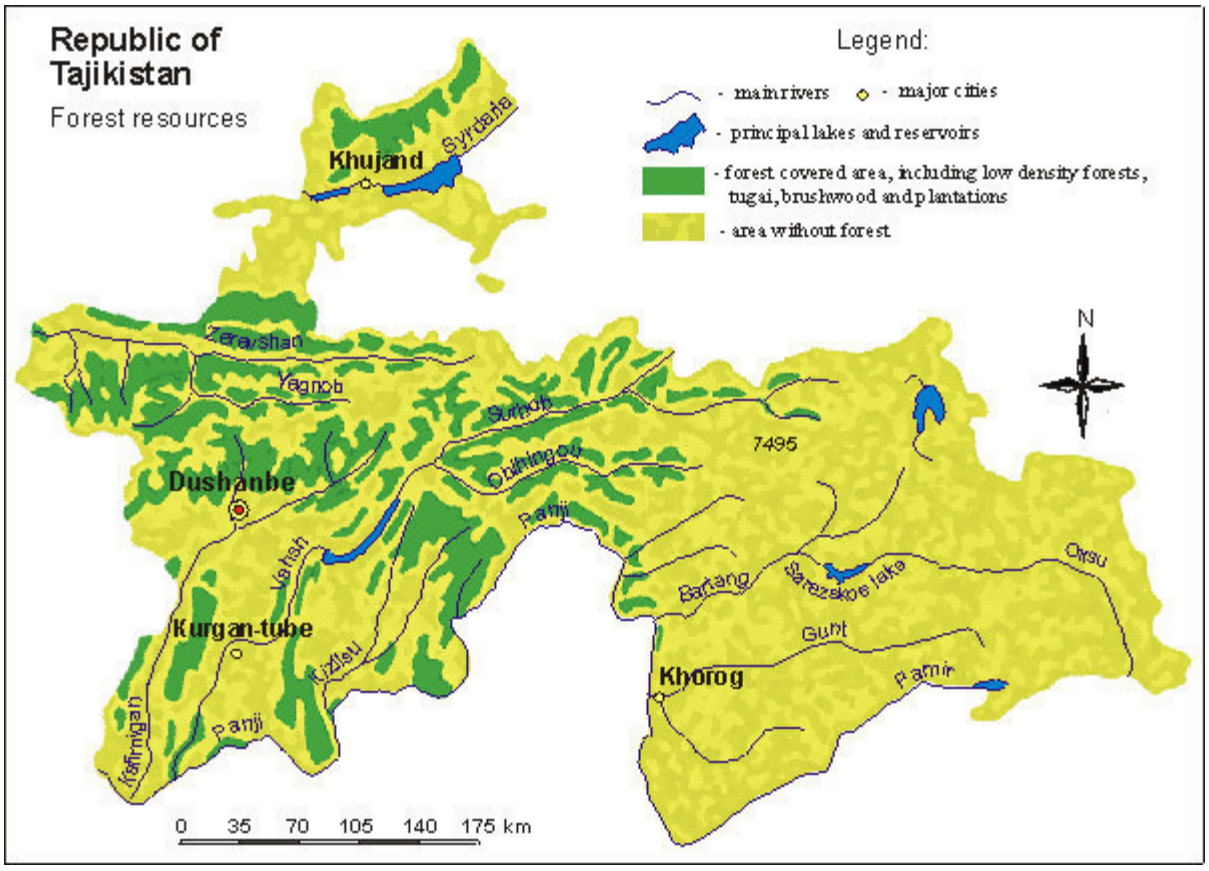
210. Close to the Project road grow some rare and endangered plant species such as *Weisia papillosissima Lasar, Stroganovia Tolmaczoyii Junuss, Crocus korolkowii, Allium suworowii, Tulipa praestans, Tulipa tubergeniana* and *Anemone bucharica*. However all of them grow on the hill and low-mountain slopes and the Project road will not affect them. Consequently, the risk of valuable habitats being present is low.

211. The Vakhsh Valley has a rather long history of human settlement featuring agricultural development with industrial activity, and this is true of the Project corridor. As such, within the immediate vicinity of the Project Road very little flora is present. Most vegetation in the Project Area now occurs in agricultural land and gardens, growing fruits, vegetables, and cereals. Both introduced and local species and varieties are used. Besides homes and private plots, in many portions of the road land immediately adjoining the road is used for vegetable growing, cereals and orchards. Either side of the road, rows of trees has been planted. Most are young (from 5 to 10 years in age) and some of them between 20 and 30 years in age approximately. Around 80% are ornamental species, primarily poplar (*Populus*) species, willow, fir-tree, pine and acacia species which make up around 50% of the total. The remaining 20% are fruit trees, including apples, walnut and mulberry.

212. Based on the conducted surveys and literature review no important, rare, endangered, or protected species of flora are found within or in the vicinity of the road.

213. Figure 27 below shows the distribution of forests in Tajikistan. It can be seen that no forest area is traversed by the Project road which links Dushanbe and Kurgonteppa.

Fig. 27: Reserved Forest in Tajikistan



2. Fauna

214. Fauna of Tajikistan is characterized by the great genetic diversity. Mountain fauna is richer than that of the plain and contains a substantial number of European-Siberian and East-Asian elements. The fauna of the hot, lowland deserts contains plenty of Indo-Himalaya, Ethiopian, and Mediterranean species.

215. In terms of zoogeographic zoning the entire length of the Project road falls under the Tajik zoogeographical site. This site is characterized by an abundance of representatives of all classes of vertebrates. This area is home to two species of amphibians, 40 species of reptiles, 186 species of birds and 45 species of mammals. The most common species here are:

Amphibians - Gray Toad (*Bufo bufo*) and Marsh Frog (*Pelophylax ridibundus*);

Reptiles – Tadjik Pygmi Gekko (*Alsophylax tadjikiensis*), Steppe Agama (*Trapelus sanguinolentus*) , Viper (Makrovipera lebetina) , Cobra (*Naja oxiana*), East Boa (*Eryx miliaris*), Steppe Turtle, Glass-lizard (*Pseudopus apodus*) and Blindworm (Anguis fragilis); Rare and endangered species included in Red Data Book are cobra (*Naja oxiana*) and steppe turtle (*Testudo horsfieldii*).

Birds – Lesser Kestrel (*Falco naumanni*), Buzzard (*Buteo spec.*) Griffon Vulture (*Gyps fulvus*), Rock Pigeon (*Columba livia*), Indian (*Acridotheres tristis*) and Pink (Sturnus or Pastor roseus) Starlings, Black-chest and Barn Sparrows (*Passer spec.*) European Bee-

eater (*Merops apiaster*), Roller, Crested Bird, Magpie (*Pica pica*), Black Check, Shrike (*Lanius spec.*), Long-tailed Shrike, and Barn Swallow (*Hirundo rustica*). Rare birds such as Partridge (*Perdix perdix*), Shahin, Egyptian vulture, Golden Eagle, Saker (*Falco cherrug*) and Pheasant are seen in this area. In general roads are a well known cause of mortality in passerine birds and other groups.

216. **Mammals** - Wolf, Fox, Porcupine *(Hystrix spec.*), Tolai Hare (*Lepus tolai*), Turkestan Rat, Wood Mouse, Vole (Microtus), Gerbils (Gerbillus), Long-eared Bat, Horseshoe Bat and Pipistrelle (*Pipistrellus pipistrellus*)[23], Long-eared Hedgehog et al. Rare and endangered species such as Porcupine, Vormela peregusna, Wild cat and Striped hyena may occasionally cross the road. **Fish** - There are 52 species of fish in Tajikistan, including acclimatized and accidentally imported, and about 85% of them are inhabitants of the Aral Sea basin. The greatest number of species of fish belong to the carp family - Cirprinidae (23), the second largest number of species is Cobitidae, also known as the True loaches (11), the third - Sturgeons - Accipenseridae (5), and the rest of the family are represented each by one or two species. The most typical fish species in Tajikistan are: Amudarya trout, Marina, Turkestan catfish, carp, Aral and Turkestan barbel, catfish and others; weeds (non-target) species - gudgeon, mosquito fish, and numerous loaches. Special protection measures are needed to organize in the upper reaches of the rivers Vakhsh and Kofarnigon at the time of spawning of Amudarya trout (*Salmo trutta axianis*). For obtaining more detailed information on the distribution of fish species in the Vaksh River a meeting took place in September 2017 with the Institute of Zoology and Parasitology in the Academy of Science. Key information was obtained from scientist Mirzoev N.M. who explores the aqua-fauna of Vahsh River. Hence the fish population in in Vahsh River is unevenly distributed and closely associated with the ecological conditions of the various habitats. The construction of cascade of dams for hydropower plants (Nurek, Baipaza, Sangtuda 1, Sangtuda 2 and Golovnoe) significantly altered the distribution of fish population in the Vahsh River basin. For this reason, the species composition of fishes varies in different sections of Vahsh River.

217. At the upper parts of Vahsh River (upstream from the Nurek water reservoir) the species composition is very poor and normally represented by 1 to 5 species (common marinka (Schizothorax intermedius), Khramulya of Samarkand (Capoeta capoeta heratensis), Turkestan catfish (Glyptosternon reticulatum) and Crested loach (Paracobitis malapterura). At the downstream sections of Vahsh River (downstream from Golovnoy reservoir), including the lakes of the “Tiger gully” preserve the quantity of fish species may reach up to 30.

218. The modern composition of fish fauna in the lower part of Vahsh (the area of bridge in Kizilkala) includes over 20 species, of which 8 are economically interesting, other have no value for commercial fishing. Some of the species are rare and endangered species and included in the Red Book of Tajikistan.

219. Economically interesting fishes downstream from the Vaksh bridge are represented by carp (sazan) – (Cyprinus carpio), Khramulya of Samarkand (Capoeta

[23] The bat species *Pipistrellus pipistrellus* is not included in the IUCN list for Tajikistan. But according to the official website of the “National Biodiversity and Biosafety Center of the Republic of Tajikistan” (http://www.biodiv.tj/en/single?cat=22&id=3) this species occurs in various natural and man-made habitats and buildings, in the mountains - up to 2000 masl.

capoeta heratensis), catfish (Siluris glanis), silver Prussian carp or Gibel carp (Carassius auratus gibelio) and Aral asp (Aspius aspius taenianus).

220. The species with no economical and fishing interest include Striped bystranka – (Alburnoides taeniatus), oriental bystranka (Alburnoides bipunctatus eichwaldi), ostroluchka (Capoetobrama kuschakewitschi), chebachok of Amur or stone moroko (Pseudorasbora parva), gambusia (Gambusia affinis holbrooki, Korean hemicutler or vostrebrushka (Hemiculter leucisculus), Amur goby- (Rhinogobius similes), crested loach – (Nemachilus malapterurus), Turkestan gobio(peskar) – (Gobio gvaobio lepidolaemus) and Aral loach (Gobitis aurata aralensis).

221. The introduced fish fauna is represented by rarely found common bighead carp – (Hypophthalmichtys molitrix) and white amur- (Ctenopharyngodon idella), The rarely and endangered fish species included in the Red Book of Tajikistan in this section of river represent ostroluchka (Capoetobrama kuschakewitschi), Aral loach – (Gobitis aurata aralensis), pike asp (Aspiolucius esocinus), Aral barbel (Barbus brachycephalus) and Turkestan barbel (Barbus capito conocephalus).

222. Surveys and discussion held in September 2017 with the fish specialist of the Institute of Zoology and Parasitology in the Academy of Science (IZPAS) confirmed that the Project is unlikely to have any significant impact on endangered fish species. This is because within a section of about 1 km up and downstream the bridge in Kyzylkala, the Vaksh River is heavily impacted by extraction activities and material dumping. Its ecology, river morphology and riparian vegetation is heavily disturbed and mainly composed of modified habitats and it can excluded that there is no presence of endangered fish species within the Project's area of influence. The fish specialist in the IZPAS also mentioned several introduced fish species, which are alien to the local aquatic ecosystem. The aquatic ecosystem was modified by many ways and the Project is not likely to contribute to any further alteration. Standard preventive measures during construction are prescribed in the EMP to minimize any possible impacts.

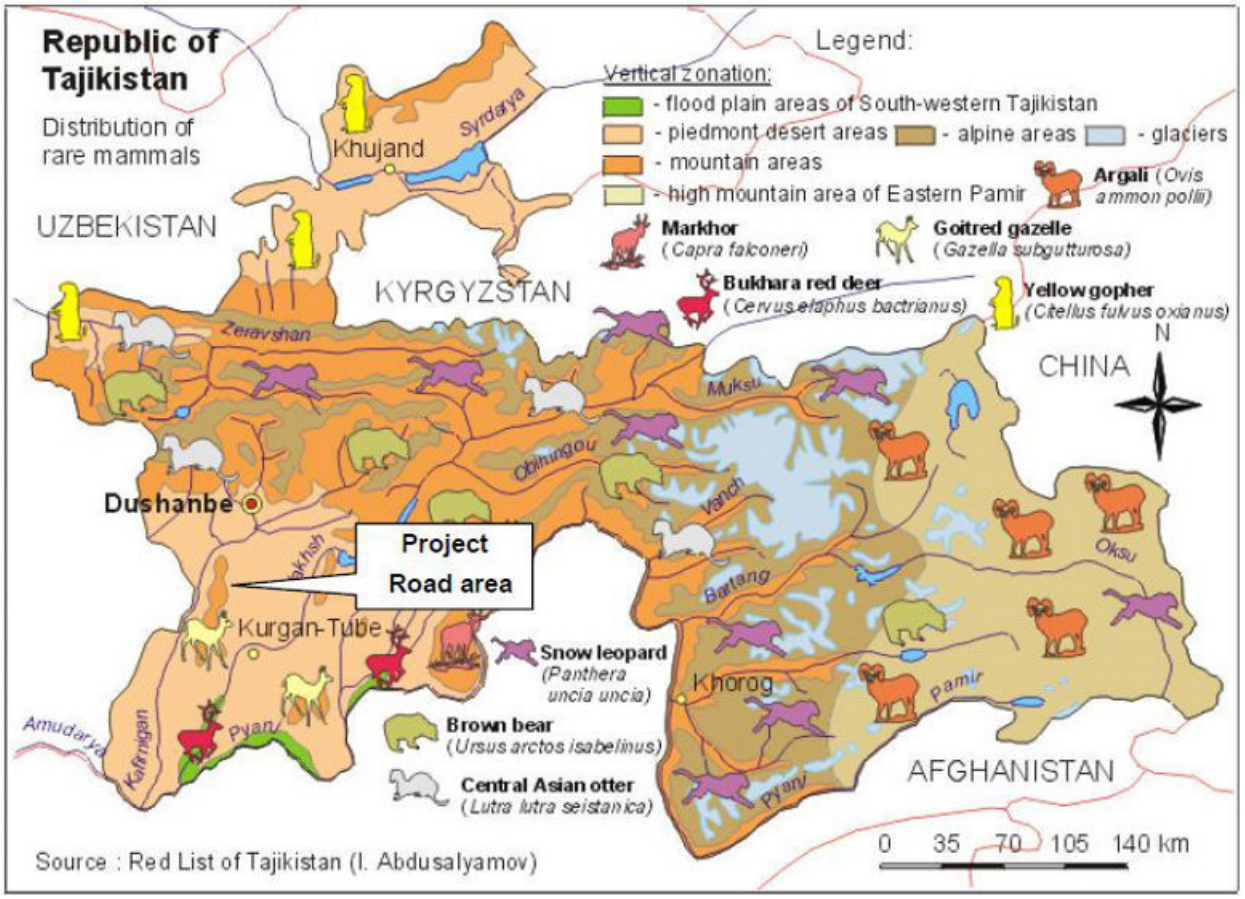
223. Naturally the Vaksh River would carry a high silt load. Since the construction of the Nurek dam, which also is acting as a sediment trap silt load of the Vaksh river has significantly decreased and the water is clearer. Aksu river that enters the Vakhsh river just few hundred meters upstream from the bridge currently provides permanent and significant silt load to the location of bridge. The figure 23 and the photo on Table 18 illustrate this very well. The water in Vahsh has become clean and transparent only after the construction of Nurek dam. Prior the filling up of Nurek reservoir the water in Vaksh river was brown with suspended particles around the year. As a result of the bridge rehabilitation and construction and to reduce any additional increase of silt load from the project, special mitigation measures, including silt traps and cofferdams are being proposed, along with a strict monitoring program during bridge construction.

224. **Insects** - Among rare and endangered insects which could be found in the vicinity of the road are following: arboreal mantis, *Empusa pennicornis Pallas, Carabus tadzhikistanus, Nola elaeagni*. All of them might live near the road and may occasionally pass the road.

225. There are no critical habitats for the described vertebrate and insect species within or in the vicinity of the Project Road. No important, rare, endangered, or protected species

or habitats were found within the Project Corridor during this study (see Figure 28 below regarding the distribution of rare mammals). However, it is recommended to install Information boards on all extinct, rare and endangered species for the population awareness raising. This instrument might be most efficient and cost effective method for conservation of endangered and rare animals.

Fig. 28: Distribution of rare animals (Red List of Tajikistan)



3. Desertification

226. Since the 1930s there has been intensive reclamation of foothill and floodplain valleys to increase the area of arable land in Tajikistan but up to 100 thousand ha of floodplain, pistachio, and partially broad-leaved forests were destroyed in the process. During the economic and energy crises in 1990s juniper forests, which are difficult to reforest, were cut down. Deforestation and animal grazing in forest areas have had a negative impact on the quality and diversity of forests and the natural regeneration of forests have practically stopped.

227. Pasture makes up 80% of agricultural land and is mainly found in the Khatlon region and the DRS. Pasture stocking today is lower than during the Soviet period 25 years ago and the condition of pastures is not adequate. In the east of the Pamir the condition of the teresken (Eurotea) pastures has become critical. Here, due to a lack of energy sources, people have started a massive uprooting of teresken that is a valuable

animal fodder, and this has resulted in the desertification of highland pastures. In other districts cattle often graze near human settlements, thus local pastures have become overgrazed and degraded. More than half of the natural pastures in the country are in the highlands at altitudes varying from 1,700-2,000 to 3,500 masl.

228. The causes of land degradation are multiple, complex, and vary across Tajikistan's regions, but to a greater extent deterioration and exhaustion of land resources is the result of admittedly incorrect and destructive agricultural practices, overgrazing, deforestation and cutting down of bushes, forest degradation. Main active factors are wind and water erosion.

229. While natural factors contribute to soil erosion, unsustainable human behavior accelerates the process to an intolerable degree: it is estimated that 97% of agricultural land in Tajikistan has some level of erosion. Land degradation caused from erosion due to overgrazing is estimated to affect approximately 3 million hectares, or 85% of pastures (Asian Development Bank, 2004). In addition, excessive use of pesticides and fertilizers has resulted in the contamination of soil and waterways.

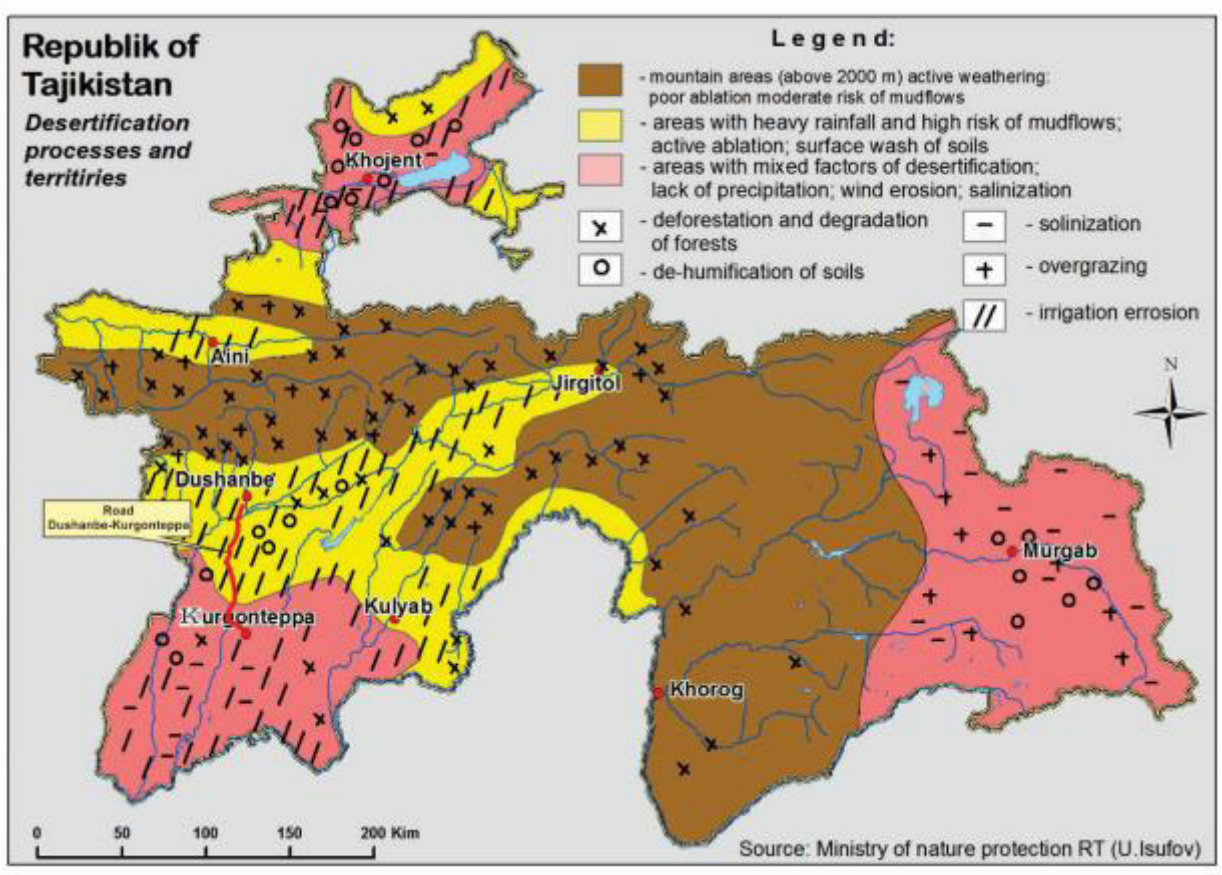


Fig. 29: Desertification in Tajikistan

230. The erosive processes are especially active in the foothill regions where poorly cemented sandstones, loess like loams, and similar rock predominate lending themselves to washing out and wind erosion. The two main factors underlying the process of soils degradation in Tajikistan are water erosion and gully erosion. However, anthropogenic

factors accentuate the erosive processes through intensive development of agriculture on slopes and unsustainable cultivation practices.

231. The incidence and causes of soil degradation vary across the country, depending on natural features, climate and land use. In the south of mostly low hills there are small sites of the unfixed sand and zones of strong degradation (e.g. in Karadum and Kumjalolkum). Above these zones there are semi-fixed sands and areas of weak and medium degradation. Among the sandy massifs there are raised areas, which are strongly subjected to water erosion. In the limits of Yavan, Gozimalik, Vakhsh and other districts there are sites of different degrees of erosion, mainly caused by water. In the limits of irrigated zones, a wide variety of erosion processes are at work. On the slopes of the mountain ranges (Babatag, Aktau, Karatau), a number of sites face water erosion to varying degrees. See Table below.

Tab. 21 Distribution of soil erosion[24]

Administrative districts and provinces	Degree of erosion (%)					
	Non-eroded	Weakly eroded	Middle eroded	Strongly eroded	Very strongly eroded	Common area
Kurgonteppa group of districts	3.2	18.8	51.8	18.0	8.2	96.8
Kulyab group of districts	2.0	14.0	43.0	26.4	14.6	98.0
Sughd province	2.8	4.5	58.6	22.0	12.1	97.2
Hissar group of districts	4.3	9.4	40.2	31.5	14.6	95.7
Garm group of districts	0.5	4.2	35.1	32.9	27.3	99.5
GBAO	–	4.2	32.8	37.8	25.4	100

232. Tajikistan's widespread land degradation will increase the sensitivity of the land to climate change impacts, while the implications of climate change for the agriculture sector and the role of the Sustainable Land Management can play in climate change adaptation are considered to be highly significant for Tajikistan[25].

233. Within the Project Area soil erosion is resulting in significant impacts to the Project Road as it is described in the chapter on "soils" and on "mudflows and slope stability".

C. Socioeconomic Environment

Background

234. This Chapter presents the findings on the major socio-economic characteristics of the affected Project communities. The chapter is based on information from the jamoats' Key-Informants, national statistical data and data collected through the socio-economic surveys and census undertaken in the Project area. The main objectives of the SES and

[24] ADB TA 5941-REG: Combating Desertification in Asia. Tajikistan Country Situation paper (CSP) prepared by Shiv Saigal, 2003.
[25] Pilot Program for Climate Resilience (PPCR). Wolfgramm et al (2011).

census surveys are to understand the existing socio-economic environment and vulnerability of affected people in the Project area, to use the data for preparation of the LARP budget and to identify groups and persons who may need additional support due to the Project's impact.

Profile of the Project Area

235. Tajikistan is a Central Asian country bordering Afghanistan, China, Kyrgyzstan and Uzbekistan. According to the 2008 census, the country's population was 7,373,800. However, the population in 2015 is estimated to be 8,610,000 people. Tajikistan is divided into four regions: Sughd, Khatlon, Gorno-Badakhshan and Region of Republican Subordination, while the capital Dushanbe is administratively separate. Each region is divided into several districts (districts) which are subdivided into village level self-governing administrative units – jamoats. There are 58 districts (rayons) and 368 jamoats in Tajikistan.

236. Section 2, which is 39.575 km long, will be rehabilitated in the second phase. It traverses the Khurason rayon ending at Vakhsh bridge (km 73+050).The road section affects five jamoats with 19 villages located along the road. Khurason district has 106,216 inhabitants living in 85 villages and 8,242 households. The following tables present the demographic and economic profile of the Project district and villages located in the Project corridor (Table 22 Demographic Profile).

Tab. 22 Population in Project Districts

District	Population	Male	Female	No of households	No of villages	No of affected villages
Khurason	106,216	53,263	52,853	8,242	85	19

237. The major economic activities in the Project district are agriculture and animal husbandry. Wheat and cotton are the major cash crop in the area. Wheat is cultivated on 7,667 hectares and cotton on 4,110 hectares. Pastures and fallow land account for 55,308 hectares. Fruit production is prevalent in the area with almost 2,859 hectares used to cultivate grapes, apples, cherries, apricots and other fruit. (Table 22).

Animal husbandry is widespread in the Project area. Almost every household that has some land, also has livestock. Animals raised in the area include cattle, sheep, goats and horses. The districts' statistics indicate that there are 71,800 sheep and goats, 32,291 head of cattle and 4,960 horses in the Project rayon. (Table 23).

Tab. 23 Economic Profile of Project Districts

District	Wheat (ha)	Cotton (ha)	Other land, (pasture etc. (ha)	Orchards (ha)	Grape (ha)	Horses (No)	Sheep/ goats (No)	Cows (No)
Khurason	7,667	4,110	55,308	1,705	1,154	4,960	71,800	32,291

Source: Districts' and jamoats' statistics

238. There are 38,598 people living in 19 project-affected villages/settlements. In total, there are 18,286 males and 20,312 females living in 5,475 households. The affected villages' populations range from 152 people in Stancia Dagana to 5,340 people in Mehnat village in Galaobod jamoat. Eight villages have more than 2,000 people each, 6 villages have a population of 1,000-2,000 and only 5 villages have less than 1,000 inhabitants. The average family size in the Project villages ranges from four persons in Lalazor to 9.3 persons per household in Vaksh village. (Table 24)

Tab. 24 Population of the Project Towns and Villages

Jamoat	Villages along the project road	Population	Male	Female	No of households (HH)	Average No of people in a HH
Obikiik	I. Somoni	699	363	336	99	7.1
	Stancia Dagana	152	80	72	23	6.6
	Daganakiik	1,452	572	880	175	8.3
	Galaobod	1,942	940	1,002	244	8
	Kushlich	2,780	1,500	1,280	354	7.9
Galaobod	Hakikat	3,399	1,199	2,200	470	7.2
	Lalazor	971	481	490	238	4.1
	Mehnat	5,340	2,604	2,736	753	7.1
	I. Somoni	373	180	193	52	7.2
Hiloli	Iftikor	1,307	650	657	184	7.1
	Chavoni	1,262	631	631	163	7.7
	Navzamin	1,981	892	1,089	262	7.6
	Khurason	2,355	1,059	1,296	289	8.1
	Vaksh	3,491	1,570	1,921	375	9.3
	Chorbog	2,002	961	1,041	360	5.6
Ayni	N. Asadullo	2,253	1,081	1,172	293	7.7
	Sarband	1,086	586	500	181	6
	Burebofon	941	480	461	157	6
Kizil-Kayla	Bandar	4,812	2,457	2,355	803	6
Total	**19**	**38,598**	**18,286**	**20,312**	**5,475**	**134.6**

238. Data available for 3 Project villages shows 219 poor households in the Project rayon. (Table 3-3). Three villages for which data is available, have poor household rate between 12% and 21%. Village Bandar has the highest poverty rate (21.05%).

Tab. 25 Poverty in Project Villages

Village	No of HH	No of poor HH	% of poor HH	Woman head of HH	Woman-headed poor HH	% of poor woman-headed HH	No of women on leadership position
Sarband	181	30	16.57	18	17	94.44	
Burebofon	157	20	12.74	15	11	73.33	
Bandar	803	169	21.05	80	80	100	189
Total	**1,141**	**219**		**113**	**108**		**189**

239. The economic data on Project villages reflect data at the district level. The major economic activities in all Project villages are agriculture, fruit production and animal husbandry. The Project 19 villages have 1,175 hectares of cotton and 997 hectares of wheat crops. The villages have 3,313 hectares of land mostly used as pastures. Fruit trees such as apple, cherry, sour cherry, apricot and peach trees are mostly found in the Project villages. There are 708 hectares of fruit trees in the Project villages and 237 hectares of grapes. (Table 26)

240. Animal husbandry is prevalent in the village households. There are 13,739 sheep and goats and 6,479 head of cattle. Some households have a few horses, although they are not commonly kept in the area. In total, there are 382 horses in the 19 Project villages. Over half of the total number of horses are kept in two Project villages with 100 in Iftikor and 104 in Burebufon.

Tab. 26 Economic Profile of the Project Villages

Project villages	Pasture (ha)	Wheat (ha)	Cotton (ha)	Other land	Grape (ha)	Fruit trees (ha)	Horses (No)	Sheep/ goats (No)	Cows (No)
I. Somoni	0	2	0	0	2	3	0	50	25
Stancia Dagana	500	0	0	15	0	0	10	410	90
Daganakiik	400	200	0	20	15	20	21	803	380
Galaobod	400	100	0	22	205	45	9	721	290
Kushlich	250	200	0	50	1	105	15	815	285
Hakikat	100	303	100	60	10	205	10	1,025	283
Lalazor	0	15	7	3	2	45	20	530	250
Mehnat	0	35	95	2	0	128	15	300	600
I. Somoni	0	6	30	4	1	6	70	250	200
Iftikor	0	3	90	4	1	11	100	1,200	500
Chavoni	10	20	16	20	0	18	0	1,295	601
Navzamin	16	33	370	40	0	42	0	1,195	595
Khurason	0	0	0	3	0	0	0	680	280
Vaksh	0	15	157	7	0	0	0	1,105	490

Chorbog	0	14	0	2	0	0	0	1,300	600
N. Asadullo	1,570	18	30	6	0	0	0	1,800	720
Sarband	30	10	60	4	0	20	5	120	150
Burebofon	30	10	20	4	0	40	104	70	120
Bandar	7	13	200	5	0	20	3	70	20
Total	**3,313**	**997**	**1,175**	**271**	**237**	**708**	**382**	**13,739**	**6,479**

Socioeconomic Survey Methodology

241. The socioeconomic surveys (SES) in the Project area were conducted in March 2017. The SES interviews were conducted after each consultation with the communities where DPs and broader community members were invited. Four experienced interviewers conducted the study. The number of interviews in each jamoat was based on the number of potentially displaced households (as indicated by the local authorities). These are households which have assets within 20 m of both sides of the road. In total, there are 19 villages/settlements located along the Project road with 306 households with assets that may be affected. Out of these, 30.7% (92) of households were covered by the SES. The SES aimed to sample 25% of the potentially displaced households. During the SES, the number of people that wanted to participate in the survey, surpassed the sample size needed for the analysis and the surveyed team interviewed anyone that wanted to participate. The SES included owners, renters and users of affected lands and buildings, owners of affected business and other community members. (Table 27)

Tab. 27 SES Sample

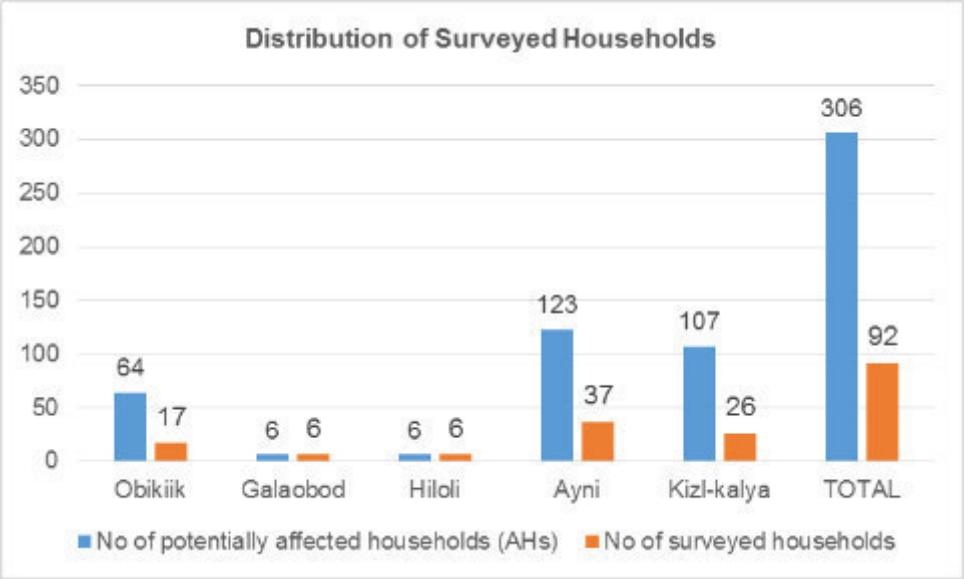
District	**Jamoat**	**No of potentially affected households (AHs)**	**No of surveyed households**	**% of surveyed households**
Khurason	Obikiik	64	17	26.56
	Galaobod	6	6	100.00
	Hiloli	6	6	100.00
	Ayni	123	37	30.08
	Kizl-kalya	107	26	24.30
TOTAL		**306**	**92**	**30.07**

242. The SES Questionnaire includes questions which aim to measure the main characteristics of affected households such as type of land use, land holdings, buildings, businesses, family type and size, main demographic data of the household members, self-reported monthly income and expenditure, sources of income, house facilities, religion, ethnicity, vulnerability, women's status, opinion about the Project, etc. Each questionnaire took around 40 minutes to complete. The collected data was processed using Microsoft Excel. (Annex 3-1: SES questionnaire)

3.4 Socioeconomic Profile of Surveyed Households

243. In total, 92 households with 704 persons were covered by the SES study. On average, there were 7.7 persons per surveyed household. The distribution of surveyed households by jamoats was as follows:

Chart 1: Surveyed Households by Jamoats



Key Facilities in the Surveyed Households

244. Each Project jamoat (local authority) has a mostly combined primary and secondary school, a mosque, health clinic, shops and small businesses along the central village road. Other services such as hospitals, larger markets and administrative services are based in jamoat and district centers. All these services are available to the Project population. The quality of available services was not assessed as it was beyond the scope of this LARP. The population covered by the SES stated that the Project will improve accessibility to social services and amenities such as larger hospitals, universities and other services in the regional centers.

245. Electricity is available in all project villages. However, during the dry season, when the production of electricity is lower, the villages get electricity supply for a few of hours a day. One village in Obikiiik and five in Galoabod, do not have piped water. People in these villages rely on wells, collection of rainwater in basins and cisterns, and purchased water costing TJS 60-100 per month, for daily usage. Other Project villages (13) have piped water for limited hours and they complement it with water from wells and purchased water. Consequently, only 13 households have a hot water system in their house, as piped water is not available everywhere. Only four surveyed household have an in-house flush toilet while all others have a latrine.

246. Every surveyed household has a TV set and 60 (65%) households own a satellite dish. Computers are owned by 23 (25%) AHs and (16) 17.4% of surveyed households have an Internet connection. However, mobile phones are used in around 96.74 % of surveyed households. A total of 77% of households have amenities such as refrigerators and 88.4% of surveyed households have electric stoves. Considering that piped water is not widely available, washing machines are present in 32% of the households. Air conditioning units are present in 46.74% of the households and 42.39% of the surveyed households have a car. Other assets listed are agricultural machinery and a couple of minivans. (Table 28)

Tab. 28 Households Assets and Amenities

Items	No of households	%
Latrine	92	100
Hot water system	13	14.13
TV	92	100.00
Satellite dish	60	65
Computer	23	25
Internet	16	17.4
Mobile phone	89	96.7
Refrigerator	71	77.17
Washing machine	30	32
Electric stove	81	88.4
Air conditioner	43	46.74
Car	39	42.39
Mini van	2	2.17
Agricultural machinery	3	3.26

247. Out of 92 surveyed households, 81 households own 140.23 hectares of land. On average, households hold around 1.73 ha of land. Around 73.57% (103.17 ha) of the land is irrigated land. The crops cultivated most are cotton, wheat, corn, various vegetables and some fruits. There are 53 hectares of pasture land. A total of 56 households have animals. People mostly keep cows, sheep, goats and chickens. (Table 29 and 30)

Tab. 29 Landholdings

No of households	Land (ha)	Dry land (ha)	Irrigated land (ha)	Cultivated (ha)	Pasture (ha)
81	140.23	8.26 (5.89%)	103.17 (73.57%)	95.73 (68.27%)	53 (37.79%)

Tab. 30 Livestock

No of households	No of cattle	No of sheep/ goats	No of horse	No of chickens
56	193	94	4	184

Employment, Income Sources and Expenses

248. Employment and income data was collected from 90 households and information is self-reported. A total of 16.30% of the heads of households and 3.59% of other family members are pensioners. The most common type of profession among the heads of households and other family members is civil servant, accounting for 23.91% and 7.03%, respectively. Business owners account for 21.74% in the heads of households group and only 2.78% among other family members. Out of 13 female heads of household, four are housewives, while among the other family members, the percentage of housewives is 23.53%. The unemployment rate is significantly higher among the heads of households (22.83%) than among the other family member (13.24%).

Tab. 31 Type of Employment

Type of employment	Head of the household		Other members	
	Number	%	Number	%
Pensioner	15	16.30	22	3.59
Civil servant	22	23.91	43	7.03
Private sector employee	4	4.35	4	0.65
Business owner	20	21.74	17	2.78
Agriculture labor	2	2.17	4	0.65
Large land owner	1	1.09	0	0.00
Other labor	1	1.04	10	1.63
Housewife	4	4.35	144	23.53
Pupil/Student	0	0	117	19.12
Unemployed	21	22.83	81	13.24
Total	**90**	**100**	**480**	

249. The data on income and expenses is self-reported. The data on average monthly income varies greatly from 200 TJS to over 60,000 TJS per month. Most of the households' income is concentrated in the two lowest categories: 200-1,000 TJS (35.87%) and 1,100-2,000 TJS (40.22%) per month. (Table 3-16). The total reported income for 92 households, amounts to 219,637 TJS, which gives an average of 2,387.36 TJS per surveyed household.

250. The data on income sources shows that the majority of the surveyed households have income earned from the employment of the households members followed by income from paid labour and income from remittances. Paid labour provides the highest average income per household (TJS 4,664.73/month). Table 3-17.

Tab. 32 Source of Income

Source	No of AHs	Total income (TJS)	Average income (TJS/AHs)
Agriculture	9	12,250	1,361.11
Employment	74	85,252	1,152.05
Business	17	27,131	1,595.94
Labour	15	69,971	4,664.73
Remittance	10	22,208	2,220.80
Other	7	2,825	403.57
Total		**219,637**	**2,387.36**

251. The average monthly expenditure for the surveyed households is 2,880 TJS, with the largest portion (36.87%) spent on the repayment of loans. Subsequent major expenses include food (24.94%), agricultural expenses such as seeds, fertilizers and hiring machinery (16.84%), and clothes accounting for 5.05% of all expenses. Other household expenses range from 0.19% for social obligations to 3.33% for transport and 3.32% for land taxes. Education (1.07%) and health (3.29%) do not present major households expenses. (Table 3-18)

252. The reported average monthly expenses exceed the average monthly income by 492.25 TJS. The gap between income and expenses was discussed with the respondents during the interviews. The respondents explained that for any major expense such as clothing for the whole family, serious illness, social obligations such as weddings and funerals etc., they either borrow money, rely on additional remittance money or if they have livestock, they sell one of their animals to cover the expenses they would not have been able to cover from their regular monthly income. The average monthly expenditure data is summarized in the following table:

Tab. 33 Households' Average Monthly Expenses

Self-reported monthly expenses	Total income (TJS)	Average income (TJS)	Total expenses (TJS)	Average expenses (TJS)	Percentage of the total (%)
Food expenses			66,068	718.13	24.94
Clothing			13,390	148.77	5.05
Health			8,705	103.63	3.29
Education			2,845	67.74	1.07
Communication			3,465	38.5	1.31
Transport			8,827	105.08	3.33
Social functions/ obligations			500	100	0.19
Agriculture expenses			44,600	14,866	16.84
Water			3,123	30.08	1.18
Utilities (electricity etc)			6,935	75.38	2.62
Land tax			8,796	102.28	3.32
Credit repayment			97,670	4,246.52	36.87
Total	**219,637**	**2,387.36**	**264,924**	**2,880**	**100.00**

3.5 Impacts of the Project as Perceived by Surveyed Households

253. There were 87 answers on the perceived benefits of the Project. A sizable portion of the respondents (63.33%) think that the new, modern road is a significant opportunity for the future, which offers prospects to the region and the country. A total of 24.44% of respondents think that they will have a good road which will add to the appearance of the villages along the road; 6.67% think the road will add to business and regional development; 4.44% expect a reduction in vehicle operating costs, accidents, travel time and cost of travel, and 1.11% think that there will not be any benefits.

Tab. 34 Perceived Project Benefits

Benefits of the Project	**Number**	**Percentage**
The road will be good and villages will look better	22	24.44
The road is an opportunity for the future and offers prospects	57	63.33
Reduction of vehicle operating costs, reduction in accidents, travel time and cost of travel	4	4.44
Faster business and regional development	6	6.67
No benefits	1	1.11
Total	**90**	

254. There was only 1 response on perceptions of the Project's disadvantages. The DP stated: 'If my home and my trees are gone due to the road, what advantage will I have from that road'? Additional comments show that DPs are concerned about potentially inadequate compensation which would not enable satisfactory restoration of lost assets. This was expressed in the words of two respondents: 'Please, calculate our loses fairly'.

255. Suggestions and requirements recorded during the SES, were:

- land for land compensation
- fair compensation sufficient for the replacement of affected assets
- street lights
- safe pedestrian crossings in the villages and mandatory speed-breakers in villagespedestrian underpasses
- passages for livestock
- work for the local population

5. Cultural and Historical Sites

256. No historically or culturally significant sites have been identified along the road sections during initial steps of this study. However the Consultant visited the Institute of History, Archeology and Ethnography under the Academy of Sciences of Tajikistan (Institute) to verify these issues. After having carried out a site survey on archaeological

issues an additional meeting took place on August 28 in which the following agreement was reached:

257. According to archaeologists there are 2 areas in phase 2 where it needs to be clarified prior to construction start whether there are any archaeological artefacts. The 2 areas are:

- At approximately km 46 -Parking of Obi Kiik (8 thousand BC) from the left side of the road on Dahana Kiik site.

- At approximately km 65-66: The ancient town of Khalkajar (1-5 centuries). It is registered in the Ministry of Culture as an historical monument of republican significance. It is cut by the road in two parts.

258. The potential sites are shown on the aerial maps below (Obi KiiK site in Figure 31 and Khalkajar site in Figure 32).

Fig. 30: Archaeological sites along the Project road

Fig. 31: Archaeological site near Obikeek

Fig. 32: Potential site of ancient town of Khalkajar

259. The methodology deployed is the following. The investigation is conducted in 2 Phases. Phase 1 is a walk over survey and visible inspection. It takes about two weeks and can be conducted in November 2017 according to information of the archaeological department. If there are no findings the investigation is finished and construction starts.

260. In case the visual inspection reveals any significant findings then excavation need to be conducted. This can only be done in spring 2018.

261. For the ancient town of Khalkajar (1-5 centuries) at approximately km 65 it is already sure that excavations need to be conducted. According to the Law on Conservation of Monuments construction can only start when there is clearance from the Archaeology.

262. PIU is liaising with the Institute of Archeology to make sure that the survey and investigations are conducted earliest possible.

VII. BASELINE MEASUREMENTS

263. Baseline measurements have been conducted for air quality, water quality, noise and vibrations in September and October 2017.

A. Air Quality

264. Air measurements have been conducted in September 2017 according to Tajikistan standards for TSP, CO, NOx and SO2. Locations where measurements have been taken are at the same 18 buildings of public interest where measurements for noise and vibrations were carried out. The locations with the respective number are shown in the map in annex 6.

265. The underlying standards were the MAC (Maximum Allowable Concentrations) of the Republic of Tajikistan for pollutants in the athmosphere of populated areas. All standards were met. A detailled description of the conducted baseline measurement exercise is given in annex 5. During construction phase regular monitoring measurements will be conducted as described in the Monitoring Plan.

B. Water Quality Measurements

266. Water quality measurements have been conducted according to Tajikistan standards for pH, suspended solids, BOD5, dissolved oxygen, salinity, oil products and electrical conductivity. Samples were taken from the irrigation channel in Uyali and from Vaksh River. From Vaksh River 4 samples were taken (1st sample at confluence with Aksu River at right bank, second sample after confluence with Aksu River at right bank, 3rd sample from the centre of Vaksh River, 4th sample at left bank of Vaksh River). The measurement results are presented in the chapter on physical resources in the project area under the headline “water quality” and summarized in Table 19. The complete laboratory report is attached as annex 5. During construction phase regular monitoring measurements will be conducted according to the Monitoring programme.

C. Noise Measurements

267. Noise levels will be monitored during construction phase within the urban and settlement areas traversed by the Project road. Monitoring is required in Obikiik, Uyali, and Kyzylkhala.

268. Baseline measurements for noise were conducted during September 13th to 14th, 2017 and then again during October 15th to 16th. The first measurement campaign in September resulted in unrealistically low noise values (e.g. 32 dB at the hospital in Kyzylkala at about 20 m from the Project road). These low values were due to mal calibration of the instrument used. Therefore a second noise measurement campaign with a different instrument was conducted on October 15th and 16th. The instrument used was the noise level meter "TESTO-815". The standards used are Tajikistan Standards (Sanitary Norms SN 2.2.4/2.1.8.562-96 – provided by Sanitary Epidemiological Surveillance Service of the Ministry of Health of the Republic of Tajikistan).

269. The measurements were taken outside the respective buildings. The exposure time during each individual measurement was between 15 and 20 minutes. As baseline index the average value was then taken. For measuring the noise meter was put on a stable and even surface. The methodology deployed is according to the SNIP CH 2.2.4/2.1.8.592-96, which is provided by the Ministry of Health of Tajikistan.

270. The measurement results are shown in the tables 35 and 36. Table 35 shows the noise measurement results for identified sensitive receptors of public interest, such as schools, Kindergartens and medical places. In addition noise measurements were taken at residential houses and other selected buildings nearby the road. The results of these measurements are shown in table 36.

271. In addition for validation of the results in February 2018 six 24 hours measurements were carried out by the State Department of Public Health of Tadjikistan. For these measurements two noise sensitive buildings were selected in Obikiik, in Uyali and in Kyzylkala, respectively. The measurements were conduceted according to legally approved national methodology. The detailed results are provided in the report in the annex 9. The 24 hours baseline measurement results are also shown in the below two tables 35 and 36.

272. The 24 hours measurements were conducted in one hour intervals. The measurement intervals were then assigned to day or night time based on the IFC/EHS guideline "1.7 Noise" which defines daytime as ranging from 07:00 to 22:00 and night time from 22:00 to 07:00. The total daytime and night time average values were then calculated.

Tab. 35 Baseline measurements for noise

№[26]	Location	Distance from Project Road	Noise standards in decibels (max)		Baseline indicators[27] Exposure Time 15-20 minutes	24 hours measurements From February 08 to 10, 2018	
			07.00-23.00	23.00-07.00	15 – 16.10.2017	Day time	Night time
1	Central Hospital of Khuroson.	200 m	50	40	No measurement because of sufficient distance to road		
2	School - Lyceum from left side of the road.	30 m	55	55	59,9	65,78	48,2
3	School is located in 150m from left side of the road.	150 m	55	55	No measurement because of sufficient distance to road		
4	Health center from right side of the road is about 40m.	40 m	55	45	59,9		
5	Kindergarten in Obi-Kiik village on right side of the road in 90m.	90 m	55	55	54,35		
6	Stadium in Obi-Kiik village. Distance from current direction of road is about 30m from right side of the road.	30 m	75	75	No measurement because stadium is not sensitive to noise emissions from road		
7	Professional Education Center on right side	140 m	55	55	No measurement because of sufficient distance to road		
8	School No2 in southern part of Obi-Kiik village from left side. Distance from road is about 20 m.	20 m	55	55	57,5		
9	Mosque is located on left side of the road.		55	45	No measurement		
10	Hospital in Uyali, is located about 320 m from Project Road	320 m	50	40	No measurement because of sufficient distance to road		
11	Kindergarten "Sitora" on right side of the road - 50 m	50 m	55	55	54,35		
12	Big mosque on left side of the road. Distance from the road is 30m.	30 m	55	45	54,6		

[26] The numbers refer to the locations which are shown in the map in annex 6
[27] Exceedances of legal standards are shown in bold figures

13	Health center in Chorbog village is located about 50m from the road to the left.	50 m	50	40	56,3		
14	School No58 in Chorbog village on left side of the road, about 200 m from the road.	200 m	55	55	No measurement because of sufficient distance to road		
15	Mosque on right side of the Project road in Kyzyl-Kala center is about 30m away.	30 m	55	45	67,75		
16	Kindergarten on right side of the road about 150m from Project road	150 m	55	55	53,15		
17	Medical center and hospital in Kyzyl-Kala center, on right side in 20m from the road.	20 m	50	40	63,15	69,63	57,76
18	School in central part of Kyzyl-Kala village, about 110m on right side of the Project road.	110 m	55	55	50,4		

Noise Standards (day time-night time):
55-45 dBA (max) - Residential area
75-75 dBA (max) - Commercial area
80-80 dBA (max) - Industrial area
50-40 dBA (max) - Hospitals
55-55 dBA (max) - Schools, Library

Tab. 36 Results of baseline measurements at residential and other selected buildings immediately adjacent to the Project road

No of Point	Location				Noise level Day Time Exposure Time 15 to 20 Minutes			24 hours measure-ments from February 08 to 10, 2018		Noise standards in decibel (max)		Average value exceeds daytime standard yes / no	24 hours measure-ment exceeds standards		Remarks
	Chainage	Town	Road side	Distance to future road edge	Max.	Min.	Average	Day	Night	07.00-23.00	23.00-07.00		day	night	
1	39+810	Obikiik	RHS	13,97 m	76.1	43.6	59.85			55	45	Yes			
2	40+110	Obikiik	RHS	5,53 m	78.9	46.4	62.65			55	45	Yes			
3	40+340	Obikiik	RHS	5,46 m	76.4	42.2	59.3			55	45	Yes			
4	40+480	Obikiik	LHS	6,5 m	68.0	42.0	55			55	45	No			
5	40+520	Obikiik	LHS	5,0 m	75.1	45.1	60.1			55	45	Yes			
6	40+760	Obikiik	LHS	2,15 m	77.8	43.8	60.8	65,47	49,3	55	45	Yes	Yes	yes	
7	60+970	Uyali	LHS	3,13 m	77.5	49.4	63.45	72,3	72,9	55	45	Yes	Yes	yes	
8	61+240	Uyali	LHS	3,42 m	74.8	51.7	63.25			80	80	No			Cotton factory
9	61+710	Uyali	RHS	6,52 m	70.2	49.6	59.9			55	45	Yes			
10	61+740	Uyali	LHS	3,22	73.7	53.4	63.55	71,2	60,7	55	45	Yes	yes	yes	
11	61+870	Uyali	RHS	4,33 m	70.1	44.9	57.5			55	45	Yes			
12	62+030	Uyali	RHS	1,73	70.3	52.2	61.25			55	45	Yes			
13	69+300	Kizilkala	LHS	10,38	76.2	49.2	62.7	73,17	57	55	45	Yes	yes	yes	
14	69+360	Kizilkala	LHS	7,22	78.9	50.6	64.75			55	45	Yes			
15	69+880	Kizilkala	RHS	3,25	74.9	49.3	62.1			75	75	No			Small market
16	70+740	Kizilkala	LHS	7,38	73.3	58.5	65.9			55	45	Yes			
17	71+140	Kizilkala	RHS	8,05	80.4	45.9	63.15			55	45	Yes			
18	71+950	Kizilkala	RHS	8,98	77.5	52.3	64,9			75	75	No			Shop

273. According to the conducted traffic analysis it is evident that nighttime traffic is much lower. The corresponding noise levels will therefore be significantly less than during daytime. The six 24 hours measurements that were conducted in general confirms this and in 5 of the selected locations the night time noise level is between 11 and 15 dB less than the day time level. Only at location number 7 in Obikiik (table 36) the measured value do not fit into the scheme. The only explanation is that there must have been other noise sources at this location during night or there was a measurement error. The figure below illustrates the hourly traffic distribution based on the 24h hours count.

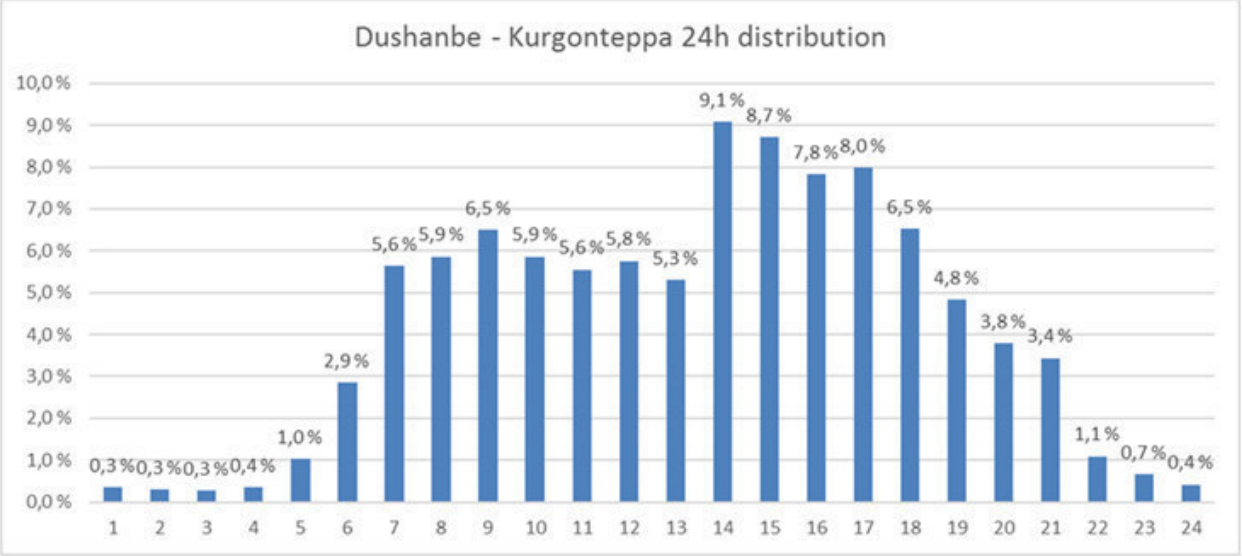


Fig. 33: 24 hour traffic distribution based on hourly traffic counts

In addition the hourly traffic distribution conducted by JICA (2013)[28] confirms the very low night time traffic load. The below figure which is based on traffic counts demonstrates that night time traffic is on average only about 20 % of day time traffic, whereas the truck traffic shows no significant decrease and is more or less constant over the whole day. Therefore the vehicle profile during night time differs in so far that the truck share during night time is higher due to the reduced amount of cars during night time. This is because the number of trucks/h remains relatively constant at abaut 30 vehicles/h for the road section at Obikhiik village and 50 vehicles for the road section at Uyali andKyzylkala villages.

[28] Japan International Cooperation Agency (JICA). 2019. Data Collection Survey on a Road between Dushanbe and Kurgan-Tyube in the Republic of Tadjikistan.

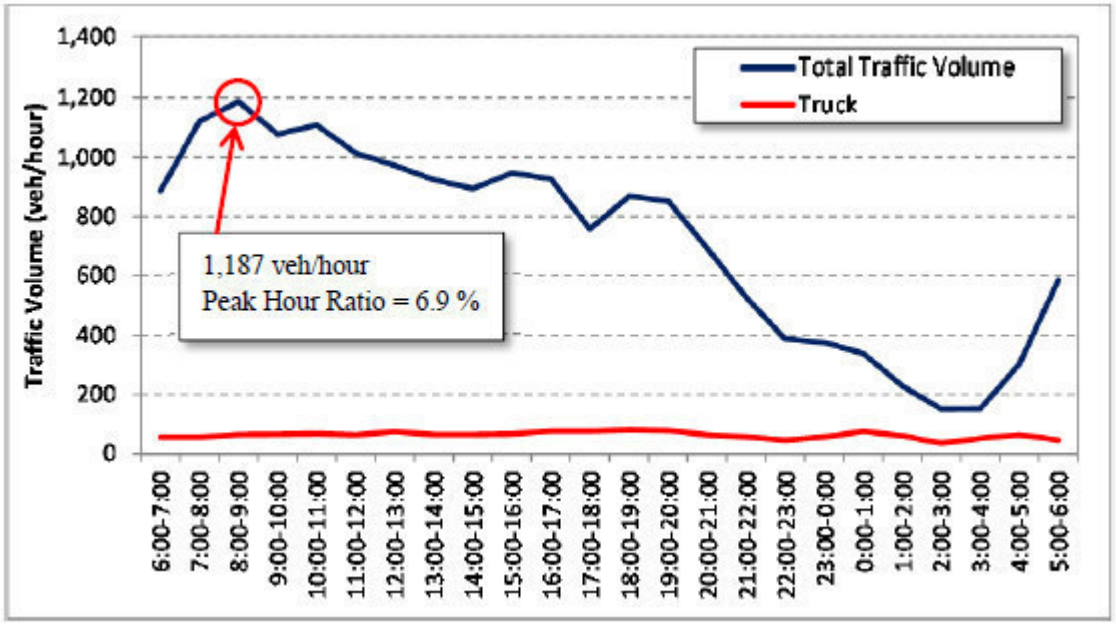


Fig. 34: Hourly Variation and Peak Hour Traffic Ration on Project Road (Station km 15. Source JICA 2013).

In order to assess the increase of night time noise level the current baseline (night time between 22:00 to 06:00 o'clock) was calculated by means of the software "soundplan" and exemplarily assessed for some receptors close to the road. The calculation is based on the conducted traffic counts which assume an average night time total traffic of 179 vehicles/h for the village Obikiik and 262 vehicles/h for the villages Uyali andKyzylkala. The truck (larger 2.5 tons) share is about 30 vehicles/h for the village Obikhiik and 50 vehicles/h for the villages Uyali andKyzylkala. The underlying speed is estimated to be 50 km/h for cars and 40 km/h for trucks. In the future the speed will be less due to the implemented safety features (speed humps). The result of the analysis is shown in table 50.

D. Vibration Measurements

274. Vibration levels will be monitored during construction phase within the urban and settlement areas crossed by the road. Monitoring is required in Obikiik, Uyali and Kyzylkhala. Baseline measurements were conducted on September 13th and 14th. The instrument used was the vibrometer "OCTAVA-101 VM".

275. Tadjikistan has no national standards for vibration but based on a mutual agreement within CIS states the following standard is used in Tajikistan: "Vibration Safety GOST 12.1.012-90 Interstate Standard, Moscow Standardinform, 2006".

276. The measured parameter is the vibrational acceleration expressed in dB or in/sec. The MAC is 107 dB (0,224 in/sec) for the Z axis (vertical axis) and 116 (0,63 in/sec) for the X and Y axis (horizontal axis) respectively. In summary no exceedances were measured. The measurement results are shown in the below table. The complete laboratory report is attached in annex 5 . During construction phase vibration levels will be monitored as indicated in the monitoring programme.

277. In order to have comparable results throughout the report the measurement unit is also expressed in in/sec. The formula for converting is the following.

$L_v = 20 * \log_{10}(v/v_{ref})$

Whereas

L_v = velocity level in decibels (VdB)

v = rms velocity amplitude

V_{ref} = reference velocity amplitude (The unit for V_{ref} is $1 * 10^{-6}$ in/sec.)

Tab. 37 Baseline measurements for vibration

№[29]	Measurement Location	Distance from Project Road	Maximum level of vibration-acceleration, dB / in/sec	Permissible values of vibration acceleration dB / in/sec Z_0 $X_0 Y_0$	
1	Central Hospital of Khuroson.	200 m	20,4 / 0,00001	107 / 0,224	116 / 0,63
2	School - Lyceum from left side of the road.	30 m	87,2 / 0,023	107 / 0,224	116 / 0,63
3	School on left side of the road.	150 m	23,7 / 0,000015	107 / 0,224	116 / 0,63
4	Health center on right side of the road	40 m	84,1 / 0,016	107 / 0,224	116 / 0,63
5	Kindergarten in Obi-Kiik village on right side	90 m	67,9 / 0,00248	107 / 0,224	116 / 0,63
6	Stadium in Obi-Kiik village on right side of the road.	30 m	85,8 / 0,0195	107 / 0,224	116 / 0,63
7	Professional Education Center on right side of the road in 140m.	140 m	22,8 / 0,0000138	107 / 0,224	116 / 0,63
8	School No2 in southern part of Obi-Kiik village on left side.	20 m	93,6 / 0,0479	107 / 0,224	116 / 0,63
9	Mosque is located on left side of the road.		87.9 / 0,02483	107 / 0,224	116 / 0,63
10	Hospital in Uyali	320 m	10,5 / 0,000003	107 / 0,224	116 / 0,63
11	Kindergarten "Sitora" on right side of the road - 50 m	50 m	78,6 / 0,0085	107 / 0,224	116 / 0,63
12	Big mosque on left side of the road. Distance from the road is 30m.	30 m	86,9 / 0,022	107 / 0,224	116 / 0,63
13	Health center in Chorbog village on left side	50 m	79,3 / 0,0092	107 / 0,224	116 / 0,63
14	School No58 in Chorbog village on left side	200 m	15,2 / 0,0000058	107 / 0,224	116 / 0,63
15	Mosque on right side of the Project road in Kyzyl-Kala center	30 m	90,0 / 0,0316	107 / 0,224	116 / 0,63
16	Kindergarten on right side of the road	150 m	20,5 / 0,00001	107 / 0,224	116 / 0,63
17	Medical center and hospital in Kyzyl-Kala center, on right side in 20m from the road.	20 m	98,7 / 0,086	107 / 0,224	116 / 0,63
18	School in central part of Kyzyl-Kala village on right side of the Project road.	110 m	24,9 / 0,000018	107 / 0,224	116 / 0,63

[29] The numbers refer to the locations which are shown in the map in annex 6

VIII. ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

278. Based on the results of the conducted field surveys and environmental assessment, the project's environmental impacts were identified and described and suitable mitigation measures prepared. The Project involves the reconstruction and widening of an existing road. Over most part of its length widening of the existing cross section will be required, which at certain sections will result in significant social and environmental interferences during construction stage, and, if not properly mitigated, during operation stage. There will however remain only low impacts once the Project has been finalized. This is because the road reconstruction scheme follows the existing alignment over most of its length. No valuable or protected natural habitats or other valuable environmental structures are significantly impacted after finalization of construction period, neither in their structure nor function.

279. This environmental assessment focuses on phase 2 only, with reference to the phase 1 where appropriate. The Phase 2 starts at km 33+475 and ends at Kurgonteppa at km 82+095. The phase 2 project cover two road sections: ADB-financed section (km 33 to-km 73) and JICA-financed section (km 73-km 82). For impact assessment a corridor of 200 meters on each side of the project road over its entire length is identified as the core impact area. The road sections where sensitive receptors are present, such as schools, hospitals or other places where people congregate are given particular attention so that adequate mitigation measures are formulated. For road sections that cross rivers, the impact assessment is expanded to cover the identified continuous extent of any ecologically important habitats / features along the Project Corridor. In addition the core impact area needs to be widened at certain locations to consider all ancillary facilities occurring outside the 200 m corridor such as borrow pits and quarries. This is the case for the Vaksh river valley which was identified as a potential source for aggregate extraction.

280. Main impacts refer to the human environment, particularly because loss of buildings and other valuable structures in the traversed towns and settlements such as Obikiik, Uyali, Kyzylkhala and Chakikho. Other interferences are due to noise emissions, emissions of pollutants and vibrations within the traversed settlements especially when the Project road runs close to sensitive receptors such as schools, hospitals, mosques, bazars or other.. In summary main impact categories arise from the following activities: (i) construction works within or close to settlements result in loss of trees and building structures, noise impacts, emission of pollutants to air and vibration which is especially of concern when the Project road comes close to sensitive receptors, (ii) site clearance activities result in loss of top soil and vegetation structures, (ii) aggregate sourcing, crushing of aggregates and asphalt plant operation may have severe impacts in case of unsuitable site selection or management. Additional impacts include (iii) impacts from bridge rehabilitation, (v) potential impacts on surface waters and potential impacts on natural habitats and biodiversity. In the following chapters named "pre-construction phase", "construction phase" and "operational phase" the impacts and mitigation measures are described.

A PRE-CONSTRUCTION (DESIGN PHASE)

1. Road alignment within ecologically sensitive areas

Impacts

281. There are no legally protected areas alongside the project road and only few structures of local environmental significance to be considered during the design stage.

282. Ecologically significant are the crossings of the Obikiik creek, Aksu creek and the Vaksh River with its associated floodplain. Potential impacts refer to possible oil spills from old or badly maintained vehicles, but also large scale water pollution may occur in case of severe casualties (e.g. if there is an accident of an oil transporting truck). Such casualties could have impacts on aquatic fauna and also pollute the crops in the irrigated fields.

283. Encroachment into valuable road side vegetation structures. Trees and shrubs in dense stands extend over many stretches of the road. Tree species are mainly elms (*Ulmus spec.*), cypresses, pines and willows (*Salix spec.*) Adjacent to the road are irrigation channels and small wetlands with reed (*Phragmites australis*).

284. Due to the widening to 4 lanes tree losses cannot beavoided. In some cases, tree losses that cannot be prevented. Based on the conducted surveys it is estimated that approximately 4000 trees need to be cut. Any tree losses are compensated by new plantations in the ratio of 1:2. Plantations shall be conducted after technical works have been completed. Planting time shall be restricted to spring (March till April) and/or autumn (September till October).

285. Additional potential impacts on the trees may include compaction of soil over the roots of the tree, alteration of ground levels besides the tree stem foot (fill up of more than 30 cm of tree stem area damages the tree), covering the soil around the tree with impervious material, release of materials that are toxic to the trees, or physical severance of the root system.

Mitigation Measures

286. In order to minimize impacts to the ecologically valuable surface waters a solid drainage system will be designed. In principle, the infiltration of surface run-off water into the slopes and in grass ditches is aimed at. Surplus water is evacuated to the nearest natural waterway. Drainage installations are designed in a way to allow for easy maintenance and operation.

287. Tree losses that cannot be prevented will be compensated by new tree plantings at the respective locations alongside the Project road, at a ratio of 1:2. Plantations shall be executed after technical works have been completed. Plantations shall be restricted to spring (March - April) and/or autumn (October). Locations for planting are within the new RoW at the locations where tree losses occurred. Therefore no additional land acquisition for tree planting is required. However the design will avoid tree losses as far as technically feasible by adjusting the roads center line. Tree losses on private land are compensated as set out in the Land Acquisition and Resettlement Plan (LARP). Suitable species for road side planting are pines (*Pinus spec.*), cypresses (*Juniperus spec.*), maples (*Acer platanoides*), poplars (*Populus alba*), willows (*Salix alba*), walnuts (*Juglans regia*), ashes (*Fraxinus angustifolia*) and platanes (*Platanus orientalis*). If irrigation channels are running alongside the road, then species requiring more moisture such as poplar (*Populus alba*) willow (*Salix alba*), maple (*Acer platanoides*) and ash (*Fraxinus angustifolia*) shall be planted. Only native species shall be planted from local genetic stocks.

288. Additional mitigation of impacts to trees can be done through refraining from storing construction material and other heavy equipment which could compact the soil near the roots, using only organic material at the tree stem zone for potential fill up, or fencing the area around the trees during construction works near the trees. The replantation ration is 1:2, meaning two newly planted trees for each felled one.

2. Road alignment dissecting cattle crossings

289. Alongside the project road pasture is the prominent land use Hence an important income source is from livestock breeding (mostly cattle and sheep). Consequently project affected people having their pasture land within the roads vicinity were requesting implementation of animal crossings. . The concern that animal crossings are required was raised during the consultation meetings that took place. There are regular migrations occurring using existing passages. The existing passages are not considered to be safe and the extension of the road from 2 to 4 lanes poses an additional barrier to cattle migrations.

Mitigation Measures

290. In total 4 animal crossings are included the Phase 2 of the Project. The proposed locations for animal crossings are shown in Table 9

291. The crossings B-6 at km 33+732 and B-10a at km 50+780 also cater for crossing of agricultural machinery.

292. Apart from cattle underpasses, Possible mitigation measures would be the provision of warning signs and reflectors may be provided near pastures and in other critical sections . This is considered duly in the design documents.

3 Project road traversing several towns and villages

293. The Project road is traversing several villages and towns, most important here is the traverse of Obikiik, Uyali and Kyzylkala. In addition agricultural area, particularly pastureland is traversed. Hence the upgaraded Project road may cause community severance and also create obstacles for farmers and villagers in accessing their fields, etc..

Mitigation Measure

294. Suitable safety features and mitigation measures have been developed and integrated into the engineering design which will avoid or substantially minimize the impacts on settlements alongside the road. These design safety features consist of speed control signs, pedestrian crossings, livestock crossings, proper road markings, streetlights, and other visual means.

4. Bridge/Culvert Rehabilitation

295. The bridge works will have potential environmental impacts that need mitigation but the impacts of culvert works can be considered as minimal.

296. Culvert replacement will contribute to sustainable functioning of the irrigation systems alongside the project road sections. Without replacement of the culverts the local irrigation system might be damaged.

297. Regarding the bridge rehabilitation, clear distinction needs to be made between impacts of bridges that are subject to only rehabilitation and bridges that require partial or total reconstruction. For example: (i) bridges needing only rehabilitation and are in fair condition; (ii) bridges needing widening or partial reconstruction but which have enough loadbearing capacity are in satisfactory to poor condition; and (iii) bridges which need reconstruction for lack of loadbearing capacity are in poor condition. Bridges for rehabilitation may require corrosion treatment for rusted reinforcement structures, which can cause severe water pollution.

298. The Vaksh River bridge is the largest one in Phase 2. The bridge still has enough bearing capacity but need to be reconstructed because of cross section widening. The new bridge may trigger water erosion processes at bridge and river embankments. This was considered in the pre-construction-/design-phase of the project.

Mitigation Measures

299. The lower parts of the bridge embankments have to be protected against erosion. This refers to all bridges that are crossing surface waters, Erosion protection is achieved by using natural stones which will be embedded in concrete. . An example of the existing situation with deficient slope protection is presented in the below figure 28 for the Vaksh River bridge..

Fig. 35: Embankment of Vaksh River Bridge

B. CONSTRUCTION PHASE

1. Impacts due to site clearance activities

300. Site preparation and clearance includes stripping and temporary storage of top soil. If top soil is not properly managed it can lead to erosion, siltation, obstruction of water courses and drainage, and loss of top soil fertility. The associated impacts to site preparation and clearance activities are expected to be spatially limited to small strips alongside the already existing road. It includes the remove of vegetation within the construction corridor.

Mitigation Measures

301. The removed top soil will be stored for re-use and long term stockpiles of top soil will be protected against erosion. This will be done for example through sowing fast growing vegetation such as grass on the stockpiles.

302. To ensure proper soil management the contractor will submit a soil management plan prior to commencing this operation. This plan will include measures for minimizing water and wind erosion, measures to minimize loss of fertility in top soil, timeframes, haul routes, disposal sites, and a re-cultivation plan in case of new borrow pits need to be opened. It will describe the mitigation measures to be taken from the beginning of the project until final disposal of spoil materials. Upon completion of the project, the contractor shall provide spoils stockpiles with grass cover.

2. Break up of old pavement layers and asphalt

303. The breaking up of the old pavement and asphalt layer will cause noise emissions, air emissions and vibrations. In addition a significant amount of spoil will be generated which will be reused as much as possible for the subbase for the new pavement.

304. Air quality impacts, noise and vibration will mostly be temporary. Sources include construction machinery, dust generated from construction works, haul roads, exposed soils, and material stock piles. Noise is temporary and results from operating construction machines. Vibration is caused by operating of construction machinery and hauling of materials.

305. In Obikiik, Uyali and Kyzylkala many residential buildings are stretching alongside the road. The distance of each building to the future road edge is indicated in the Table in annex 7. Construction noise and vibration are assessed in separate chapters. During construction phase there will be noise and vibration monitoring.

Mitigation Measures

306. Within settlements, of particular concern are Obikiik, Uyali, Kyzylkala and Chakikho a monitoring programme will be established for the construction stage. The parameters to be monitored are indicated in the Environmental Monitoring Plan.

307. For the preservation of evidence the contractor is advised by PIU to document the condition of houses close to the road. Photographs of all residential houses nearby the

road will be taken as a protection for possible complaints regarding damages in house walls etc. This is part of the contract.

308. To avoid damages due to vibration, special construction techniques will be applied in areas where buildings and structures are close to the road and the vibration monitoring shows that the specified construction vibration limit is reached at a particular location. The Contractor would be directed by the Engineer to suspend the construction activities that generate the excessive vibration at such location, and with the approval of the Engineer take mitigative actions necessary to keep the construction vibration within the specified limit. Such actions may include, alternative construction methods such as: (i) decrease of vibration emission from the particular equipment item; (ii) substitution of the particular equipment item at such location by other equipment capable of variable vibration control; (iii) use of smaller equipment; (iv) compaction without vibration rollers; (v) decreasing the thickness of material layers below the maximum thickness permissible under the specification; (vi) building wave barriers (trench or ditch) where appropriate; (vii) change the pavement type for example from flexible to rigid pavement, (viii) any other method of Contractor's choice that may be used while ensuring compliance with the specification for the material that is being compacted. A list of the potentially affected buildings is given in the table in annex 7.

309. For purpose of spoil reduction it is proposed to recycle construction materials. Recycled material from the existing pavement and special recycling techniques shall be used in the reconstruction of the new pavement layers. The cost effectiveness of reconstruction measures could be enhanced greatly by the application of recycled pavement materials. Recycling options include hot mix recycling (HMR) with/without new materials and cold mixing recycling with/without new materials.

310. Recycled material will be used to the largest extent feasible to reduce the volume of spoils that needs to be disposed of.

311. Prior to commencing the activities, the contractor will submit a waste management plan indicating detailed management of the waste produced in the project, including proper waste disposal sites.

3. Impacts due to earthworks

312. About 84,000.00 m^3 of unsuitable excavation material will be generated by the Project which needs to be safely disposed. In addition there need to be storage locations for temporary disposal of aggregates and fill material.

Mitigation Measures

313. Temporary storage of surplus spoil shall be close to the excavation area preferably on barren land without any wooden vegetation.

314. For final and temporary disposal of surplus spoil suitable sites have been identified which are shown in figures 3 to 7. The identified sites have been agreed with respective authorities.

315. The contractor shall dispose the surplus material within the identified sites by adhering to the following measures for impact mitigation and erosion protection:

(i) Any stockpile of disposed surplus material will be allocated at least 100 m distance from any water course and no woody vegetation shall be filled up or cut. Height of stockpiles will not exceed 3 m. For purpose of erosion protection fast growing vegetation, e.g. grass species, shall be sawn for stabilizing the disposed material.

(ii) The selected disposal sites are not expected to be a source of erosion as unsuitable material will fill up the existent gullies and depressions. However the contractor is advised to compact end evenly distribute the surplus material by layers where possible, to minimize piling and impacts to landscape. The stockpiles shall be sawn with fast growing grass to avoid erosion by the root system. During dry and windy periods, water should be spread on the disposed material to avoid dusting.

4. Reconstruction of pavement inclusive widening of existing road

316. The reconstruction activities cause air quality impacts, noise and vibration. The impacts are temporarily restricted to the construction phase. Impact sources include construction machinery, dust generated from construction works, haul roads, exposed soils, and material stock piles. Noise is temporary and results from operating construction machines. Vibration is caused by operating of construction machinery and hauling of materials.

317. The impacts on soil originate from the surface sealing due to the road widening, compaction of soil, site preparation and clearance, and improper storage of spoil material.

318. Compaction of soil on especially agricultural land can lead to degradation of its fertility. Agricultural lands are common along the whole length of the Project road.

Mitigation Measures

319. To prevent soil compaction the contractor shall limit the use of heavy machinery to the existing RoW especially in the vicinity of agricultural land.

320. The following mitigation measures will be implemented by the contractor to reduce emission levels of construction equipment: (i) maintenance of construction equipment in good condition and avoiding, as much as possible, idling of engines; (ii) banning of the use of machinery or equipment that cause excessive pollution (e.g., visible smoke); (iii) the contractor should utilize construction machinery with low emission levels.

321. Settlements next to the project road will be exposed to some degree of vibration. Therefore the potential magnitude of impact was assessed in a separate chapter.

322. Negative effects of noise are mitigated by limiting construction work to 07.00 am - 10.00 pm within 500 m of settlements, and by limiting hauling traffic through settlements. In addition the following measures need to be implemented: Noise control at source (using less noisier equipment, mufflers, dampeners, enclosures, proper maintenance of equipment, providing training to operators, etc), noise control at path (using natural structures with screening properties and acoustic barriers).

323. Construction stage monitoring is conducted for air quality, noise and vibrations as described in the EMP.

5. Impacts from borrow areas

324. The impacts related to establishment of borrow pits are largely dependent on the need for opening new pits. The proposed borrow area for Phase 2 of the Project is in Vakhsh river bed. The borrow area is already in operation and therefore environmental impacts concerning potential disfigurement of landscape, vegetation losses and damage to access roads are kept to a minimum.

325. The proposed borrow area in Vakhsh River bed is located close to the Project road on the right bank of Vaksh River at a distance of 2 km downstream from the Vaksh Bridge. The investigations and previous test results indicate that the naturally occurring granular material in the project area is in most cases suitable for fill, capping and sub-base construction but requires in most cases further processing (crushing and screening). The impacts from utilizing borrow areas include siltation or obstruction of water ways and dust emissions from hauling of materials. The amount of river material that can be extracted is about 480,000.00 m^3/a according to the geotechnical report.

326. An additional potential borrow area is located near Dahanikiik, at the beginning of phase 2. These are limestone and dolomite rock exposures which can be mined for obtaining aggregates and crushed-stone sand for concrete production. These potential quarries are located not far from the road and can be easily assessed. A few stone quarries are already in operation in the area. Approximate deposit of the quarry areas can be safely estimated to be about 250,000.00 m^3.

327. If borrow activities within the riverbed come closer than 1 km to the bridge over the Vakhsh iver there is the potential risk that due to changes in hydrology the bridge foundations might be impacted because of erosion processes in the channel bed.

328. According to the map on ground water resources in the study area the ground water level where the proposed borrow area is located is ranging between less than 1 and between 1 and 5 m below ground. In addition the upper layers are mainly gravel and sand and highly permeable which makes the ground water susceptible to pollution. An additional potential impact therefore refers to the possible change of the direction of ground water flow within vicinity of the extraction site.

Mitigation Measures

329. The contractor will refrain from storing material near surface waters to prevent siltation or obstruction of water ways.

330. The contractor will wet the unpaved routes which go next to settlements to suppress dust pollution when hauling material from borrow pits and provide covers for the load of all hauling vehicles to prevent dust pollution. Also wetting the aggregate load reduces potential dust emissions. The contractor will submit a Construction EMP which addresses also site specific dust reduction measures, including transportation and post-closure rehabilitation of borrow sites.

331. The access to selected the borrow area in Vakhsh River bed is via the project road. The contractor must include mitigation measures for dust pollution by the settlements along the way. The hauling traffic should be carried out only between 6.00 am and 9.00 pm.

332. For purpose of protection of bridge foundations from erosion processes due to changed hydrology any borrow activities with the Vakhsh river bed shall not be closer to the bridge foundations than 1 km.

333. In order to avoid any ground water pollution the used machinery needs to be in good technical condition and properly maintained, so that no leakages of oil or any other pollutants may occur. In addition before starting material extraction the contractor will need to obtain the environmental permit from the CEP which may also include provisions for landscaping measures after finalization of the extraction activities.

6. Asphalt Plants and Aggregate Crushers

334. Impacts from asphalt plants include pollutant and odor emissions, possible water pollution from bitumen spills, and safety risks. The impacts can be minimized by acquiring the needed asphalt from an existing asphalt plant. In case a new asphalt plant must be set up, certain provision and mitigation measures have to be taken.

335. Air quality impacts are temporary. Impact sources include construction machinery, fugitive emissions from asphalt plants, aggregate crushers, and dust generated from construction works, haul roads, exposed soils, and material stock piles. Noise is temporary and results from operating construction machines. Vibration is caused by operating of construction machinery and hauling of materials.

336. Aggregate crushers produce noise and dust emissions, and they require certain mitigation measures.

337. In road rehabilitation the most severe possible water quality impact could come from spilled bitumen or any petroleum products used to thin it with. Bitumen is stored in drums which may leak or which are often punctured during handling after long periods (more than 6 months in the elements) of storage.

Mitigation Measures

338. To ensure minimal impacts on settlements and productive land, the asphalt plants and aggregate crushers must be located downwind of settlements at a distance of 1000 meters or more.

339. Bitumen will not be allowed to enter either running or dry streambeds and nor can be disposed of in ditches or small waste disposal sites prepared by the contractor. Bitumen storage and mixing areas must be protected against spills and all contaminated soil must be properly handled. Storage areas should be lined with impermeable layer to mitigate impacts of potential spills. As a minimum, these areas must be designed so, that any spills can be immediately contained and cleaned up.

340. The contractor shall have provisions for spill and fire protection equipment and shall submit an emergency response plan (in case of spills, accidents, fires and the like) prior to operation of the plant, and asphalt plants shall not be located close to plantations and productive land.

341. Bitumen storage and mixing areas must be protected against spills and all contaminated soil must be properly handled according to legal environmental

requirements. Such storage areas must be contained so that any spills can be immediately contained and cleaned up.

342. Prior to commencing operation of the asphalt plant, the contractor must receive all relevant permissions and the site selection for the asphalt plant and aggregate crusher must be approved by Construction Supervision Consultant.

343. Both, asphalt plant and aggregate crusher are sources of emission of noise, vibrations and air pollutants. Therefore regular monitoring measurements shall be conducted at these facilities as described in the monitoring table of the EMP.

7. Bridge and Culvert Reconstruction Works

344. The natural watercourses that are crossed within phase 2 are the Obikiik, Aksu and Vakhsh River. In addition there are several irrigation channels.

345. Potential impacts include the generation of turbidity and siltation including change of surface hydrology in the water body by increased sediment load, and pollution of these water ways.

346. The impacts of stockpiling of top soil and material are mitigated by storing the material at a safe distance from nearby surface waters and by providing for long term stockpiles a grass cover. These mitigation measures prevent also the impacts of increased sediment load on surface hydrology. Settlement ponds must be implemented to places where construction activities come near the natural water courses.

347. When construction activities are being carried out on or in the vicinity of watercourses improper handling and storage of materials (concrete, asphalt, lubricants, fuels, solvent) may pose the risk of water contamination. In addition embankments and construction materials (fill, sand and gravel) are subject to wash out with rainwater. Oil and grease concentrations in surface waters will increase especially if oil leaks from engines are not properly controlled.

348. During construction of the bridge over the Vakhsh River, mitigation measures to reduce silt load include silt traps and temporary cofferdams. Silt traps must be located at specific locations and not across the water course as this can interfere with the fish movement. In addition, the Contractor must ensure the water to be pumped from the cofferdam is put through a settling pond prior to discharge back into the river. In addition, the Contractor will closely monitor the status of the river in terms of pollution and silt load.

349. Within the floodplain of the Vakhsh River the ground water table is shallow, ranging in between 1 and 5 meters below ground.

350. Possible impact on water quality of surface waters refers to the rivers that are crossed by the Project road. There is the potential risk of leakage of hazardous substances such as oil into the shallow ground water during bridge construction activities.

Mitigation Measures

351. Appropriate mitigation measures must be taken for ground and surface water protection, such as regular maintenance of the construction equipment to prevent oil leaks,

in addition chemicals and oil will be stored in secure, impermeable, and bound area far away from surface waters.

352. Water quality monitoring shall be conducted during construction stage for the following parameters: pH, dissolved oxygen, sulfate (mg/l), NH4-N (mg/l) and oil products. Reference measurements shall be conducted prior to construction start, monitoring measurements shall than be conducted during construction stage on a quarterly basis. At Obikiik and Aksu River the monitoring locations shall be 100 m up- and downstream the bridge. For the Vakhsh River the location for water sampling shall be 500 m up- and downstream the bridge.

353. Chemicals used for possible bridge corrosion treatment are especially hazardous for water ways and the treatment requires special provisions for preventing chemicals reaching the water. When carrying out corrosion treatment the contractor need to present a method statement on this.

354. The bridge reconstruction debris has to be removed in an environmentally safe manor and the costs of environmental measures have to be included in the unit costs of the contractor.

355. The contractor shall submit a method statement or plan for the execution of bridge construction works including measures that will be undertaken to address adverse environmental impacts such as erosion of river embankment and siltation of watercourses that may result from such activities. The plan shall be submitted to the Construction Supervision and PIU, which include: (i) installing of water diversion structures upslope for reducing gully erosion, (ii) installation of retention structures (e.g. shallow basins) during construction activities near river for capturing of sediments, and (iii) the watering of stockpiles during dry season to avoid wind erosion.

356. Storage of any hazardous construction material needs to be on sealed surfaces only in order to prevent leakages into the groundwater.

8. Operation of Working Camps

357. To mitigate the construction camp related impacts, the contractor shall arrange the facilities, services, and water supply of the work camp so that it won't compete on the same resources with nearby communities. The contractor shall also employ, to the largest extent feasible, people from the local communities to the workforce. Local communities will also be preferred, to largest extent feasible, when employing people for the tree planting works, drainage cleaning, and other suitable tasks.

358. Impacts produced by workers camps are manifold and include generation of solid and liquid waste, equipment maintenance related pollutants spills, potential spills from stored materials (chemicals, fuels, etc.), competition for water resources with local needs, and health and safety risks to workers and locals, including risk of HIV / AIDS and other STD's.

359. Construction worksites may place stresses on resources and infrastructure of nearby communities. This may lead to friction between local residents and the temporary workers.

360. In addition construction camps are likely to have public health impacts. There will be a potential for diseases to be transmitted, exacerbated by inadequate health and safety practices. Therefore the contractor will be required to recruit a health, and safety specialist to address such concerns in the work sites. The specialist shall also liaise/work with the nearby communities when it is necessary for mitigation of health and safety concerns.

Mitigation Measures

361. Prior to construction works, the contractor shall provide a comprehensive Construction EMP covering the aspects that are described in the chapter "Environmental Management Plan". .

362. The camp shall not be set up on top of a ground water area, nor near any surface water areas.

363. Prior to commencing operation the contractor shall indicate proper sources of drinking and construction water which won't compete with local needs. This will be done together with local authorities.

364. For health and safety protection of workers and adjacent communities the following shall be provided: (i) Adequate health care facilities (including first aid facilities) within construction sites; (ii) Training of all construction workers in basic sanitation and health care issues, general health and safety matters, and on the specific hazards of their work; (iii) Personal protection equipment for workers, such as safety boots, helmets, gloves, protective clothing, goggles, and ear protection in accordance with legal legislation; (iv) Clean drinking water to all workers; (v) Adequate protection to the general public, including safety barriers and marking of hazardous areas; (vi) Safe access across the construction site to people whose settlements and access are temporarily severed by road construction; (vii) Adequate drainage throughout the camps so that stagnant water bodies and puddles do not form; (viii) Sanitary latrines and garbage bins in construction site, which will be periodically cleared by the contractors to prevent outbreak of diseases.

365. Where feasible the contractor will arrange the temporary integration of waste collection from work sites into existing waste collection systems and disposal facilities of nearby communities. This shall be taken into consideration when deciding the place for the camp.

366. The contractor shall hire a qualified health and safety expert who will provide safety training to the staff according to the requirements of the individual work place. Prior to the commencement of works, the work site personnel shall be instructed about safety rules for the handling and storage of hazardous substances (fuel, oil, lubricants, bitumen, paint etc.) and also the cleaning of the equipment. In preparation of this the contractor shall establish a short list of materials to be used (by quality and quantity) and provide a rough concept explaining the training / briefing that shall be provided for the construction personnel.

367. The contractor shall provide information to workers, encouraging changes in individual's personal behavior and encouraging the use of preventive measures. The goal of the information is to reduce the risk of HIV / STD transmission among construction workers, camp support staff and local communities.

368. Contractors' conformity with contract procedures and specifications during construction will be carefully monitored. Contractors will be made to follow standard construction practices, monitored and supervised by construction supervision consultants employed under the Project.

9. Traffic Impacts

369. Traffic impacts of the road rehabilitation project will include disturbance of traffic along the road sections.

370. Transport of potentially hazardous or toxic materials on the road poses a risk to the local population. Impacts in case of an accident which causes a spill may include pollution of surface water or ground water through leaching.

Mitigation Measures

371. Prior to commencing operations the contractor shall submit a traffic management plan to local traffic authorities, and provide information to the public about the scope and schedule of construction activities and expected disruptions and access restrictions.

372. During the construction work the contractor will arrange for adequate traffic flow around construction areas.

373. The contractor shall enhance traffic safety by providing adequate signalization, lighting, traffic safety signs, barriers and flag persons for traffic control. Adequate training shall be provided to the workers on traffic control prior to commencing operations.

374. The contractor shall include action plan to mitigate impacts from transport of hazardous and toxic materials to the traffic emergency response plan for the operation phase of the road.

C. CONSTRUCTION NOISE ASSESSMENT AND CALCULATION

1. Introduction

375. During construction works, airborne noise is generated by construction equipment such as milling machines, excavators, bulldozers, pavers, compactors and generators.

376. Construction noise control should be based on a balance between the interests of those who want to build and possible annoyance by neighbours near the building site. The value of the construction activities for society is commonly recognized, however, people exposed to the involved noise emission expect a responsible approach to minimize the annoyance of such activities

2. Methodology for Construction Noise Assessment

377. The methodology for assessing the effects of construction noise from the Project can be divided into following general steps:

- Establish, through measurement, the current ambient noise environment for sensitive receptors that may in future be affected by construction noise from the Project;

- Identify those construction activities with the potential to generate significant construction noise levels;
- Determine distances from construction noise sources to sensitive receivers based on the proposed alignment and construction methodology;
- Analyse obtained equipment data and calculate noise emission at the source;
- Assess the noise effects of the Project for sensitive receivers in the vicinity;
- Develop best practicable noise mitigation measures.

3. Sensitive Receptors

378. Sensitive receptors of public interest concerning noise emissions are schools, hospitals mosques or other social infrastructure facilities. They are located within the settlements alongside the Project road. Sensitive receptors at which baseline measurements have been taken are listed in the Table below.

Tab. 38 List of sensitive receptors

№[30]	Location	Distance from Project Road	Noise standards in decibels (max)		Baseline indicators[31]
			07.00-23.00	23.00-07.00	15 – 16.10.2017
1	Central Hospital of Khuroson.	200 m	50	40	No measurement because of sufficient distance to road
2	School - Lyceum from left side of the road.	30 m	55	55	59,9
3	School is located in 150m from left side of the road.	150 m	55	55	No measurement because of sufficient distance to road
4	Health center from right side of the road is about 40m.	40 m	55	45	59,9
5	Kindergarten in Obi-Kiik village on right side of the road in 90m.	90 m	55	55	54,35
6	Stadium in Obi-Kiik village. Distance from current direction of road is about 30m from right side of the road.	30 m	75	75	No measurement because stadium is not sensitive to noise emissions from road
7	Professional Education Center on right side	140 m	55	55	No measurement because of sufficient distance to road
8	School No2 in southern part of Obi-Kiik village from left side. Distance from road is about 20 m.	20 m	55	55	57,5
9	Mosque is located on left side of the road.		55	45	No measurement
10	Hospital in Uyali, is located about 320 m from Project Road	320 m	50	40	No measurement because of sufficient distance to road
11	Kindergarten "Sitora" on right side of the road - 50 m	50 m	55	55	54,35

[30] The numbers refer to the locations which are shown in the map in annex 6
[31] Exceedances of legal standards are marked with yellow colour

12	Big mosque on left side of the road. Distance from the road is 30m.	30 m	55	45	54,6
13	Health center in Chorbog village is located about 50m from the road to the left.	50 m	50	40	56,3
14	School No58 in Chorbog village on left side of the road, about 200 m from the road.	200 m	55	55	No measurement because of sufficient distance to road
15	Mosque on right side of the Project road in Kyzyl-Kala center is about 30m away.	30 m	55	45	67,75
16	Kindergarten on right side of the road about 150m from Project road	150 m	55	55	53,15
17	Medical center and hospital in Kyzyl-Kala center, on right side in 20m from the road.	20 m	50	40	63,15
18	School in central part of Kyzyl-Kala village, about 110m on right side of the Project road.	110 m	55	55	50,4

379. In addition all residential houses are sensitive receptors regarding noise impacts. A complete list of the noise affected houses alongside the Project road is given in annex 7.

380. Therefore in addition baseline noise measurements have been conducted at residential houses and other selected buildings alongside the Project road. Results are shown in the chapter on baseline measurements in table 36.

4. Working Hours

381. Normal working hours are from Monday to Saturday from 8 am to 6 pm. Night-time working and working on Sunday or public holidays is not foreseen.

5. Construction Method and Equipment

382. There is limited information available on construction methods, plant and equipment before the Works Contract is awarded, but based on the anticipated scope of works it can be assumed that standard construction methods and equipment would be used for the civil works for rehabilitation and upgrading of the Dushanbe – Kurgonteppa road.

383. The construction equipment expected to be employed for construction has been identified and Table 2 below lists the likely construction equipment usage at each of the major work sites. Stationary plants and equipment are not considered, as the location of the stationary plants should be select in sufficiently distance to sensitive receptors.

Tab. 39 Equipment likely to be used during major construction activities and location

Activity	Equipment	Work Site Location
Demolition / Breaking Up Concrete	Hydraulic hammers Wheeled Loader Trucks Excavators Breaker	Existing structures (bridges and culverts) and houses to be demolished
Site Clearance	Milling machine Wheeled Loader Trucks Excavators Dozer	Across the work site
Earthworks	Excavators Loaders Dump trucks Graders Dozers Vibrating rollers Compactors	Across the work site
Bridge/Structure Works	Excavators Drilling Rig Concrete Mixer Trucks Concrete pumps Trucks Crane Poker Vibrator Diesel Generator	At all bridge location
Road Pavement Works	Water Tanker Graders Road Sweeper Bitumen Sprayer Paver Multi-tried Rollers	Across the work site

384. Ideally, noise data in calculations should be for the specific equipment to be used on site. However, at the assessment stage the equipment has not been selected, and data are not available. Therefore, for initial predictions reference noise data from BS 5228-1:2009 has been used.

385. BS 5228-1:2009 includes reference noise level data for typical construction equipment. These data have been obtained from measurements at construction sites in the United Kingdom on similar types of equipment to that used internationally. These data are used as a guide to establish the construction noise emissions.

386. Where there is a moving source, the BS 5228-1 data relates to the equipment at the nearest (loudest) point rather than being an average value. For slow-moving sources in a constrained area, BS 5228-1 makes allowance for the times when the equipment is further away from the houses and therefore quieter. This is done by effectively reducing the operating time, using the correction factor extracted from equation F9 within BS 5228-1:

$$L_{Aeq(T)} = 10\log 10 \frac{1}{T} \sum_{i=1}^{n} t_i 10^{0.1 L_i}$$

where:

$L_{Aeq(t)}$ is the is the combined equivalent continuous A-weighted sound pressure level, in decibels (dB), over a given period T;

L_i is the individual equivalent continues A-weighted sound pressure level, L_{Aeq}, for an item of plant or activity during a period t_i , in decibels (dB);

n is the total number of individual equivalent continuous A-weighted sound pressure levels to be combined.

387. The table below presents the A-weighted sound pressure level at 10 m for the anticipated generic construction equipment together with an estimate on the length of time the construction equipment is used.

Tab. 40 Sound pressure level of generic construction equipment

Equipment Description	BS 5228-1 Reference	Sound Pressure Level, dB, at 10 m	Duration of Activity as percentage of 10 h (On time) %
Asphalt Paver	Table C5, Ref. No. 33	75	60
Breaker (Pneumatic)	Table D2, Ref. No. 11	87	50
Concrete Mixer Truck	Table C4, Ref. No. 27	79	80
Concrete Pump	Table C4, Ref. No. 29	80	80
Compactor	Table C8, Ref. No. 1	80	80
Crane	Table C5, Ref. No. 37	76	60
Diesel Generator	Table C4, Ref. No. 85	66	100
Dozer	Table C2, Ref. No. 1	75	80

Drilling Rig	Table C3, Ref. No. 14	83	80
Excavator	Table C5, Ref. No. 18	80	80
Grader	Table D9, Ref. No. 7	83	80
Hydraulic hammers	Table C1, Ref. No. 7	93	50
Milling Machine	Table C5, Ref. No. 7	82	80
Multi-tired Roller (asphalt)	Table C5, Ref. No. 29	82	80
Poker Vibrator	Table C4, Ref. No. 34	69	80
Road Sweeper	Table C4, Ref. No. 90	76	20
Truck	Table C2, Ref. No. 30	79	60
Vibrating Roller	Table C5, Ref. No. 28	77	60
Water Tanker	Table C4, Ref. No. 89	79	50
Wheeled Loader	Table C2, Ref. No. 28	76	80

6. Calculated Noise Emissions

388. The tables below contain summary noise emission levels for major construction activities to be undertaken for rehabilitation and upgrading of the Dushanbe - Kurgonteppa road. To calculate the combined noise level for a construction activity the following equation has been used to combine the noise levels from the individual construction equipment:

Combined Noise Level = 10 x Log10 ($10^{(L1/10)}$ + $10^{(L2/10)}$ +……..+$10^{(Ln/10)}$

where: L = individual noise events

Tab. 41 Noise emission for Demolition / Breaking up Concrete Works

Activity: Demolition / Breaking up Concrete

Equipment Type	Noise level at 10 m L_{Aeq} (dB)	Duration of Activity as percentage of 10 h	Correction to L_{Aeq} (dB)	Activity Noise Level $L_{Aeq(10)}$ (dB)
Hydraulic Hammer	93	50	-3.0	90.0
Breaker	87	50	-3.0	84.0
Excavator	80	80	-1.0	79.0
Wheeled Loader	76	80	-1.0	75.0
Truck	79	60	-2.2	76.8
Total Activity				**91.5**

Tab. 42 Noise emission for Site Clearance Works

Activity: Site Clearance

Equipment Type	Noise level at 10 m L_{Aeq} (dB)	Duration of Activity as percentage of 10 h	Correction to L_{Aeq} (dB)	Activity Noise Level $L_{Aeq(10)}$ (dB)
Milling Machine	82	80	-1.0	81.0
Dozer	75	80	-1.0	74.0
Excavator	80	80	-1.0	79.0
Wheeled Loader	76	80	-1.0	75.0
Truck	79	60	-2.2	76.8
Total Activity				**84.9**

Tab. 43 Noise emission for Earthworks

Activity:	**Earthworks**			
Equipment Type	Noise level at 10 m L_{Aeq} (dB)	Duration of Activity as percentage of 10 h	Correction to L_{Aeq} (dB)	Activity Noise Level $L_{Aeq(10)}$ (dB)
Excavator	80	80	-1.0	79.0
Wheeled Loader	76	80	-1.0	75.0
Excavator	80	80	-1.0	79.0
Truck	79	60	-2.2	76.8
Grader	83	80	-1.0	82.0
Dozer	75	80	-1.0	74.0
Vibrating Roller	77	60	-2.2	74.8
Compactor	80	80	-1.0	79.0
Total Activity				**87.3**

Tab. 44 Noise emission for Bridge/Structure Works

Activity:	**Bridge/Structure Works**			
Equipment Type	Noise level at 10 m L_{Aeq} (dB)	Duration of Activity as percentage of 10 h	Correction to L_{Aeq} (dB)	Activity Noise Level $L_{Aeq(10)}$ (dB)
Excavator	80	80	-1.0	79.0
Drilling Rig	83	80	-1.0	82.0
Concrete Mixer Truck	79	80	-1.0	78.0
Concrete Pump	80	80	-1.0	79.0
Truck	79	60	-2.2	76.8
Crane	76	60	-2.2	73.8
Poker Vibrator	69	80	-1.0	68.0
Diesel Generator	66	100	0.0	66.0
Total Activity				**86.7**

Tab. 45 Road Pavement Works

Activity:	**Road Pavement Works**			
Equipment Type	Noise level at 10 m L_{Aeq} (dB)	Duration of Activity as percentage of 10 h	Correction to L_{Aeq} (dB)	Activity Noise Level $L_{Aeq(10)}$ (dB)
Water Tanker	79	50	-3.0	76.0
Graders	83	80	-1.0	82.0
Road Sweeper	76	20	-7.0	69.0
Bitumen Sprayer	79	50	-3.0	76.0
Asphalt Paver	75	60	-2.2	72.8
Total Activity				**84.2**

389. The potential noise impacts during the construction are presented in Table 45 below. All noise predictions are for a circumstance where specific or general noise mitigation has not been implemented on site. Therefore, noise levels from the activity would generally be lower than shown in the tables. The predicted noise levels in the tables represent the highest noise level likely to be received from the construction site without any mitigation.

Tab. 46 Activity Noise Levels depended on Distance

Activity	Activity Noise Level				
	at 10 m (dB)	at 20 m (dB)	at 50 m (dB)	at 100 m (dB)	at 200 m (dB)
Demolition	91.5	85.5	77.5	71.5	65.5
Site Clearance	84.9	78.9	70.9	64.9	58.9
Earthworks	87.3	81.3	73.3	67.3	61.3
Bridge/Structure Works	86.7	80.7	72.7	66.7	60.7
Road Pavement Works	84.2	78.2	70.2	64.2	58.2

7. Construction Noise Prediction at Sensitive Receptors

390. The noise prediction has been modelled using the computer software package SoundPlan Essential 2.0. The noise prediction model takes account of losses due to geometrical spreading from the noise source, absorption from the ground and shielding from the ground topography and physical noise barriers where provided.

391. However, despite the sophisticated noise prediction model used for the calculation of the construction noise, the calculations suffer from accuracy limitations due to user-defined noise emission levels for each generic type of construction equipment. Consequently, the resulting predicted noise levels and noise contour lines are again only as good as the veracity of the input assumptions.

392. Since construction activities will be subsequently carried out, for the noise prediction modelling at sensitive receptors only the noisiest activity ‘earthworks’ in the vicinity of the receptor has been considered. However, the foreseen mitigation measures are valid for all construction activities, not only the noisiest and there is a regular noise monitoring during construction phase. No work at night-time is envisaged and therefore not included in the prediction model. Major construction works are anticipated in year 2019 and therefore in addition to the construction noise also the calculated noise from 2019 year traffic are included.

Tab. 47 Predicted maximum construction noise at sensitive receptors

No [32]	Sensitive Receptor Number[33]/Name	Side of Building	Floor	Calculated Construction Noise with calculated noise level for year 2019, max. dB (A) Day	Baseline Indicators 13 – 14.09.2017
	Obikiik				
2	4/School Lyseum	SW	Ground	83.5	59,9
3	3/School No. 1	SW	Ground	73.6	32,6
4	4/Health Center	NE	Ground	81.1	59,9
5	5/Kindergarten	NE	Ground	75.8	54,35
7	8/Professional Centre	E	Ground	75.8	47
7	8/Professional Centre	E	1st floor	76.1	--
8	9/School No. 2	W	Ground	80.3	57,5
	Uyali				
10	12/Hospital	SE	Ground	63.9	41
11	13/Kindergarten	SE	Ground	65.1	54,35
15	15/Large Mosque	N	Ground	65.4	54,6
	14/Mosque	SE	Ground	62.3	--
	11/Sunday market	E	Ground	83.1	--
	Kizil - Kala				
16	22/Kindergarten	E	Ground	59.5	53,15
16	22/Kindergarten	E	1st floor	59.9	--
17	23/Medical Centre/Hospital	E	Ground	64.1	63,15
17	23/Medical Centre/Hospital	E	1st floor	64.9	--
17	23/Medical Centre/Hospital	E	2nd floor	65.4	--
17	23/Medical Centre/Hospital	E	Ground	65.3	--
17	23/Medical Centre/Hospital	E	1st floor	65.8	--
17	23/Medical Centre/Hospital	E	2nd floor	66.3	--
15	20/Mosque	SE	Ground	60.1	67,75
	21/Mosque	E	Ground	63.0	--
	19/School	E	Ground	63.6	--
	19/School	E	1st floor	64.1	--
18	24/School	E	Ground	61.9	50,4
18	24/School	E	1st floor	62.2	50,4

393. Certain receptors are located adjacent to the project road and therefore highly affected by construction noise. An example is the building number 2 (school / lyseum in Obikiik) where a noise level of 81,1 dB is anticipated during construction.

394. In addition all residential buildings are sensitive receptors. A complete list is given in annex 7. All houses in this list will be affected by exceedance of noise standards during construction phase. During construction phase the noise level at this houses will be equal to the building number 2 cited in the para 379, which means above 80 dB. This cannot be avoided but will be mitigated by suitable measures as far as technically feasible. The mitigation measures are part of the EMP.

[32] Number of Locations according to the map in annex 6
[33] Number of Sensitive Receptors according to List in Annex 3

395. For specific operations (earthworks and road resurfacing) in close proximity to houses, noise levels may potentially exceed the noise daytime criteria. However, these predicted high noise levels would occur only during limited times and respite periods might be introduced by restricting the hours that the very noisy activities can occur. The affected community should identify times when they are less sensitive to noise, such as before and after school for works near schools or kindergartens.

8. Mitigation of Construction Noise

396. As a mitigation measure there will be strict noise monitoring and liaison with residents will be required to adequately manage noise effects.

397. In addition the noise impact of the construction phases can be minimised by use of the noise control measures, as suggested in Section 8 of BS 5228-1:2009. General principles for the control of noise during the construction works are presented below.

- Appropriate choice of equipment;
- Regular equipment maintenance to keep plant in good working condition and reduce noise from machinery;
- Careful phasing of the proposed operations, including working during school breaks when working close to the schools; and
- Provision of temporary noise barriers.

8.1 Noise Reduction at Source/Equipment

398. Most construction noise originates from internal combustion engines. A large part of the noise emitted is due to the air intake and exhaust cycle. All construction equipment should be fitted with suitable engine mufflers with tight fitting engine enclosures and panels. All mobile equipment should be maintained in good mechanical condition.

399. No plant and equipment shall be left running if not required for immediate use. Where this is not practicable, equipment shall be set to idle in the quietest manner to minimise noise emissions.

400. Where equipment would operate near to noise sensitive locations additional noise attenuation measures may be required, such as improved residential mufflers. The construction contractor would be required to monitor construction noise levels at sensitive locations during construction activities to confirm that compliance with the noise criteria is achieved and that additional noise attenuation measures are not required for construction equipment, vehicles or activities.

401. Where feasible equipment modifications should be considered, such as dampening of metal surfaces, which is effective in reducing noise due to vibration.

8.2 Noise Barriers

402. Temporary noise barriers will be utilised for those areas where sensitive receptors are significantly affected during construction. Temporary barriers are typically constructed

from plywood and should be of sufficient height to screen acoustic line-of-sight between the receiver and the noise source. Solid plywood site hoarding can often be effective as a temporary noise barrier.

403. Construction noise barriers should be implemented if effective and practicable. This would be decided on a case-by-case basis.

8.3 Scheduling of Construction Activities

404. The most effective method to control construction noise is through proactive management. This includes assessment of all activities and consideration of potential noise and appropriate mitigation.

405. Construction activities should be scheduled to minimise the multiple use of the most noisy items of equipment near sensitive receivers;

D. ASSESSMENT OF VIBRATION IMPACT DURING CONSTRUCTION

406. The Project road is traversing the cities of Obikiik, Uayli and Kyzylkala. Buildings within these settlements are located close to the road and during construction phase they will be effected by vibration to a certain degree. Therefore an assessment of the potential magnitude of vibration impacts is presented in this chapter.

407. Tadjikistan has no national standards for vibration.

408. As described in the chapter on baseline measurements vibration levels will be monitored during construction phase within the urban and settled areas crossed by the road. Baseline measurements were conducted on September 13th and 14th.

409. Monitoring of vibaration during construction phase is crucial because many residential houses and other building structures are located fairly close to the Project road. The table in annex 7 provides an inventory of all house adjacent to the road including distance from future road/embankment edge to existing houses.

410. The effects of vibration on structures depends on the construction machinery and equipment (emission source) and on the structural conditions of the potentially affected building structures (receptors).

411. Damages due to vibration are always a potential impact when construction activities come close to building structures. Therefore, as a common good practice, a preconstruction survey will be jointly conducted by the Contractor and the Engineer to document the pre-construction condition of the structures, including all the defects and existing damages.

The surveys should be conducted in the presence of and with the permission of the property owners. The survey reports should also be verified by the property owners. Secondary purposes of the pre-construction surveys include answering any questions the building owner may have regarding the project and looking for anything that might require correcting before construction starts. Most building owners do not have experience with

construction vibration, and may have concerns about their own safety and the safety of their structures. Knowledgeable persons should attend to adequately answer questions. If the situation warrants, ad-hoc meetings should be held and a presentation made that explains the reason for the project, that construction will be necessary, what the residents can expect to hear and feel from the construction, any specific warning signals that will be used, and the intent of the pre-construction surveys.

412. For purpose of assessment the magnitude of impact both elements, the type of receptor (structural condition of the potentially affected building) and the type of machinery (emission source) need to be considered.

413. The buildings within the Project area are relatively old structures and generally in poor to fair condition.

414. As there are no standards for vibration in Tajikistan the threshold criteria that are recommended in CALTRANS (2013)[34] were used for the assessment of the building structures. These criteria draw from a large review of international standards including, the American Association of State Highway and Transportation Officials (AASHTO), Swiss Association of Standardization, and British Standards. The cited threshold criteria are shown in the following table:

Tab. 48 Guideline Vibration Damage Potential Threshold Criteria

	Maximum PPV (in/sec)	
Structure and Condition	**Transient Sources**	**Continuous/Frequent Intermittent Sources**
Extremely fragile historic buildings, ruins, ancient monuments	0.12	0.08
Fragile buildings	0.2	0.1
Historic and some old buildings	0.5	0.25
Older residential structures	0.5	0.3
New residential structures	1.0	0.5
Modern industrial/commercial buildings	2.0	0.5

Note: Transient sources create a single isolated vibration event, such as blasting or drop balls. Continuous/frequent intermittent sources include impact pile drivers, pogo-stick compactors, crack-and-seat equipment, vibratory pile drivers, and vibratory compaction equipment.

415. Existing buildings along the project road are predominantly buildings with plastered walls, wooden ceilings and walls in masonry. To take a conservative approach in assessing the structure, the criteria for historic and old buildings were taken as a reference for the vibration assessment. This categorization is based on the field survey carried out. No facilities with equipment sensitive to vibration were identified in the immediate vicinity of the Project road.

The following pictures give an impression of the building structures alongside the road and demonstrate that the categorization is justifiable.

[34] California Department of Transportation (2013): Transportation and Construction Vibration. Guidance Manual.

Fig. 36: Typical old house alongside the project road (Km 62+065 to Km 62+095 Left Side). Constrution material is made of burnt bricks.

Fig. 37: Typical new house alongside the project road (Km 61+770 to Km 61+805). Construction material is made of clay brick mansonry.

Fig. 38: Typical fairly old house alongside the project road (Km 61+810 to Km 61+835). Construction material is made of clay brick masonry.

416. For historic and old buildings the given threshold value is 0.25 in/sec for continuous or frequent intermittent sources as it is typical for construction vibration.

417. For the various type of construction machinery the average vibration levels at a distance of 25 feet (approximate 7,5 m) from the emission source are the following (Caltrans 2013)[35]:

Tab. 49 Vibration Source Amplitudes for Construction Equipment

Equipment	Reference PPV at 25 ft./ approximate 7.5 m (in/sec)	Reference in dB
Vibratory roller	0.210	106
Large bulldozer	0.089	98
Caisson drilling	0.089	98
Loaded trucks	0.076	97
Jackhammer	0.035	90
Small bulldozer	0.003	69

[35] California Department of transportation (2013): Transportation and Construction Vibration.

418. Using these source levels, vibration from the equipment can be estimated by the following formula:

$PPV_{Equipment} = PPV_{Ref} * (25/D)^n$ in/sec
Where:
PPV_{Ref} = reference PPV at 25 ft.
D = distance from the equipment to the receiver in feet.
N = 1.1 (the value related to the attenuation rate through ground)[36]

419. By transposing this formula the required minimum distance can be calculated as follows:

$$D = \frac{25}{\sqrt[n]{\frac{ppv\ equipment}{ppv\ ref}}}$$

420. By applying this formula and using as threshold values for $PPV_{Equipment}$ and PPV_{Ref} 0.25 in/sec the calculated minimum safe distance for the fragile buildings adjacent to the project road is 25 feet, respectively 7.5 meters. The threshold value used for the building structures is valid for historic and old buildings and emission from a continuous source[37]. The reference PPV applied for the construction machinery (0,25 in/sec) is slightly above the standardized PPV_{Ref} of the vibratory roller in table 49. Hence the assessment can be considered to be on the safe side.

421. As a result it can therefore be concluded that fragile buildings closer than 7.5 m to the future road edge are at risk of damages. The buildings are indicated in yellow colour in the table in annex 7 (buildings coloured red will be demolished). In total 122 buildings are within the defined contour of 7.5 m to the future road edge and may potentially suffer from vibration damages.

422. The following mitigation measures will be implemented during construction phase.

The bidding documents for civl works will require that the Contractor submit to the Engineer for review and approval a written Construction Vibration Management Plan (CVMP) detailing the procedures for vibration monitoring and control. The CVMP plan will include the requirement for trial construction sections to determine the likely magnitude of vibrations at defined distances from a vibration source. These programs would be reviewed and approved by the Engineer to ensure compliance with contractual specifications, including the EMP. The maximum permissible vibration limit set at 0.25 inch/s (para 421) must not be exceeded within the defined contour (7.5m from the road edge) where houses may be at potential risk of damages (para 422).

Where the results of the vibration monitoring, or from a trial construction section, show that the specified construction vibration limit is reached at a particular location, the Contractor would be directed by the Engineer to suspend the construction activities that generate the excessive vibration at such location, and with the approval of the Engineer take mitigative actions necessary to keep the construction vibration within the specified limit.

[36] The value 1.1 for n is suggested in CALTRANS (2013). It is used for class III soils which are defined as Hard Soils, such as: dense compacted sand, dry consolidated clay, consolidated glacial till, some exposed rock (cannot dig with a shovel, need a pick to break up).
[37] Threshold criteria according to table 48 (Table 19 in CALTRANS (2013))

Such actions may include, alternative construction methods such as: (i) decrease of vibration emission from the particular equipment item; (ii) substitution of the particular equipment item at such location by other equipment capable of variable vibration control; (iii) use of smaller equipment; (iv) compaction without vibration rollers; (v) decreasing the thickness of material layers below the maximum thickness permissible under the specification; (vi) building wave barriers (trench or ditch) where appropriate; (vii) change the pavement type for example from flexible to rigid pavement, (viii) any other method of Contractor's choice that may be used while ensuring compliance with the specification for the material that is being compacted.

423. Once work in a particular section of the road has been scheduled, nearby residents and property owners should be notified about the specific times and dates that vibration generating activity will occur. Night work will be avoided.

E. OPERATIONAL PHASE

1. Population and Communities

Potential impacts

424. *Settlement patterns*. No significant changes in settlement patterns are anticipated as a result of proposed road upgrading.

425. *Community impacts*. Potential community-level impacts can include economic enhancement, split communities, bypassed loss of roadside community business and social activities, impacts on current mode of transportation, impacts related to culture shock, and conversion to higher value land users.

- *Split communities*. As the project will upgrade the road from 2 to 4 lane with separation it can cause split communities, and create obstacles for farmers and villagers in accessing their fields, etc.

- *Impacts on Current Modes of Transport*. As the project will upgrade the road category to the one with higher speed limit it can impede road crossings, restrict parking of informal public transport vehicles and reduce the attractiveness of current transport modes such as cartage.

- *Impacts on Bypassed Communities.* No bypasses are included in the project.

- *Impacts on Tourism*. The project could a positive impact on the tourism potential of the areas served by the improved roadways.

- *Impacts Related to Culture Shock*. Rapid exposure of isolated communities to increased communication and contact with the outside world may lead to significant community impacts referred to as "culture shock". No significant impacts of this nature are anticipated as a result of the project.

Mitigation Measures

In order to preserve the cohesion of the community, the project design includes several type of improved crossings for cattles and pedestrians such as (i) at grade intersections and pedestrian crossings secured by refuges in the median, (ii) two

overpasses in Uyali and Kizilkala villages, and (iii) several underpasses, most of which are suited for cattle crossings and agricultural machineries. The Project design also paid specific attention to safety for all road users. Gateaways treatments -including flat topped humps and adequate road signs- will be used in populated areas to mark the change in speed environement (speed limit set at 40 km/h in towns and villages) and ensure safe crossings for all.

2. Traffic impacts

426. The proposed project will result in better road condition. In combination with the implemented road safety features and crossing facilities for pedestrians, cattle and agricultural machinery this is expected to result in better traffic flow and less congestion within urban areas and in addition to less accidents and better safety for the population alongside the Project road. Due to improved traffic flow also local communities who access the road via side roads will benefit from the Project because there is less delay from congestion.This is also valid for the many residential and retail units alongside the Project road.

427. In order to assess noise impacts during operational Phase noise levels within the traversed settlements of Obikiik, Uyali, Kizil-Kala and Kurgonteppa were calculated by using the software “Soundplan” for the expected opening year 2022 and in addition for the year 2031. The calculation was conducted for day and night time. The generated detailed maps showing the outcome of the noise calculation are presented in the annex 4.

428. Below table 50 show the results of noise calculation for the identified sensitive receptors in Obikiik, Uyali and Kurgonteppa respectively.

Tab. 50 Results of Noise Modelling for the Identified Sensitive Receptors

No[38]	Sensitive Receptor Number[39]/Name	Distance to road edge	Side of Building	Floor	Noise Standard. Max. dB (A)		Calculated Noise Level 2021 in dB (A) / Difference to Baseline Measurements[40]		Calculated Noise Level 2031 in dB (A) / Difference to baseline measurements		Conflicts / Exceedance in year 2021 in dB		Conflicts / Exceedance in year 2031 in dB		Baseline measurements[41] dB		Requirement of additional noise protection measures (see footnote 44)
					day	night	day	night	day	night	day	night	Day	night	day	night	
Obikiik																	
2	4/School Lyseum	30 m	SW	Ground	55	45	61,3 / + 1,4	.	62,7 / + 2,8	55,6	yes	n.a.	yes	n.a.	59,9	55,2	no
3	3/School No. 1	150 m	SW	Ground	55	45	51,4	n.a.	52,8	45,7	no	n.a.	no	n.a.	----	45,3	no
4	4/Health Center	40 m	NE	Ground	55	45	58,7 / -1,2	n.a.	60,2 / + 0,3	53.	yes	n.a.	yes	n.a.	59,9	52,7	no
5	5/Kindergarten	90 m	NE	Ground	55	45	53,5 / -0,85	n.a.	55 / +0,65	47,8	no	n.a.	no	n.a.	54,35	47.5	no
7	8/Professional Centre	140 m	E	Ground	55	45	53,5	n.a.	55,	47,9.	no	n.a.	no	n.a.	---	47,5	no
7	8/Professional Centre	140 m	E	1st floor	55	45	53,8	n.a.	55,3	48,1	no	n.a.	yes	n.a.	---	47,8	no
8	9/School No. 2	20 m	W	Ground	55	45	58 / +0,5	n.a.	59,5 / +2	52,3	yes	n.a.	yes	n.a.	57,5	52,0	no
Uyali																	
10	12/Hospital	320 m	SE	Ground	55	45	46,3	39,0	47,8	40,4	no	no	no	no		38,8	no
11	13/Kindergarten	50 m	SE	Ground	55	45	51,9	n.a.	53,4	46	no	n.a.	no	n.a.	54,35	43,5	
12	15/Large Mosque	30 m	N	Ground	---	---	57,5	n.a.	58,9	51,6	no	n.a.	no	n.a.	54,6	49,4	no

[38] Number of Location where baseline measurements were taken (locations shown in map in annex 6)
[39] Number of Sensitive Receptors according to List in Annex 3
[40] According to IFC EHS guidelines at receptors where standards are already exceeded without the Project an additional maximum increase of 3dB (A) is acceptable and no additional noise protection is required
[41] Baseline day measurements drawn from table 42. No night time measurements were conducted. Average night time values were calculated for selected receptors.

No[38]	Sensitive Receptor Number[39]/Name	Distance to road edge	Side of Building	Floor	Noise Standard. Max. dB (A)		Calculated Noise Level 2021 in dB (A) / Difference to Baseline Measurements[40]		Calculated Noise Level 2031 in dB (A) / Difference to baseline measurements		Conflicts / Exceedance in year 2021 in dB		Conflicts / Exceedance in year 2031 in dB		Baseline measurements[41] dB		Requirement of additional noise protection measures (see footnote 44)
					day	night	day	night	day	night	day	night	Day	night	day	night	
--	14/Mosque		SE	Ground	---	---	48,8	n.a.	50,3	42,9	no	n.a.	no	n.a.	---	40,3	no
--	11/Sundaymarket		E	Ground	75	75	60,2	n.a.	61,6	n.a.	yes	n.a.	no	n.a.	---		no
Kizil-Kala																	
15	20/Mosque	30 m	SE	Ground	---	---	59,3	n.a.	60,7	53,4	no	n.a.	no	n.a.	67,75	50,7	no
--	21/Mosque		E	Ground	---	---	60,7	n.a.	62,1	54,8	no	n.a.	no	n.a.	---	52,1	no
--	19/School		E	Ground	55	45	50,0	n.a.	51,5	44,1	no	n.a.	no	n.a.	---	42,9	no
--	19/School		E	1st floor	55	45	50,8	n.a.	52,2	44,9	no	n.a.	no	n.a.	---	43,5	no
16	22/Kindergarten	150 m	E	Ground	55	45	49,7	n.a.	51,2	43,9	no	n.a.	non	n.a.	53,15	41,4	no
16	22/Kindergarten	150 m	E	1st floor	55	45	50,1	n.a.	51,6	44,2	no	n.a.	no	n.a.	---	41,9	no
17	23/Medical Centre/Hospital	20 m	E	Ground	55	45	61,1 / -2,05	53,7	62,6 / -0,55	55,2	yes	Yes	yes	Yes	63,15	52,6	no
17	23/Medical Centre/Hospital	20 m	E	1st floor	55	45	62,5	55,1	63,9	56,6	yes	Yes	yes	Yes	---	53,9	no
17	23/Medical Centre/Hospital	20 m	E	2nd floor	55	45	63,2	55,8	64,7	57,3	yes	yes	yes	yes	---	54,6	no
17	23/Medical Centre/Hospital	20 m	E	Ground	55	45	60,1	52,7	61,6	54,2	yes	yes	yes	yes	---	51,9	no
17	23/Medical Centre/Hospital	20 m	E	1st floor	55	45	61,0	53,6	62,5	55,1	yes	yes	yes	yes	---	52,6	no
17	23/Medical Centre/Hospital	20 m	E	2nd floor	55	45	61,9	54,5	63,3	56,0	yes	yes	yes	yes	---	53,1	no

No[38]	Sensitive Receptor Number[39]/Name	Distance to road edge	Side of Building	Floor	Noise Standard. Max. dB (A)		Calculated Noise Level 2021 in dB (A) / Difference to Baseline Measurements[40]		Calculated Noise Level 2031 in dB (A) / Difference to baseline measurements		Conflicts / Exceedance in year 2021 in dB		Conflicts / Exceedance in year 2031 in dB		Baseline measurements[41] dB		Requirement of additional noise protection measures (see footnote 44)
					day	night	day	night	day	night	day	night	Day	night	day	night	
18	24/School		E	Ground	55	45	48,0	n.a.	49,4	42,1	no	n.a.	no	n.a.	50,4	40,4	no
18	24/School		E	1st floor	55	45	49,0	n.a.	50,5	43,1	no	n.a.	no	n.a.	---kk	41,1	no

429. The above table shows that exceedances of noise standards with regard to the identified sensitive receptors are anticipated to occur in Obikiik and Kizil-Kala. In Uyali the night standard is exceeded for the Kindergarten, but this is considered of being of no relevance because there is only day time use. For the Sunday market in Uyali the standard for commercial areas was taken which is met.

430. In Obikiik exceedances were calculated for the health centre, for 2 schools and for the professional centre.

431. In addition exceedances were calculated for the medical centre / hospital in Kizilkala which also keeps patients during night time. Also the baseline indices exceeds the standards. The increase for the prognosis horizon 2031 is less than 3 dB. Therefore according to IFC standards no mitigation measures are required. For certain facilities that are not in use during night only the day time values were considered and the night values are indicated as not applicable (n.a.) in the above tables.

432. When comparing the modelled figures with the baseline noise measurements it can be seen that for the buildings at which the modelling shows exceedances also the baseline indices are above the applied standards. Therefore the IFC EHS guidelines need to be considered which specify a maximum increase of 3 dB(A) at receptors. When applying these guidelines none of the identified receptors is above this threshold and therefore no additional noise protection measures are required at the identified receptors for the operational phase. However, for the hospital in Kyzylkala noise protection windows should be implemented, since the noise level exceeds the applicable standard value and the 3 db threshold is only mariginal failed.

433. Also for the residential houses alongside the Project road baseline measuerments are above the legal standards of Tajikistan (see table 36 in the chapter on baseline measurements for noise). In analogy to the conclusions for the public sensitive receptors also for the residential houses the IFC EHS standards need to be applied therefore. Following international best practice for consideration of noise protection measures the modelled baseline values need to be taken for comparison with the forecasted noise levels because only this is objective. The measured baseline indices in chapter VII C, table 35 and 36 can only be taken for validation and testing of plausibility of the results because with field measurements there is always disturbance involved which cannot be completely filtered. For none of the identified residential houses an increase above the threshold value of 3 dB(A) is anticipated. Therefore no further action is required for the operational phase in terms of noise protection measures. This is also valid for day and night time.

434. Based on the results of the noise forecast, it is recommended to monitor the future traffic volumes and consider installation of noise protected windows in the identified school buildings and the medical centers, and built a high wall around the school to decrease effects of operational noise levels to the students.

435. Other alternatives such as acoustic screens and tree belts were also considered but were not found suitable under the given conditions in Obikiik and Uyali. The reason is that acoustic screens usually are not installed within urban areas or villages due to the damaging effect they have on the overall appearance of the scenery. Vegetation belts only have a limited effect on noise reduction. Therefore the option “noise protected windows” is preferred. Additional measures to mitigate noise emissions include a speed limit which is set to 4o km/h within sections passing through settlements and also speed bumps and other road safety installations.

436. Road safety features such as speed control signs, proper road markings, streetlights, pedestrian crossing, livestock crossings and other visual means has been duly provided in the design of the new road.

3. Damages to Drainage and Erosion

437. Damaged drainage can result in damage to local irrigation systems, and erosion can have adverse effect on the road.

Mitigation Measures

438. These damages will be mitigated by conducting routine monitoring of drainage and erosion at least twice a year. In case there are any damages identified these have to be repaired. Defects liability period from the side of the contractor is for 1 year. After this year maintenance and repair, if required have to be done by MoT.

F. Positive Impacts

439. There are many positive impacts associated with the Project. Main positive impacts refer to accessibility, regional cooperation and community impacts.

1. Accessibility and Regional Cooperation

440. The improvement of the Dushanbe – Kurgonteppa road is extremely important for a landlocked country such as Tajikistan It provides access to domestic and regional markets. It will help provide services throughout the country and generation of employment is also enhanced. In addition it is the most important direct surface link between Dushanbe and Afghanistan.

2. Community Impacts

441. Proposed improvements in the road carrying capacity and surface condition are expected to facilitate movement of people, produce, and products along these established travel corridors. Local residents will benefit from easier access to the market place and

improved traffic safety. Manufacturers and processors will benefit from more reliable transportation links between suppliers of raw materials and major markets both within and outside the immediate area. Consumers may be able to more readily access these markets to obtain goods that were previously unobtainable or prohibitively expensive. Within the project area many agricultural households cultivate fruits and vegetables for sale in local markets. The project road is crucial for transporting these products to market where they can be sold to consumers. The project will help alleviate poverty by facilitating transport of produce to more distant markets where grower can receive higher prices.

G. Cumulative Impacts

442. Cumulative impacts can be described as the combined changes of environment that are the result, not only of a single project, but of all human activities, past, present and future (as far as it is foreseeable) in the study area. Hence cumulative impact assessment requires the assessment of the combined effects resulting from implementation of Phase 1 and Phase 2 together, including all the ancillary facilities such as temporary diversions, access roads, borrow areas and disposal sites for surplus material. It thus integrates the identified impacts of Phase 1 and Phase 2 and analyses the social and environmental implications regarding the area of influence when both Project components are considered together.

443. As an example the impacts associated with the implementation of contractor's yard are assessed. Cumulative impacts may arise regarding the potential spread and increase of transmissible diseases due to a significantly larger workforce within the Project area of influence.

444. There are also positive cumulative impacts when considering both Project phases and their ancillary facilities like increased spending capacity.

445. In general it can be concluded that most of the identified Phase 2 specific impacts, positive and negative, will aggravate when assessed together. This is because additive, multiplicative and synergetic effects might occur.

IX. ENVIRONMENTAL MANAGEMENT AND MONITORING

A. INSTITUTIONAL REQUIREMENTS

446. The EMP included in this IEE together with the Construction EMP that need to be prepared by the contractor provide the overall Project environmental management framework.

447. The Construction EMP must be submitted within 30 days of the contract award and Preconstruction and Construction cannot commence until the Construction EMP is approved by the MoT and the Engineer.

448. The Bid Documents for the potential Contractor(s) shall contain two sections relating to environmental issues, firstly a basic clause indicating that the Contractor will be

responsible for following the requirements of this IEE EMP and that he should prepare his own Construction EMP for the Project. Secondly, the EMP of the IEE shall be repeated in its entirety as an Annex to the Bid Documents so as the bidder is aware of his environmental requirements under the Project (both Pre-construction, Detailed Design and Construction) and help him put costs to his proposal (such as costs for noise monitoring, etc).

449. The Contract Documents should follow a broadly similar pattern to the Bid Documents. It is not considered necessary to repeat the mitigation measures. The Contract should specify that the Contractor(s) is responsible for implementation of the EMP via his Construction EMP. Again, the EMP should be included at an Annex to the Contract so the Contractor(s) is liable for any non-conformance with the EMP, and thereby this IEE.

450. The Contractor(s) will be responsible for the preparation of the Construction EMP. The preparation of the Construction EMP requires a qualified environmental person. The work will need to be fully compliant with the EMP and will need to be prepared within 30 days of Contract award.

451. During the Construction phase the Contractor must retain the expertise of an Environmental Officer (EO) to update the SSEMP and to oversee and report on the operation throughout the contract period. The EO should be full-time member of contractor's staff.

452. The Construction Supervision Consultant team will include a national and international Environmental Specialist to ensure that the Contractor is compliant with his environmental obligations. Specifically, the Engineer should be responsible for preparing a monthly environmental report outlining the Contractors environmental performance during that period. The national specialist shall be engaged on a full time basis to undertake day to day monitoring of the contractors activities. He will be assisted by the International specialist who will provide intermittent inputs.

B. Environmental Management Plan

453. The EMP describes the various measures proposed under this Project, which were designed to avoid, mitigate, or compensate the adverse environmental impacts that may result from the Project. As such the EMP considers all phases of the Project cycle, namely the detailed design, construction and operational phases of the Project.

454. To ensure that the proposed mitigation measures will be carried out by the contractors during the construction stage, the design consultant will clearly set out in the tender and contract documents the contractor's obligation to undertake the respective environmental mitigation measures.

455. The EMP consists of two tables. Table 1 summarizes the environmental mitigation measures, and table 2 describes the environmental monitoring requirements. At the end is a statement which includes the timeframes and responsibilities for carrying out the environmental monitoring.

Tab. 51 Summary of Environmental Mitigation Measures

MITIGATION MEASURES DURING DESIGN, CONSTRUCTION AND OPERATION				
Activity / Location	**Potential Impact**	**Mitigation measures**	**Institutional Responsibility**	
			Implement	Monitor
DETAILED DESIGN PHASE				
Road alignment in areas of tree plantations. There is a considerable number of tree losses involved.	In some cases, tree losses that cannot be prevented. Main species are pines, cypresses, elms, poplars, willows and robinia.	Any tree losses are compensated by new plantations in the ratio of 1:2. Plantations shall be conducted after technical works have been completed. Planting time shall be restricted to spring (March till April) and/or autumn (September till October). Locations for tree plantings are within the existing Right of Way (RoW) at the locations where tree losses occur. Trees to be planted shall have the following parameters: 1.5 – 2 m height, age 5 – 6 years. Distance in between individual trees shall be 10 – 12 m. The following species mix shall be planted: Species: Pines (Pinus spec.), cypresses (Juniperus spec.), maples (Acer platanoides), poplars (Populus alba), willows (Salix alba), walnuts (Juglans regia), ashes (Fraxinus angustifolia) and platanes (Platanus orientalis). Where irrigation channels are running alongside the road, species requiring more moisture such as poplar (Populus alba), willows (Salix alba), maple (Acer platanoides) and ashes (Fraxinus angustifolia) shall be planted. Only native species shall be planted from local genetic stocks.	Design Consultant	PIU
Reconstruction of culverts	Potential damage to local irrigation system if new culverts should not be sufficiently dimensioned or in case that not all existing culverts should be rehabilitated in the course of the road rehabilitation.	In the course of the road rehabilitation all existing culverts will be replaced. All culverts are sufficiently dimensioned in order to prevent any damages or blockages to the existing local irrigation systems.	Design Consultant	PIU

MITIGATION MEASURES DURING DESIGN, CONSTRUCTION AND OPERATION				
Activity / Location	**Potential Impact**	**Mitigation measures**	**Institutional Responsibility**	
			Implement	Monitor
Reconstruction of bridge over Obikiik creek, Aksu creek and Vakhsh River	Potential water erosion processes at bridge and river embankments.	Design of erosion protection measures at lower parts of bridge embankments. Prefabricated concrete protection plates prevent erosion processes at the lower and lateral parts of bridge and river embankments. Detailed design of the respective protection measure is drafted in the technical design documentation for the respective bridges.	Design Consultant	PIU
Road traversing through Obikiik, Uyali and Kyzylkala.	Current cross section is too narrow for 4 lanes. If standard cross section is implemented than there is encroachment in environmental structures and private and social property assets (tree losses, masonry retaining wall, private yards, building structures).	The chosen alignment and cross section will aim on reducing the loss of building structures as far as technically feasible. Loss of structures that cannot be prevented will be compensated according to the LARP.	Design Consultant	PIU
Road in close proximity to archaeological relevant areas	Destruction of artefacts	Two phased archaeological investigation Phase 1: Walk over survey Phase 2: Excavation	Archaeological Institute Dushanbe	Archaeological Institute Dushanbe
Road traversing cattle crossings	Accidents because of collision with cattle	Design of cattle crossings or improvement of safety of existing crossings. In total six animal crossings are implemented. Location has been identified based on the public consultation process and approved by the respective authorities	Design Consultant	PIU
CONSTRUCTION PHASE				
Top soil preservation	Loss of top soil.	Removing of top soil occurring within site clearing corridor. Topsoil shall be removed and stored for reuse. Long-term stockpiles of topsoil will immediately be protected to prevent erosion or loss of fertility. For erosion protection it will be sawn with a fast growing vegetation, e. g. grass	Contractor	Construction supervision Consultant (CS)
Disposal areas for stockpiling demolished pieces of structures,	Loss of valuable ecological structures if the selected disposal sites are not carefully selected.	No agricultural area or river floodplain shall be selected as disposal site. Minimum distance to any watercourses must be at least 100 m.	Contractor	Construction supervision (CS)

MITIGATION MEASURES DURING DESIGN, CONSTRUCTION AND OPERATION				
Activity / Location	**Potential Impact**	**Mitigation measures**	**Institutional Responsibility**	
			Implement	Monitor
surplus soil, pieces of asphalt pavements etc.		Disposal sites shall be preferably on barren land without any wooden vegetation.		
Selected disposal sites for cut material	Potential wind and water erosion	The contractor is advised to compact end evenly distribute the surplus material by layers where possible, to minimize piling and impacts to landscape. The stockpiles shall be sawn with fast growing grass to avoid erosion by the root system. During dry and windy periods, water should be spread on the disposed material to avoid dusting.	Contractor	Residential Engineer
Road alignment in areas of tree plantations. Embankment filling of the tree stem area.	Tree losses due to embankment fill.	A maximum fill up of the tree stem area of 30 cm can be accepted. Fill up material in the tree stem area has to be organic soil. A filling up of more than 30 cm will damage the tree. In this case cutting can't be prevented and a new tree is to be planted as a compensation measure at the respective location within the existing RoW. Species to be planted are pines, cypresses, elms, poplars, willows, walnuts and robinia Plantings shall be conducted after technical works have been completed. Planting time shall be restricted to spring (March till April) and/or autumn (September till October). Quality of newly to be planted trees shall be 16 to 18 cm of stem circumference in 1 m height.	Contractor	Construction supervision (CS)
Bottom of embankment of designed road lying very close to tree rows	Potential damaging of trees during construction activities	Implementation of a temporary vegetation protection fence during construction activities.	Contractor	Construction supervision (CS)
Construction activities nearby valuable surface waters, in particular Obikiik creek, Aksu creek, Vakhsh	Possible alteration of surface water hydrology resulting in increased sediment by increased soil erosion at construction site	Implementation of settlement ponds at locations where construction site comes close to natural watercourses to retain sediments and mitigate possible impacts on water hydrology. Oil and solid waste management	Contractor	Construction supervision (CS)

MITIGATION MEASURES DURING DESIGN, CONSTRUCTION AND OPERATION				
Activity / Location	**Potential Impact**	**Mitigation measures**	**Institutional Responsibility**	
			Implement	Monitor
River and several irrigation channels		need to be described in the SSEMP and consider these sensitive receptors (rivers and their floodplains). No campsite is allowed near river floodplains. Mitigation measures to reduce silt load include silt traps and temporary cofferdams. Silt traps must be located at specific locations and not across the water course as this can interfere with the fish movement. In addition, the Contractor must ensure the water to be pumped from the cofferdam is put through a settling pond prior to discharge back into the river.		
Operation of borrow areas and quarries	Potential disfigurement of landscape, vegetation losses and damage to access roads Increased dust emission Siltation and obstruction of surface waters	The proposed borrow area in Vakhsh River is already in operation. Therefore environmental impacts concerning potential disfigurement of landscape, vegetation losses and damage to access roads are kept to a minimum. Wet aggregates and/or provide cover on haul trucks to minimize dust emission and material spillage. In addition watering of unpaved access roads for reduction of dust emission. The hauling traffic should be carried out only between 6.00 am and 9.00 pm. Locate stockpiles away from surface waters. Prior to start material extraction the contractor submit his SSEMP through the Construction Supervisor (CS) to the Executing agency of the PIU indicating the location of the proposed extraction site as well as rehabilitation measures and implementation schedule for the borrow areas and access roads. Rehabilitation measures may not be necessary for borrow areas still in operation after road works have finished. The SSEMP	Contractor	Construction supervision (CS), PIU

MITIGATION MEASURES DURING DESIGN, CONSTRUCTION AND OPERATION				
Activity / Location	**Potential Impact**	**Mitigation measures**	**Institutional Responsibility**	
			Implement	Monitor
		needs to address the sensitive issues of avoidance of transportation through residential areas as far as technically feasible and closure rehabilitation.		
Operation of aggregate crusher	Increased dust emission and noise emission	Careful site selection of aggregate crusher in order not to interfere with any sensitive receptor. Distance to next settlement and residential houses at least 1000 m downwind. Site selection for aggregate crusher has to be approved by the PIU..	Contractor	Construction supervision (CS), PIU.
Operation of asphalt plant	Odor emission and safety risks	Asphalt plants shall be 1000 m downwind from any settlements and residential houses. Provide spill and fire protection equipment and submit an emergency response plan (in case of spills, accidents, fires and the like) to the authority in responsibility prior to operation of the plant. Secure official approval for installation and operation of asphalt plants from MoT.	Contractor	Construction supervision (CS), Executing agency of PIU.
	Water pollution due to spilled bitumen	Bitumen will not be allowed to enter either running or dry streambeds nor shall it be disposed of in ditches or small waste disposal sites prepared by the contractor. Bitumen storage and mixing areas must be protected against spills and all contaminated soil must be properly handled according to legal environmental requirements. Such storage areas must be contained so that any spills can be immediately contained and cleaned up.	Contractor	Construction supervision (CS)
Site selection, site preparation and operation of contractor's yard	Potential soil and water pollution	The contractor shall submit documents for approval (short statement and site plan in appropriate scale) which indicate: • Site location, surface area required and layout of the work camp. The layout plan shall also contain details of the proposed	Contractor	Construction supervision (CS); Safeguard Department in IPIG of MoTC

MITIGATION MEASURES DURING DESIGN, CONSTRUCTION AND OPERATION				
Activity / Location	**Potential Impact**	**Mitigation measures**	**Institutional Responsibility**	
			Implement	Monitor
		measures to address adverse environmental impacts resulting from its installation. • Sewage management plan for provision of sanitary latrines and proper sewage collection and disposal system to prevent pollution of watercourses; • Waste management plan covering provision of garbage tons, regular collection and disposal in a hygienic manner, as well as proposed disposal sites for various types of wastes (e.g., domestic waste, used tires, etc.) consistent with appropriate regulations; • Description and layout of equipment maintenance areas and lubricant and fuel storage facilities including distance from water sources and irrigation facilities. Storage facilities for fuels and chemicals will be located away from watercourses. Such facilities will be bounded and provided with impermeable lining to contain spillage and prevent soil and water contamination. Prior to the commencement of works the site installations shall be inspected for approval. The selected site will not be on top of ground water area or near surface waters.		
	Competition for water resources	Prior to establishment of the work camps, conduct consultations with local authorities to identify sources of water that will not compete with the local population.	Contractor	Construction supervision (CS)
Site selection, site preparation and operation of contractor's yard (continuation)	Health and safety risks to workers and adjacent communities	For health and safety protection of workers and adjacent communities the following shall be provided: • adequate health care facilities (including first aid facilities) within construction sites;	Contractor	Construction supervision (CS); PIU

MITIGATION MEASURES DURING DESIGN, CONSTRUCTION AND OPERATION				
Activity / Location	**Potential Impact**	**Mitigation measures**	**Institutional Responsibility**	
			Implement	Monitor
		• training of all construction workers in basic sanitation and health care issues, general health and safety matters, and on the specific hazards of their work; • personal protection equipment for workers, such as safety boots, helmets, gloves, protective clothing, goggles, and ear protection in accordance with legal legislation; • clean drinking water to all workers; • adequate protection to the general public, including safety barriers and marking of hazardous areas; • safe access across the construction site to people whose settlements and access are temporarily severed by road construction; • adequate drainage throughout the camps so that stagnant water bodies and puddles do not form; • sanitary latrines and garbage bins in construction site, which will be periodically cleared by the contractors to prevent outbreak of diseases. Where feasible the contractor will arrange the temporary integration of waste collection from work sites into existing waste collection systems and disposal facilities of nearby communities;		
Work site operation / Operation of equipment maintenance and fuel storage areas	Worker's health and soil / water pollution	The contractor shall hire a qualified health and safety expert who will provide safety training to the staff according to the requirements of the individual work place. Prior to the commencement of works, the work site personnel shall be instructed about safety rules for the handling and storage of hazardous substances (fuel, oil, lubricants, bitumen, paint etc.) and also the cleaning of the equipment. In preparation of this the	Contractor	Construction supervision (CS); EA of PIU.

MITIGATION MEASURES DURING DESIGN, CONSTRUCTION AND OPERATION				
Activity / Location	**Potential Impact**	**Mitigation measures**	**Institutional Responsibility**	
			Implement	Monitor
		contractor shall establish a short list of materials to be used (by quality and quantity) and provide a rough concept explaining the training / briefing that shall be provided for the construction personnel. Locate storage facilities for fuels and chemicals away from watercourses. Such facilities will be bounded and provided with impermeable lining to contain spillage and prevent soil and water contamination. Store and dispose waste/used oil consistent with environmental legal requirements. Work site restoration: After completion of construction works the contractor shall execute all works necessary to restore the sites to their original state (removal and proper disposal of all materials, wastes, installations, surface modeling if necessary, spreading and leveling of stored top soil).		
Operation of construction camp	Road construction projects bear a high potential risk to affect local communities and the health and well-being of those that live in or near to the temporary work camps by supporting the spread of STD and HIV/AIDS. In addition, the transport sector itself actually helps the epidemic, as infrastructure and associated transport services give people and infections mobility.	Providing information to workers, encouraging changes in individual's personal behavior and encouraging the use of preventive measures. The goal of the information is to reduce the risk of HIV / STD transmission among construction workers, camp support staff and local communities.	Contractor	Construction supervision (CS), Ministry of Health
Earth works and various construction activities	Loss of topsoil	Topsoil shall be removed and reused to cover areas where excess materials will be dumped and on road embankments. In addition a soil management plan shall be provided detailing measures to be undertaken to minimize effects of wind and water erosion on stockpiles, measures to minimize loss of	Contractor	Construction supervision (CS)

MITIGATION MEASURES DURING DESIGN, CONSTRUCTION AND OPERATION				
Activity / Location	**Potential Impact**	**Mitigation measures**	**Institutional Responsibility**	
			Implement	Monitor
	Water erosion in river	fertility of top soil, timeframes, haul routes and disposal sites. As erosion protection measure at river banks natural stone fillings shall be used as additional measures if required.		
Earth works and various construction activities (continuation)	Siltation of surface waters and/or impact on soils due to improper disposal of excess materials	Mostly all excavated material will be reused. In addition the reclaimed asphalt pavement will be recycled for the construction of new pavement. Thus potential impacts due to the need for disposal of excess material will be kept to a minimum.	Contractor	Construction supervision (CS)
	Competition for water resources	Conduct consultation with local authorities to identify sources of water (for spraying and other construction requirements) that will not compete with the local population. Water use shall be minimized by recycling and reuse. Technical waste water which will be generated as a result of cleaning and washing equipment, trucks and Batching Plant shall be used for dust suppression measures after treatment, as far as technically possible.	Contractor	Construction supervision (CS)
	Air pollution due to exhaust emission from the operation of construction machinery	The contractor will maintain construction equipment to good standard and avoid, as much as possible, idling of engines. Banning of the use of machinery or equipment that cause excessive pollution (e.g., visible smoke).	Contractor	Construction supervision (CS)
	Disturbance of adjacent settlements due to elevated noise levels	Restrict work between 06.00 am to 9.00 pm within 500m of the settlements. In addition, a limit of 70 dBA will be set in the vicinity of the construction site and strictly followed. In addition the following measures need to be implemented: Noise control at source (using less noisier equipment, mufflers, dampeners, enclosures, proper maintenance of equipment, providing training to operators, etc), noise control at path (using natural structures with screening properties and acoustic barriers).	Contractor	Construction supervision (CS)

MITIGATION MEASURES DURING DESIGN, CONSTRUCTION AND OPERATION				
Activity / Location	**Potential Impact**	**Mitigation measures**	**Institutional Responsibility**	
			Implement	Monitor
	Soil compaction due to operation of heavy equipment	Confine operation of heavy equipment within the corridor that is absolutely necessary for the road construction to avoid soil compaction and encroachment into agricultural used land close to the road.	Contractor	Construction supervision (CS)
Earth works and various construction activities (continuation)	Traffic impairment	Submit a traffic management plan to local traffic authorities prior to mobilization. Provide information to the public about the scope and schedule of construction activities and expected disruptions and access restrictions Allow for adequate traffic flow around construction areas. Provide adequate signalization, appropriate lighting, well - designed traffic safety signs, barriers and flag persons for traffic control.	Contractor	Construction supervision (CS), EA of PIU.
Archaeological chance finds	Potential damage to archaeological artefacts due to construction activities, particularly earthworks	In the event of the unexpected discovery of archaeological objects during construction operations the contractor shall immediately inform the residential engineer who will notify the Institute of Archaeology / Ministry of Culture and the PIU for further instructions. In this case the construction works at the localized site would be stopped until Institute of Archaeology give clearance for the continuation of the operations. Works will resume only after appropriate measures have been taken as requested by the Institute of Ministry of Culture and confirmation has been received that works may continue.	PIU, Residential Engineer and Contractor	PIU and Institute of Archaeology
Within settlements, encroachment into building structures private assets and residential land	Dislocation or involuntary resettlement of people.	Resettlement Specialist will issue LARP covering assessment of loss and compensation procedure.	EA of PIU	EA of PIU

MITIGATION MEASURES DURING DESIGN, CONSTRUCTION AND OPERATION				
Activity / Location	**Potential Impact**	**Mitigation measures**	**Institutional Responsibility**	
			Implement	Monitor
Within settlements. Potential damage due to vibration at locations where the Project road comes close to residential buildings in Obikiik, Uyali and Kizilkala.	Damages to buildings	For the preservation of evidence the contractor is advised by PIU to document the condition of houses close to the road. Photographs of all residential houses nearby the road will be taken as a protection for possible complaints regarding damages in house walls etc. This is part of the contract.	Contractor	CS
As above	As above	Where the results of the vibration monitoring show that the specified construction vibration limit is reached at a particular location, the Contractor shall suspend instantly the construction activities that generate the excessive vibration at such location, notify the Engineer and take mitigative actions necessary to keep the construction vibration within the specified limit. Such actions may include, but shall not be limited to alternative construction methods such as: • decrease of vibration emission from the particular equipment item • substitution of the particular equipment item at such location by a modern equipment capable of efficient vibration control • use of smaller equipment • decreasing the thickness of material layers below the maximum thickness permissible under the specification • compaction without vibration rollers, or • any other method of Contractor's choice that may be used in order to comply with this specification. • During construction phase vibration levels will be monitored as indicated in the monitoring programme.	Contractor	CS
Within settlements, encroachment on business assets and / or Disturbance to business, people, activities and socio-cultural	Loss of businesses and income of people operating their business within the existing RoW	Resettlement Specialist will issue LARP covering assessment of loss and compensation procedure. In addition the following mitigation measures shall be implemented:	EA of PIU	EA of PIU

MITIGATION MEASURES DURING DESIGN, CONSTRUCTION AND OPERATION				
Activity / Location	**Potential Impact**	**Mitigation measures**	**Institutional Responsibility**	
			Implement	Monitor
resources due to construction work		Inform all residents and businesses about the nature and duration of work well in advance so that they can make necessary preparations. Limit dust by removing waste soil quickly; by covering and watering stockpiles, and covering soil with tarpaulins when carried on trucks Increasing workforce and use appropriate equipment to complete the work in minimum time in the important areas Avoid construction work in sensitive times like festivals near religious places		
Within settlements disproportionate encroachment on poor people's assets.	Loss of wealth and property of poor people. Poor and vulnerable households might be affected.	Resettlement Specialist will issue LARP covering assessment of loss and compensation procedure.	EA of PIU	EA of PIU
Construction activities in close vicinity to existing infrastructure such as water supply pipes and other facilities, waste water discharge facilities, electricity lines etc.	Damage to infrastructure, supply cuts of infrastructure services.	Measures will be ensured in engineering designing to avoid any disturbance to the existing infrastructure. Prior to construction start the respective service agencies shall be informed about the construction work. Coordinate with respective agencies and provide prior information to the public in case of any required disruption in services during construction	Contractor	Construction supervision (CS); PIU
Rehabilitation works within villages, settlements and along sensitive receptors such as schools and hospitals.	Noise exceeding applicable noise standards. Vibrations may result in damage to local infrastructure, including private property and local (haulage) roads. Within the settlements of Obikiik, Uayali and Kyzylkala there will be noise monitoring according to the	For sensitive receptors of public interest such as schools and hospitals and also for residential houses alongside the Project road applicable noise standards shall be complied with as far as technically feasible by means of noise measurements. In case of exceed of standards, ascribe of time restrictions for construction activities between 7 am and 6	Contractor	Construction supervision (CS); PIU.

MITIGATION MEASURES DURING DESIGN, CONSTRUCTION AND OPERATION				
Activity / Location	**Potential Impact**	**Mitigation measures**	**Institutional Responsibility**	
			Implement	Monitor
	stipulations in the montoring programme.	pm. Close to schools, construction work to be undertaken only during school breaks. For potential damages to local infrastructure, including private property and local (haulage) roads, compensation procedures will have to be established prior to the beginning of construction and approved by the engineer. In addition grievance redress procedures shall be put in place to facilitate communication between the contractor and potentially affected people. In addition haul routes and construction site access roads should be discussed and jointly approved between the contractor and local officials to minimize the risk of conflicts.		
As above	Construction noise	To avoid excessive noise levels near sensitive receptors the following mitigation measures are foreseen. All construction equipment should be fitted with suitable engine mufflers. All mobile equipment should be maintained in good mechanical condition. No plant and equipment shall be left running if not required for immediate use. Where this is not practicable, equipment shall be set to idle in the quietest manner to minimise noise emissions. Where feasible equipment modifications should be considered, such as dampening of metal surfaces, which is effective in reducing noise due to vibration. Temporary noise barriers will be utilised for those areas where sensitive receptors are significantly affected during construction.	Contractor	CS

MITIGATION MEASURES DURING DESIGN, CONSTRUCTION AND OPERATION				
Activity / Location	**Potential Impact**	**Mitigation measures**	**Institutional Responsibility**	
			Implement	Monitor
		Temporary barriers are typically constructed from plywood and should be of sufficient height to screen acoustic line-of-sight between the receiver and the noise source. Construction noise barriers should be implemented if effective and practicable. This would be decided on a case-by-case basis.		
Construction activities close to building structures, particularly within settlements of Obikiik, Uayali and , Kyzylkala. Aggregate extraction. Haulage of aggregates and construction equipment.	Potential Impact on Community Health and Safety	a. The community members will be advised on road safety with the key messages reinforced with communities throughout construction. b. Clear signs will be placed at construction sites including borrow pits, in view of the public, warning people of potential dangers such as moving vehicles, hazardous materials and excavation and raising awareness on safety issues. c. Heavy machinery will not be used after day light and all such equipment will be returned to its overnight storage area/position before night. d. All sites including storage areas will be made secure, prohibiting access by members of the public by fencing when appropriate. e. Install barriers to keep pedestrians away from hazardous areas such as constructions sites and excavation sites. f. Install signage at the periphery of the construction site advising road users that construction is in progress. g. Strictly impose speed limits on construction vehicles along residential areas and where other sensitive receptors such as schools, medical places and other populated areas located.	Contractor	Construction supervision (CS); PIU.

MITIGATION MEASURES DURING DESIGN, CONSTRUCTION AND OPERATION				
Activity / Location	**Potential Impact**	**Mitigation measures**	**Institutional Responsibility**	
			Implement	Monitor
		h. Provide security personnel in hazardous areas to restrict public access. j. If necessary, provide safe passageways for pedestrians crossing the construction site and for people whose access has been disrupted due to construction woks.		
Utilities Provision All sites where utilities will be interrupted	Potential impact on community health and safety	a. The affected people will be consulted during project implementation and will make the project contractors aware of any significant issues resulting from loss of electricity. b. People will be informed in advance of any power cuts and the duration of the cut will be made clear in order that they can plan around the lack of power.	Contractor	Construction supervision (CS); PIU.
Traffic Management. All construction sites	Potential impact on community health and safety	a. Implement a traffic management plan that will set out how access along the project road will be maintained safely during construction. b. Provide clear signs to guide road users and advise them on changes to road priorities in order to make their journey as smooth as possible and to ensure road safety as unanticipated changes e.g. change of lane, will be avoided. c. Ensure access in areas to be closed temporarily by providing temporary/alternative access.	Contractor	Construction supervision (CS); PIU.
Possible damage to properties and community facilities. Construction sites.	Community Health and Safety impacts	a. Immediately repair and/or compensate for any damage caused by construction works and activities to existing communities and their property and facilities b. Maintain access roads used for transport of construction materials and other construction related activities are maintained to ensure that they remain in at least in their pre-project condition for the duration of the project.	Contractor	Construction supervision (CS); PIU.

MITIGATION MEASURES DURING DESIGN, CONSTRUCTION AND OPERATION				
Activity / Location	**Potential Impact**	**Mitigation measures**	**Institutional Responsibility**	
			Implement	Monitor
OPERATION PHASE				
4-lane road passes through Obikiik, Uayali and Kyzylkala.	Within this section noise levels during operational phase might exceed the standards at identified sensitive receptors (school, medical center and residential buildings nearby the <Project road).	Based on the results of the conducted baseline measurements already now the Tajikistan legal standards are exceeded. Based on the conducted modelling no further exceedances above the EHS threshold of 3 dB(A) is anticipated. Therefore no noise protection measures are required for the operational phase. However, it is recommended to monitor the future traffic development and consider installation of noise protected windows at the hospital in Kyzylkala and other sensitive receptors of public interest such as schools and Kindergartens. To the school located closest to the road built a high wall around the school to decrease effects of operational noise levels to the students.	PIU	PIU
Increased traffic flow	Elevated levels of gaseous and noise emissions due to increased traffic. In addition increased pedestrian vs. vehicle accidents due to traffic volume and higher speed as a result of improved road design	Integrate in the engineering design safety features such as speed control signs, proper road markings, streetlights, pedestrian crossing, livestock crossing and other visual means.	Design Consultants	Construction Supervision (CS)
Increased traffic volumes and higher vehicle speeds	Increased risk of accidents with possible spills of harmful substances	Spill-contingency plan A contingency plan or emergency response plan is a set of procedures to be followed to minimize the effects of an abnormal event on the Project roads, such as a spill of oil, fuel or other substances that may harm drinking water resources or have adverse effects on the natural balance of sensitive areas. Additional measures to mitigate risk of accidents and spill of harmful substances are speed control and weight stations.	PIU	PIU
Damaged drainage or uncontrolled erosion.	Harmful environmental impacts resulting from damaged drainage or uncontrolled erosion.	Routine monitoring of drainage and erosion control at least twice a year.	EA in PIU	EA in PIU

456. Prior to construction works, the contractor shall provide a comprehensive Construction EMP covering the following aspects:

- Dust management which shall include schedule for spraying on hauling and access roads to construction site and details of the equipment to be used
- Layout of the work camp and details of the proposed measures to address adverse environmental impacts resulting from its installation
- Sewage management including provision of sanitary latrines and proper sewage collection and disposal system to prevent pollution of watercourses
- Waste management covering provision of garbage bins, regular collection and disposal in a hygienic manner, as well as proposed disposal sites for various types of wastes (e.g., domestic waste, used tires, etc.) consistent with appropriate regulations
- Description and layout of equipment maintenance areas and lubricant and fuel storage facilities including distance from water sources and irrigation facilities. Storage facilities for fuels and chemicals will be located away from watercourses. Such facilities will be bounded and provided with impermeable lining to contain spillage and prevent soil and water contamination
- Soil Management Plan detailing measures to be undertaken to minimize effects of wind and water erosion on stockpiles of topsoil and excess materials, measures to minimize loss of fertility of top soil, timeframes, haul routes and disposal sites for excess materials.
- Emergency response plan (in case of spills, accidents, fires and the like) prior to operation of the asphalt plant
- Method statement or plan for the execution of bridge construction works including measures that will be undertaken to address adverse environmental impacts such as erosion of river embankment and siltation of watercourses that may result from such activities
- Traffic Management Plan
- Borrow Pit Management Plan
- Tree cutting and planting plan
- Asphalt plant and concrete plant plan

457. The Construction EMP shall be submitted by the contractor for approval to the Construction Supervision Consultant

C. Environmental Monitoring Plan

458. Environmental monitoring is an important aspect of environmental management during construction and operation stages of the project to safeguard the protection of environment. During construction, environmental monitoring will ensure the protection of embankment from potential soil erosion, borrow pits restoration, quarry activities, location of work sites, material

storages, asphalt plants, community relations, and safety provisions. During operation, air, noise, and surface water quality monitoring will be important parameter of the monitoring program.

459. The parameters to be monitored are outlined in the following plan. The client shall supervise the road project regularly, and submit quarterly reports based on the monitoring data and laboratory analysis report.

Tab. 52 Environmental Monitoring Plan

Issue	What parameter is to be monitored?	Where is the parameter to be monitored	How Is the parameter to be monitored?	When is the parameter to be monitored? Frequency	Institutional responsibility
Construction stage					
Water quality in surface waters (rivers). Natural surface waters are Obikiik creek, Aksu creek and Vakhsh river. River. In addition water quality in the large irrigation channels at km 60+880 in Uyali (Bridge 11) and km 46+750 before Mekhnat (Bridge 10)	pH, suspended solids, BOD5, dissolved oxygen, salinity, oil prodicts and electrical conductivity	Down- and upstream where the Project road crosses the rivers. For Vakhsh river 500 m, for Obikiik, Aksu creek and the irrigation channels at at km 60+880 in Uyali (Bridge 11) and km 46+750 before Mekhnat (Bridge 10)100 m up and downstream the existing bridge.	Measurement either directly in river water with a suitable measurement device or sample taking and measurement in a certified laboratory.	Baseline measurements before construction activities commence. Than measurements on a quarterly basis during construction stage.	SC (Supervision Consultant) and EA of PIU.
Noise Rehabilitation works within settlements at locations where the Project road runs close to sensitive receptors such as schools, hospitals, mosques, bazars or other sensitive socioeconomic infrastructure. Affected settlements are Obikiik, Uyali and Kyzylkala. ,	Measurement of noise and vibrations-	Measurements shall be undertaken within the traversed settlements of Obikiik, Uyali and, Kyzylkala.	By means of portable noise / vibration measurement device	Prior to construction and during construction activities. Establishment of baseline conditions before construction start. Than monitoring measurements on a quarterly basis during construction stage.	SC (Supervision Consultant).

Issue	What parameter is to be monitored?	Where is the parameter to be monitored	How Is the parameter to be monitored?	When is the parameter to be monitored? Frequency	Institutional responsibility
Air quality deterioration	Dust, SO2, NOx, CO	Measurements shall be undertaken within the traversed settlements of Obikiik, Uyali and Kyzylkala. In addition there need to be air quality measurements near the asphalt plant and the aggregate crusher.	By means of suitable portable measurement device	Prior to construction and during construction activities. Establishment of baseline conditions before construction start. Than monitoring measurements on a quarterly basis during construction stage.	SC (Supervision Consultant).
Potential tree losses because tree stem area is subject to embankment filling.	Trees located within the newly designed embankment.	At respective tree locations.	Inspections; observation. An embankment fill of up to 30 cm at the bottom of the tree stem area can be accepted. A filling up of more than 30 cm will damage the tree and cutting will be necessary. Decision is to be made by the construction supervision engineer.	During construction phase.	Construction Supervision (CS)
Top soil preservation	Stockpiling and means of protection	Job site	Inspections; observation	Upon preparation of the construction site, after stockpiling and after completion of works on shoulders	Construction Supervision (CS
Equipment servicing and fuelling	Prevention of spilling of oil and fuel	Contractor's yard	Inspections; observations	Unannounced inspections during construction	Construction Supervision (CS)

Issue	What parameter is to be monitored?	Where is the parameter to be monitored	How Is the parameter to be monitored?	When is the parameter to be monitored? Frequency	Institutional responsibility
Worker's safety and health	Official approval for worker's camp; Availability of appropriate personal protective equipment; Organization of traffic on the construction site Provision of safety training to the staff according to the requirements of the individual work place	Job site and worker's camp	Inspection; interviews; comparisons with the Contractor's method statement	Weekly site visits by the hired Health and safety expert. Unannounced inspections during construction and upon complaint.	Construction Supervision (CS)
Worker's education on AIDS and STD	Has relevant education been provided?	To be determined by assigned Construction Supervision	To be determined by assigned Construction Supervision	After beginning of works and at appropriate intervals throughout construction	Construction Supervision (CS)
Material supply Asphalt plant	Possession of official approval or valid operation license	Asphalt plant	Inspection	Before work begins	Construction Supervision (CS)
Borrow areas	Possession of official approval or valid operation license	Sand and gravel borrow pit and / or quarry	Inspection	Before work begins	Construction Supervision (CS)
Material transport Asphalt	Are the truck loads covered or wetted?; Compliance with the Contractor's method statement	Job site / haul routes	Supervision	Unannounced inspections during work	Construction Supervision (CS)
Stone		Job site / haul routes	Supervision spot checks	Unannounced inspections during work	Construction Supervision (CS)

Issue	What parameter is to be monitored?	Where is the parameter to be monitored	How Is the parameter to be monitored?	When is the parameter to be monitored? Frequency	Institutional responsibility
Sand and gravel	(restricted working hours; haul routes) dust suppression methods where required	Job site / haul routes	Supervision	Unannounced inspections during work	Construction Supervision (CS)
Surface water protection	Contractor's compliance with his approved method statement	Bridges and Culverts	Inspection	Unannounced inspections during bridge and culvert works	Construction Supervision (CS)
Air pollution from improper maintenance of equipment Asphalt plant and Machinery	Exhaust fumes, dust	At site	Measurement at asphalt and crushing plants. Regular check certificate of vehicles and equipment	Unannounced inspections during construction works	Construction Supervision (CS
Planting of new road side trees	Regular monitoring and control of successful growth of new planted trees	At locations of new planted trees	Replanting of trees that have died	Monitoring to be conducted in autumn so as to allow for replacement of failures	Contractor 1st Year / EA of PIU in the subsequent Year(s)
Operational stage					
Increased road kills of animals due to higher traffic loads and vehicle speeds	Road kills of animals	Along the new road	Keep records of accidents. In the case that accident hot spots with large mammals are identified, appropriate protective measures shall be elaborated (e.g. reflectors / local fencing, warning signs, speed reductions etc.)	Throughout the Year	MoT
Increased traffic volumes may increase possible spills of harmful substances	Accidents that cause spills of harmful substances	Along the new road	Counting of accidents	Throughout the Year	MoT

Issue	What parameter is to be monitored?	Where is the parameter to be monitored	How Is the parameter to be monitored?	When is the parameter to be monitored? Frequency	Institutional responsibility
Damaged drainage or uncontrolled erosion	Leakages in drainage system and damages due to erosion	Culverts and drainage facilities	Documentation	Throughout the Year	MoT
Based on the results of the noise forecast there might be possible exceedances of noise standards at the school buildings and the health centre in Obikiik and at the medical centres in Kyzylkala.	Noise level	At the school buildings and the health centre in Obikiik and at the medical centres in Kyzylkala.	By means of portable noise measurement device	In the opening year 2020. In subsequent years until 2030 one measurement per year.	MoT

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Tab. 53 Cost Estimate for Mitigation Measures (USD)

Description	Unit	Quantity	Rate USD	Amount USD
Protection of Environment				
Planting, maintenance and watering (during construction stage) of trees on the road side as explained in the EMP. Section 1	Pieces	8.000,00	22.00	176.000,00
Protection of trees during the construction activities.	l.s.			3.000,00
Preparation of Construction EMP	L.s.			10.000,00
Clearing of Construction Corridor.	l.s.			Included in civil engineering works
Removal and Storage of Topsoil.	l.s.			Included in civil engineering works
Protection of Water Resources.	l.s.			Included in civil engineering works
Management of Solid Waste and Sewage Waste from the Construction Camp.	l.s.			Included in civil engineering works
Potential restoration of Work and Storage Sites, Quarries and Borrow Pits, Construction Site Roads.	l.s.			Included in civil engineering works
Dust suppression measures during dry period (water spraying)	L.s.	Daily during dry summer period (3 periods)	10.000,00	30.000,00
Securing of Storage and Equipment Maintenance Areas.	l.s.			Included in civil engineering works
Contractor's Safeguard Specialist	month	30	2.000	60.000,00
Supervision Consultant's National Safeguard Specialist	month	16 (includes one month training)	3.000	48.000,00
Supervision Consultant's International Safeguard Specialist	month	6	20.000	120.000,00
HIV / AIDS Seminar	Every 4 months during construction time	9	1.000	9.000,00
Noise protected windows (double glass windows). Delivery and installation.	l.s. Estimate in m²	1000 m²	100 USD per m²	100,000,00
Training of PIU Safeguard Department	L. s.			30,000.00

Description	Unit	Quantity	Rate USD	Amount USD
Archaeological Inverstigation	L. s.			25.000,00
Subtotal (Mitigation and Management Measures)				**611.000,00**

Tab. 54 Cost Estimate for Baseline Monitoring (USD)

Description	Unit	Quantity	Rate USD	Amount USD
Baseline Monitoring				
Noise Monitoring. Baseline measurement. Than quarterly measurements over construction time in Obikiik, Uayali and Kyzylkala.	Number	195: 15 locations multiplied by 13. (1 baseline measurement and 12 construction period measurements)	100,00	19.500,00
Vibration Monitoring over construction period,	Number.	130: 10 locations multiplied by 13. (1 baseline measurement and 12 construction period measurements)	100,00	13.000,00
.Dust and air pollutants measurement over construction period. Location Obikiik, Uayali and Kyzylkala. Asphalt plant and aggregate crasher	Number	225 Quantity as noise measurements plus asphalt plant and aggregate crusher.	150,00	33.750,00
Water quality monitoring in Obikiik creek, Aksu creek and Vakhsh River. In addition water quality monitoring in the large irrigation channels at km 60+880 in Uyali (Bridge 11) and km 46+750 before Mekhnat (Bridge 10)	. Number	140 20 baseline measurements (2 for each waterbody) plus 120 monitoring measurements.	200,00	28.000,00
Subtotal (Monitoring)				**94.250,00**
Total (Mitigation Measures plus Monitoring)				**705.00,250**

X. STAKEHOLDER CONSULTATION AND INFORMATION DISCLOSURE

A. Consultation Process

460. The IEE process for the Dushanbe – Kurgonteppa road rehabilitation project includes stakeholder participation and consultation to help MoT to achieve public acceptance of the project. The purpose of the Public Consultation is 1) inform people about the project, 2) receive a feedback, 3) incorporate all relevant views of affected people and other stakeholders into decision making, such as project design, mitigation measures, etc. According to the SPS of ADB the Public Consultation begins early in the project preparation stage and is carried out on an ongoing basis throughout the project cycle". Consequently starting from the initial project stage consultations were conducted in all project affected villages. People were invited on Jamoat basis. All chairmen of Project affected Jamoats were contacted and invitation of all Project affected people in the villages arranged. In addition with there have been consultations with Hukomat and city authorities in order to assure that all project affected people, stakeholders and officials were reached and informed about the Project.

461. During the consultation meetings the Project and the potentially occurring environmental and social impacts including possible mitigation measures were explained. The minutes of the meetings are attached in the annex.

462. The environmental specialist took part in communication meetings with social team undertaken in village of Mehnat, Hiloli jamoat, Huroson district and village of Chahkiko, Bohtaryen Jamoat and Bohtar district. It was found that environmental issues are not a priority concern for most of people living near the right of way. Main concerns were on compensation issues, also regarding anticipated impacts such as noise and air pollution during construction, this was for instance mentioned in the village of Mehnat.

463. During consultation in the village of Chahkiko of Bahtoryian jamoat a local man living near the road stated that even noise from the current road creates many of problems for his family. By his words, he and his family often feel headache, and discomfort due to traffic noise. He was concerned by the anticipated increase of the level of noise after widening of the road and increase the traffic.

464. It was answered that this issues requires further investigation. In the case if the level of predicted noise will increase the valid Tajik standards values for allowed level of noise in residential areas the noise reducing barriers may be designed if possible and necessary.

465. On the whole people living along the road expressed the support to the Project.

466. The following consultations has been conducetd (Table 22). MoM of the consultations are attached.

Tab. 55 Consultations with Communities

No	Date	Location (Jamoat/Rayon)	No of participants		
			Males	Females	Total
1	07.03.2017	Khurason Rayon, Obikiik Jamoat, Village: I. Somoni	33 men	14	47
2	09.03.2017	Galaobod Jamoat, Village: Chashmasor	9		9
3	10.03.2017	Hiloli Jamoat, Village: Mehnat	13	1	14
4	13.03.2017	Ayni Jamoat, Village: Chorbog/Khurason	52	13	65
5	14.03.2017	Kizil-Kala Jamoat, Village: Bandar	59		59
6	15.03.2017	Village Chahiho	16	1	17
Total			**182**	**29**	**21198**

B Information Disclosure

467. MOT will make the environmental assessment and other environment-related documents available in accordance with Tajikistan's and ADB requirements for disclosure. Timing for disclosure is scheduled immediately after obtaining of the SEE (State Ecological Expertise) m which is the clearance (environmental permit) from the State Agency of Environmental Protection.

468. After finalization the IEE report documenting the mitigation measures and consultation process will be submitted to MoT and ADB and will be disclosed on ADB and MOT websites.

C. Grievance Redress Mechanism

1 Objectives

469. The scope of the GRM addresses issues related to involuntary resettlement, social and environmental performance, and information disclosure.

470. The LARP includes in its scope the establishment of a responsive, readily accessible and culturally appropriate grievance redress mechanism (GRM) capable of receiving and facilitating the resolution of affected persons' concerns and grievances related to the project. There is one GRM which applies to social, resettlement and environmental concerns of project affected people and stakeholders. The GRM is a formalized way for the PIURR to identify and resolve concerns regarding environmental and social issues including DPs' grievances. It offers stakeholders and DPs a forum to voice their concerns, seek clarifications to their queries, or register complaints related to the Project's performance.

471. Any stakeholders and the DPs will have the right to file complaints and/or queries on any aspect of the Project, including environment, land acquisition and resettlement. Under the adopted grievance mechanism, the DPs may appeal any decision, practice or

activity related to the Project. All possible avenues will be made available to the DPs to voice their grievances. The PIURR will ensure that grievances and complaints on any aspect of the project are addressed in a timely and effective manner.

472. The fundamental objectives of the Grievance Redress Mechanism are:

- To reach mutually agreed solutions satisfactory to both, the Project and the DPs, and to resolve any grievances locally, in consultation with the aggrieved party;
- To facilitate the smooth implementation of the LARP, particularly to cut down on lengthy litigation processes and prevent delays in Project implementation;
- To facilitate the development process at the local level, while maintaining transparency as well as to establish accountability to the affected people.
- To consider raised concerns and complaints on environmental issues as far as it is technically feasible;

473. The MOT issued a letter No 516 on 20 May, 2016, requiring the establishment and development of the GRM at the jamoat (sub-district) level. (Annex 5-1 in the LARP document) The Grievance Redress Committees (GRC) are established at the jamoats at each Project district and the PIURR levels. The GRCs include the following institutions and their representatives:

- Rayon jamoat's chairman or person authorized by jamoat (raisi mahala);
- Land planning engineer
- The jamoat chairman (focal point to accept and register grievances);
- Rayon's State Committee on Land Use and Geodesy;
- Rayon's architecture department;
- State executive authority/ deputy head of district.

474. All grievances related to the Project will be addressed with the participation of the PIURR, Consultant and Contractor’s representatives. In more complex cases, representatives of other authorized institutions will be invited. The GRM covers issues related to social, environmental and other safeguard issues under the ADB SPS 2009 and applicable laws of Tajikistan.

475. The PIURR members of the GRCs include:

- Chief Engineer
- Social safeguard specialist
- Environmental safeguard specialist
- MoT lawyer
- Other specialists as necessary

476. There are five Grievance Redress Committees at the jamoat level - one in each Project jamoat and one at the central level. A Focal Person (FP) is appointed at each Project jamoat and at the PIURR. The PIURR FPs participated in all consultations with communities and shared their contact details with participants for questions related to the

Project and in the event of grievances for the entire duration of the Project, including the preparation and implementation of the LARP.

477. The GRCs will function for the duration of the project implementation. The PIURR and the PPTA Consultant conducted training for members of five GRC at the jamoat's level. (Annex 5-2 in the LARP document).

2 Grievance Resolution Process

478. Grievances can be lodged with the Focal Person at the jamoat's GRC. The jamoat's FP, in consultations with the PIURR safeguard specialist, will screen the grievance for eligibility. If eligible, the jamoat's FP will organize a meeting of the Grievance Redress Committee (GRC). The PIURR representatives will be informed and invited to the meeting.

479. The complaint registered with the GRM should be reviewed, addressed and a decision made on its relevancy to the Project within 14 calendar days of lodgment. If the case is complex or requires more detailed investigation (e.g. inspection by technical experts or legal opinion from the state or certified private entities) the complaint review period may be extended to 30 calendar days or more, if necessary. In such cases, written notification should be sent to the complainant explaining the reasons for extension, describing the process and indicating the expected dates for the delivery of the results of the revision.

480. All supporting documents such as, photographs, related certificates and legal and technical expert opinions, if required, should be prepared, reviewed and assessed. Once the complaint is resolved, the GRC will organize a complaint closure meeting, where the complainant confirms the closure of the complaint. The PIURR representative will oversee the resolution of the complaint.

481. If the complaint is found to be invalid, the GRC formulates a response and sends a written letter to the complainant, explaining the reasons for the rejection. The complainant may lodge the case in the local court or at the ADB Accountability Mechanism at any time of the grievance process. The GRM at the Project level does not impede the access of DPs to the ADB Accountability Mechanism (AM) or to the country's judicial or administrative remedies. All complaints and resolutions will be properly documented by the PIURR and made available for review, monitoring and evaluation purposes.

482. If DPs want to register a complaint with the ADB AM, the Focal Person will provide the complainants the following contact information:

- National Social Safeguards Focal Point
- Resident Mission of Asian Development Bank in Republic of Tajikistan
- 45 Sovetskaya Street, Dushanbe. Tajikistan
- Tel: 992 372 210558
- and/or

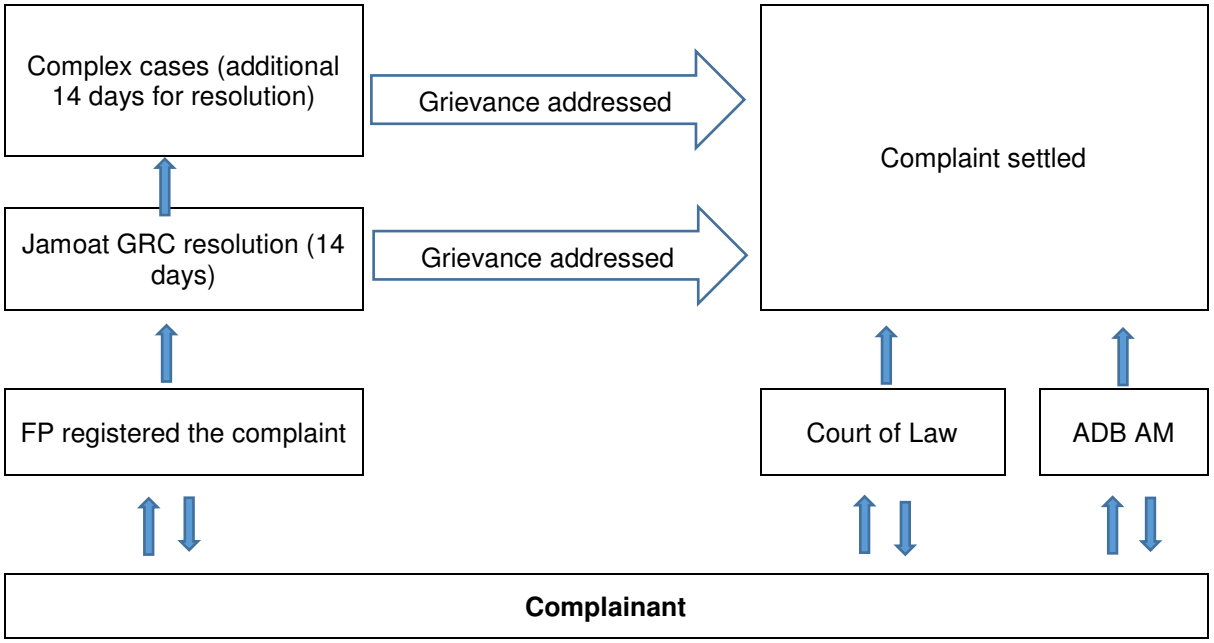
- Special Project Facilitator Asian Development Bank
- Email: to be access from www.adb.org/site/accountability-mechanism/contacts
- Fax number: (63-2) 636-2490

483. When the grievance is forwarded to ADB (TJRM), ADB will contact PIU/MoT to review the case and suggest the resolution at the project level. In case of complex issues and not reaching an agreement, the case will be logged to the AM of ADB. All reports on the GRM decisions and evidences will be included.

484. All efforts will be made to settle issues at the Project level. All complaints and resolutions will be properly documented by the PIURR and made available for review, monitoring and evaluation purposes. PIU safeguard specialist keeps regular contact and will have a database for the whole project grievances cases including status of grievances. This report will be regularly included in monthly project progress reports.

485. The grievance redress process is shown in the Figure below.

Fig. 39: Grievance Redress Process



486. GRM proceedings may need one or more meetings for each complaint and may require field investigations by specific technical or valuation experts. Grievance cases shared by more than one complainant may be held together as a single case.

487. For appeals lodged directly to the MoT, the FP at PIURR will review the case together with the respective GRC at jamoat level and attempt to find a resolution together with the aggrieved person.

488. At each level of appeal, the GRC will be assisted, as required, by the professional capacity needed to solve specific cases. This may include among others:

- Jamoat and/or hukumat representatives
- Rayon land committee
- Representatives of the State Agency for Architecture
- The State Committee for Land Management and Geodesy (SCLMG)Ministry of Architecture
- State Agency for Environment and Forestry
- State Unitary Enterprise for Housing and Communal Services
- Technical expertise from professional engineers
- Other specialized organizations as necessary

3 Duties of GRC Members

Focal Point (FP)

489. Once the FP receives a written notification of a complaint s/he will:

- Based on the simple screening procedure, asses the grievance and determine if the grievance is eligible for the GRM; if eligible, register the grievance in the complaints logbook;
- Wright a grievance summary to be signed by the complainant and the FP indicating name of the complainant, date and place of presentation of complaint, description of complaint and supporting documents, if any;
- Send the complaint summary to all members of the local level GRC;
- Convey requests and enquiries of the complainants to PIURR/MOT and to the other members of the GRC at the local level;
- Organize a grievance redress meeting;
- Maintain records of each meeting and each communication between the FP/GRC and the complainants;
- Participate at appeal cases at all levels;
- Ensure the administrative and organizational support for GRC members.

Supervision Consultant Resettlement Specialist

490. Once notified of a complaint and invited the FP to a grievance meeting the Consultant will:

- Participate to all grievance meetings, provide opinions and analysis;
- Accompany eventual assessment/valuation specialists in the field,
- Provide other GRC members as relevant with opinion and suggestion for resolution to be reflected in the final meeting report.

GRC Chairperson / Head/Deputy of PIURR of MoT

491. Once notified that a complainant has lodged an appeal case at the central level, the GRC chairperson will:

- Review the local level GRC decision;
- Invite the GRC members to the meeting;

- Chair the GRC meetings and ensure that the minutes of the meeting are taken and shared with all relevant parties;
- Inform the aggrieved person of the GRC's decision;
- Ensure the administrative and organizational support for GRC members to work;
- Support the decision made by the GRC and follow up to ensure action is taken.

PIURR Project Coordinator

492. Once notified that a complainant has lodged an appeal case at central level project coordinator will:

- Participate in all grievance redress meetings at jamoat and central level, provide opinions and analysis;
- Ensure that records at jamoat GRC are maintained;
- Request additional assessment/valuation specialists' opinions and accompany them in the field if needed;
- Request that the chairperson organizes meetings, as necessary;
- Ensure a proper PIURR Complaint Register is maintained.

Representatives of the PIURR Safeguards Unit

493. Once notified that a complainant has lodged at the central level, the representatives of the PIURR safeguard and technical unit will:

- Participate in GRC meetings at local and central level;
- Prepare the chronology of events to understand the sequence of developments prompting the complaint;
- Provide opinion on resettlement impacts claimed by the claimant;
- Request that the chairperson organizes meetings, as necessary;
- Maintain communication between the GRC and the complainants.

Technical Experts

494. When requested by the PIURR to provide a technical expertise for the assessment of an impact claimed by the complainant, the relevant expert will:

- Examine the case, perform relevant tests or an investigation;
- Prepare a short report based on the results of the examination completed;
- Recommend if further or additional legal opinion or expertise is needed to make a judgment on the substance of the case.

4 GRC Complaint Register, Records and Documentation

495. The PIURR of the MoT will maintain the complaint register. This will include a record of all complaints for regular monitoring of grievances and results of services performed by the GRCs for periodic review by the ADB. A sample of the GRC Grievance Registration Form can be found in Annex 5-2.

D. Implementation Arrangements

496. The overall responsibility for implementation of the Project lies at the GoT. The relevant organizational entity for the project implementation is the Execute Agency of the PIU which is part of the MoT.

497. MoF (Ministry of Finance) is the responsible government body for coordination with ADB and other donors for foreign assistance.

498. Environmental permitting and monitoring of Project implementation is within the responsibility of the State Ecological Review Committee and its regional offices. Furthermore, according to the 2012 Law on State Ecological Expertise, all civil works, including rehabilitation ones, should be assessed for their environmental impacts and the proposed mitigation measures should be reviewed and monitored by the CEP (Committee for Environmental Protection under the Government of Tajikistan).

499. Responsibilities for the implementation of the environmental mitigation measures and monitoring measures during construction phase will be taken over by the Supervision Consultant who will report to the PIU on a regular basis.

500. The tender and contract documents will clearly set out the contractor's obligations to undertake environmental mitigation measures set out in the Environmental Management Plan.

501. PIU will monitor and measure the progress of implementation of the EMP. In this regard semiannual monitoring reports during construction stage will be prepared by the Construction Supervision Consultant and submitted to within 1 month after the reporting period.

XI. CONCLUSION

502. The IEE has been prepared for the Phase 2 (48+620 km) of 82 km long road section from Dushanbe to Kurgonteppa. The road forms part of CAREC (Central Asia Regional Economic Cooperation) corridors 2, 5 and 6.

503. The 82 km long road section was divided into two phases according to priority. The Phase 1 covers 33.2 km of road section from Dushanbe to the village Chashmasoron. The Phase 2 covers the remaining road section until Kurgonteppa.

504. IEE is required for category B Projects in order to warrant compliance of the Project with the ADB Safeguard Policy Statement (June 2009). As such the IEE provides a road map to the environmental measures needed to prevent and/or mitigate negative environmental effects associated with the development project. The IEE also provides a detailed description of the direct and indirect environmental effects associated with the Project during key periods of work, namely the design, construction and operational phase.

505. Based on the IEE Environmental impacts of the Dushanbe – Kurgonteppa road rehabilitation are evaluated as medium. This is because there will be widening of cross section required over nearly the whole Project length which will result in significant social and environmental interferences during pre-construction and construction stage. After Project implementation, during operational stage, there will be however only very low remaining impacts, mainly because the reconstruction follows the existing alignment and no valuable or protected natural habitats or other valuable environmental structures are significantly impacted after finalization of construction period, neither in their structure nor function.