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International

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) FOR SISIAN-KAJARAN (NORTH-SOUTH CORRIDOR) ROAD PROJECT, ARMENIA

Volume 6. Environmental and Social Management Plan (ESMP)



Source: projections of the proposed road collated from the '3D description of the Sisian-Kajaran Road', Armenian Road Department, 2022
[<https://www.youtube.com/watch?v=fu-dgAwjSsU>]

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**ENVIRONMENTAL AND SOCIAL IMPACT
ASSESSMENT (ESIA)
FOR SISIAN-KAJARAN
(NORTH-SOUTH CORRIDOR)
ROAD PROJECT,
ARMENIA**

**Volume 6. Environmental and Social
Management Plan (ESMP)**

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Prepared for:

**The "Road Department" Fund under the Ministry of Territorial Administration
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LIST OF ABBREVIATIONS

AASHTO	The American Association of State Highway and Transportation Officials
ADB	Asian Development Bank
BAP	Biodiversity Action Plan
EBRD	European Bank for Reconstruction and Development
EHS	Environmental, Occupational Health and Safety
EIA	Environmental Impact Assessment
EIB	European Investment Bank
E&S	Environmental and social
ESAP	Environmental and Social Action Plan
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESMS	Environmental and Social Management System
ESS	Environmental and Social Standards (of the EIB)
ICH	Intangible cultural heritage
ISO	International Organisation for Standardisation
NSRC	North-South Road Corridor
NTS	Non-technical Summary
OHS	Occupational Health and Safety
PR	Performance Requirement (of the EBRD)
RA	Republic of Armenia
RD	Road Department Fund
SDA	Spoil disposal area
SEP	Stakeholder Engagement Plan
S-K	Sisian-Kajaran (Road)

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PREAMBLE

This document is the **Environmental and Social Management Plan (ESMP)** for the proposed greenfield Armenian Sisian-Kajaran (S-K) Road section (the Project) of the North-South Road Corridor (NSRC). It forms **Volume 6** of the Environmental and Social Impact Assessment Report (ESIA) for the Project.

The ESIA Report consists of several volumes with related annexes, as follows:

- Volume 1 – Project Definition including Project introduction, context and rationale, project description, alternatives, legal framework, and ESIA methodology (this Report).
- Volume 2 – Biodiversity including baseline analysis, risk/impact assessment (including critical habitat assessment and appropriate assessment) and mitigation.
- Volume 3 – Physical Environment including baseline analysis, risk/impact assessment and mitigation in relation to air quality and climate, noise and vibration, landscape, etc.
- Volume 4 – Social Environment including socio-economic, gender and cultural heritage baseline analysis, risk/impact assessment and mitigation, as well as stakeholder engagement.
- Volume 5 – Cumulative Impact Assessment.
- **Volume 6 – Environmental and Social Management Plan (ESMP) (this Report).**
- Volume 7 – Conclusions and Recommendations.

This ESIA is subject to public disclosure for a minimum period of 120 days according to the international Lenders' requirements. In addition to the ESIA report, the ESIA disclosure package includes:

- Non-technical Summary (NTS) which is a concise and over-arching document summarising the results of the ESIA in non-technical language.
- Stakeholder Engagement Plan (SEP) that guides information disclosure and meaningful engagement with Project stakeholders, as well as a grievance mechanism.
- Resettlement Framework that guides issues related to Project-induced physical and economic displacement, land acquisition, compensation and livelihood restoration.
- Biodiversity Action Plan (BAP) that articulates actions that can help ensure the conservation or enhancement of potentially affected habitats and species considered to be of conservation value.
- Environmental and Social Action Plan (ESAP) that contains specific actions required to be completed to ensure Project compliance with the international Lenders' requirements.

All maps and charts in this Volume are prepared by the Consultant unless indicated otherwise.

1 PURPOSE AND SCOPE

The purpose of this ESMP is to:

- Provide an overview of the environmental and social (E&S) Policy and legislative framework applicable to the Project.
- Ensure that the requirements of relevant Lenders' E&S Policies are met.
- Outline the organisational structure, and key roles and responsibilities associated with E&S management.
- Document how the E&S risks and impacts identified through the EIA and ESIA processes will be managed. Management implies avoiding or limiting the adverse impacts as well as maximising the positive impacts (benefits) of the Project.
- Define E&S monitoring and reporting requirements.

The scope of this ESMP includes both the construction and operations phases of the Project. The Plan will therefore apply to all Contractors and sub-contractors and the Road Department Fund (RD) involved in the construction, operation, and maintenance of all Project components, including:

- The road itself including cuts, embankments, retaining walls, culverts, etc.
- Tunnels.
- Bridges.
- Quarries.
- Asphalt plant.
- Concrete batching plant.
- Construction camp(s).
- Contractor lay down areas.

The development of this ESMP is aligned with the requirements of ISO 14001:2015, the International Organisation for Standardisation's (ISO) specification for environmental management systems. ISO14001 is an internationally recognised standard for managing environmental responsibilities in a systematic manner to achieve good environmental performance. As such, this ESMP aims to achieve a management approach that is robust, effective and adaptable and reflects the following components of the management systems' standard, as illustrated schematically in **Figure 1**:

1. Environmental and Social Policy,
2. Planning,
3. Implementation and Operation,
4. Checking and Corrective Action, and
5. Management Review.

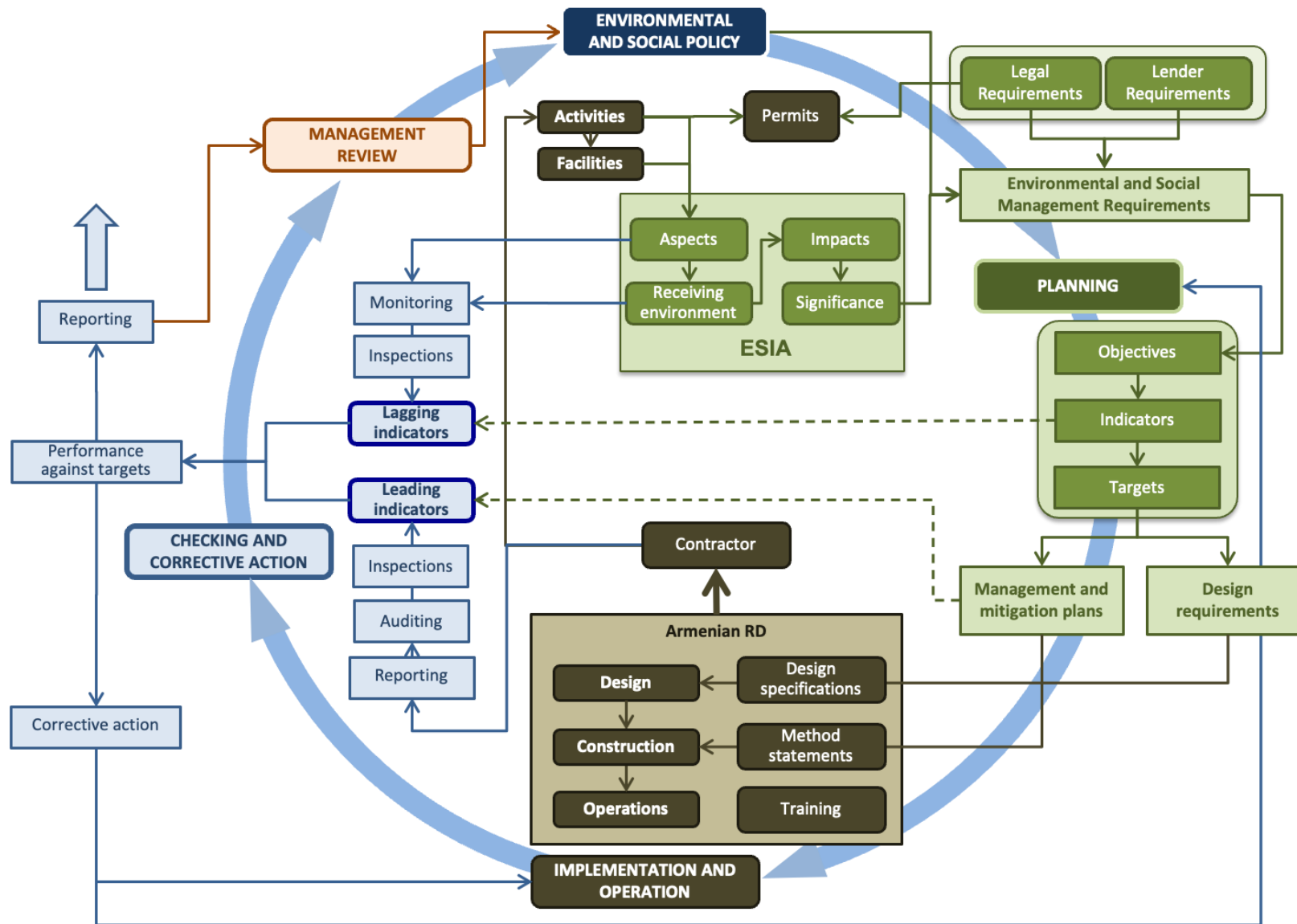


Figure 1. Schematic illustration of the E&S management approach for the Sisian-Kajaran Road Project

2 PROJECT DESCRIPTION

The Sisian-Kajaran Road Project, in the Republic of Armenia (the RA), comprises the construction of a new, single carriageway road, approximately 60 km in length with a design speed of 100 km/h, and incorporating three main interchanges (to connect the northern and southern most ends of the new road with the existing M2 and to connect the new road with existing roads around the Shamb reservoir), 27 bridges (between 60 m and 560 m in length crossing rivers and valleys) and 9 tunnels including the 8,600 m long Bargushat Tunnel. The nominal road width is approximately 16m.

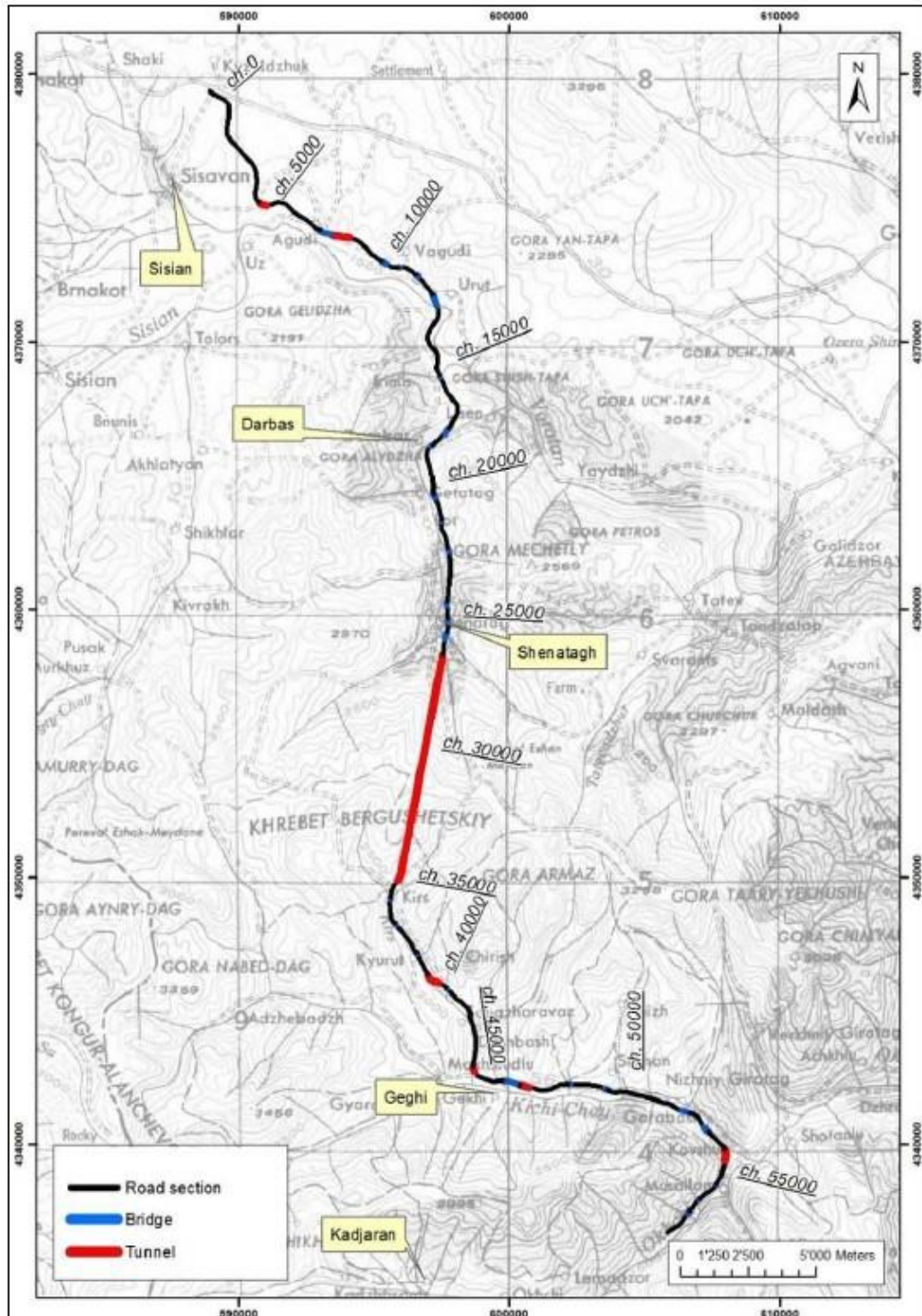
The new road is intended to provide an alternative route between Sisian and Kajaran as part of Armenia’s North South Road Corridor, which is critical to enabling in-country connectivity and boosting socio-economic development. The Project offers a replacement for the two existing route options; the M2 Goris-Kapan Road that cannot be used by vehicles with Armenian registration plates and the H-45 road via Tatev, that features steep gradients, tight bends and is overloaded with heavy goods vehicles for which it was not designed. The new road will provide a more direct route between Sisian and Kajaran and will adhere to international road safety standards. The Project location is presented in **Figure 2** and a more detailed overview of the Project route is shown in **Figure 3** below.



Figure 2. Location of the Project

The 2019 design of the Project also includes 5 cattle crossing underpasses and 4 underpasses to allow for the passage of agricultural vehicles. Drains and culverts will be sized for future possible storm events intended to prevent the road from flooding. The road will have an asphalt

surface complying with Armenian, AASHTO¹ and Euro Standards. Service (secondary) roads will be built to connect to existing roads.



Source: Section Sisian-Kajaran, Detailed Design, General Report, April 2019

Figure 3. Route of the Proposed Sisian-Kajaran Road

¹ The American Association of State Highway and Transportation Officials.

3 ROLES AND RESPONSIBILITIES

3.1 Road Department Fund

The RD is the executing agency with overall accountability for the Project and implementation of this ESMP. The RD is responsible for ensuring compliance with all Armenian E&S legal requirements and that commitments made in the ESIA Report are met. Whilst many of the requirements of the ESMP will need to be fulfilled by the construction Contractor (and sub-contractors), the RD will retain overall accountability for the E&S performance of the Project. The RD also has responsibility for the development of the Stakeholder Engagement Plan, Biodiversity Action Plan, Cultural Heritage Management Plan and Resettlement Action Plan, and required Operations Phase E&S Management Plans.

The RD has a Social and Environment Impacts Management Office (within the Projects Management and Procurement Department). This comprises both a Social Impacts and Resettlement Management Unit, including the Head of the Social Department and two Social Specialists, and an Environmental Impacts Management Unit, including two specialists responsible for supervising the fulfilment of Project obligations relating to ESHS matters.

3.2 Supervision Engineer

The Supervision Engineer will be appointed by the RD to oversee Project implementation during the Construction phase and ensure compliance with the requirements of the ESMP and other Project Construction E&S Management Plans and Procedures. This includes developing and implementing a monitoring programme, record keeping and reporting to the RD in relation to Contractor E&S performance, including non-compliances observed and the respective corrective actions with specified timelines roles and responsibilities. The Supervision Engineer will provide capacity building activities for the Contractor's E&S team as needed.

The Supervision Engineer will be required to appoint suitably qualified and experienced ESHS individuals into the following specific Roles:

- International Occupational Health and Safety Specialist,
- International Environmental Specialist,
- Local Occupational and Community Health and Safety Specialist,
- Local Environmental Specialist,
- Local Social (including Gender) and Resettlement Specialist,
- Local Archaeologist [referred in the ESIA as 'Cultural Heritage Monitor'²],
- Biodiversity Specialist with international experience / experience with lender requirements.

3.3 Construction Contractor

The Construction Contractor (selected through a RD tendering process) has overall accountability for the construction of the Project. The Contractor must fully comply with the requirements of this ESMP and RD Management Plans. This will include developing the Construction Phase E&S Management Plans outlined in **Section 4.2.4** and ensuring that all

² Cultural Heritage Monitor in the Supervision Engineer's team will be responsible for monitoring and oversight of the implementation of the Cultural Heritage Management plan by the Contractor's Cultural Heritage staff/subcontractor and will ensure independence and objectivity of reporting on cultural heritage issues.



E&S management and mitigation measures specified in those Plans are effectively implemented during construction activities. The Contractor is responsible for ensuring that all sub-contractors also comply with the requirements of all Project E&S Management Plans and Procedures.

The Construction Contractor will be required to appoint suitably qualified and experienced individuals into the following specific ESHS Roles:

- Project Manager,
- Environmental Specialist,
- Occupational and Community Health and Safety Specialist(s),
- Social Safeguards and Resettlement Specialist,
- Cultural Heritage Expert³,
- Biodiversity Specialist with international experience / experience with lender requirements.

3.4 Lenders

The Project Lenders (EBRD - European Bank for Reconstruction and Development, EIB - European Investment Bank, and ADB - Asian Development Bank) will monitor the E&S performance of the Project to ensure compliance with the requirements of their respective E&S Policies.

3.5 PIU Consultant

The PIU Consultant will, *inter alia*: assist the RD in implementing measures required in the ESMP and ESAP, provide training, as appropriate, to increase E&S management capacity of the RD and its contractors engaged in the Project implementation, review of the site-specific ESMPs, assist the RD in developing and integrating the policies, plans, procedures, actions, and mitigation measures required under the ESAP, Resettlement Plan, SEP, BAP, CHMP and other MPs into the Project overall management system and budget approval procedures, as appropriate.

4 THE ENVIRONMENTAL AND SOCIAL MANAGEMENT APPROACH

4.1 Environmental and Social Policy

4.1.1 Road Department's Environmental and Social Policy

Currently the RD has no E&S Policy and no ESMS at the organisational level⁴. In implementing Lender-funded projects, the RD relies on the project-specific E&S management frameworks and systems developed and implemented by their contractors (including Construction Contractors and Maintenance Contractors).

³ This staff's tasks include training / induction for workers, reporting requirements; maintaining logs of chance finds, etc.

⁴ On its website, the RD refers to ADB's safeguard policies <https://armroad.am/en/safeguard/social-impact-and-resettlement/guidelines>.

4.1.2 Project Environmental and Social Policy

In implementing the Sisian-Kajaran Road Project, the Road Department commits to the following:

- A focus not just on technical elements but also the E&S sustainability of the activities required for the project and the area in which the project will unfold;
- Ensuring that activities required for the project will not result in degradation of the environment or negative impacts on people who may be directly affected by the roadway project, most especially the poor and the vulnerable, by ensuring that such communities are protected from potentially negative impacts arising from the project;
- Seeking to maximise the human development impact of the project with a special focus on empowering women, by maximising the employment of local people who live on either side of the roadway;
- Recognising the importance of low carbon activities and the promotion of clean energy;
- Seeing active stakeholder engagement as a crucial tool for understanding how to prevent adverse effects and enhance the benefits associated with project activities. Also believing in the rights of people to be properly informed as to the nature of project activities;
- Dedicating resources (E&S staff) and budget to implement the ESMS and ESMP effectively;
- Communicating the policy to all levels of its organization;
- Ensuring good governance internally, and across all contractors and sub-contractors.

The Road Department will align with the requirements of the Lenders and to that end commit to:

- Ascertaining the E&S risks that may be associated with project activities;
- Developing apposite mitigation for all potential impacts and effectively implementing the same;
- Developing and implementing objectives, indicators and targets that will serve to frame and guide E&S management activities and associated performance;
- Minimising water and energy use and maximising the efficiency of that use;
- Preventing pollution and minimising waste;
- Ensuring the safe disposal of waste that cannot otherwise be reused or recycled;
- Maintaining an effective and efficient reporting regime of E&S management performance;
- Commit to comply with applicable laws, regulations, and Lenders' E&S requirements.

4.2 Planning

4.2.1 Legislative and Policy Framework

The Project is committed to meeting the requirements of:

- Applicable national E&S laws and regulations.
- Applicable international conventions ratified by Armenia.
- Applicable EU legislation.

Table 1 outlines the RA legislative framework for the Project and the applicability of each of the relevant Law and Code.

Table 1. Applicable Armenian Legislative Requirements

Legal act	Applicability
<i>Law on Environmental Impact Assessment and Expert Examination (2014)</i>	Outlines the types of activities, according to their expected environmental impacts, that must undergo Environmental Impact Assessment and expert examination.
<i>Water Code (2002)</i>	Provides the legal basis for the protection of water resources, provision of water for people and economic sectors through effective management of water resources and for ensuring the protection of water resources for future generations.
<i>Land Code (2001)</i>	Defines the key provisions for land-use in Armenia. Also specifies soil preservation principles, objectives and regulations.
<i>Law on surveillance over the land use and land conservation (2008)</i>	Provides objectives and types of effective use and conservation of RA lands, inspection related to enforcement of land legislation and institutions, procedures of control, rights and responsibilities of entities controlling land use and protection. The Law applies to all lands of the RA Land Fund, irrespective of purpose, ownership and/or right to use.
<i>Law on Waste (2004)</i>	Provides the legal basis for the collection, transportation, disposal, treatment and re-use of wastes. Defines the roles and responsibilities of state authorities as well as of waste generator organizations in waste management activities.
<i>Law on alienation of property for overriding interests of the public (2006)</i>	Defines procedures for determining the overriding public interest, for alienating property in order to ensure public interest and for compensation for the alienated property.
<i>Law on Atmospheric Air Protection (1994)</i>	Regulates emission permits and provides permissible limits/concentrations for atmospheric air emissions.
<i>Law on Flora (1999) and Law on Fauna (2010)</i>	Outline Armenia's policies for the conservation, protection, use, regeneration and management of natural populations of plants and animals, as well as the impact of human activities on biodiversity. These laws are aimed at the sustainable preservation and use of flora/fauna and the conservation of biodiversity. The laws also contain provisions for assessing and monitoring flora and fauna, especially rare and threatened species.
<i>Law on Special Protected Areas of Nature (2006)</i>	Regulates special protected areas of the RA and eco-systems that have environmental, economic, social, scientific, educational, historical, cultural, healthcare and recreation value. It also outlines the legal basis for state policies regarding sustainable development, restoration, protection, reproduction and use of natural objects and complexes.
<i>Law on Protection and Use of Immovable Cultural and Historic Monuments and Historic Environment (1998)</i>	Provides the legal and policy basis for the protection and use of such monuments in Armenia. Article 15 of the Law describes the procedures for discovering and registering monuments, establishing protection zones around them and creating historical and cultural reserves. Article 22 stipulates that land plots located in historically sensitive areas can be allocated for construction, agricultural and other activities only upon approval of the authorized state body (Department of Historic and Cultural Monuments Preservation). The Law also sets the roles and responsibilities of State bodies engaged in management of cultural and historic monuments through the Procedure for State registration, study, conservation, strengthen, repair, reconstruction and use of immovable historic and cultural monuments.
<i>Law on Intangible Cultural Heritage (2009)</i>	Regulates the legal relations arising from the processes of preservation, safeguarding, and development of intangible cultural heritage, including identification, documentation, research, application, recreation, teaching, and dissemination of intangible cultural values, protection of the property rights over such values, maintenance of intangible cultural heritage of Armenia, international cultural cooperation, cultural communication between peoples of foreign countries and those of the RA.

Legal act	Applicability
Code on Subsoil Resources (2011)⁵	Contains the main provisions for the use and protection of mineral resources and underground water, including the establishment of sanitary protection zones for underground water resources.
Law on Road Safety Provision (2005)	Regulates road safety, establishes the principles and directions of Armenia's policy on traffic safety, the legal basis for traffic safety provisions, as well as defining the powers and responsibilities of State and local self-governmental bodies and other traffic related participants.
Forest Code (2005)	Regulates the sustainable management of forests: guarding, preserving, rehabilitation, afforestation and rational use of forests and forest lands in Armenia as well as with forest stock-taking, monitoring and control
Law on Environmental Oversight (2005)	Regulates the organization and enforcement of the oversight of national environmental legislation and defines the legal and economic basis underlying the specifics of oversight for the fulfilment of environmental requirements and relations between parties.
Law on Sanitary and Epidemiologic Security of Population (1992)	Defines the legal, economic and organizational basis for insuring sanitary and epidemiological security of the RA population, as well as state guarantees, eliminating adverse impact of the harmful working conditions on human health, and providing for favourable conditions for human life and vital activities for future generations.
Labour Code (2004)	Regulates collective and individual employment relationships; defines the basis for the establishment, revision and cessation of that relationship, defines conditions for occupational health and safety (OHS). Recognizes workers' rights to form and to join workers' organizations of their choice, contains provisions for enabling collective bargaining, and prohibits any type of forced labour.
Law on Fire Safety (2001)	Regulates the relations of the state bodies and local self-governing bodies of Armenia, organizations/companies and people in fire safety. The Law is supplemented by the Fire Safety Rules (Order No.595-N of the RA Minister of Territorial Administration and Emergency Situations (2015).

Table 2 outlines the International Conventions and Protocols that are ratified by RA and applicable to the Project.

Table 2. Applicable International E&S Conventions and Agreements

International Convention or Protocol	Description
Convention on Wetlands of International Importance - (Ramsar 1971)	The Ramsar Convention is an intergovernmental treaty to maintain the ecological character and plan the sustainable use of Wetlands of International Importance. The Convention entered into force in Armenia in 1993.
Paris Convention for the Protection of the World Cultural and Natural Heritage (1972)	The Convention establishes the need to preserve natural and cultural heritage and the balance between the two. Armenia became a State party in 1993.
The Convention on the Conservation of Migratory Species of Wild Animals (1979) (Bonn Convention)	The objective of the Bonn Convention, which was adopted in 1979, is to ensure the conservation of land, marine and air migratory species over the whole of their area of distribution. Armenia is a State party since 2011
Convention on International Trade in Endangered Species (CITES) (1973)	This convention is designed to ensure that international trade in animals and plants does not threaten their survival in the wild. Armenia joined this convention in 2008.
Convention on the Conservation of European	The Bern Convention is a binding international legal instrument in the field of nature conservation, covering most of the natural heritage of the European continent and

⁵<https://www.arlis.am/documentview.aspx?docid=146898> <https://www.arlis.am/documentview.aspx?docid=146898>

International Convention or Protocol	Description
Wildlife and Natural Habitats, Bern (1979)	extending to some States of Africa. Ratified by Armenia in 2008.
The Convention on Biological Diversity (1992)	The three main objectives of the Convention are: the conservation of biological diversity; the sustainable use of the components of biological diversity; and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources. Signed by Armenia in 1993.
European Landscape Convention, Florence (2000)	The European Landscape Convention of the Council of Europe promotes the protection, management and planning of the landscapes and organises international co-operation on landscape issues. Ratified by Armenia in 2004.
United Nation Framework Convention on Climate Change (1992)	The UNFCCC is one of the "Rio Conventions" adopted at the Rio Earth Summit in 1992. The principal objective is to prevent "dangerous" human interference with the climate system. The UNFCCC entered into force in March 1994 and the first Conference of the Parties of the Convention took place in Berlin, 1995. Armenia became a state party in 2002.
Paris Agreement under the United Nations Framework Convention on Climate Change	The aim of the agreement is to decrease global warming through: (a) Holding the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change; (b) Increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low greenhouse gas emissions development, in a manner that does not threaten food production; (c) Making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development. Ratified by Armenia in 2017.
UN Convention to Combat Desertification, Paris (1994)	This Convention is the sole legally binding international agreement linking environment and development to sustainable land management. The Convention addresses specifically the arid, semi-arid and dry sub-humid areas, known as the drylands, where some of the most vulnerable ecosystems and peoples can be found. Ratified by Armenia in 1997.
UNESCO Convention for the Safeguarding of the Intangible Cultural Heritage (2003)	The purposes of this Convention are: (a) to safeguard the intangible cultural heritage; (b) to ensure respect for the intangible cultural heritage of the communities, groups and individuals concerned; (c) to raise awareness at the local, national and international levels of the importance of the intangible cultural heritage, and of ensuring mutual appreciation thereof; (d) to provide for international cooperation and assistance. Ratified by Armenia in 2006.
Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (1998)	The Aarhus Convention is a multilateral environmental agreement through which the opportunities for citizens to access environmental information are increased and transparent and reliable regulation procedure is secured. Armenia became a State-party in 2001.
International Labor Organization (ILO) Conventions	Armenia has ratified 29 ILO conventions including the following fundamental ones: <ul style="list-style-type: none"> • Forced Labour Convention, 1930 (Ratified 17.12.2004), • Freedom of Association and Protection of the Right to Organize Convention, 1948 (Ratified 02.01.2006), • Right to Organize and Collective Bargaining Convention, 1949 (Ratified 12.11.2003), • Equal Remuneration Convention, 1951 (Ratified 29.07.1994), • Abolition of Forced Labour Convention, 1957 (Ratified 17.12.2004) • Discrimination (Employment and Occupation) Convention, 1958 (Ratified 29.07.1994), • Minimum Age Convention, 1973 (Ratified 27.01.2006), • Worst Forms of Child Labour Convention, 1999 (Ratified 02.01.2006).

The **European Union (EU) legislation** that is applicable to the Project includes the following Directives:

- Directive 2010/75/EU on Industrial Emissions (integrated pollution prevention and control).

- EU Directive 2019/1936 of the European Parliament and of the Council of 23 October 2019 amending Directive 2008/96/EC on Road Infrastructure Safety Management.
- Directive 2004/54/EC Minimum Safety Requirements for Tunnels in the Trans European Network.
- Directive 2011/92/EU, as amended by Directive 2014/52/EU on the assessment of the effects of certain public and private projects on the environment.
- EU Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora.
- Directive 2008/98/EC on waste and repealing certain Directives.
- EU Water Framework Directive (2000/60/EC).
- Council Directive 2009/147/EC on the conservation of wild birds.

4.2.2 Lenders' Policy Requirements

The Project is also committed to complying with the following Lenders' Policies:

- European Bank for Reconstruction and Development (EBRD) Environmental and Social Policy (2019), including Performance Requirements (PRs) 1-6, 8 and 10.
- European Investment Bank (EIB) Environmental and Social Policy (2022), including Environmental and Social Standards (ESSs) 1-10.
- Asia Development Bank (ADB) Safeguard Policy Statement (2009), including Safeguard Requirements 1 and 2.

4.2.3 Project E&S Management Requirements

4.2.3.1 Project Adopted Environmental Limit Values

Table 3 outlines the limit values for environmental parameters that should not be exceeded as a result of construction or operations activities. In accordance with Lenders' Policies, these are based on the most stringent of relevant national or EU legislation. The Contractor / RD should conduct environmental monitoring to verify that these limit values are not being exceeded as a result of construction activities or the operation of the road, and review whether additional mitigation measures or controls are required in the event of any breaches.

Table 3. Environmental Limit Values Adopted by the Project

Category	Project Adopted Standard	Parameter	Limit Value
Air Emissions	WHO Air Quality Guidelines (2021)	PM2.5	15 µg/m ³ - 24 hour average value
		PM10	45 µg/m ³ - 24 hour average value
		O3	45 µg/m ³ - 8 hour average value
		SO2	40 µg/m ³ - 24 hour average value
		NO2	25 µg/m ³ - 24 hour average value
		CO	4,000 µg/m ³ - 24 hour average value
Noise	WHO Guidelines for Community Noise (1999)	Residential outdoor living area Free-field rating level (L _{Ar} , Tr) in daytime (07:00–23:00)	55 LAeq (dB)

Category	Project Adopted Standard	Parameter	Limit Value
	RA Sanitary Norms №2-III-11.3 for territories adjacent to residential buildings, clinics, ambulatories, rest houses, care homes, disabled persons homes, libraries, kinder gardens, schools and other educational facilities. (Max Noise Level – Day only)	Average sound level at residential façade over 8 hours (LA-q T) at night-time (23:00–07:00)	45 LAeq (dB)
		Max Noise Level Day (07.00 – 23.00)	70 dBA
		Maximum sound level at residential façade (LAmax, f) at night (23:00–07:00)	60 LAeq (dB)
Vibration	Chiapetta F., Van Vreden A., 2000. Vibration/Air blast Controls, Damage Criteria, Record Keeping and Dealing with Complaints. 9th Annual BME Conference on Explosives, Drilling and Blasting Technology, CSIR Conference Centre, Pretoria, 2000	Buildings/Structures (including residential dwellings)	25 mm/s
		Cultural Heritage Structures located within 50m of the edge of road alignment construction zones.	6 mm/s
Surface Water Quality	See Annex 2	See Annex 2	See Annex 2
Sanitary Sewage Discharges	IFC EHS Guidelines (2007): Wastewater and Ambient Water	pH	6-9
		BOD	30 mg/l
		COD	125 mg/l
		Total Nitrogen	10 mg/l
		Total Phosphorous	2 mg/l
		Oil and Grease	10 mg/l
		Total suspended solids	50 mg/l
		Total coliform bacteria	400 Most Probable Number (MPN)/100 ml

4.2.4 E&S Management Plans

The following E&S Management Plans are to be owned and implemented by the RD and are prepared in advance of the contractor tendering process. As such, the specific requirements of these Plans must be taken into account by the prospective Contractors in the development of their proposals; in terms of technical limitations and cost/schedule implications with regard to the approach to construction. These include:

- Cultural Heritage Management Plan;
- Stakeholder Engagement Plan;
- Biodiversity Action Plan;
- Resettlement Framework (the Resettlement Plan will be prepared later).

The Contractor will be required to develop and implement the following specific Construction Phase E&S Management Plans and Procedures, incorporating the relevant recommended mitigation measures listed in [Table 4](#) below, and other GIP measures as appropriate:

- Air Quality Management Plan;
- Topsoil Management Plan;
- Waste Management Plan (including a Spoil Disposal sub-plan);
- Erosion Control Plan;

- Slope Stabilisation Plan (to be informed by the required geo-hazards risk assessment);
- Wastewater and Stormwater Management Plan;
- Noise and Vibration Management Plan (including a Blasting Management Plan);
- Spill Management Plan;
- Hazardous Materials Management Plan;
- Tunnel Water Management Plan (including groundwater diversion from tunnels);
- Traffic Management Plan (including a Road Audit & Condition Survey, Temporary Road sub-plans and Access and Local Connectivity Plan);
- Community and Occupational Health and Safety Plan;
- Labour and Working Conditions Management Plan (with a Worker Accommodation Plan as a sub-plan, and a grievance mechanism for workers);
- Worker Code of Conduct;
- Cultural Heritage Management Plan;
- Chance Finds Procedure;
- Emergency Preparedness and Response Plan;
- Invasive Species Management Plan (as indicated in the Biodiversity Action Plan);
- Recultivation /Land Restoration Plan (for temporarily used sites);
- Construction Camp Management Plan (based on the Accommodation Option Risk Assessment);
- Concrete Batching Management Plan;
- Asphalt Plant Management Plan;
- Procurement Plan;
- Utilities Protection and Relocation Plan;
- Demobilisation Plan;
- Recruitment Policy for the Project;
- Recruitment Plan.

The RD will be responsible for the development and implementation of the following Operations Phase E&S Management Plans, incorporating the relevant recommended mitigation measures listed in **Table 4** below:

- Noise and Vibration Management Plan;
- Air Quality Management Plan;
- Waste Management Plan;
- Emergency Preparedness and Response Plan;
- Community and Occupational Health and Safety Plan;
- Spill Response Plan;
- Stakeholder Engagement Plan;
- Biodiversity Action Plan;
- Worker Code of Conduct;
- Procurement Plan;
- For larger maintenance works also: Operation Phase Recruitment Plan, and Labour and Working Conditions Management Plan.

4.2.5 Environmental and Social Mitigation Requirements

To ensure the effective management of potential E&S risks and impacts identified through the ESIA process (see Volumes 2, 3, 4 and 5⁶), **Table 4** outlines the recommended minimum mitigation and control measures that should be implemented, and/or included in relevant E&S Management Plans to avoid or limit the extent of adverse risks/impacts and to enhance benefits. However, the RD and Contractor should seek to ensure that all good international practice mitigation measures are included in Management Plans to meet Lenders' requirements.

Table 4. Environmental and Social Mitigation/Control and Enhancement

Topic	Recommended minimum mitigation/control and enhancement measures	Relevant E&S Management Plan(s)	Responsibility (D&I, A or M) ⁷	Target / Indicator	Indicative cost of mitigation (USD) ⁸
Pre-construction and Construction					
Obtaining licenses, permits and agreements	Obtain all required permits and conclude all required agreements, including (but not limited to): <ul style="list-style-type: none"> • Topsoil removal approval, waste generation and disposal permits/limits, wastewater discharge permits/limits, water abstraction and use permits/limits - agreed by the Ministry of Environment. • Agreements with licensed waste and wastewater disposal/treatment companies (for non-hazardous and hazardous waste and wastewater/sewage sludge etc.) • State Environmental Expertise conclusions / MoE and municipal government authorizations for those spoil disposal areas, concrete batching and asphalt plants that will be subject to a national EIA. 	N/A	D&I: Construction Contractor M: Engineer	Copies of all required permits/agreements and conclusions provided to the Supervising Engineer and RD prior to construction commencing.	Included in the contracts of the Construction Contractor and Supervising Engineer as outlined in Section 4.6.
Air quality	<ul style="list-style-type: none"> • The contractor will evaluate PM2.5 and other exhaust emissions from construction vehicles once the construction activities are identified and further mitigation must be developed and implemented if the assessment shows a need for the same. • Minimizing dust from material handling sources, such as conveyors and bins, by using covers and/or control equipment (water suppression). 	Air Quality Management Plan	D&I: Construction Contractor A: Supervising Engineer, RD. M: Supervising Engineer	Air Quality Management Plan is developed and approved prior to construction commencing.	Estimates of instrumental measurements – 46,080 USD for construction (Table 7);

⁶ Where differences in the wording of mitigation measures are identified between these volumes and the current ESMP, the ESMP will prevail as an approach to provide more detailed mitigation in the ESMP was adopted.

⁷ D: Development, I: Implementation, A: Approval (NB: the RD may issue non-objections to illustrate its approval), M: Monitoring of effective implementation of required control/mitigation measures. The PIU Consultant holds a review role for all activities in order to support the RD (unless indicated otherwise).

⁸ This is based on the ESIA Consultant's assumptions and prepared for the indicative purposes only.

Topic	Recommended minimum mitigation/control and enhancement measures	Relevant E&S Management Plan(s)	Responsibility (D&I, A or M) ⁷	Target / Indicator	Indicative cost of mitigation (USD) ⁸
	<ul style="list-style-type: none"> • Minimizing dust from open area sources, including storage piles, by using control measures such as installing enclosures and covers, and increasing the moisture content. • Dust suppression techniques should be implemented, such as applying water or chemical binders to minimize dust from vehicle movements on unpaved roads, especially in dry or windy conditions. • Use of dust screens close to material stockpiles. • Siting of construction facilities and equipment (including concrete and asphalt batching plants, rock crushing plants and construction camps) will be prohibited within 500 m of any residential area or sensitive receptor (school, hospital, church etc.) and at least two kilometres from protected areas where possible. • Siting of facilities and equipment must also consider the prevailing wind direction. • Open burning of waste is prohibited. • Apply speed limits on construction sites and unpaved roads to lower the quantity of dust arising from vehicle movements. • Compaction of unpaved road surfaces should be undertaken where possible. • Provide truck-washing facilities at tunnel portals and at safe distances from bridge construction sites to prevent the track-out of mud and dust. • All trucks used for transporting materials to and from construction sites should be covered. • Fuel used should comply with Armenian guidelines for gas emissions. • Vehicles and construction equipment should not be allowed to idle when not in use. • The use of diesel generators should be minimised where possible. • Position any stationary emission sources (e.g., portable diesel generators, compressors, etc.) as far as is practical from sensitive receptors. • Asphalt works to be ideally carried out in low temperatures, as per climate proofed standards for road design, construction and maintenance defined by the European Climate Adaptation Platform • Ensure all machinery and vehicles are maintained to minimise exhaust emissions. Vehicles and equipment that emit smoke will not be used and if they can't be fixed must be removed from the project. 			<p>All specified mitigation measures are implemented effectively throughout construction.</p>	<p>Modelling exercises – 30,000 USD.</p> <p>Other costs included in the project budgets of each party, and ESHS management costs are outlined in Section 4.6.</p>

Topic	Recommended minimum mitigation/control and enhancement measures	Relevant E&S Management Plan(s)	Responsibility (D&I, A or M) ⁷	Target / Indicator	Indicative cost of mitigation (USD) ⁸
	<ul style="list-style-type: none"> Undertake immediate repairs of any malfunctioning construction vehicles and equipment. Use construction equipment and vehicles that meet national emission standards. Wherever possible, use electric-powered equipment rather than gas or diesel-powered equipment. After the traffic studies are completed, re-run the modelling for operations phase NO2, CO and PM2.5 and consider if additional mitigation measures are required (if so, and implement them). 				
Noise & Vibration	<ul style="list-style-type: none"> Noise and Vibration Management Plans is to include pre-construction condition survey of all structures located within 25 m from the construction sites and 100m from the tunnel portals if larger blasting charge will be used there (for CH structures – see below); The requirements of the Noise and Vibration and Blasting Management Plans should be aligned with the Cultural Heritage Management Plan to ensure that relevant mitigation measures are implemented to avoid/limit damage to cultural heritage assets. As such, include therein the pre-construction condition survey of all CH sites located within 50m from the proposed road footprint (the border of construction site) and within 50m from the minimal charge blasting source and 200m from the tunnel portals (as there is a potential for larger charges blasting); as well as all monitoring and control actions that the CH Expert should perform jointly with the Contractor's structure/seismic engineers responsible for the Noise and Vibration Management Plan [and CH Monitor to observe]. Supervising Engineer will implement focused instrumental measurements at selected sensitive locations (CH sites and/or residential buildings) during the most impacting phases of the construction works and shall determine the transient and continuous adjacent level of vibration velocity. The received data shall be compared with the regulative limits presented in Table 3. Should the Contractor exceed these limits or be close to them, the engineer shall stop the works and recommend another mode of work in order to reduce the vibrations and the annoyance and suggest adaptation/adjustment of the construction method. The Contractor could be requested to change the operation mode of machinery and equipment, etc. 	Noise & Vibration Management Plan Blasting Management Plan	D&I: Construction Contractor (including structure/seismic engineer) A: Supervising Engineer, RD, Lenders. M: Supervising Engineer (including structure/seismic engineer and verification vibration instrumental monitoring)	Noise & Vibration Management Plan and Blasting Management Plan are developed and approved prior to construction commencing. All specified mitigation measures are implemented effectively throughout construction.	Estimates of noise and vibration instrumental measurements – 374,400 USD (Contractor); Estimates of verification vibration instrumental measurements - 25,600 USD (by Supervising Engineer). Other costs included in the project budgets of each party, and ESHS management costs are outlined in Section 4.6 .

Topic	Recommended minimum mitigation/control and enhancement measures	Relevant E&S Management Plan(s)	Responsibility (D&I, A or M) ⁷	Target / Indicator	Indicative cost of mitigation (USD) ⁸
	<ul style="list-style-type: none"> • All diesel-powered vehicles and equipment (such as generators and air compressors) should be kept at a high level of maintenance. This should particularly include regular inspection and, if necessary, replacement of intake and exhaust silencers. Any change in the noise emission characteristics of equipment should serve as trigger for withdrawing it for maintenance. • Equipment with lower sound power levels must be selected when making new purchases, where feasible. Vendors should be required to guarantee optimised equipment design noise levels. • Machinery/vehicles that are used intermittently will be shut down or throttled back during periods when not in use. • Any plant, such as generators or pumps, that are required to be operated before and after designated working hours will be surrounded by an acoustic enclosure. • Use construction equipment and vehicles fitted with appropriate noise suppression. Fit all pneumatic tools with an effective silencer on their air exhaust port. • Minimise the need for vehicles to reverse. • Keep to a no horn policy unless vitally necessary. • Specify the use of noise limiting construction methods, for example: specifying the use of rotary rather than driven piling. • Whenever possible: enclose noisy equipment, restrict non- stop operation of noisy equipment, avoid simultaneous operation of noise generating equipment. • Inform the community of the schedule and duration of construction activities, particularly where these are likely to generate high noise levels. • Limit truck speeds - not to exceed 40 km/h, when driving through local communities • Provision of measures to reduce the noise nuisance impacts on sensitive receptors, for example: <ul style="list-style-type: none"> ○ Installation of temporary barriers. ○ Restriction of some activities to less sensitive times, for example: restricting blasting/piling activity to the mid-day (10:00 – 14:00) only. 				

Topic	Recommended minimum mitigation/control and enhancement measures	Relevant E&S Management Plan(s)	Responsibility (D&I, A or M) ⁷	Target / Indicator	Indicative cost of mitigation (USD) ⁸
	<ul style="list-style-type: none"> Noise barriers/ temporary enclosures should be used at tunnel entrances/ exits to reduce night-time noise from these areas. Construction activities will be strictly prohibited between 10 PM and 6 AM near residential areas. When operating close to sensitive areas (within 250 m) such as residential, schools, or medical facilities, the Contractors' hours of work shall be limited to 8 AM to 6 PM. The Contractor must respond to any noise & vibration related grievances and implement remediation measures as soon as practical. Blast designs should be reviewed prior to first blast to ensure that the charge is appropriate and minimise potential off-site impacts. Ensure drill and blast designs and compaction activities are adopted to minimise ground vibration. Only apply electronic initiation systems to facilitate single hole firing. Design for smaller diameter blast holes that will use fewer explosives per blast hole. Apply mechanical excavations where possible to reduce the need for blasting. 				
Geology and Geo-hazards	Please see the required scope of work for the Geo-hazards Risk Analysis outlined in Annex 1 .	Potentially – a Slope Stabilisation Plan ⁹ as an outcome of the geohazards assessment	D&I: Construction Contractor A: Supervising Engineer, RD. M: Supervising Engineer	Results of the Risk Analysis are used to inform the development of a Slope Stabilisation Plan, to be approved prior to construction commencing. All specified mitigation measures are implemented	Geological studies funded by the EBRD; Design changes and plan development included in the budgets of the Contractor and Supervision, and in the RD budget

⁹ The Slope Stabilisation Plan should be an outcome of the geohazards assessment ([Annex 1](#)) and is more of an engineering function than environmental necessarily. It is expected to be developed by the Construction Contractor in any case as part of the technical documentation.

Topic	Recommended minimum mitigation/control and enhancement measures	Relevant E&S Management Plan(s)	Responsibility (D&I, A or M) ⁷	Target / Indicator	Indicative cost of mitigation (USD) ⁸
				effectively throughout construction.	
Surface Water and Groundwater	<ul style="list-style-type: none"> Foundation works for bridges and any other works adjacent to or within surface water bodies shall be conducted in periods of low flows as far as possible. Construct collection ponds to regulate the flow of run-off into surface water bodies where necessary, and to enable settlement of soil particles to minimise turbidity impacts. All vehicles and construction equipment will be well maintained to ensure that there are no oil or fuel leakages. Maintenance of vehicles and equipment/plant to be undertaken in designated areas for the purpose (workshop). If the maintenance of vehicles is necessary on site, drip trays and spill kits must be available/used and maintenance to be undertaken at a safe distance (at least 100m) from any watercourses. All temporary fuel tanks and fuel storage areas must be located at least 100 m away from any surface water body and outside of any flood plain. All fuel/oil/chemical containers shall be placed in a secured, covered area within secondary containment with 110% of capacity of the container. All fuel powered stationary equipment should have a drip tray placed beneath it to contain any leaks of fuel/oil. The discharge of any untreated wastewater effluent into a surface water body is strictly prohibited. Treated wastewater discharges must comply with relevant standards for effluent quality and any license / permit requirements. The discharge of cement contaminated water directly into surface water bodies is strictly prohibited. Washing out concrete trucks at construction sites will be prohibited unless specific concrete washout areas are provided for this purpose at the construction site. The washout area will be impermeable and emptied when 75% full. Appropriately and adequately stocked spill kits to be available at all construction sites to clear up any accidental spills/leaks of fuel/oil/chemicals. 	Tunnel Water Management Plan Spill Management Plan Wastewater and Stormwater Management Plan Hazardous Materials Management Plan Topsoil Management Plan Concrete Batching Management Plan Construction Camp Management Plan	D&I: Construction Contractor A: Supervising Engineer, RD. M: Supervising Engineer	All relevant Management Plans are developed and approved prior to construction. All specified mitigation measures are implemented effectively throughout construction.	Estimates of instrumental measurements – 6400 USD during the pre-construction phase and 360,000 USD during construction (see Table 8); Other costs included in the project budgets of each party, and ESHS management costs are outlined in Section 4.6 .

Topic	Recommended minimum mitigation/control and enhancement measures	Relevant E&S Management Plan(s)	Responsibility (D&I, A or M) ⁷	Target / Indicator	Indicative cost of mitigation (USD) ⁸
	<ul style="list-style-type: none"> Any Project sewage treatment plants will be managed in accordance with the manufacturer's instructions by competent personnel, and any discharges regularly monitored. If discharges cannot be treated to the required standard, liquid wastes must be removed by a licensed company and disposed in an environmentally responsible manner. Any Project septic tanks shall be made of impermeable material and will be emptied regularly by a licensed company for disposal in an environmentally responsible manner. Surface water bodies/ rivers should only be crossed via bridges¹⁰. Wastewater facilities must be established to collect/treat water draining or de-watered from tunnels (and especially the Bargushat Tunnel) during construction prior to discharge or removal from site. Treatment must facilitate settlement as a minimum and a neutralisation function to reduce high pH levels. Stormwater drains and oil water separators must be regularly serviced and maintained to ensure that they remain effective and do not become saturated and or blocked over time. 				
Waste (including hazardous waste) and Spoil	<ul style="list-style-type: none"> Contractor to identify and estimate the expected quantities of all types of waste that will be generated during the construction phase. Each waste type must be assessed against the waste management hierarchy to explore options for minimizing the volume of waste ultimately requiring disposal. Waste Transfer Notes must be completed for all waste removed from site. The contractor will subcontract a licensed company (or companies) to collect and dispose of all waste in an environmentally responsible manner. Material Safety Data Sheets to be provided and easily available wherever hazardous wastes are being stored. Hazardous waste containers to be clearly labelled. 	Waste Management Plan (including a Spoil Disposal Sub-Plan)	D&I: Construction Contractor A: Supervising Engineer, RD, Lenders (Spoil Disposal sub-plan). M: Supervising Engineer	Waste Management Plan and Spoil Disposal Sub-Plan are developed and approved prior to construction commencing. All specified mitigation measures are implemented effectively throughout construction.	Included in the project budget of each party

¹⁰ If temporary bridges may appear to be required and will be developed by the Contractor, their designs should be reviewed and agreed upon by the E&S team.

Topic	Recommended minimum mitigation/control and enhancement measures	Relevant E&S Management Plan(s)	Responsibility (D&I, A or M) ⁷	Target / Indicator	Indicative cost of mitigation (USD) ⁸
	<ul style="list-style-type: none"> • Hazardous waste storage areas to be clearly labelled as such, well lit and ventilated, have an impermeable floor, be covered and lockable. • Liquid waste to be stored in leak-proof, sealed containers. • Adequate secondary containment (110% of the volume of the container) to be provided for any liquid waste. • Waste to be segregated at source to enable re-use and recycling. • Recyclable waste streams to be collected/stored in dedicated, separate containers, clearly labelled as to their contents (e.g. paper, wood, metal, glass, plastic). • All waste containers to have secure lids. • Incompatible hazardous wastes will not be stored together. • Hazardous waste storage areas will be equipped with spill kits, eye wash kits and fire extinguishers. • Excess spoil to only be disposed of at designated sites. 				
Soil	<ul style="list-style-type: none"> • Drip trays to be placed beneath any stationary construction equipment to catch leaks of fuel/oil. • Appropriately and adequately stocked spill kits to be available at all construction sites to clear up any accidental spills/leaks of fuel/oil/chemicals. • Interruption of work activities in case of uncontrolled spillage of fuel, engine oil, chemicals, etc. and remediation of contaminated soil by removing the contaminated soil layer (to be further treated as hazardous waste) and restoring the new soil layer. • If possible, reuse excavated material. Excess material will be disposed of at a designated spoil disposal site only. • No servicing, washing or maintenance, re-fuelling of trucks and construction machines will be carried out on bare ground but in dedicated areas with impermeable surfaces. • Fuel will be stored in designated areas, in double skinned containers or tanks placed within in a protected separation pit, equipped with an oil-resistant cover. The volume of this pit must exceed the maximum capacity of the barrel/tank placed in the pit by at least 10% in case of leakage. • In case of accidental spills/leaks of pollutants, contaminated soil will be removed immediately and treated as hazardous waste. 	Spill Management Plan Hazardous Materials Management Plan Waste Management Plan (including a Spoil Disposal sub-plan) Wastewater and Stormwater Management Plan	D&I: Construction Contractor A: Supervising Engineer, RD, Lenders (Spoil Disposal sub-plan). M: Supervising Engineer	All relevant Management Plans are developed and approved prior to construction commencing. All specified mitigation measures are implemented effectively throughout construction.	Included in the project budget of each party, and ESHS management costs are outlined in Section 4.6.

Topic	Recommended minimum mitigation/control and enhancement measures	Relevant E&S Management Plan(s)	Responsibility (D&I, A or M) ⁷	Target / Indicator	Indicative cost of mitigation (USD) ⁸
Topsoil	<ul style="list-style-type: none"> The top layer of soil will be removed (preferably in dry conditions) and stored separately to prevent mixing with sub-soil, until works are completed, in a condition to preserve the natural seed bank. Topsoil stockpiles will be located at least 50 m distance from any watercourses to avoid water siltation. Topsoil stockpiles should not be located adjacent to future planned excavations. The height of the stockpiles should not exceed 3 m. The gradient of topsoil stockpile slopes should not exceed 25°. Topsoil stockpiles will be clearly labelled as such. Topsoil stockpiles will be covered to avoid soil erosion where natural revegetation has not occurred. Topsoil stockpiles will be fenced to prevent access and compaction by Project vehicles. Drainage channels will be installed around the base of topsoil stockpiles if required to direct run-off away from the stockpile. 	Topsoil Management Plan	D&I: Construction Contractor A: Supervising Engineer, RD. M: Supervising Engineer	Topsoil Management Plan is developed and approved prior to construction commencing. All specified mitigation measures are implemented effectively throughout construction.	Included in the project budget of each party, ESHS management costs are outlined in Section 4.6 .
Hazardous Materials	<ul style="list-style-type: none"> Material Safety Data Sheets to be provided and easily available wherever hazardous materials are being stored. Hazardous materials inventory to be maintained and easily available wherever hazardous materials are being stored. Hazardous materials containers to be clearly labelled according to contents and hazards. Hazardous materials storage areas to be clearly labelled as such. Hazardous materials storage areas to be well lit, ventilated, have an impermeable floor and dedicated drainage, be covered and lockable. Hazardous liquids (including oils and chemicals) to be stored in leak-proof, sealed containers with adequate secondary containment (110% of the volume of the container). Incompatible hazardous materials must not be stored together. Hazardous materials storage areas will be equipped with eye wash kits and fire extinguishers. Appropriate and fully stocked spill kits must be provided wherever hazardous materials are being stored/used. 	Hazardous Materials Management Plan	D&I: Construction Contractor A: Supervising Engineer, RD. M: Supervising Engineer	Hazardous Materials Management Plan is developed and approved prior to construction commencing. All specified mitigation measures are implemented effectively throughout construction.	Included in the project budget of each party, and ESHS management costs are outlined in Section 4.6 .

Topic	Recommended minimum mitigation/control and enhancement measures	Relevant E&S Management Plan(s)	Responsibility (D&I, A or M) ⁷	Target / Indicator	Indicative cost of mitigation (USD) ⁸
Biodiversity	<p>Mitigation measures to be implemented as per the Biodiversity Action Plan (and other plans to be developed as stipulated in the Biodiversity Action Plan, such as the Invasive Species Management Plan and Biodiversity Offsetting Management Plan).</p> <p>Mitigation measures related to the arrangement of wild animal passages as listed in Annex 5.</p>	<p>Biodiversity Action Plan</p> <p>Invasive Species Management Plan and Biodiversity Offsetting Management Plan</p>	<p>D: RD, PIU and Supervising Engineer</p> <p>I: Construction Contractor</p> <p>A: Supervising Engineer, RD, Lenders.</p> <p>M: Supervising Engineer</p>	<p>Biodiversity Action Plan is developed and approved prior the tendering process for the Construction Contractor.</p> <p>Other Biodiversity plans developed prior to construction.</p> <p>All specified mitigation measures are implemented effectively throughout construction.</p>	<p>Indicative costs are 1.5-2mln USD (see Section 4.6).</p> <p>Other costs included in the project budget of each party, and ESHS management costs are outlined in Section 4.6.</p>
Landscape and visual amenity	<ul style="list-style-type: none"> The critical mitigation requirement is a change in the proposed road alignment adjacent to the Vorotnavank Monastery to reduce the negative visual impact on this highly significant heritage resource and its curtilage and, thereby reducing visual impacts to acceptable levels. If the alignment could be directed to the valley bottom, there would be a material reduction in the scale of the cut and fill and reduce the size of the bridge and change its position. In all circumstances where embankments are to be constructed the embankments are to be landscaped to reduce the juxtaposition with the existing landscape and at least create the illusion of a much smaller impact on the landscape. Landscaping may require stepping of the upslopes of road cuts which would then best be executed as part of the construction phase. 	Cultural Heritage Management Plan	<p>D: RD with support of technical consultant</p> <p>I: Construction Contractor</p> <p>A: Supervising Engineer, RD, Lenders.</p> <p>M: Supervising Engineer</p>	<p>Design changes explored and implemented; if impossible, a clear justification should be provided</p>	<p>Re-alignment at Vorotnavank Monastery – time of the MTAI and government, as well as of all parties involved</p> <p>A dedicated estimated will be required from the Contractor</p>
Economy and employment	<p>Contractor to:</p> <ul style="list-style-type: none"> Prioritize employment from Project affected municipalities (and in particular from affected villages) through local recruitment campaigns. Organise information campaigns in the Project-affected municipalities to promote the application of women for various Project positions. Develop and deliver a training programme to train the locally sourced workforce to the Project labour needs. Prioritize the procurement of goods and services from Project affected municipalities. 	<p>Procurement Plan</p> <p>Construction Phase Recruitment Plan</p> <p>Recruitment Policy</p>	<p>D&I: Construction Contractor</p> <p>A: Supervising Engineer, RD.</p> <p>M: Supervising Engineer</p>	<p>Procurement Plan and Recruitment Policy are developed and approved prior to construction commencing.</p> <p>All specified mitigation measures are implemented effectively throughout construction.</p>	<p>Included in the project budget of each party, and ESHS management costs are outlined in Section 4.6.</p>

Topic	Recommended minimum mitigation/control and enhancement measures	Relevant E&S Management Plan(s)	Responsibility (D&I, A or M) ⁷	Target / Indicator	Indicative cost of mitigation (USD) ⁸
	<ul style="list-style-type: none"> Establish a female employment target of at least 15% of the Project construction workforce. Identify suitable locations within the Project affected municipalities for the accommodation of workers. Organize special training sessions for local women entrepreneurs in order to develop and strengthen entrepreneurial skills. Prior to construction works engage with bee-keepers in affected villages and map the locations of the bee-hives against the construction sites and access roads (yet to be determined). In case the bee-hives are located closer than 90-100m (taking a conservative approach) from the construction sites and access roads, assist the bee-keepers in the relocation of the bee-hives farther from the sources of disturbance. 				
Labour and working conditions	<ul style="list-style-type: none"> A Worker Code of Conduct specifying expected standards of behaviour will be developed by the Contractor to be signed by all contractor and sub-contractor workers as part of their contract. Equal opportunities should be provided to all workers. A reliable and sufficient supply of safe potable water will be always provided. Canteen/rest areas with hand washing facilities will be established. Toilet and washing facilities will be provided for workers at all work sites, with separate toilets provided for women. Construction camps will be equipped with a health clinic for all workers. Contractors will appoint a female grievance officer ('confidant') for gender sensitive issues at each construction camp; make the contact details available to all female employees. A Workers Grievance Mechanism will be developed and implemented with all grievances being registered and tracked to an acceptable conclusion within the specified timeframes. The Grievance Mechanism will ensure confidential channels, including for reporting and investigating GBVH incidents, and the provision of support, in a safe way. Hold training sessions on the gender elements of the Worker Code of Conduct for the Contractor's and Supervision Engineer's staff. 	Labour and Working Conditions Management Plan (and Worker Accommodation Sub-Plan). Grievance Mechanism for Workers Worker Code of Conduct Construction Camp Management Plan (based on the Accommodation Option Risk Assessment)	D&I: Construction Contractor A: Supervising Engineer, RD, Lenders. M: Supervising Engineer	All relevant Management Plans / Codes / Mechanisms are developed and approved prior to construction commencing. All specified mitigation measures are implemented effectively throughout construction.	Included in the project budget of each party, and ESHS management costs are outlined in Section 4.6 .

Topic	Recommended minimum mitigation/control and enhancement measures	Relevant E&S Management Plan(s)	Responsibility (D&I, A or M) ⁷	Target / Indicator	Indicative cost of mitigation (USD) ⁸
	<ul style="list-style-type: none"> • Undertake information campaigns aimed at preventing GBVH risks and raising awareness among employees and residents of Project-affected villages. • Compliance with national laws and international standards regarding the employment of minors, including the employment of workers under the age of 18 will be prohibited. • Any form of forced labour will be prohibited. • Workers will be provided with copies of their contract prior to commencing work that will include clear and transparent information on their wages, benefits and working arrangements (hours of work and overtime, annual leave entitlements, accommodation entitlements, etc.) • Regular health checks will be conducted to ensure all workers are fit to work. • Employment of members of vulnerable groups will not be avoided in any way. • All workers will be provided with Induction training (including on ESHS issues) and any specific training relevant to their role as per a training program to be developed by the Contractor. • Adequate housing conditions and services will be provided for all workers at the construction camp/camps as per requirements of national legislation, and EBRD standards, including EBRD/IFC Guidance Note: Workers' Accommodation Processes and Standards 102 and ILO Workers' Housing Recommendation 1961 (No. 115). • Adequate working Personal Protective Equipment (PPE) will be provided to workers of both sexes - customised by anthropometric specifications for male and female workers. • The Contractor will develop a Demobilisation Plan during the first six months of the construction period. The plan will: <ul style="list-style-type: none"> ○ Provide the schedule for de-mobilising groups of Project direct employees during the construction phase; ○ Specify benefits for the demobilised construction staff including e.g. <ul style="list-style-type: none"> • paid training at adult training centres for demobilised unskilled workers of their choice, to enhance their further employment perspectives; 	Demobilisation Plan			

Topic	Recommended minimum mitigation/control and enhancement measures	Relevant E&S Management Plan(s)	Responsibility (D&I, A or M) ⁷	Target / Indicator	Indicative cost of mitigation (USD) ⁸
	<ul style="list-style-type: none"> provision of an employment reference/confirmation letter and a skills/training log. 				
Access and Local Connectivity	<ul style="list-style-type: none"> Provide alternative temporary access to properties and natural resources (pastures, land plots, businesses, forests and rivers) where access is temporarily restricted due to construction activities. Ensure local connectivity arrangements are aligned with the Traffic Management Plan and requirements of the Stakeholder Engagement Plan. Provide alternative permanent access where there are cases of permanent blockage of access to several land plots that are not covered by the Resettlement Plan. Arrange additional underpasses for cattle by extending the designed culverts or including new passes in the design at the locations proposed by female and male residents of the affected settlements (see Annex 3). 	Access and Local Connectivity Plan Traffic Management Plan	D&I: Construction Contractor A: Supervising Engineer, RD, Lenders (Access and Local Connectivity Plan, Labour and Working Conditions Management Plan). M: Supervising Engineer	All relevant Management Plans are developed and approved prior to construction commencing. All specified mitigation measures are implemented effectively throughout construction.	Included in the project budget of each party, and ESHS management costs are outlined in Section 4.6 .
Public Utilities, Services and Transport Infrastructure	<p>Impacts on Local Healthcare Facilities</p> <ul style="list-style-type: none"> Construction camps will be equipped with a health clinic for all workers, staffed with qualified medical personnel 24 hours a day, 7 days a week. Contractors will provide advanced notice to all local healthcare facilities regarding workforce numbers and the duration of construction activities. <p>Impacts on the Local Road Network</p> <ul style="list-style-type: none"> The Contractor will conduct a Road Audit & Condition Survey to assess the physical condition of existing roads and bridge crossings in the Project area in order to i) assess risks of road pavement damage and bridge collapse, ii) predict traffic intensity and traffic throughput capacity, and iii) assess risks of transport accidents at specific road sections/junctions. The Contractor will develop (based on the findings of the Road Audit & Condition Survey) an optimal Construction Traffic Scheme in collaboration with relevant municipal, traffic police, and/or road authorities. This should be used to inform the development and implementation of the Traffic Management Plan by indicating: <ul style="list-style-type: none"> The conditions of the existing unpaved and paved tracks to determine if they need to be upgraded or rehabilitated to bear the weight of the Project's heavy vehicles. 	Utilities Protection and Relocation Plan Traffic Management Plan (including a Road Audit & Condition Survey). Accommodation Camp Management Sub-Plan Emergency Preparedness and Response Plan	D&I: Construction Contractor A: Supervising Engineer, RD, Lenders. M: Supervising Engineer	All relevant Management Plans / Codes / Mechanisms are developed and approved prior to construction commencing. All specified mitigation measures are implemented effectively throughout construction.	A separate budget will be developed for the preparation and implementation of this Plan to be covered from the Project budget. Other costs included in the project budget of each party, and ESHS management costs are outlined in Section 4.6 .

Topic	Recommended minimum mitigation/control and enhancement measures	Relevant E&S Management Plan(s)	Responsibility (D&I, A or M) ⁷	Target / Indicator	Indicative cost of mitigation (USD) ⁸
	<ul style="list-style-type: none"> ○ Mapping of social infrastructure (in particular, schools, kindergartens, and healthcare facilities), residential buildings and cultural heritage sites (churches and cemeteries, monuments) located in the settlements along any of the roads that will be used by Project transport; ○ The availability of adequate road signage, e.g. relating to speed limits or other specific warning signs around the mapped sensitive social infrastructure, residential buildings and cultural heritage sites; if/where necessary applying for installation of additional signage to ensure road safety and safety of buildings. <ul style="list-style-type: none"> ● The Contractor will inform local residents of likely construction traffic impacts at least two weeks before construction commences. ● Following construction, the Contractor will rehabilitate public roads used by the Project to the pre-project or better condition. ● Contractor will coordinate any track/road upgrade or rehabilitation activities with due municipal and roads authorities, local users, and other stakeholders as needed. <p>Impacts on Public Utilities</p> <ul style="list-style-type: none"> ● Conduct a pre-construction survey to confirm the location of all public utilities that could be affected by construction of the main road alignment and service roads. ● Develop detailed designs for the relocation of each affected utility if irreparable damage is unavoidable, based on the technical conditions received from the utility company and in compliance with the Armenian design standards; the detailed designs should be approved by owners of the affected utilities and include estimations of utility relocation costs. ● Engage with the utility companies to ensure that they notify any customers who may be affected by service disruptions and can provide alternative services, as much as possible. ● Ensure utility repair/relocation costs are factored in as part of Project construction costs. 				
Public Health, Safety, and Security	<ul style="list-style-type: none"> ● When developing the Traffic Management Plan, consult local communities to identify sensitive times for when additional traffic restrictions should apply, 	Community and Occupational	D&I: Construction Contractor	All relevant Management Plans / Codes / Mechanisms	Included in the project budget of each party, and

Topic	Recommended minimum mitigation/control and enhancement measures	Relevant E&S Management Plan(s)	Responsibility (D&I, A or M) ⁷	Target / Indicator	Indicative cost of mitigation (USD) ⁸
	<p>e.g., when pupils go to and return from school, when people attend church and cemetery (applicable for some side roads that can potentially be used by Project vehicles).</p> <ul style="list-style-type: none"> • Provide driver training programmes to ensure that Contractor's and sub-contractor's staff are aware of community sensitivities, such as specific livestock movement periods, and with a focus on manoeuvring in mountainous terrains and in bad weather conditions, as well as on actions in case of traffic accidents. • Locate and design pedestrian crossings in consultation with local residents, local and municipal authorities and traffic police bodies (for the list of proposed locations refer to Annex 4). • Provide safe pedestrian crossings including adequate signals and the use of flagmen to alert construction traffic of the presence of children and families. • Provide a series of road safety awareness sessions for schools in the Project Area. The sessions will be provided on a six-monthly basis throughout the construction phase. As part of the awareness sessions, children will be given reflective badges to fix to their coats and school bags. • Ensure all construction driving is to occur during daytime hours, where possible. • Avoid to the extent possible movement of construction vehicles during the periods of peak traffic at the affected roads (holidays and morning and evening traffic peaks). • Install information boards about public safety hazards and emergency contact information • Establish and clearly sign temporary diversions for the local access routes where required. • Ensure lighting in public places is adequate and is maintained, particularly to reduce gender-based violence and construction and road safety risks at night. • Provide appropriate security measures to prevent unauthorised access to hazardous work sites, including fencing of all areas of excavations greater than 1 m deep. Enforce access restrictions by means of regular monitoring of site boundaries (either by patrols or by camera). • Accommodate non-local workers in the worker accommodation camps. 	<p>Health and Safety Plan</p> <p>Traffic Management Plan (including a Road Audit & Condition Survey)</p> <p>Emergency Preparedness and Response Plan</p>	<p>A: Supervising Engineer, RD. M: Supervising Engineer</p>	<p>are developed and approved prior to construction commencing. All specified mitigation measures are implemented effectively throughout construction.</p>	<p>ESHS management costs are outlined in Section 4.6.</p>

Topic	Recommended minimum mitigation/control and enhancement measures	Relevant E&S Management Plan(s)	Responsibility (D&I, A or M) ⁷	Target / Indicator	Indicative cost of mitigation (USD) ⁸
	<ul style="list-style-type: none"> Establish communication protocols with local hospitals to ensure timely updates in case of outbreaks of communicable diseases. A Worker Code of Conduct specifying expected standards of worker (including security staff) behaviour and restrictions on interactions with local residents will be developed by the Contractor to be signed by all contractor and sub-contractor workers as part of their contract. The ESHS induction will cover the Code's provisions including on GBVH, sexually transmitted infections, appropriate conduct, respect of human rights, engagement with stakeholders, and appropriate use of force, cultural sensitivity, etc. Local residents will be informed, as part of stakeholder engagement activities, about the Project's public safety and security arrangements in advance of construction commencing. Local residents will be informed, as part of stakeholder engagement activities, about the Project's community Grievance Mechanism in advance of construction commencing. The Contractor will take all necessary security precautions to prevent theft, or unauthorised use of hazardous materials and project vehicles/equipment by providing suitable locks, lockable containers and/or lockable valves where necessary. Ensure watering or more effective dust suppression measures, such as chemical binding, at these sensitive locations to control road dust emissions in dry days of spring and summer. 				
Occupational Health and Safety	<ul style="list-style-type: none"> All workers (including sub-contractors) will receive a formal induction ahead of starting works, in a language(s) and format easily understood. This will include information on health and safety measures, emergency response in case of accidents, fire, earthquakes, landslides, flash foods, disease etc, and minimisation of environmental and community impacts. The Contractor will also develop and implement a safety and security training program including toolbox talks, safety briefings, and topic specific training. The Contractor will conduct safety meetings on a monthly / regular basis. The Contractor will conduct emergency drills on a regular basis. Assess the requirement for and provide a sufficient number of fire extinguishers and first aid kits at all Project construction sites and facilities, and in the vehicles used for workers' commute. These will be checked at least monthly to ensure that they are in date and fully functional. 	Community and Occupational Health and Safety Plan Labour and Working Conditions Management Plan (and Worker Accommodation Sub-Plan). Emergency Preparedness	D&I: Construction Contractor A: Supervising Engineer, RD, Lenders (Labour and Working Conditions Management Plan). M: Supervising Engineer	All relevant Management Plans / Codes / Mechanisms are developed and approved prior to construction commencing. All specified mitigation measures are implemented effectively throughout construction.	Included in the project budget of each party, and ESHS management costs are outlined in Section 4.6 .

Topic	Recommended minimum mitigation/control and enhancement measures	Relevant E&S Management Plan(s)	Responsibility (D&I, A or M) ⁷	Target / Indicator	Indicative cost of mitigation (USD) ⁸
	<ul style="list-style-type: none"> • Define the weather conditions under which construction works should be paused and resumed only upon authorization. • Allow smoking only in designate areas equipped with fire extinguishers/fire sand and safe cigarette disposal containers. • A permit to work system will be established and implemented for hazardous work activities (including but not limited to: working at height, confined spaces, blasting, electrical works). • The Contractor shall develop women-only training sessions and safety meetings and discuss any additional OHS concerns from a gender perspective. • A process will be developed for reporting and investigating incidents, injuries, near misses and unsafe conditions. • All safety equipment will be regularly inspected, tested and maintained. Safety equipment that is not in working order, damaged and/or not fit to use will be immediately replaced. • Ensure reversing signals are installed and working on all construction vehicles. • Implement fall prevention and protection measures whenever a worker is exposed to the hazard of falling more than two meters, falling into operating machinery, falling through an opening in a work surface, or other dangerous locations. • Prohibit entry into confined spaces, except by specifically trained persons. • Ensure that all electrical equipment is suitable for use in a harsh construction environment. • Regularly inspect electrical equipment and replace / repair if damage is identified. • Only employees who have passed appropriate training and hold certificates should have access to the high-voltage equipment and/or perform electrical works. • Ensure that power supply is disconnected and isolated before work is allowed on electrical systems. • Ensure that all lifting operations are planned and supervised by suitably qualified and experienced persons, to minimise risk to persons on site, and to co-ordinate with other site activities. This must include measures to avoid 	and Response Plan			

Topic	Recommended minimum mitigation/control and enhancement measures	Relevant E&S Management Plan(s)	Responsibility (D&I, A or M) ⁷	Target / Indicator	Indicative cost of mitigation (USD) ⁸
	<p>contact of lifting equipment and loads with above ground utilities and structures.</p> <ul style="list-style-type: none"> • Prevent persons from walking beneath loads being lifted. • Ensure all loads being lifted are properly secured. • A programme of inspection and testing to be developed and implemented for all lifting equipment, including all straps, chains, shackles, etc. • Ensure that all hazardous materials are stored appropriately in suitable containers and labelled with the name and hazards of the contents. • Provide suitable clothing for work during cold and/or weather to all employees. • Provide shaded rest areas and drinking water and organize work to allow for sufficient rest breaks during hot weather. • Provide sufficient lighting at night within and in the vicinity of construction sites. • Construction vehicles to keep to agreed access routes and adhere to construction speed limits (5km/h in work zones). • Avoid the need for vehicle reversing where possible. • Provide segregated routes and site entrances (i.e. with no vehicles) for pedestrians. • Provide appropriate personnel protection equipment (PPE) and harnesses (safety boots, helmets, gloves, protective clothes, breathing mask, goggles, and ear protection) adequate to task/activity. The PPE is to be provided for all site personnel – contractors, subcontractors, Project Management and Supervision staff, and site visitors (including drivers who leave their vehicle cabs while on site). Sufficient stocks of PPE must be held at all construction sites. • Noise protection PPE will be provided for workers who are working in areas where noise levels are higher than 80 dB(A), and made available to all workers on request, regardless of noise level. Mandatory use of hearing protection will be required at noise levels over 85 dB(A). • Adequate ventilation must be provided in tunnels or other areas with limited natural air circulation. • Air quality in tunnels must be monitored continuously whenever there are workers present within the tunnel. 				

Topic	Recommended minimum mitigation/control and enhancement measures	Relevant E&S Management Plan(s)	Responsibility (D&I, A or M) ⁷	Target / Indicator	Indicative cost of mitigation (USD) ⁸
	<ul style="list-style-type: none"> A register of workers entering/exiting tunnels should be always maintained. Mandatory use of masks with PM10 filters by workers when performing operations that generate high volumes of dust. In case of a major accident (fire, spill), conduct an independent investigation of the root causes and develop an action plan. Include medical emergencies in the Emergency Preparedness and Response Plan. 				
Tangible Cultural Heritage	<ul style="list-style-type: none"> A Cultural Heritage Management Plan should be developed and agreed with the Lenders and relevant National Authorities in accordance with the site specific cultural heritage mitigation measures included in Annex 6 to this ESMP to inform the construction contract tender process. Contractor to engage a qualified Cultural Heritage Expert (Archaeologist) from an authorized institution as a watching brief during construction works. Sites for construction camps, equipment lay-down areas, SDAs, access roads and any other facilities not yet determined should be selected in consultation with the Cultural Heritage Expert and the Cultural Heritage Management Plan revised to include additional mitigation measures if required. If the use of Spoil Disposal Areas (SDA) 1, 2, 3, 4 and 5 is confirmed apply the mitigation measures as specified for these SDAs in Annex 6. After the mitigation is implemented, the SDAs can be used. If the possibility of arranging SDAs in the Shenatagh and Qirs Valleys are further explored, conduct the surveys as indicated for these SDAs in Annex 6. The requirements of the Noise and Vibration and Blasting Management Plans should be aligned with the Cultural Heritage Management Plan to ensure that relevant mitigation measures are implemented to avoid/limit damage to cultural heritage assets. As such, include therein the pre-construction condition survey of all CH sites located within 50 m from the proposed road footprint (the border of construction site) and within 50m from the minimal charge blasting source and 200m from the tunnel portals (as there is a potential for larger charges blasting); as well as all monitoring and control actions that the CH Expert should perform jointly with the engineers responsible for the Noise and Vibration Management Plan [and CH Monitor to observe]. 	Cultural Heritage Management Plan Chance Finds Procedure	D: RD (Cultural Heritage Management Plan with support of EBRD-funded consultant) A: Lenders and relevant National Authorities (Cultural Heritage Management Plan) D&I: Contractor (Chance Finds Procedure) A: Supervising Engineer, RD, Lenders (Chance Finds Procedure) M: Supervising Engineer	Cultural Heritage Management Plan is developed and approved for inclusion in tender documentation for the construction contract. Chance Finds Procedure is developed and approved prior to construction commencing. All specified mitigation measures are implemented effectively throughout construction.	As indicated in Annex 6 and included in the project budget of each party; ESHS management costs are outlined in Section 4.6 .

Topic	Recommended minimum mitigation/control and enhancement measures	Relevant E&S Management Plan(s)	Responsibility (D&I, A or M) ⁷	Target / Indicator	Indicative cost of mitigation (USD) ⁸
	<ul style="list-style-type: none"> Prior to construction works commencing, develop a Chance Finds Procedure for the Project and train workers in applying it (so that they can identify chance finds, stop work and notify management). The Contractor/sub-contractor will not disturb any chance find until an assessment by the cultural heritage expert(s) is made and actions consistent with national laws and Lender requirements are implemented. 				
Cumulative Impacts	<ul style="list-style-type: none"> Proactively engage with ZCMC CJSC regarding the potential overlap of their facilities to be constructed in the Geghi area with the planned road. Inform the developers of concurrent projects reviewed in this CIA, namely: <ul style="list-style-type: none"> Construction of power lines for Project needs; Kajaran-Agarak section of the NSRC; Rehabilitation / re-cultivation of Voghji and Pkhрут tailing facilities; Construction of the industrial water supply system for CJSC ZCMC, about the workplans / schedules of the Project road construction to allow for mutual adjustments and thus avoidance and/or minimisation of additive air and noise pollution impacts on local communities and workers. Areas of potential simultaneous occurrence of activities to be discussed and coordinated relate to: <ul style="list-style-type: none"> the Geghi area (works on the Project's construction sites and works in the CJSC ZCMC pipeline corridor starting at the Geghi reservoir); Western part of Lernadzor settlement (houses along at the western edge of Lernadzor which is close to the road leading from the M2 to Pkhрут tailing facility), and Settlements located along the routes that will be used by the construction transport of the planned and/or concurrent projects in the Sisian and Kajaran Communities. Instruct the designers of the power lines that will serve the Project to select the route of the power lines so that to avoid protected areas, KBAs/KBIs, and Emerald sites and consider the groundwater levels when siting the towers. In order to balance cumulative traffic loads, when optimising transport of construction materials, equipment and workers, and developing the Project's Construction Traffic Management Plan, consider envisioning therein higher 'baseline' traffic loads that may be associated with the concurrent projects included in this CIA (where the implementation of the projects overlaps in time). 	Traffic Management Plan Topsoil Management Plan Biodiversity Action Plan with related Management Plans Stakeholder Engagement Plan Community and Occupational Health and Safety Plan Waste Management Plan Hazardous Materials Management Plan Spill Management Plan Cultural Heritage Management Plan	D: RD (Biodiversity Action Plan, Cultural Heritage Management Plan, Stakeholder Engagement Plan) A: Supervising Engineer and relevant National Authorities D&I: Contractor (other management plans) A: Supervising Engineer, RD, Lenders (Chance Finds Procedure) M: Supervising Engineer	The management plans are developed and approved. All specified mitigation measures are implemented effectively throughout construction.	RD staff / project budget

Topic	Recommended minimum mitigation/control and enhancement measures	Relevant E&S Management Plan(s)	Responsibility (D&I, A or M) ⁷	Target / Indicator	Indicative cost of mitigation (USD) ⁸
	<ul style="list-style-type: none"> Request the Construction Contractor to clearly indicate the boundaries of the Project construction sites and implement security provisions to prevent unauthorised / accidental access. Request the Construction Contractor to ensure topsoil stripped during the site preparation/excavation works is properly stored and implement measures to prevent inadvertent spills of hazardous materials or poor waste management (detailed in the Waste Management Plan, Hazardous Materials Management Plan, and a Spill Management Plan) to control these possible risks to soils within the Project construction sites; Request the Construction Contractor to inform Project workers in case of temporal overlaps of construction activities with other projects; where relevant, include OHS risks of such overlaps in the OHS risk assessment (which is part of the Project’s E&S management system). To mitigate cumulative impacts on biodiversity, seek firstly to avoid biodiversity, and only if avoidance is not possible implement additional measures to achieve “no net loss” and, where possible, a “net gain” through offsets or additional conservation actions. Request the Construction Contractor to avoid creating new access routes for project activities and/or local community access. Existing access roads must be prioritized for use to minimize impacts on biodiversity 				
Operations Phase¹¹					
Air Quality	<ul style="list-style-type: none"> Maintain the community Grievance Mechanism to track trends in air quality complaints in certain areas. Where there are clusters of air quality complaints – implement additional monitoring to establish pollutant levels. Maintain roadside vegetation. Monitor air quality at sensitive receptor locations as per the Operations Monitoring Plan. Conduct regular checks and maintenance of tunnel ventilation systems. 	Air Quality Management Plan	D&I: RD, Maintenance Contractor. A: Lenders M: RD	Air Quality Management Plan is developed and approved prior to the Operational Phase commencing. All specified mitigation measures are implemented	Instrumental monitoring costs for the first two years of operations – 240,000 USD (see Table 8). ESHS management

¹¹ Where the Construction Contractor’s activities get prolonged into the operations phase, the Contractor will be held responsible for completing / finalising such activities.

Topic	Recommended minimum mitigation/control and enhancement measures	Relevant E&S Management Plan(s)	Responsibility (D&I, A or M) ⁷	Target / Indicator	Indicative cost of mitigation (USD) ⁸
	<ul style="list-style-type: none"> • Maintenance Contractor to apply the same mitigation measures as for the construction phase to reduce dust and emissions during maintenance activities. • Collaborate with local Police to conduct regular speed checking campaigns along the road alignment. • Engage with government to encourage adoption of legislation geared towards motor vehicle emissions reductions. • Implement additional air quality mitigation measures if air quality levels consistently exceed limit values in certain areas. These may include: <ul style="list-style-type: none"> ○ Reduction of speed limits along the road to reduce emissions. ○ Introduce emissions charging zones 			effectively throughout operation of the road.	included in the project budget of each party.
Noise & vibration	<ul style="list-style-type: none"> • Maintain roadside vegetation. • Collaborate with local Police to conduct regular speed checking campaigns along the road alignment. • Maintain the community Grievance Mechanism to track trends in noise & vibration complaints in certain areas. • Where there are clusters of noise/vibration complaints – implement additional noise monitoring to establish noise or vibration levels. • Monitor noise and vibration levels at sensitive receptor locations as per the Operations Monitoring Plan. • Maintenance Contractor to apply the same mitigation measures as for the construction phase to reduce noise/vibration levels during maintenance activities. • Implement additional noise abatement measures (on top of those included in the detailed design for operations stage) if noise levels consistently exceed limit values. These may include: <ul style="list-style-type: none"> ○ Reduction of speed limits along the road to reduce the noise/vibration levels. ○ Installation of noise attenuation barriers. ○ Additional planting of vegetation to provide a noise buffer strip ○ Physical relocation of affected individuals. 	Noise & Vibration Management Plan	D&I: RD, Maintenance Contractor. A: Lenders M: RD	Noise & Vibration Management Plan is developed and approved prior to the Operational Phase commencing. All specified mitigation measures are implemented effectively throughout operation of the road.	Instrumental monitoring costs for the first two years of operations – 12,800 USD (see Table 8). Estimates for permanent physical / structural mitigation will be based on the site-specific design decisions to be taken during the update of the detailed design. Indicatively, the cost could be

Topic	Recommended minimum mitigation/control and enhancement measures	Relevant E&S Management Plan(s)	Responsibility (D&I, A or M) ⁷	Target / Indicator	Indicative cost of mitigation (USD) ⁸
					around 500,000-600,000 USD ¹² , ESHS management included in the project budget of each party.
Pollution prevention	<ul style="list-style-type: none"> • Store hazardous and potentially contaminating materials required for maintenance activities in accordance with the Construction Phase Hazardous Materials Management Plan. • Maintain the integrity of the surface water drainage system, including the removal of accumulated sediments and cleaning of oil/water separators, to avoid blockages, overflow and direct discharge of contaminated runoff into surface water courses. • Monitor water quality at sensitive receptor locations as per the Operations Biodiversity Action Plan. • Perform maintenance paving in dry weather to prevent contamination from surface run-off. • During maintenance works, apply the same mitigation measures as per the construction stage for Water Resources. • Where possible, limit the use of de-icing chemicals during cold weather, give preference to mechanical means such as scrubbers and snow ploughs. • Include required measures for the effective containment and clean up of hazardous/polluting materials in case of spills, traffic accidents, fire, etc. in the Emergency Preparedness and Response Plan 	Spill Response Plan Emergency Preparedness and Response Plan	D&I: RD, Maintenance Contractor. A: Lenders M: RD	Relevant Management Plans are developed and approved prior to the Operational Phase commencing. All specified mitigation measures are implemented effectively throughout operation of the road.	Maintenance and operations costs born by the RD ESHS management included in the project budget of each party.
Waste	<ul style="list-style-type: none"> • Waste generated during maintenance activities should be managed in accordance with the Construction Phase Waste Management Plan. • Install waste bins with lids in rest/parking areas along the road alignment. 	Waste Management Plan	D&I: RD, Maintenance Contractor. A: Lenders M: RD	Waste Management Plan is updated and approved prior to the Operational Phase commencing.	Maintenance and operations costs born by the RD

¹² Assuming that noise abatement will be required for around 4 km at the residential areas; of which 1.5km can be protected by vegetation screens (two or three rows), 2km by absorbing noise barriers (with an average height of 2m), and houses along 500m – by soundproof windows (with two or three panes).

Topic	Recommended minimum mitigation/control and enhancement measures	Relevant E&S Management Plan(s)	Responsibility (D&I, A or M) ⁷	Target / Indicator	Indicative cost of mitigation (USD) ⁸
	<ul style="list-style-type: none"> Sub-contract a local licensed waste collection and disposal company(or companies) to empty waste bins and remove illegally dumped waste along the road alignment on no less than a monthly basis. Prohibit the dumping of waste and undertake regular inspections of obvious dumping sites. Conduct quarterly litter collection exercises along the road alignment to remove loose waste. 			All specified mitigation measures are implemented effectively throughout operation of the road.	ESHS management included in the project budget of each party.
Biodiversity	Update and implement the BAP and define precise actions to be implemented during the first years of operations, to ensure the objectives defined in the BAP are met.	Operations BAP	D&I: RD (possible specialist consultancy) A: Lenders M: RD	Operations BAP. approved prior to the Operational Phase commencing. All specified mitigation measures are implemented effectively throughout operation of the road.	Costs of biodiversity consultant will be calculated when updating the Plan (assuming 100,000 USD). ESHS management included in the project budget of each party.
Economy and labour market	For larger maintenance projects: <ul style="list-style-type: none"> Maintenance Contractor to prioritize employment from Project affected municipalities. Maintenance Contractor to prioritize the procurement of goods and services from Project affected municipalities. The RD to organise short-term vocational training for women in the Project-affected settlements in order to help them acquire / relevant qualifications to be employed in the hotel, restaurant and café sector. The RD to organize special training sessions for women entrepreneurs in order to develop and strengthen entrepreneurial skills. 	Recruitment Plan Procurement Plan	D&I: RD, Maintenance Contractor. A: Lenders M: RD	Recruitment Plan and Procurement Plan are developed and approved prior to commencement of planned larger maintenance projects. All specified mitigation measures are implemented effectively throughout the maintenance project.	ESHS management included in the project budget of each party.
Labour and working conditions	In relation to larger maintenance projects, the relevant mitigation measures included in the Construction Phase Recruitment Plan, and Labour and Working Conditions Management Plan should be adopted and a Workers Grievance Mechanism developed and implemented.	Recruitment Plan Labour and Working Conditions	D&I: RD, Maintenance Contractor. A: Lenders M: RD	Relevant Operations Phase Management Plans are developed and approved prior to commencement of	ESHS management included in the

Topic	Recommended minimum mitigation/control and enhancement measures	Relevant E&S Management Plan(s)	Responsibility (D&I, A or M) ⁷	Target / Indicator	Indicative cost of mitigation (USD) ⁸
	All Maintenance Contractors should develop and implement a Workers Code of Conduct.	Management Plan Worker Code of Conduct		planned larger maintenance projects. All specified mitigation measures are implemented effectively throughout the maintenance project. Worker Code of Conduct should be developed and adopted by all Maintenance Contractors throughout the operation of the road.	project budget of each party.
Public Health, Safety, and Security	<ul style="list-style-type: none"> Develop and implement road safety programmes for local communities, specifically covering school children and farmers (to prevent livestock and agricultural machinery on the highway). Inform local communities at least 2 weeks in advance of any planned maintenance works or diversions. Establish and maintain an accident log to track accident 'hotspots' and identify the need for additional mitigation measures to reduce future accidents. Establish a maintenance plan to ensure safe conditions for road users and project affected communities (including maintenance of road signs, traffic and streetlights, tunnel ventilation system, road surface, passageways for livestock and agricultural machinery). Implement planned tunnel design characteristics¹³ including escape ways and access to them, fire extinguishers, fire systems, longitudinal ventilation 	Community and Occupational Health and Safety Plan Emergency Preparedness and Response Plan Stakeholder Engagement Plan	D&I: RD, Maintenance Contractor. A: Lenders M: RD	Relevant Management Plans are developed and approved prior to the Operational Phase commencing. All specified mitigation measures are implemented effectively throughout operation of the road.	ESHS management included in the project budget of each party.

¹³ In compliance with the "Safety Requirements for Tunnels in the Trans-European Road Network Regulations" (Directive 2004/54/EC).

Topic	Recommended minimum mitigation/control and enhancement measures	Relevant E&S Management Plan(s)	Responsibility (D&I, A or M) ⁷	Target / Indicator	Indicative cost of mitigation (USD) ⁸
	<p>in preparation for emergency situations in the tunnels. Conduct regular maintenance of the fire system and electrical equipment.</p> <ul style="list-style-type: none"> • Include required measures for the effective management of public health and safety in the Emergency Preparedness and Response Plan in collaboration with local emergency services and healthcare facilities. 				
Occupational Health and Safety	<p>In relation to maintenance works, the relevant mitigation measures included in the Construction Phase Community and Occupational Health and Safety Plan should be adopted. Additionally:</p> <ul style="list-style-type: none"> • Establish an adequate perimeter around planned maintenance/repair works – using barriers, cones and other barricades that will indicate to road users where the worksite begins and ends. • Impose decreased speed limits in sections of the road adjacent to maintenance works. • Increase workers and work site visibility using lighting during evening/night work. • Plan maintenance activities for times when the road is expected to be less busy (including overnight). • Post traffic signs well before the maintenance work zone to warn drivers of changes such as reduced speed restrictions or lane closures. And allow drivers enough space to safely transition out of the work zone and back into the regular flow of traffic. 	Community and Occupational Health and Safety Plan	D&I: RD, Maintenance Contractor. A: Lenders M: RD	<p>Community and Occupational Health and Safety Plan Is developed and approved prior to the Operational Phase commencing.</p> <p>All specified mitigation measures are implemented effectively throughout operation of the road.</p>	
Tangible Cultural Heritage (CH)	<p>Following de-mobilisation of the Construction Contractor a Cultural Heritage Completion Audit Report must be completed to demonstrate the implementation of the construction phase Cultural Heritage Management Plan in line with Lenders' Policy requirements.</p> <p>RD to ensure that Maintenance Contractors, in developing Method Statements for maintenance activities, should ensure that:</p> <ul style="list-style-type: none"> • prior to commissioning the road, the speed limitation signage is installed for the relevant CH sites, as determined in the specific protection measures for these CHs. • road repair work sites are restricted to the road's right-of-way and limit maintenance vehicle movements and machinery activities to the access roads arranged during the construction; • works areas comply with the demarcation of the CH sites; if such was not preserved since construction, retreat the Cultural Heritage Management Plan 	N/A	RD with support of the External Consultant Maintenance Contractor	Completion Audit Report submitted and accepted by the Lenders.	<p>Completion Audit – 15,000 USD, RD's budget</p> <p>ESHS management included in the project budget of each party.</p>

Topic	Recommended minimum mitigation/control and enhancement measures	Relevant E&S Management Plan(s)	Responsibility (D&I, A or M) ⁷	Target / Indicator	Indicative cost of mitigation (USD) ⁸
	and CH site-specific sub-plans and comply with the relevant protection measures and activities regimes.				
Intangible Cultural Heritage (ICH)	As an enhancement measure, in order to support the possible benefits relative to ICH, the RD to engage with the Ministry of Economy (Committee for Tourism) and Ministry of Education, Science, Culture and Sport to inform about a potential for developing tourism and reviving ICH features and to promote a state-facilitated support in this regard.	N/A	RD	Information provided to the Ministry	RD's budget

4.3 Implementation and Operation

4.3.1 General Requirements: Demarcation of No-go Areas

No go areas are to be defined for the project based on the following criteria:

- Critical or natural habitat;
- Formally protected areas (notably Zangezur);
- Cultural heritage structures and sites;
- Private property;
- Surface water and buffer areas on other side of the surface water;
- Restricted areas as defined by the Armenian authorities for electricity generation;
- Military installations or properties;
- Areas defined in the ESIA as environmentally or socially sensitive and that are not listed above.

4.3.2 Minimal Specific Design Requirements

4.3.2.1 Spoil disposal areas (SDAs)

- No SDAs in demarcated no-go areas;
- Avoid vehicle transport of spoil as practicable;
- Divert stormwater runoff away from spoil disposal areas
- No contaminated stormwater runoff from SDAs
- Minimise overall vehicle distance travelled;
- Avoid double handling of spoil
- Provide dust control mechanisms at SDA's
- Characterise greenhouse gas emissions from vehicles transporting waste and implement measures to reduce such emissions
- Identify potentially sensitive receptors and ensure that noise, dust, light and vibration does not result in significant impacts on such receptors
- Develop landscaping plans for reducing visual impacts of SDA's at the end of the project.

4.3.2.2 Power lines

- No power lines to transform land/habitat or the character of demarcated no-go areas;
- Reduce visual impact of power lines by avoiding ridges
- Install bird flappers or equivalent to minimise risk of collisions with birds.

4.3.2.3 Green bridges/underpasses

- Develop green bridges or underpasses to maintain currently used large mammal movement routes
- Avoid transformation of habitat in the creation of underpasses.

4.3.2.4 Bridges

- Bridges to be sized for peak flows based on seasonal flow characteristics and for additional intensity and frequency of storms due to climate change
- Bridges to be sized for 1:200 year storms

4.3.2.5 Access roads

- No access roads in demarcated no-go areas

4.3.2.6 Construction camps, lay-down areas and batching / asphalt plants

- No siting in demarcated no-go areas
- Minimise vegetation clearing to only those areas where absolutely necessary
- Provide access control and fencing.
- Plants will be located downwind of residential areas and not within 500m of any residential area or other social receptor.
- The entire batching / asphalt plant area traversed by vehicles – including driveways leading into and out of the area – will be paved with a hard, impervious material.

4.3.2.7 Borrow pits/quarries

- No borrow pits in demarcated no-go areas
- In obtaining the permits for the borrow pits determine the closure obligations that are associated with the permission;
- Determine the future land use of the area in which the borrow pit exists and tailor the closure and rehabilitation plan to meet those land use objectives;
- In particular determine whether there are any infilling requirements and determine how these would be implemented if such is required;
- Prior to opening the borrow pit define how that would happen to ensure that provision is made at the outset for the rehabilitation and closure requirements as determined above.
- Ensure that the topsoil is carefully excavated and stored suitably for later reapplication in establishing vegetation growth;
- Prevent topsoil stockpiles from erosion and/or compaction;
- Allow topsoil stockpiles to become weeded over if the weeds prevent erosion.
- Borrow pits must be closed in such a way as to ensure that erosion and sedimentation of surface water is prevented;
- Stabilise all cleared surfaces as quickly as possible through planting and propagating suitable vegetation;
- Direct surface water runoff away from the borrow pit to minimise the hydraulic strength of the water that would be crossing the cleared surfaces;
- Inspect rehabilitated borrow pits to identify and repair areas of erosion and washaway;
- Strengthen areas in which channels are likely to form, using paving blocks if so required.

4.3.3 Training

An Environmental, Social, and Health and Safety (ESHS) training programme should be developed by the Contractor and approved by the Supervising Engineer prior to start of construction. The Engineer will deliver selected ESHS trainings, that will be aligned, as needed, with the capacity-building programme to be delivered by the PIU Consultant.

All personnel (contractor and sub-contractor workers and site visitors) will receive Induction Training, incorporating ESHS risks and management requirements before entering any Project site or facility, including (but not limited to) the following topics:

- Environmental risks and impacts of Project activities.
- Social risks and impacts of Project activities.
- Health and Safety risks and impacts of Project activities.
- Specific instructions in relation to required ESHS mitigation measures at the Project sites and facilities (including the Permit to Work system).
- Emergency Response.
- Worker Code of Conduct.
- Working and contractual conditions.
- Chance Finds Procedure.

A flexible, modular-based, Training Programme should be developed to ensure that all Project workers can receive an appropriate range of training commensurate with their roles and the scope of work they will be expected to do. The Programme must ensure that all workers receive an adequate level of awareness and understanding of how their activities during the construction phase can affect the environment and local communities, the principles of ESHS management and the practical actions they must take as individuals to comply with Project ESHS requirements (as outlined in this ESMP) and ensure good Project ESHS performance. Training sessions must be scheduled frequently enough to ensure that all workers on site (including any new workers) have received the necessary training to perform their work duties safely, and without adversely impacting the environment or local communities. A register should be taken at each training session to provide a written record of the training each worker has received against individual training requirements.

E&S training modules may include:

- The careful use of resources (e.g. water/fuel consumption)
- Project requirements to safeguard biodiversity resources such as flora, fauna, watercourses, and habitats.
- Specific local constraints and risks.
- Spill prevention.
- Storage of hazardous materials.
- Cultural heritage protection.
- Construction best practices to control disruptive noisy activities and dust.
- Land access.
- Waste management.
- Interactions with local communities.

The Contractor should reinforce mandatory training modules with additional, daily toolbox talks at the start of workers' shifts. These talks can be used as an opportunity to reiterate specific Project ESHS requirements, including if trends in poor performance are detected (e.g. to remind workers of waste management requirements if on-site littering by the workforce is a persistent issue), following an incident (to help explain the root cause(s) and prevent future recurrences) or to inform workers of any changes in mitigation measures (if additional or alternative mitigation measures are being introduced in response to an incident or poor performance).

4.4 Checking and Corrective Action

4.4.1 Monitoring

Table 5 and **Table 6** outline the E&S monitoring that should be undertaken during both the construction and operations phases of the Project, to ensure that the requirements of the E&S Management Plans, Lenders' Policies and ESIA commitments are being met.

Table 5. Construction Phase Monitoring

Topic	Parameters and Limit Values / Aspects to be monitored	Location(s)	Frequency	Method	Responsibility
Environmental Monitoring					
Air Quality	As per Table 3	Dust fallout monitoring at the following locations: Sisan, Ishkhanasar, Aghitu, Noravan, Vaghatin, Vorohtavan, Darbas, Lor, Shenatagh, Getatagh, Geghi, Getishen, Kavchut, Nor Astghaber, Dzagikavan, Lernadzor ¹⁴	Continuous Dust monitoring during dry / windy conditions. Not less than monthly and in response to community grievances	Continuous visual observations of dust levels – dust fallout monitoring using dust buckets. Instrumental (episodic continuous measurement campaigns to determine the airborne PM10 and PM2.5 concentrations in areas where there is possible human exposure to the same)	Contractor (analysis to be conducted by an accredited laboratory)
Noise	As per Table 3	At all locations where there are sensitive noise receptors (such as residential houses and social facilities (healthcare, kindergartens), which are located closest to the construction sites in: Musallam, Kavchut, Verin Geghavank, Geghi (including dwellings ~700 m to the west-northwest of Geghi), Karut, Kitsk, Shenatagh, Lor, Getatagh, Darbas, Dwellings ~1.2 km to the west-northwest of Shamb, Vorotan, Vaghatin (including dwellings ~780 m to the south of Vaghatin), Aghitu (including dwellings	Not less than monthly where there are on-going construction activities and in response to community grievances.	Type 1 sound level meter that meets all appropriate International Electrotechnical Commission's standards and is subject to annual calibration by an accredited laboratory. The sound level meter should be located approximately 1.5 m above the ground and no closer than 3 m to any noise reflecting surface. Efforts should be made to ensure that measurements are not affected by the residual noise and extraneous influences, e.g., wind, electrical interference and any other non-acoustic interference, and that the instrument is operated under the conditions specified by the manufacturer. It is good practice to avoid conducting measurements when the wind speed is more than 5 m/s, while it is raining or when the ground is wet.	Contractor

¹⁴ Kitsk, Karut, Verin Geghavank, Geghavank and Vocheti have had no permanent population since at least 2011. Seasonal residents sometimes visit Kitsk, Karut, and Verin Geghavank villages, so monitoring at these locations is required only if the seasonal residences are occupied.

Topic	Parameters and Limit Values / Aspects to be monitored	Location(s)	Frequency	Method	Responsibility
		~450 m to the west of Aghitu), Sisian ¹⁵			
Vibration	As per Table 3	All identified structures (within 25 m from the construction sites and 100m from the tunnel portals if larger blasting charge will be used there) and cultural heritage assets (within 50m from the construction sites and 100m from the tunnel portals if larger blasting charge will be used there) that are vulnerable to vibration impacts from vibration generating activities (blasting, pile driving etc.). Two locations In Zangezur Sanctuary above the tunnel.	Continuous during relevant vibration generating construction activities.	Instrumentation. When blasting the following information should also be collected: <ul style="list-style-type: none"> • Blast information summary • Meteorological information at time of the blast. • Video Recording of the blast. • Fly rock observations. 	Contractor
		Selected sensitive locations (CH sites and/or residential buildings)	Twice during the most impacting phases of the construction works (assumed 160 locations)	Instrumentation	Supervision Engineer
Surface Water Quality	As per Annex 2	<ul style="list-style-type: none"> • 50m upstream and downstream of all Project discharge points. • 50m upstream and downstream of any 	<ul style="list-style-type: none"> • Not less than monthly • Not less than weekly but more frequently if there are visible signs of 	Continuous visual observations to detect oil/grease and high levels of suspended solids Instrumentation	Contractor (analysis of samples to be conducted by an accredited laboratory as necessary).

¹⁵ Kitsk, Karut, Verin Geghavank, and Geghavank have had no permanent population since at least 2011. Seasonal residents sometimes visit Kitsk, Karut, and Verin Geghavank villages, so monitoring at these locations is required only if the seasonal residences are occupied.

Topic	Parameters and Limit Values / Aspects to be monitored	Location(s)	Frequency	Method	Responsibility
		works being undertaken within a watercourse.	contamination.		
		All springs within 300 m from the proposed road alignment (where present in Aghitu, Vaghatin, Darbas, Lor, Getatagh, Shenatagh, Geghavank, Getishen, Kavchut and Dzagikavan (Musallam) settlements)	Not less than monthly (need to start measurements prior to construction)	Instrumentation	
Resource Consumption	<ul style="list-style-type: none"> Volume of water abstracted from groundwater/surface water sources or water supply from utilities providers/other providers. Volume of fuel (petrol/diesel) consumed by Project vehicles and equipment. Volume of electricity consumed at Project Facilities. 	Each Project facility/Construction site	On-going	Instrumentation, records provided by utilities/other providers.	Contractor
Groundwater Quantity (yield of the springs)	Litre per second	All springs within 300 m from the proposed road alignment (where present in Aghitu, Vaghatin, Darbas, Lor, Getatagh, Shenatagh, Geghavank, Getishen, Kavchut and Dzagikavan (Musallam) settlements)	Not less than monthly (need to start measurements prior to construction)	Instrumentation and visual inspections	Contractor
Sanitary Wastewater Discharges	As per Table 3	Discharge outlet (before discharge point)	Not less than monthly	Instrumentation	Contractor (analysis of samples to be conducted by an accredited laboratory as necessary).
Waste Management	Volume of waste generated (by waste stream). Volume of waste re-used.	All Project Facilities and worksites	Not less than monthly	Continuous visual inspections of waste management requirements. Review of waste transfer notes.	Contractor

Topic	Parameters and Limit Values / Aspects to be monitored	Location(s)	Frequency	Method	Responsibility
	Volume of waste recycled (by waste stream). Volume of waste disposed of to landfill. All requirements of the Waste Management Plan are being met.			Audit against requirements of Waste Management Plan	
Spoil Management	All requirements of the Spoil Disposal Sub-Plan are being met.	All Spoil Disposal Sites	Not less than monthly	Audit against requirements of Spoil Disposal Sub-Plan	Contractor
Hazardous Materials	Number of spills/leaks of hazardous materials reported. Required number of fully and appropriately stocked spill kits are provided. All requirements of the Hazardous Materials Management Plan are being met	All Project construction sites and facilities.	Not less than monthly	Review records of environmental incidents. Visual inspection of spill kits. Audit against requirements of Hazardous Materials Management Plan.	Contractor
Geo-hazards	Soil erosion Ground movement	Steep slopes	Not less than monthly	Visual inspections of indicators of soil erosion (rilling, gullies, sediment deposition). Visual inspections of any ground movement on steep slopes (land slumps, slope failures, land slides). Use of inclinometers if necessary to establish rates of ground movement.	Contractor
Landscape and Visual Amenity	All requirements of the Topsoil Management Plan are being met. All requirements of the Recultivation/Land Restoration Plan are being met.	All topsoil storage locations. All areas where temporarily used land is being restored.	Not less than monthly	Audit against requirements of Topsoil Management Plan and Recultivation/Land Restoration Plan.	Contractor
Biodiversity	Parameters in the Biodiversity Action Plan and the related MPs	In the areas determined in the Plans	Frequency as per the Plans	Field surveys and analysis	Contractor
Social Monitoring					
Labour	All required training has been provided to all workers depending on the activities they will perform. Trends in worker grievances relating to working conditions, contractual	All Project Facilities and worksites	Monthly	Review of training records Review of worker Grievance Register Review of Project employment statistics	Contractor

Topic	Parameters and Limit Values / Aspects to be monitored	Location(s)	Frequency	Method	Responsibility
	<p>arrangements, GBVH, and accommodation.</p> <p>Percentage of female workers employed on the Project.</p> <p>Percentage of foreign versus Armenian workers employed.</p> <p>All employees have been provided with a copy of their contract and signed the Worker Code of Conduct.</p> <p>No employees are minors.</p>			<p>Review of new employee contracts, to ensure all have signed the Worker Code of Conduct.</p> <p>Review of all new employee documents to ensure they are not under age.</p>	
OHS	<p>Number of near misses reported.</p> <p>Number of lost time injuries.</p> <p>Number of fatalities.</p> <p>Number of traffic accidents involving Project employed drivers.</p> <p>Required number of in date, fire extinguishers are provided.</p> <p>Required number of fully stocked first aid kits are provided.</p> <p>All electrical equipment is in good working order and testing is up to date.</p> <p>All workers have received required OHS training for their role(s).</p> <p>Trends in worker grievances relating to OHS.</p> <p>Number of medical checks undertaken on Project drivers.</p> <p>Number of emergency drills held for fire and tunnel evacuation.</p> <p>All required PPE has been provided and is being used.</p>	All Project Facilities and worksites	Monthly	<p>Review of training records</p> <p>Review of records of emergency drills held</p> <p>Review of incident reports</p> <p>Review records of near misses</p> <p>Inspection of first aid kits</p> <p>Inspection of fire extinguishers.</p> <p>Inspection of electrical equipment.</p> <p>Review worker Grievance Register.</p> <p>Review medical records of Project drivers.</p> <p>Review of air quality monitoring data in the tunnels.</p>	Contractor
Land	<p>Additional land required for construction realignment (m2).</p> <p>Accidental impacts to land due to negligence of contractor's labour force</p>	All Project Facilities and worksites	Monthly	<p>Review community Grievance Register.</p> <p>Review of other data as per the Resettlement Plan</p>	Contractor

Topic	Parameters and Limit Values / Aspects to be monitored	Location(s)	Frequency	Method	Responsibility
	Other parameters per the Resettlement Plan				
Community Health, Safety and Security	Trends in Community grievances including in relation to dust, noise, traffic, water, security, waste and the project workforce. Number of traffic accidents on the local road network or Project access roads, and any traffic accidents involving Project vehicles. Number of instances of unauthorised access to construction sites.	Entire Project Area	Not less than monthly	Review Community Grievance Register Review incident reports.	Contractor
Cultural Heritage	Vibration levels Condition of cultural heritage structures. Chance Finds Requirements of the Cultural Heritage Management Plan are being met.	Vibration monitoring of all tangible cultural heritage assets located within 50m from the edge of the road alignment construction zone, and within 200 m from the tunnel portals (as there is a potential of larger charge blasting)	Continuous monitoring of vibration levels. Daily visual observation of structural conditions	Permanent Instrumental Visual observation	Contractor Cultural Heritage Expert
Economy	Percentage of total goods and services procured from Project affected Municipalities. Percentage of workforce employed from Project affected Municipalities.	Project affected Municipalities	Monthly	Review of employment records	Contractor
Public Utilities and Services and Transport Infrastructure	Number of Project workers requiring treatment at local medical facilities. Condition of local roads/access tracks used by Project traffic. Number of incidents of damage to utilities as a result of Project activities.	Whole Project Area	Monthly	Review of workers medical records. Visual inspections of local roads/access tracks used by Project Vehicles. Review of incident reports.	Contractor

Table 6. Operational Phase Monitoring

Topic	Parameters and Values/Aspects monitored	Limit to be	Location(s)	Frequency	Method	Responsibility
Environmental Monitoring						
Air Quality	As per Table 3		NO2 (nitrogen dioxide) and SO2 (sulphur dioxide) at a single most exposed locations in Aghitu, Shenatagh, Kavchut.	Continuous monitoring, and in response to community grievances.	Instrumental continuous	RD or contracted third party (analysis to be conducted by an accredited laboratory)
Noise	As per Table 3		At all locations where there are sensitive noise receptors (such as residential houses and social facilities (healthcare, kindergartens), which are located closest to the construction sites in: Musallam, Kavchut, Verin Geghavank, Geghi (including dwellings ~700 m to the west-northwest of Geghi), Karut, Kitsk, Shenatagh, Lor, Getatagh, Darbas, Dwellings ~1.2 km to the west-northwest of Shamb, Vоротan, Vaghatin (including dwellings ~780 m to the south of Vaghatin), Aghitu (including	No less than quarterly for the first two years then semi-annually, and in response to community grievances.	Type 1 sound level meter that meets all appropriate International Electrotechnical Commission's standards and is subject to annual calibration by an accredited laboratory. The sound level meter should be located approximately 1.5 m above the ground and no closer than 3 m to any noise reflecting surface. Efforts should be made to ensure that measurements are not affected by the residual noise and extraneous influences, e.g., wind, electrical interference and any other non-acoustic interference, and that the instrument is operated under the conditions specified by the manufacturer. It is good practice to avoid conducting measurements when the wind speed is more than 5 m/s, while it is raining or when the ground is wet.	RD or contracted third party.

		dwelling ~450 m to the west of Aghitu), Sisian ¹⁶			
Surface Water Quality	As per Annex 2 The condition of culverts, crossings, etc. along the road and SDAs.	50m upstream and 250m downstream of any point of discharge from the road drainage system into a surface watercourse along the whole road alignment.	Not less than every 6 months.	Instrumentation Visual observation	RD or a contracted third party (analysis of samples to be conducted by an accredited laboratory as necessary).
	As per Annex 2	Same springs that were monitored during the construction phase	Not less than every 6 months for the first two years of operations. In response to community grievances.	Instrumentation	
Groundwater Quantity (yield of the springs)	Litre per second	Same springs that were monitored during the construction phase	Not less than every 6 months for the first two years of operations (to identify delayed trends). In response to community grievances.	Instrumentation and visual inspections	RD
Resource Consumption	Volume of electricity consumed	Whole road alignment	On-going	Review electricity consumption records	RD
Waste Management	Volume of waste generated during maintenance activities (by waste stream). Volume of maintenance waste re-used. Volume of maintenance waste recycled (by waste stream).	Whole road alignment	Monthly	Continuous visual inspections of waste management performance. Review of waste transfer notes. Audit against requirements of Waste Management Plan	RD

¹⁶ Kitsk, Karut, Verin Geghavank, and Geghavank have had no permanent population since at least 2011. Seasonal residents sometimes visit Kitsk, Karut, and Verin Geghavank villages, so monitoring at these locations is required only if the seasonal residences are occupied.

	Volume of waste disposed of to landfill. All requirements of the Waste Management Plan are being met.				
Spoil Management	Condition of spoil disposal sites	All spoil disposal sites	Quarterly	Visual inspection of the condition of spoil disposal sites to ensure stability, no encroachment of spoil material on structures or surface water bodies, and no visible soil erosion.	RD or a contracted third party
Hazardous Materials/Spill Response	Number of accidental spills of hazardous materials requiring clean up operations. Number of incidents of surface water pollution due to accidental spills of hazardous materials. Number of incidents of soil pollution due to accidental spills of hazardous materials requiring soil excavations. All requirements of the Spill Response Plan have been met in the event of a spill.	Whole road alignment.	Quarterly	Review of incident reports. Audit against requirements of the Spill Response Plan.	RD
Geo-hazards	Soil erosion Ground movement Condition of soil erosion mitigation measures. Condition of reinstatement of steep slopes.	Steep slopes	Quarterly	Visual inspections of the condition of surface drainage systems and indicators of soil erosion (rilling, gullies, sediment accumulation). Visual inspection of condition of retaining walls, gabion walls etc. and indicators of ground movement on steep slopes (slope failures, land slumps, land slides) Visual inspection of success of planting/natural revegetation on steep slopes.	RD or a contracted expert third party.
Landscape and Visual Amenity	Percentage of replanted trees that have survived.	Whole road alignment	No less than every 6 months (for the first 5 years)	Visual inspections	RD or a contracted third party.

	Percentage of vegetation cover in areas of reinstatement. Accuracy of contouring of excavated and backfilled landscapes.				Contractor will be required to repair any defects in accordance with warranty obligations
Biodiversity	Parameters in the Biodiversity Action Plan and the related plans	In the areas determined in the Plans	Frequency as per the Plans	Field surveys and analysis	RD with support of a contracted third party.
Social Monitoring					
Labour	All required training has been provided to all maintenance/third-party contractor employees depending on the activities they will perform. All maintenance/third party contractor employees have been provided with a copy of their contract prior to commencing work. No maintenance/third party contractor employees are minors. Percentage of maintenance contractor workforce employed from local Municipalities (for large maintenance jobs).	Whole road alignment	Quarterly	Audit of maintenance/third-party contractor training records. Audit of maintenance/third-party contractor employment records.	RD
OHS	Number of near misses reported by Maintenance/Third Party contractor workforce. Number of lost time injuries amongst Maintenance/Third Party contractor workforce. Number of fatalities amongst Maintenance/Third Party contractor workforce. Number of traffic accidents involving Maintenance/Third Party contractor employees.	Whole road alignment	Quarterly	Audit of maintenance/third-party contractor OHS statistics and incident reports.	RD

<p>Community Health, Safety and Security</p>	<p>Number of traffic accidents on the Road alignment. Number of fatalities on the Road alignment. Number of traffic accidents on the road alignment involving livestock. Number of traffic accidents on the road alignment involving agricultural machinery. Trends in community grievances including in relation to traffic, safety, noise, air quality and waste.</p>	<p>Whole road alignment</p>	<p>Quarterly</p>	<p>Review of Community Grievance Register Review of accident reports</p>	<p>RD</p>
<p>Emergency Response</p>	<p>Number of emergencies Number of emergency drills held. All requirements of the Emergency Preparedness and Response Plan are being met.</p>	<p>Whole road alignment</p>	<p>Quarterly</p>	<p>Review incident reports. Review emergency drill records. Audit against requirements of the Emergency Preparedness and Response Plan.</p>	<p>RD</p>

4.4.2 E&S Reporting Requirements

Table 7 outlines the Project reporting requirements with regard to E&S management performance.

Table 7. Project E&S Reporting Requirements

Responsibility	Project Phase	Frequency	E&S Content Required	Recipient
Supervising Engineer	Construction	Monthly Progress Report	Progress Report based on information provided in the Contractor's monthly Report, including on Project E&S performance.	RD
Supervising Engineer	Construction	Quarterly	Progress made and problems associated with environmental matters, any adverse environmental impacts that have occurred during construction, the corrective measures taken to remedy these impacts, and the steps taken to avoid their recurrence. Progress made and problems associated with social safeguards and resettlement.	RD
Supervising Engineer	Construction	Semi-Annual Environmental Monitoring Report	The status of compliance with project Environmental Management Plans, records of related activities, environmental grievances raised and solutions, and the results of environmental monitoring.	RD
Supervising Engineer	Construction	Semi-annual Social Safeguards Monitoring Report	The status of land acquisition and resettlement activities; presenting the observations, findings, issues, non-compliance, and any variance from the provisions of the RP, status of grievance redress mechanism, recommended solutions and actions necessary to ensure compliance with the terms of the approved RP and Lenders' Policies. The status of compliance with Project's Social Management Plans, including the SEP, Labour and Working Conditions Management Plan (with a Worker Accommodation Plan as a sub-plan) & Worker Code of Conduct, Community and Occupational Health and Safety Management Plan, Cultural Heritage Management Plan.	RD
Contractor	Construction	Monthly	Progress Report including E&S monitoring undertaken and the results, details of worker and community grievances raised, the status of required permits, E&S training completed, results of any E&S audits/inspections undertaken by the Contractor, details of any incidents and the outcome of investigations, summary of any chance finds, any non-compliances with the requirements of the E&S Management Plans.	Supervising Engineer
RD	Construction	Semi-annual E&S Report Monitoring Reports until the construction starts Quarterly E&S Reports to the	ESAP progress and the Project's E&S performance (including ESMP delivery).	Lenders

Responsibility	Project Phase	Frequency	E&S Content Required	Recipient
		Lenders on the ESAP progress and the Project's E&S performance and ESMP actions (during construction or until otherwise instructed by Lenders)		
RD	Operations	Semi-annual E&S Reports to ADB after the construction phase is over and before the Project Completion Report is issued, and annual E&S Reports to EBRD and EIB until the loan is re-paid	ESAP progress and the Project's E&S performance (including ESMP delivery) during operations.	Lenders
External Social Consultant	Pre-construction and construction phases, and first two years of operations (unless otherwise is requested by the Lenders)	As will be required by the Project activities (potentially either quarterly or semi-annually)	External monitoring of the Project's social performance against the Lenders' requirements, including the completion of labour audits, preparation of the resettlement Compliance Report(s)	Lenders RD
External Environmental Consultant			External monitoring of the Project's environmental performance against the Lenders' requirements.	Lenders RD

4.4.3 Compliance Assurance

The compliance assurance process for the Project will ensure compliance with the requirements of this ESMP and other relevant Project ESHS standards and specifications. The process is based on the Contractors undertaking a structured self-verification process to monitor implementation of the E&S Management Plans (including sub-contractor implementation of the same), as well as the Supervising Engineer undertaking monitoring, oversight and assurance activities of Contractor (and sub-contractor) performance.

Non-conformances are unapproved deviations from the requirements of this ESMP and Contractor Management Plans, Procedures, Codes and other ESHS standards and specifications. These should be detected through the oversight and assurance process (daily monitoring, inspections and audits by the Supervising Engineer, and monitoring conducted by the Lenders). All non-conformances should be registered and tracked though to closure by the Supervising Engineer and presented in weekly discussions with the Contractor as well as in Monthly Reports to the RD. A Non-Conformance Management Procedure should be developed by the Supervising Engineer that defines non-conformances categories according to severity, and the management approach for each category. Major non-conformances (e.g. incidents that have resulted in physical harm, damage to a sensitive environmental receptor, or have impacted a large number of local residents/households/livelihoods) should be managed as follows:

1. Initiate – The originating person submits a Non-Conformance Report by providing concise non-conformance description, indication of deviated requirement / procedure and identification of location/ area where the non-conformance occurred.
2. Response – The Contractor investigates and identifies the Root Cause, proposes corrective actions and actions to prevent re-occurrence and drafts a Non-Conformance Action Plan.

3. Review – Supervising Engineer reviews and confirms or comments on the proposed corrective actions.
4. Implement – The Contractor finalises the Non-Conformance Action Plan and initiates implementation of corrective actions according to set deadlines. As actions are implemented, the Contractor provided relevant supporting documentation confirming implementation to the Supervising Engineer.
5. Close out – Supervising Engineer confirms, validates and closes out the non-conformance.

4.4.3.1 Incidents

Serious non-conformances, i.e. incidents involving extensive environmental damage, social impacts or fatalities should be reported to the RD within 1 hour, and Lenders within 24 hours of the occurrence.

The Contractor should provide a detailed written Incident Report including as a minimum:

Initial Incident Report (within 3 days of the incident):

- A brief description of the incident;
- Persons and parties involved;
- Details of the incident;
- Photos/Videos.

Complete Accident Report (within maximum of 2 weeks):

- Investigation activities;
- Analyses and results (Root cause);
- Advice and Corrective and Preventive Actions (with implementation timelines);
- Lessons Learned;
- Photos/Videos

The RD (supported by the Supervising Engineer and Lenders) will be responsible for reviewing and approving these reports and monitoring the implementation of any required corrective and preventive actions identified.

4.5 Management Review

RD E&S Management Review is the final component of an ESMP and helps to ensure the effectiveness of the overall E&S management system. This should be undertaken annually as a minimum, and will be informed by the more regular Contractor and Supervising Engineer review activities (including e.g. weekly E&S Team meetings, monthly Project management meetings, reporting and performance reviews). There are three main objectives of the RD Management review:

1. To provide the RD with a summary of Project E&S performance over the year, including:
 - Non-conformities and corrective actions
 - Monitoring and measurement results
 - Stakeholder feedback and concerns
 - Adequacy of E&S resources

- Regulatory changes
 - E&S incident trends, response and reporting.
2. Identify opportunities for improvements in E&S Performance.
 3. Summarise the on-going significant E&S risks and propose additional mitigation/control measures if necessary, or the requirement of additional resources.

4.6 Indicative Cost Estimates

Indicative costs of the recommended minimum mitigation and control measures are presented in **Table 4** of this report and can be summarised as follows:

- The costs of preparing, implementing, and managing SESMPs are part of the direct costs of implementing the Project and will be included in the Construction Contractor's budget. Indicatively, they would be around 4 million USD¹⁷, of which:
 - ca. 1,091,840 USD are expected to be required for instrumental monitoring during pre-construction and construction (refer to **Table 7**) and 30,000 USD for modelling exercises,
 - ca. 1,000,000 USD would be allocated for ESHS staffing¹⁸;
 - ca. 1,779,000 USD are estimated for the implementation of the Cultural Heritage Management Plan (see **Annex 6**) and 15,000 for the Completion Audit Report;
- Supervising Engineer's E&S management costs (including oversight, research, training, public relations, and reporting) will be included in the Supervision Engineer's budget. Indicatively, these staffing costs would make around 600,000 USD for six years of construction. In addition, instrumental vibration monitoring is to be implemented by Supervising Engineer during construction and would require about 25,600 USD¹⁹.
- ca. 1,500,000 – 2,000,000 USD are estimated for the delivery of the Biodiversity Action Plan (including the Offsetting Plan, Invasive Species Management Plan and replanting as part of the Recultivation Plan).

Various administrative, procedural (related to obtaining national EIA conclusions and other permits) and indirect expenses, as well as taxes and profit, would be envisioned by the Contractor and Engineer in their respective budgets on top of the above listed estimates.

Table 8. Indicative Estimate of Contractor's Instrumental Monitoring Costs

Phase	Parameter	Unit Cost	Number of units (approximate)	Total Cost	Total Cost by Phase	Assumptions/comments
Pre-construction (one time)	Air quality					was completed within the ESIA
	Surface water springs quality	300	20	6000		2 springs per 10 villages

¹⁷ Costs of construction activities are not estimated as they are part of the Contractor's construction budget.

¹⁸ The assumption is 1,500 USD / month per national staff multiples by the number of engagement months (which varies for various positions between 24 to 72). 2,500 USD per month is assumed for the international staff of the Supervision Engineer.

¹⁹ Based on the assumption of undertaking measurements four times at 80 sensitive locations.

Phase	Parameter	Unit Cost	Number of units (approximate)	Total Cost	Total Cost by Phase	Assumptions/comments
	Groundwater quantity (yield of the springs)	20	20	400		2 springs per 10 villages
			Sub-total	6400	6400	
Construction (monthly during 72 months)	Air quality (PM2.5, PM10)	80	8	640		1 point per 16 villages (50% of villages are affected at one time during one month)
	Noise	80	25	2000		3 points per 14 villages + separately located houses (assume 6), (50% of points are affected at one time during one month)+2 points in Zangezur Sanctuary (during the tunnel construction)
	Vibration (including CH sites)	80	40	3200		40 CH sites, as some will be relocated, + social infra/houses (2 per 16 villages)+ separate houses (assume 6) + 2 points in Zangezur Sanctuary above the tunnel. Assume that not more than 50% of receptors can be affected at one time during one month
	Groundwater quantity (yield of the springs)	20	10	200		2 springs per 10 villages, construction at 50% of villages at one time
	Surface water spring quality	300	16	4800		4 discharge points and 4 watercourses crossed
	Sanitary wastewater discharges	300	2	600		2 discharge points, one per each camp
				Sub-total	11440	823680
Operations (quarterly during the first two years, apart from air)	Air (NO2, SO2)	3	70000	210000		1 monitoring station per each of 3 villages (the analyzer will run for the whole year, 60K is the station + 10K annual maintenance). Alternatively, one station can be installed at the nearest receptors.
	Noise	80	20	1600		1 point per 14 villages + separately located houses (assume 6)
	Surface water springs quality	300	6	1800		selected locations
	Groundwater quantity (yield of the springs)	20	6	120		selected locations
			Sub-total	213520	268160	for two years
			Grand-total		1098240	

The Resettlement Plan costs will be allocated from the state budget separately from the above estimates.

Annex 1. GEO-HAZARDS RISK ANALYSIS

Objectives:

- Provide detailed and precise geodetic and geological data for detailed design of rehabilitation/ stabilization of unstable slopes along the road alignment in accordance with the laws of Armenia and relevant technical design regulations and standards.
- Complete a risk analysis of potential slope failures along the road alignment, classifying each feature into high, medium or low risk to the integrity of the road.
- Provide a preliminary design of proposed mitigation measures and estimated costs.
- To prepare, based on surveying and geological data gathered, detailed designs for the optimal technical-economic solution for each slope location (standard protective structures).

Specific actions

Risk assessment (general)

The investigation and modelling of geohazards must include: Rockfall, rockslides and unstable slopes/ landslides seismic risk and avalanches.

The risk assessment shall be carried out in two steps. The first step is a desktop study using available surface data (especially high resolution DTM) and available geologic and morphologic data (geological and geomorphic maps and surveys etc.) in order to define areas with potentially unstable slopes due to rock fall or landslides (see detailed description below).

Areas with no risk (Category 0) require no further investigations. Areas with potential georisk shall be investigated in detail in the next project phase including field survey and detailed simulations as the basis for detailed design of standard protective and slope stabilization measures.

Area of interest (AOI)

The area of interest is defined by the proposed highway corridor and the whole slope side on which the alignment is located from valley bottom to mountain ridge. It must also be recognised that the alignment might change and can be shifted within the slope.

The investigation and modelling of geohazards shall focus on geohazards upslope of the new road alignment and threaten the road an appurtenant infrastructure.

Downslope stabilisation is already part of the road design.

Phase I Basic risk assessment (desktop study)

The basic risk assessment shall be based on state of the art 3-D rockfall modelling software using a DTM (digital terrain model) provided by the client. The study must comprise the following items:

- Identification of morphological anomalies that could be an indicator for mass movements or slope failure
- GIS based slope inclination analysis to define possible source areas for rockfall and avalanches
- Analysis of geological geotechnical and other geohazard maps (seismic maps, etc.)
- Analysis of other available geomorphological, geological and geotechnical information, which may include satellite imagery, aerial photographs or publicly available data such as google maps

- Seismic and seismotectonic desktop study for the area of interest based on earthquake data including instrumental, historical and pre-historic earthquakes and on active faults and geodetic data. This also includes a review of existing hazard models covering the area of interest with respect to seismic ground motion (PGA).

The results of phase I shall be presented in a geological hazard map detailing distinguishing no risk areas, low risk areas and high-risk areas (slopes).

Phase II Detailed risk assessment (including field investigations)

Field investigations

Field surveys must be used to ground true information from the desk study and to observe geomorphology of the area and other site-specific conditions that could influence the selection of mitigation (including but not limited to surface topography and local runoff and rock conditions such as degree of weathering, fracture and joint density and patterns, bedding patterns and presence of faults)

The consultant must conduct field investigations in all areas defined as potential high or low risk areas to create the basis for the detailed rockfall simulations. The field work shall be based on ISRM and EN ISO 14688-1 and EN ISO 14689-1 standards and include inter alia, the following:

Morphological information.

- Slope inclination
- Slope anomalies
- Signs of recent or historical instabilities (open cracks, debris cones, etc.)

Geological information:

- Lithology/ geological unit and formation
- Genetic group (sedimentary, metamorphic or igneous rock)
- Weathering
- Rock strength (UCS, estimated)
- Stability in water
- Fracturing
- Discontinuity sets, presence of faults

Moreover, the required input data for a state-of-the-art rockfall and avalanche modelling such as source areas, terrain materials, forest, rock size and shape must be collected:

- Source areas - generally, the source areas from the overview modelling (areas steeper 45° in the DEM) must be adopted and verified in the field considering geological information (lithology, discontinuities, failure modes, etc.)
- Terrain materials. Material Parameters like damping, depending on the slope surface conditions must be defined during field work (bedrock (clean, hard/ weathered), soft soil/ earth, debris, etc.)
- Forest. Detailed mapping must be carried out to generate a proper dataset of the forest cover for simulation for all slopes where a rockfall risk was detected.
- Rock size and shape. The data obtained in the field and used as input data for simulations must be presented and documented in map at an appropriate scale.
- 3-D Avalanche modelling. For the 3-D avalanche modelling, the data mentioned above can be used (morphology, forest, etc.) but information on snow depths sourced



from state institutions or open data sources. The results of avalanche modelling must define the range of avalanches in risk maps at an appropriate scale, as well as static equivalent loads.

- Seismic risk. The results from geological mapping must be integrated with seismic risk factors. A qualitative assessment of the susceptibility of slopes for mass movement and an assessment of failure modes (rock fall, surface slide, deep slide) as well as an identification of potentials for soil liquefaction must be done.
- Slope risk rating. Based on the geological description and the rock fall analysis, a slope risk rating and risk ranking of all possible geological hazard along the route for their potential to impact the integrity of the road shall be conducted by defining what can happen (e.g., rock fall with small blocks or big blocks on the road or slide of loose material on road, etc.) and how often this event is likely to occur. The likelihood of a possible event must be combined with possible costs of an event by defining consequence classes in a risk matrix resulting in a risk score.

This must also include the identification of road sections subjected to different levels of seismotectonic hazards (expert statement), identification of constructions requiring seismic engineering (e.g., bridges, tunnel portals).

Design

The design for the slope protection and stabilization works will follow European standards and technical requirements and – if available – Armenian legislation and regulations. Recommendations of the design shall be in terms of the current condition, the proposed solution and the remedial construction in relation to the ground. Documentation shall include the assessment of the current state of slopes (unstable, conditionally stable and stable) and shall list priority of slopes for rehabilitation as defined in the risk assessment and matrix outlined above.

The most important factors are:

- Stability and durability of the structures
- Economic efficiency of structures
- Ease of maintenance of structures
- Safe work conditions
- Road safety.

The area to be included in the design is based on the latest road alignment and covers all slopes where rockfall or landslide events potentially impact the road alignment. These areas shall be extended if there is a risk of landslides from high slopes above (or below with a potential for headward erosion) the Project section, to ensure the final detailed design provides complete protection of the road from landslides, rockfall etc. In addition to the slopes above the Project section, slopes above the entrance and exit portals of tunnel sections and the protection of the road at the cuttings approaching tunnels need to be considered and protected if necessary.

The design shall be conducted in two steps:

1. A preliminary design of the proposed measures with an initial order of magnitude cost estimate. This preliminary design should consider and state the estimated probability of success of the measures and should also include discussion of any annual maintenance works and associated costs.
2. Developing the detailed design of the proposed works. The detailed design must comprise all potentially unstable slopes, in which standard measures such as rock fall

protection kits (fences), wire mesh nets, etc. are suitable to protect the road from rockfall or slides. If the designer concludes that additional detailed investigation measures and a customized special design of support measures (individual design of pre-stressed anchors, anchor beams, retaining walls, galleries, or comparable) are necessary, such must be specified in the report. The consultant shall also propose necessary investigation measures and set out possible solutions.

It shall be understood that at various junctures, approval of documentation by either or both the Beneficiary or state authorities shall be required. The engineer responsible for the design must supervise the construction to ensure that conditions encountered are as anticipated and the design is adequately constructed.

Annex 2. WATER QUALITY PARAMETERES ACCORDING TO RIVER CLASS

The rivers and/or their tributaries that potentially can be affected due to Project implementation are part of the Vorotan, Voghji and Geghi River basins. The water quality criteria for those river basins are presented in **the below tables** (as per annexes 20, 23 and 24 of the RA Government decisions No. 75).

Water quality criteria for the Vorotan River basin

Quality criteria	Quality classes					Unit
	I	II	III	IV	V	
Dissolved oxygen	>7	>6	>5	>4	<4	mgO ₂ /l
BOD ₅	3	5	9	18	>18	mgO ₂ /l
COD (bichromate)	10	25	40	80	>80	mgO ₂ /l
COD (permanganate)	1.0	10	15	20	>20	mgO ₂ /l
Nitrate ion	0.328	2.5	5.6	11.3	>11,3	mgN/l
Nitrite ion	0.007	0.06	0.12	0.3	>0.3	mgN/l
Ammonium ion	0.39	0.4	1.2	2.4	>2.4	mgN/l
Total inorganic nitrogen	0.27	4	8	16	>16	mgN/l
Phosphate ion	0.15	0.3	0.6	1.2	>1.2	mg/l
Total phosphorus	0.078	0.2	0.4	1.0	>1.0	mg/l
Zinc, total	2.0	100	200	500	>500	µg/l
Copper, total	2.0	22.0	50	100	>100	µg/l
Chrome, total	0.5	10.5	100	250	>250	µg/l
Arsenic, total	0.56	10	50	100	>100	µg/l
Cadmium, total	0.01	1.01	2.01	4.01	>4.01	µg/l
Lead, total	0.14	10.14	25	50	>50	µg/l
Nickel, total	0.45	10.45	50	100	>100	µg/l
Molybdenum, total	1	2	4	8	>8	µg/l
Manganese, total	4	8	16	32	>32	µg/l
Vanadium, total	8	16	32	64	>64	µg/l
Cobalt, total	0.14	0.28	0.56	1.12	>1.12	µg/l
Iron, total	0.08	0.16	0.5	1.0	>1.0	mg/l
Barium	0.006	0.012	0.024	1.0	>1.0	mg/l
Beryllium	0.027	0.054	0.108	1.0	>1.0	µg/l
Lithium	2.0	4.0	8.0	16.0	>16.0	µg/l
Boron	0.004	0.45	0.7	1.0	>1.0	mg/l
Aluminium	0.14	0.28	0.56	5.0	>5.0	mg/l
Selenium, total	0.34	20	40	80	>80	µg/l
Antimony, total	0.25	0.5	1.0	2.0	>2.0	µg/l
Tin, total	0.08	0.16	0.32	0.64	>0,64	µg/l
Sodium	4.2	60	120	240	240	mg/l
Potassium	2.2	20	40	80	>80	mg/l
Calcium	6.4	75	150	300	>300	mg/l
Magnesium	2.0	50	100	200	>200	mg/l
Chloride ion	4	75	150	300	>300	mg/l
Sulphate ion	8.5	75	150	300	>300	mg/l
Silicate ion	12	24	48	96	>96	mgSi/l
Total dissolved salts	55	500	1000	1500	>1500	mg/l
Electrical conductivity	81	770	1500	2300	>2300	µS/cm
Hardness	0.5	10	20	40	>40	mg eq./l
Suspended solids	4.6	30	60	120	>120	mg/l
Smell (20°C and 60°C)	<2 (natural)	2 (natural)	2	4	>4	rate
Colour	(natural)	<5 (natural)	20	30	>200	degree

Water quality criteria for the Voghji River basin

Quality criteria	Quality classes					Unit
	I	II	III	IV	V	
Dissolved oxygen	>7	>6	>5	>4	<4	mgO ₂ /l
BOD ₅	3	5	9	18	>18	mgO ₂ /l
COD (bichromate)	10	25	40	80	>80	mgO ₂ /l
COD (permanganate)	5	10	15	20	>20	mgO ₂ /l
Nitrate ion	0.194	2.5	5.6	11.3	>11.3	mgN/l

Quality criteria	Quality classes					Unit
	I	II	III	IV	V	
Nitrite ion	0.003	0.06	0.12	0.3	>0.3	mgN/l
Ammonium ion	0.017	0.4	1.2	2.4	>2.4	mgN/l
Total inorganic nitrogen	0.122	4	8	16	>16	mgN/l
Phosphate ion	0.1	0.3	0.6	1.2	>1.2	mg/l
Total phosphorus	0.016	0.2	0.4	1.0	>1.0	mg/l
Zinc, total	3	100	200	500	>500	µg/l
Copper, total	4	24	50	100	>100	µg/l
Chrome, total	0.46	10.46	100	250	>250	µg/l
Arsenic, total	0.27	10	50	100	>100	µg/l
Cadmium, total	0.1	1.1	2.1	4.1	>4.1	µg/l
Lead, total	0.1	10.1	25	50	>50	µg/l
Nickel, total	0.64	10.64	50	100	>100	µg/l
Molybdenum, total	15	30	60	120	>120	µg/l
Manganese, total	4	8	16	32	>32	µg/l
Vanadium, total	0.38	0.76	1.52	3.04	>3.04	µg/l
Cobalt, total	0.09	0.18	0.36	0.72	>0.72	µg/l
Iron, total	0.031	0.062	0.5	1.0	>1.0	mg/l
Barium	18.3	75	150	300	>300	mg/l
Beryllium	4.8	50	100	200	>200	µg/l
Lithium	0.02	0.04	0.08	1.0	>1.0	µg/l
Boron	0.028	0.056	0.112	100	>100	mg/l
Aluminium	1.45	20	40	80	>80	mg/l
Selenium, total	5.300	60	120	240	>240	µg/l
Antimony, total	5.0	10.0	20.0	40.0	>40.0	µg/l
Tin, total	0.032	0.45	0.7	1.0	>1.0	µg/l
Sodium	0.03	0.06	0.12	5.0	>5.0	mg/l
Potassium	1.1	20	40	80	>80	mg/l
Calcium	0.5	1	2	4	>4	mg/l
Magnesium	0.077	0.15	0.3	0.6	>0.6	mg/l
Chloride ion	6	75	150	300	>300	mg/l
Sulphate ion	27	75	150	300	>300	mg/l
Silicate ion	7.1	14	28	56	>56	mgSi/l
Total dissolved salts	105.800	500	1000	1500	>1500	mg/l
Electrical conductivity	168.500	770	1500	2300	>2300	µS/cm
Hardness	1.5	10	20	40	>40	mg eq./l
Suspended solids	8.4	30	60	120	>120	mg/l
Smell (20°C and 60°C)	<2 (natural)	2 (natural)	2	4	>4	rate
Colour	(natural)	<5 (natural)	20	30	>200	degree

Water quality criteria for the Geghi River basin

Quality criteria	Quality classes					Unit
	I	II	III	IV	V	
Dissolved oxygen	>7	>6	>5	>4	<4	mgO ₂ /l
BOD ₅	3	5	9	18	>18	mgO ₂ /l
COD (bichromate)	10	25	40	80	>80	mgO ₂ /l
COD (permanganate)	0.5	10	15	20	>20	mgO ₂ /l
Nitrate ion	0.214	2.5	5.6	11.3	>11.3	mgN/l
Nitrite ion	0.006	0.060	0.12	0.3	>0.3	mgN/l
Ammonium ion	0.02	0.4	1.2	2.4	>2.4	mgN/l
Total inorganic nitrogen	0.25	4	8	16	>16	mgN/l
Phosphate ion	0.09	0.3	0.6	1.2	>1.2	mg/l
Total phosphorus	0.015	0.200	0.400	1.0	>1.0	mg/l
Zinc, total	1.0	100	200	500	>500	µg/l
Copper, total	2.0	24	50	100	>100	µg/l
Chrome, total	0.46	10.46	100	250	>250	µg/l
Arsenic, total	0.28	10	50	100	>100	µg/l
Cadmium, total	0.03	1.03	2.03	4.03	>4.03	µg/l
Lead, total	0.11	10.11	25	50	>50	µg/l
Nickel, total	0.53	10.64	50	100	>100	µg/l
Molybdenum, total	7	14	28	56	>56	µg/l
Manganese, total	5	10	20	40	>40	µg/l

Quality criteria	Quality classes					Unit
	I	II	III	IV	V	
Vanadium, total	1	2	4	8	>8	µg/l
Cobalt, total	0.11	0.22	0.44	0.88	>0.88	µg/l
Iron, total	0.06	0.12	0.5	1.0	>1.0	mg/l
Barium	22.8	75	150	300	>300	mg/l
Beryllium	4.4	50	100	200	>200	µg/l
Lithium	0.02	0.04	0.08	1.0	>1.0	µg/l
Boron	0.009	0.018	0.036	100	>100	mg/l
Aluminium	1.12	20	40	80	>80	mg/l
Selenium, total	5.0	60	120	240	>240	µg/l
Antimony, total	7.0	14	28	56	>56	µg/l
Tin, total	0.016	0.45	0.7	1.0	>1.0	µg/l
Sodium	0.05	0.1	0.2	5.0	>5.0	mg/l
Potassium	0.25	20	40	80	>80	mg/l
Calcium	0.42	0.84	1.68	3.36	>3.36	mg/l
Magnesium	0.06	0.12	0.24	0.48	>0.48	mg/l
Chloride ion	3.5	75	150	300	>300	mg/l
Sulphate ion	16	75	150	300	>300	mg/l
Silicate ion	5.5	11.0	22.0	44.0	>44.0	mgSi/l
Total dissolved salts	127	500	1000	1500	>1500	mg/l
Electrical conductivity	183	770	1500	2300	>2300	µS/cm
Hardness	1.6	10	20	40	>40	mg eq./l
Suspended solids	10	30	60	120	>120	mg/l
Smell (20°C and 60°C)	<2 (natural)	2 (natural)	2	4	>4	rate
Colour	(natural)	<5 (natural)	20	30	>200	degree

Annex 3. LOCATIONS OF ADDITIONAL PASSAGES FOR CATTLE AS PROPOSED DURING THE INTERVIEWS AND CONSULTATIONS AT THE AFFECTED SETTLEMENTS

As additional passages require adjustments or changes to design, the following categorisation of changes is used and further work between the designers and local communities is required (see ESIA Volume 1 for explanations):

Category 0 (Cat 0)	No changes, usage of nearest structures is proposed as is, additional stakeholder engagement will be required (where indicated as *)
Category 1 (Cat 1)	mitigation can be implemented without changing the alignment or design criteria.
Category 2 (Cat 2)	mitigation can be implemented by changing the alignment but without changing the design criteria (e.g., changes to speed or gradient)
Category 3 (Cat 3)	mitigation can be implemented only after changing the design criteria (change of speed, gradient), then changing a vertical or horizontal alignment

Reason for additional proposals: statements by the local residents that they need the crossing for maintaining their agricultural activities and indications of the potential locations on the map.

Additional cattle crossing proposed	Existing solutions in the 2019 Detailed Design				Solutions as of 27 Feb 2023 - to be included in the ToR for designers
	Station	Evaluation comments per design	Fulfilled by design?	If no, recommendations of the technical team	
	2+700 KM	Cattle Crossing (CC001) 5.0x3.0m, L = 35.11m	no	Provision of extra cattle crossing at km 4+675 recommended	Leave the envisioned cattle crossing at 2+700 as it is
4+675 KM	4+760 KM	Tunnel portal (T01 North portal)	no	Consider enlarging planned culvert at km 4+375 to enable a cattle crossing	Cat 1 – arranging a crossing too close to the tunnel portal is unsafe (also need to lift the tunnel), so it is only possible to enlarge the closest planned culvert*
9+305 KM	9+296 KM	CW Culvert (CB022) 1.5mx1.5m	no	Consider enlarging planned culvert at km 9+296 to enable a cattle crossing	Cat 1 - enlarging the closest planned culvert
9+770 KM	9+527 KM	CW Culvert (CB022) 1.5mx1.5m	no	Cattle crossing at 9+770 is difficult due to the emergency ramp; consider enlarging planned culvert at km 9+527 to enable a cattle crossing or provide an extra underpass at km 9+650.	Cat 1 - enlarging the closest planned culvert
	12+223 KM	Cattle crossing (CC005) 5.0x3.0m, L = 25.10m	no		The envisioned cattle crossing at 12+223 will remain as it is
13+300 KM	13+361 KM	CW Culvert (CB030) 1.5mx1.5m	no	Consider enlarging planned culvert at km 13+361 to enable a cattle crossing	Cat 1 - enlarging the closest planned culvert
15+890 KM	15+900 KM	Bridge (BR007) 15+769 - 16+015 KM, 72.0x16.80m max. between two piers	yes	None	Cat 0 - Cattle will pass under the nearest bridge in 10 m
18+700 KM	18+690 KM	CW Culvert (CB044), 1.5x1.5m	no	Consider enlarging planned culvert at km 18+690 to enable a cattle crossing	Cat 1 - enlarging the closest planned culvert
19+350 KM	19+050 KM	Bridge (BR09) 19+034 - 19+136 KM, 42.0mx25.3m max. between two piers	large bridges close by	Check whether bridges are sufficiently close to required cattle crossings	Cat 0 - Cattle will pass under the nearest bridge in 250 m*
19+490 KM	19+600 KM	Bridge (BR010) 19+624 - 19+708 KM, 28.0x20m max. between two piers			Cat 0 - Cattle will pass under the nearest bridge in 100 m*
20+255 KM	20+218 KM	CW Culvert (CB046), 1.5x1.5m	no	Consider enlarging planned culvert at km 20+218 to enable a cattle crossing	Cat 1 - enlarging the closest planned culvert
20+375 KM	20+497 KM	CW Culvert (CB047), 1.5x1.5m	no	Consider whether planned culvert at km 20+497 is sufficiently close and if yes, should be enlarged to enable a cattle crossing	Cat 1 - enlarging the closest planned culvert

Additional cattle crossing proposed	Existing solutions in the 2019 Detailed Design				Solutions as of 27 Feb 2023 - to be included in the ToR for designers
	Station	Station	Evaluation comments per design	Fulfilled by design? / If no, recommendations of the technical team	
20+865 KM	20+642 KM	CW Culvert (CB048), 1.5x1.5m	no	Consider whether planned culvert at km 20+642 is sufficiently close and if yes, should be enlarged to enable a cattle crossing	Cat 1 - enlarging the closest planned culvert and explaining to the villagers that it is 225 m from the desired location*
21+535 KM	21+100 KM	Bridge (BR011) 20+968 - 21+100 KM, 48x26m max. between two piers	Large bridge is likely too far away and not useful given the topography	Consider possibility of adapting SR012 for use as a cattle crossing	Cat 1 - enlarging the closest planned culvert in 500m* OR
	21+800 KM	Sec, Road SR012			Cat 1: place the SR above the alignment (minor modification), but it will be in 250 m from the desired location though*
22+135 KM	22+009 KM	CW Culvert (CB052), 1.5x1.5m	Sec, Road SR012 provides a crossing to the required area	Consider possibility of adapting SR012 for use as a cattle crossing	Cat 1: Adaptation of SR012 for use as a cattle crossing
22+515 KM	22+476 KM	CW Culvert (CB053), 1.5x1.5m	no	Consider enlarging planned culvert at km 22+476 to enable a cattle crossing	Cat 1 - enlarging the closest planned culvert
22+900 KM	22+677 KM	CW Culvert (CB054), 1.5x1.5m	BR012 is sufficiently sized and close	None	Cat 0 - BR012 is in 200m and cattle can pass under it*
23+800 KM	23+710 KM	CW Culvert (CB58), 1.5x1.5m	no	Consider enlarging planned culvert at km 23+710 to enable a cattle and pedestrian crossing	Cat 1 - enlarging the closest planned culvert in 50-90 m to enable a cattle and pedestrian crossing
25+780 KM			BR015 is sufficiently sized and covers this location	None	Cat 0 - BR015 is in 20m and cattle can pass under it
26+625 KM		Bridge (BR016) 26+257 - 26+504 KM, 72x34m between two piers	BR016 is sufficiently sized and covers this location; but re-routing of access tracks required		Cat 0 - BR016 is in 100m and villagers and cattle can pass under it*
35+975 KM	36+350 KM	Bridge (BR017) 36+315 + 36+537 KM, 66x20m between two piers	BR017 is sufficiently sized and close	None	Cat 0 - BR017 is in 400m and cattle can pass under it*
44+690 KM			no	Location not considered appropriate for a cattle crossing. The road is cut into the side of a steep slope.	no options - unless the southern part is lowered - CAT 3

Annex 4. LOCATIONS OF PEDESTRIAN CROSSINGS AS PROPOSED DURING THE INTERVIEWS AND CONSULTATIONS AT THE AFFECTED SETTLEMENTS

As additional pedestrian crossings require adjustments or changes to design, the following categorisation of changes is used and further work between the designers and local communities is required (see ESIA Volume 1 for explanations):

Category 0 (Cat 0)	No changes, usage of nearest structures is proposed as is, additional stakeholder engagement will be required (where indicated as *)
Category 1 (Cat 1)	mitigation can be implemented without changing the alignment or design criteria.
Category 2 (Cat 2)	mitigation can be implemented by changing the alignment but without changing the design criteria (e.g., changes to speed or gradient)
Category 3 (Cat 3)	mitigation can be implemented only after changing the design criteria (change of speed, gradient), then changing a vertical or horizontal alignment

Reason for proposals: statements by the local residents that they need the crossing for maintaining their daily activities and indications of the potential locations on the map.

Pedestrian crossings	Existing solutions in the 2019 Detailed Design				Solutions as of 27 Feb 2023 - to be included in the ToR for designers	
	Station	Station	Evaluation comments per design	Fulfilled by design? If no, recommendations of the technical team		
	21+735 KM	21+844 KM	CW Culvert (CB051), 3.0x3.0m	Pedestrian crossing cannot be provided at a grade due to highway speed	Walkway along SR012 should be provided	Cat 1 - provide a walkway along SR 012 (from 21+800 KM to the 21+735 KM - the needed location)*
	23+330 KM	23+100 KM	Bridge BR012 23+065 - 23+221KM, 66x13m between two piers	Pedestrian crossing cannot be provided at grade due to highway speed	None	Cat 0 - BR012 is in 230m and villagers can pass under it*
	23+640 KM	23+710 KM	CW Culvert (CB58), 1.5x1.5m	no	Consider enlarging planned culvert at km 23+710 to enable a cattle and pedestrian crossing	Cat 1 - enlarging the closest planned culvert in 50-90 m to enable a cattle and pedestrian crossing
	23+650 KM	23+710 KM	CW Culvert (CB58), 1.5x1.5m	No	Consider enlarging planned culvert at km 23+710 to enable a cattle and pedestrian crossing	Cat 1 - enlarging the closest planned culvert in 50-90 m to enable a cattle and pedestrian crossing
	23+965 KM	24+100 KM	Bridge (BR013) 24+041 - 24+143 KM, 42x20m between two piers	BR013 is sufficiently sized and close	None	Cat 0 - BR013 is in 135m and villagers can pass under it*
	24+480 KM	24+100 KM	Bridge (BR013) 24+041 - 24+143 KM, 42x20m between two piers	no, BR013 too far away.	Consider enlarging planned culvert at km 24+400 or providing an alternative pedestrian crossing possibility	Cat 1 - enlarging the closest planned culvert (in 80m) to enable a pedestrian crossing
	24+850 KM	24+855 KM	CW Culvert (CB062), ? x1.5m	BR014 is sufficiently sized and close	None	Cat 0 - BR014 is in 250m and villagers can pass under it*
	25+190 KM			BR014 is sufficiently sized and covers this location	None	Cat 0 - BR014 is in 100m and villagers can pass under it*
	25+350 KM	25+100 KM	Bridge (BR014) 25+136 - 25+250 KM, 48x24m between two piers	No, and track up the hillside is not considered in the design	Alternative vehicular access from BR015 should be considered.	Cat 0 - BR014 is in 250m and villagers can pass under it*
	25+575 KM	25+800 KM	Bridge (BR015) 25+730 - 25+886 KM, 66x24m between two piers	BR015 is sufficiently sized and close	None	Cat 0 - BR015 is in 25m and villagers can pass under it*
	26+575 KM	26+250 KM	Bridge (BR016) 26+257 - 26+504 KM, 72x34m between two piers	BR016 is sufficiently sized and covers this location; but re-routing of access track required	Area likely to be significantly disturbed during construction; re-routing of access track through BR016 should be considered	Cat 0 - Area likely to be significantly disturbed during construction; re-routing of access track through BR016 should be considered

Annex 5. PROPOSED LOCATIONS OF WILD ANIMAL PASSAGES

As animal passages require adjustments or changes to design, the following categorisation of changes is used and further work between the designers and local communities is required (see ESIA Volume 1 for explanations):

Category 0 (Cat 0)	No changes, usage of nearest structures is proposed as is, additional stakeholder engagement will be required (where indicated as *)
Category 1 (Cat 1)	mitigation can be implemented without changing the alignment or design criteria.
Category 2 (Cat 2)	mitigation can be implemented by changing the alignment but without changing the design criteria (e.g., changes to speed or gradient)
Category 3 (Cat 3)	mitigation can be implemented only after changing the design criteria (change of speed, gradient), then changing a vertical or horizontal alignment

Wild animal passages proposed		Existing solutions in the 2019 Detailed Design				Solutions as of 27 Feb 2023 - to be included in the ToR for designers
Station	Reason / justification	Station	Evaluation comments per design	Fulfilled by design?	If no, recommendations of the technical team	
14+400 KM	Desirable as the animal use this pathway, but not critical.	12+850 KM	Bridge (BR005) 12+646-13+200, 66.0x31.40m max. between two piers	yes, bridge sizes large enough, but are not at km 14+400	Cattle crossing currently provided at logical location and the bridge is further on. Consider shifting cattle crossing at km 14+250 to km 14+400 and enlarge as necessary	Cat 1: move a cattle crossing envisioned in the original design at km 14+250 to km 14+400*
		14+250 KM	Cattle Crossing (CC002) 5.0x3.0m			
		14+268 KM	RC Culvert (CB033) 3.0x3.0m			
		15+000 KM	Bridge (BR006) 14+950 - 15+250, 28.0x21.8m max. between two piers			
37+250KM	Proposed wildlife crossing or bridge (Green Bridge - GB5)	37+200KM	CW Culvert (CB069) 1.5x1.5m	no, BR018 does not cover the area	Topography does not lend itself well to a bridge (alignment at valley floor level); consider a wildlife overpass	Cat 2: extend BR18 - to redesign within the existing design criteria, so that the animals can pass under it
		37+242KM	CW Culvert (CB070) 3.0x3.0m			
		37+475KM	Bridge (BR018) 37+425 - 37+525, 48.0x14.8m max. between two piers			
38+760KM	Proposed Green Bridge 4	38+840KM	Cattle Crossing (CC03) 5.0x3.0m, L = 30.09m	no, crossing size for larger animals 15 x 3.5 m recommended; openness index too small (H*B/L) = 0.5	Consider adapting cattle crossing size to create a large underpass and avoid a green bridge	Cat 1: enlarge the cattle crossing envisioned in the original design in 80 m and propose fencing to direct animals to the pass
		38+860KM	CW Culvert (CB074) 3.0x3.0m, L = ?			
39+650KM	Proposed bridge	39+499 KM	CW Culvert (CB075) 2.0x2.0m, L = ?	no, culvert sizes are too small,	Very difficult location to create either a bridge or an underpass due to the steepness of the valley. The road is cut into the side of a steep slope.	Cat 0: The animals will find way to cross over the tunnel that is in 105 m
		39+687KM	CW Culvert (CB076) 2.0x2.0m, L=?			
		39+755KM	tunnel portal T005 North portal			
40+700KM	Proposed Green Bridge 3	40+650KM	Bridge (BR019) 28.0x31.40m max. between two piers	yes, bridge size large enough	None, unless the ESIA Consultant really wants a bridge over the road	Cat 0: BR019 is in 50m and wild animals should be able to pass under it
41+300KM	Proposed Green Bridge 2	41+270KM	CW Culvert (CB078) 1.5x1.5m, L=?	no, culvert sizes are too small	Consider a green bridge over the road	Cat 1 - the closest culvert should be enlarged a bit, no way to have an overpass
43+300KM	Proposed Ecoduc if road at the bottom of the valley to join the rocky areas	43+430KM	RC Culvert (CB084) 1.5x1.5m (above road alignment?), L = 19.13m	no, culvert sizes are too small	Road is already descending at the maximum gradient; difficult to amend without a change in design parameters. The road is cut into the side of a steep slope.	no options - unless the southern part is lowered - CAT 3
47+850KM	Proposed bridge	47+893KM	RC Culvert (CB094) 1.5x1.5m, L = ?	no, crossing size for larger animals 15 x 3.5 m recommended; openness index too small (H*B/L) = 0.38,	Underpass is possible. Elevated road structure instead of large embankment should be considered	Cat 1 - Adjust the nearest cattle crossing in 70 m to be used by the animals + direct them OR
		47+921KM	Cattle Crossing (CC04) 5.0x3.0m, L = 40.12m			Cat 2 - to move the cattle crossing down the hill by 50m - (re-designing)
48+600KM	Proposed Green Bridge 1	48+598KM	CW Culvert (CB097) 3.0x3.0m, L = ?	no, culvert sizes are too small	Consider an underpass in discussion with ESIA Consultant	Cat 1 - enlarge the culvert to be used by the animals



Wild animal passages proposed		Existing solutions in the 2019 Detailed Design				Solutions as of 27 Feb 2023 - to be included in the ToR for designers
Station	Reason / justification	Station	Evaluation comments per design	Fulfilled by design?	If no, recommendations of the technical team	
50+000KM	Proposed bridge	49+452KM	Bridge (BR021) 66.0x30.30m max. between two piers	No	The south side of the alignment is in cut so a bridge on the current alignment is not possible; moving the road out of the hillside would enable a bridge	Cat 1 - Adjust the nearest culvert in 120 m to be used by the animals + measures needed to direct them OR
		49+878KM	R/C Culvert (CB101) 2.0x2.0m (above road alignment?)			Cat 2 – moving the road out of the hillside would enable a bridge

Annex 6. CH SITE-SPECIFIC MITIGATION MEASURES AND ESTIMATED BUDGET AND TIMING

NB: Use of non-intrusive methods might be considered instead of trial trenching.

Site	CH units	Type of the CH monument	Location, point	Potential to be impacted	CH code from the State List of Monuments / CH Status	Potential importance	Mitigation measures	Estimated budget, USD ²⁰	Timing, months
1	1	Natural monument	km 1.4+50	likely	newly discovered	local	1. Relocate next to the proposed road as an aesthetic-decorative monument	4,000.00	less than 1
2	2	Shrine-sanctuary "Stephan Ukht"	km 2.3+20	likely	newly discovered	regional	1. Develop and implement protection measures to avoid damage during construction works. 2. The earthworks should be performed under the supervision of a Cultural Heritage Expert (CH Monitor). 3. Arrange an alternative temporary access to the shrine for the locals. 4. Arrange a fencing or other protection for the site ensuring the buffer zone that will be determined by the CH Expert / Monitor / state bodies.	2,000.00	N/A
3	3-15	Settlement and tomb field	km 2.5+50 - km 3.7+50	likely	8.6.4.1	national	1. Complete trial trenching (i.e., test excavation); 2. Plot the impacted area; 3. Consider if the change of embankment configuration can exclude impacts; 4. If not or partially possible, identify surface and volume of the required safeguard excavations; 5. Complete safeguard excavations	180,000.00	4 to 6

²⁰ Vibration monitoring cost of CH is not included in this estimate.

Site	CH units	Type of the CH monument	Location, point	Potential to be impacted	CH code from the State List of Monuments / CH Status	Potential importance	Mitigation measures	Estimated budget, USD ²⁰	Timing, months
4	16	Section of diatomite origin lacustrine sediments 1	km 4.6+00	likely	newly discovered	local	1. Develop and implement special protection measures to avoid damage during construction works (e.g., fencing, speed limits)	2,500.00	N/A
5	17	Section of diatomite origin lacustrine sediments 2	km 4.9+50	likely	newly discovered	local	1. Research impacts and protect the basal part of the sediment that will be opened during the tunnel construction	2,500.00	less than 1
6	18-20	Tomb field	km 5.1+00 - km 5.5+50	likely	newly discovered	national	1. Complete trial trenching (i.e., test excavation); 2. Plot the impacted area; 3. Identify surface and volume of the required safeguard excavations; 5. Complete safeguard excavations to preserve the affected units	60,000.00	1 to 2
7	21	Unclassified structure remains 1	km 6.0+00	likely	newly discovered	national	1. Complete trial trenching; 2. Plot the impacted area; 3. Identify surface and volume of the required safeguard excavations; 4. Complete safeguard excavations to preserve the affected units	30,000.00	less than 1
8	22	Natural monument 1	km 6.0+40	unlikely	newly discovered	local	1. Consider the embankments of the secondary road can be adjusted. 2. If not, relocate next to the proposed road as an aesthetic-decorative monument	4,000.00	less than 1
9	23	Unclassified structure remains 2	km 6.5+50	likely	newly discovered	national	1. Complete trial trenching; 2. Plot the impacted area; 3. Identify surface and volume of the required safeguard excavations; 4. Complete safeguard excavations to preserve the affected units	25,000.00	less than 1
10	24	Structure remnants or settlement 1	km 6.8+50	likely	newly discovered	national	1. Complete trial trenching (i.e., test excavation); 2. Plot the impacted area; 3. Consider if adjusting embankments can help avoid some impacts.	25,000.00	less than 1

Site	CH units	Type of the CH monument	Location, point	Potential to be impacted	CH code from the State List of Monuments / CH Status	Potential importance	Mitigation measures	Estimated budget, USD ²⁰	Timing, months
							4. Based on this, identify surface and volume of the required safeguard excavations; 5. Complete safeguard excavations		
11	25	Tomb field or cemetery	km 7.0+20	likely	newly discovered	national	1. Complete trial trenching (i.e., test excavation); 2. Plot the impacted area with the focus on southern part of the tomb field; 3. Identify surface and volume of the required safeguard excavations; 4. Complete safeguard excavations	45,000.00	3 to 6
12	26	Structure remnants or settlement 2	km 7.6+30	likely	newly discovered	national	1. Complete trial trenching (i.e., test excavation); 2. Plot the impacted area; 3. Consider the adjustment of a bridge pillar can help avoid impacts; 4. If not or partially, identify surface and volume of the required safeguard excavations; 5. Complete safeguard excavations; 6. Develop and implement special protection measures	35,000.00	2 to 4
13	27-29	Structure remnants in shape of walls and tombs 1	km 8.7+90 - km 8.8+30	likely	newly discovered	national	1. Complete trial trenching (i.e., test excavation); 2. Plot the impacted area; 3. Identify surface and volume of the required safeguard excavations; 5. Complete safeguard excavations	45,000.00	less than 1
14	30	Natural monument 2	km 9.0+30	likely	newly discovered	local	1. Remove and place next to the proposed road as an aesthetic-decorative monument	4,000.00	less than 1
15	31	Structure remnants in shape of walls and tombs 2	km 9.0+90	likely	newly discovered	national	1. Develop and implement special protection measures during the construction, especially the earthworks.	13,000.00	N/A
16	32	Natural monument 1	km 9.2+20	unlikely	newly discovered	local	N/A		N/A

Site	CH units	Type of the CH monument	Location, point	Potential to be impacted	CH code from the State List of Monuments / CH Status	Potential importance	Mitigation measures	Estimated budget, USD ²⁰	Timing, months
17	33	Natural monument 2	km 9.2+50	likely	newly discovered	local	1. Consider if adjustment of the embankment can help avoid impacts. 2. If not, remove and place next to the proposed road as an aesthetic-decorative monument	5,000.00	less than 1
18	34	Wall structure remnants near Natural monument 2	km 9.2+50	likely	newly discovered	national	1. Complete trial trenching; 2. Plot the impacted area; 3. Identify surface and volume of the required safeguard excavations or needed protection measures; 4. Complete safeguard excavations or implement the protection measures	30,000.00	less than 1
19	35	Natural monument 3	km 9.4+00	unlikely	newly discovered	local	N/A		
20	36	Remnants of a truncated settlement	km 9.5+00	likely	newly discovered	national	1. Complete test excavation in one part of the site that is closer to the road; 2. Plot the impacted area; 3. Identify surface and volume of the required safeguard excavations or needed protection measures; 4. Complete safeguard excavations or implement the protection measures	25,000.00	less than 1
21	37	Natural monument 3	km 9.7+00	likely	newly discovered	local	1. Consider if adjustment of the embankment can help avoid impacts. 2. If not, remove and place next to the proposed road as an aesthetic-decorative monument	5,000.00	less than 1
22	38	Section of diatomite origin lacustrine sediments	km 10.6+00	likely	newly discovered	local	1. Conduct a study of the basal part of the sediment that may open during the construction works. 2. Develop and implement protection measures	3,000.00	less than 2

Site	CH units	Type of the CH monument	Location, point	Potential to be impacted	CH code from the State List of Monuments / CH Status	Potential importance	Mitigation measures	Estimated budget, USD ²⁰	Timing, months
23	39	Surface finds around wall structure remnants	km 10.8+90	likely	newly discovered	national	1. Perform test excavations to clarify historical-cultural value of the structures. 2. Develop and implement mitigation measures (e.g., safeguard excavations or needed protection measures)	35,000.00	less than 1
24	40	Wall structure remnants	km 11.2+30	likely	newly discovered	national	1. Perform test excavations to clarify historical-cultural value of the structures. 2. Develop and implement mitigation measures (e.g., safeguard excavations or needed protection measures)	35,000.00	1 - 2
25	41	Medieval village remains and Spring-monument	km 11.9+00	likely	newly discovered	National (spring is local)	1. Complete trial trenching; 2. Plot the impacted area; 3. Identify surface and volume of the required safeguard excavations; 4. Complete safeguard excavations and retain the spring and access to it, if possible	45,000.00	1 - 3
26	42-45	Wall structures preserved in the area of old gardens	km 12.1+00 - km 12.5+90	likely	newly discovered	national	1. Perform test excavations to clarify historical-cultural value of the structures. 2. Develop and implement mitigation measures (e.g., safeguard excavations or needed protection measures)	40,000.00	less than 1
27	46	Section of diatomite origin lacustrine sediments	km 12.5+90	likely	newly discovered	local	1. Conduct a study to identify protection measures required to preserve the sediments during construction. 2. Develop and implement protection measures	3,000.00	?
28	47-49	Vorotan (Voroṭn) Medieval village remains and cemetery,	km 13.2+40 - km 13.5+50	likely	8.78.2 and 8.78.2.1	national	1. Complete field work to determine the number of and to remove all the gravestones and the stellae; 2. Complete trial trenching and	130,000.00	4 to 6

Site	CH units	Type of the CH monument	Location, point	Potential to be impacted	CH code from the State List of Monuments / CH Status	Potential importance	Mitigation measures	Estimated budget, USD ²⁰	Timing, months
		Bronze-Iron Age tomb field					plotting of the impact area; 3. Consider if the change of embankment configuration can reduce impact; 4. Determine the actual surface and volume of the required safeguard excavations to excavate the graves and tombs and relocate to another place, 5. Complete safeguard excavations.		
29	50	Flint raw-material source for making stone tools	km 15.2+00	likely	newly discovered	national	1. Develop and implement protection measures required to preserve the site during construction	2,000.00	less than 1
30	51	Structure remnants in shape of tombs	km 15.6+60	likely	newly discovered	national	1. Perform test excavations to clarify historical-cultural value of the structures. 2. Develop and implement mitigation measures (e.g., safeguard excavations or needed protection measures)	25,000.00	less than 1
31	52-53	Shrine (church) ruins, cemetery and khachkars (Parvants)	km 17.6+90	likely	8.31.3	national	1. Change the configuration of the embankment. 2. If not possible to change, complete plotting for safeguard excavations; 3. Excavate the whole site and reinstall it in the vicinities	165,000.00	1 to 3 (if the excavation will be required)
32	54	"Arzuman's bridge" and Medieval road	km 18.6+00	unlikely	8.31.10	national	N/A		
33	55	Enclosed khachkar or "Loriki khach (Lorik's Cross)"	km 22.2+00	unlikely	8.41.2.1	national	N/A		
34	56	Cave complex carved in a section of diatomite origin lacustrine sediments	km 22.7+50	likely	newly discovered	national	1. Perform test excavations to identify the site's borders and size. 2. propose and implement mitigation measures (either safeguard excavation or special protection measures)	20,000.00	1 to 2

Site	CH units	Type of the CH monument	Location, point	Potential to be impacted	CH code from the State List of Monuments / CH Status	Potential importance	Mitigation measures	Estimated budget, USD ²⁰	Timing, months
35	57	Mardakayr Medieval village remains and Tsaru S. Hovhannes church, tomb field	km 23.1+60	likely	8.41.6 and 8.41.4	national	1. Carry out the construction works under the supervision of an archaeologist. 2. Perform test excavations to identify the site's borders and size. 3. Consider an adjustment of an embankment. 4. Propose and implement mitigation measures (either safeguard excavation or special protection measures)	125,000.00	N/A
36	58	Medieval village remains	km 23.3+90	likely	newly discovered	national	1. Develop and implement protection measures to avoid damage during construction works. 2. The earthworks should be performed under the supervision of an archaeologist.	14,000.00	N/A
37	59	Section of diatomite origin lacustrine sediments	km 23.9+50	unlikely	newly discovered	local	N/A		
38	60	Spring-monument	km 25.7+00	unlikely	-	regional	N/A		
39	61	Surface finds at the base of a hill with an Iron Age fortress	km 25.6+60	likely	newly discovered	national	1. Perform test excavations to identify the site's borders and size. 2. propose and implement mitigation measures (either safeguard excavation or special protection measures)	30,000.00	1 to 2
40	62	Cave complex carved in a section of diatomite origin lacustrine sediments	km 25.7+00	likely	newly discovered	national	1. Conduct test excavations. 2. Consider if adjustments to the embankment can reduce impacts. 3. Complete safeguard excavations	10,000.00	1 to 3
41	63	"Sagu ghala" fortress	km 26.4+90	likely	8.71.1	national	1. Field work to suggest possible relocations of the bridge's pillar. 2. Plot the remaining impacted area; 3. Conduct safeguard excavations at some parts of the site	135,000.00	1 to 2
42	64	Natural monument complex 1	km 26.9+20	likely	newly discovered	local	The monument cannot be relocated and preserved.		

Site	CH units	Type of the CH monument	Location, point	Potential to be impacted	CH code from the State List of Monuments / CH Status	Potential importance	Mitigation measures	Estimated budget, USD ²⁰	Timing, months
							No mitigation is possible		
43	65	Natural monument complex 2	km 26.9+90	likely	newly discovered	local	The monument cannot be relocated and preserved. No mitigation is possible		
44	66	Medieval village remains 1	km 36.1+40	likely	newly discovered	national	1. Conduct trial excavations at the relevant parts of the site. 2. Plot the impact area. 3. Identify surface and volume of the required safeguard excavations. 4. Complete safeguard excavations	35,000.00	1 to 3
45	67	Church	km 36.3+00	likely	8.112.1.2	national	1. Complete trial trenching to identify and map graves, if any, and to determine exact protection measures for the church and graves; 2. Move the pillars away from the church as much as technically feasible; 3. Establish protection measures for the church and graves, for instance fencing or else; 4. complete safeguard excavations = relocation of (some) graves, if required	2840,000.00	1 to 3
46	68	Medieval village remains 2	km 36.6+50	likely	8.112.1.1	national	1. Complete trial trenching and map affected areas; 2. Establish special protection measures for the construction stage	12,000.00	N/A
47	69	Medieval and modern cemetery	km 36.7+20	likely	8.112.1.1.1	national	1. Complete trial trenching and map affected areas; 2. Establish special protection measures for the construction stage	10,000.00	N/A
48	70	Siliceous limestone raw-material source 1	km 42.3+00	unlikely	newly discovered	local	N/A		
49	71	Natural monument 1	km 42.5+70	likely	newly discovered	local	The monument cannot be relocated and preserved No mitigation is possible.		
50	72	Natural monument 2	km 42.6+40	likely	newly discovered	local	The monument cannot be relocated and preserved.		

Site	CH units	Type of the CH monument	Location, point	Potential to be impacted	CH code from the State List of Monuments / CH Status	Potential importance	Mitigation measures	Estimated budget, USD ²⁰	Timing, months
							No mitigation is possible.		
51	73	Siliceous limestone raw-material source 2	km 47.0+00	likely	newly discovered	local	1. Consider if adjustments to the embankment can help avoid impact. 2. Develop and implement special protection measures	3,000.00	N/A
52	74	Structure remains (Medieval village remains)	km 48.6+00	likely	newly discovered	national	1. Complete trial trenching; 2. Plot the impacted area; 3. Identify surface and volume of the required safeguard excavations and needed protection measures; 4. Complete safeguard excavations and implement the protection measures	35,000.00	1 to 3
53	75	Cave-complex Lernadzor-1	km 53.2+20	likely	newly discovered	national	1. Perform text excavations. 2. Complete a total excavation as the relocation of the site is not possible	25,000.00	2 to 4
54	76	Tomb field	km 53.3+60	unlikely	newly discovered	national	N/A		
DA 001	Several historical-cultural sites are found at the south-western boundary of DA 001	Aghitu	likely	Bordering on unit 21	n/a		1. Mitigation as proposed for Unit 21 above. 2. If needed, additional fencing at the buffer zone for the CH sites before any spoil disposal	Budget of unit 21	1
DA 002	Potentially Bronze-Iron Age period burial mounds	Aghitu	likely	Bordering on units 28, 31, 34, 36, and 37	n/a		Additional investigation will be carried out together additional studies recommended for units 28, 31, 34, 36, and 37 (see above). If safeguard excavations are required, then additional budget will apply as indicated to the right.	Additional budget of 6,000	1 to 2
DA 003	Potential for of diatomite lacustrine deposits of Pleistocene	Darbas area	likely	Not yet researched extensively	n/a		Complete trial trenching / additional investigation	2,000	1
DA 004	Potential for of diatomite lacustrine deposits of Pleistocene	Darbas area	likely	Not yet researched extensively	n/a		Complete trial trenching / additional investigation	2,000	1
DA 005	Potential for of diatomite lacustrine deposits of Pleistocene	Darbas area	likely	Bordering on units 52-53	n/a		Additional investigation will be carried out together with the mitigation actions for units 52-53 (see above).	Budget of units 52-53	1 to 2
	Additional SDA proposed in	Shenatagh Valley	n/a	Not yet researched	n/a		Cultural heritage field survey	3,000	1

Site	CH units	Type of the CH monument	Location, point	Potential to be impacted	CH code from the State List of Monuments / CH Status	Potential importance	Mitigation measures	Estimated budget, USD ²⁰	Timing, months
	Additional SDA proposed in	Qirs Valley	n/a	Not yet researched	n/a	Cultural heritage field survey		3,000	1
Total estimated budget, USD								1,779,000.00	