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ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA)

SISIAN-KAJARAN (NORTH-SOUTH CORRIDOR) ROAD PROJECT, ARMENIA

Volume 1. Project Definition:

Project introduction, context and rationale, project description, alternatives, legal framework, and ESIA methodology

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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DISCLAIMER

An Environmental and Social Impact Assessment (ESIA) is necessarily predictive in that it gets completed well before the project being assessed is actually implemented. The information on which the assessment is based comes from multiple sources including the feasibility report, the detailed design document, reports on studies that were conducted as part of the feasibility investigations, records of meetings, other publications, various databases, data that is collected by the team conducting the ESIA, anecdotal information and others. It is extremely difficult to verify the information that is used other than through testing the logic of that information as well as that can be done. In preparing this document, care has been taken to ensure that whatever information has been available has been accurately reproduced in the ESIA. Should information be found in this document that is incorrect then it is respectively requested that the incorrect information be brought to our attention so that the ESIA can be updated accordingly. We cannot be held accountable for information that we have accepted and reproduced in good faith regardless of the consequences of such information being incorrect. Anyone reproducing information contained in this ESIA does so entirely at their own risk.

LIST OF ABBREVIATIONS

ADB	Asian Development Bank
AMSL	above mean sea level
BAP	Biodiversity Action Plan
DD	Detailed Design
E&S	Environmental and social
EBRD	European Bank for Reconstruction and Development
EAAAs	Ecologically appropriate areas of analysis
EIA	Environmental Impact Assessment
EIB	European Investment Bank
ESAP	Environmental and Social Action Plan
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESMS	Environmental and Social Management System
ESP	Environmental and Social Policy (of EBRD)
ESS	Environmental and Social Standard (of EIB)
EU	European Union
GIP	good international practice
ha	hectare
IFC	International Finance Corporation
IFI	International Financial Institution
ILO	International Labor Organization
kph	kilometre per hour
m	metre
MTAI	Ministry of Territorial Administration and Infrastructure of Armenia
NGO	Non-governmental organisation
NSRC	North-South Road Corridor
NSRCIP	North-South Road Corridor Investment Project
NTS	Non-Technical Summary
OHS	Occupational Health and Safety
PCU	passenger car units
PR	Performance Requirement (of the EBRD)
R	Radius
RA	Republic of Armenia
RF	Resettlement Framework
RD	Road Department Fund
SDA or DA	(Spoil) disposal area
SEP	Stakeholder Engagement Plan
SPA	Special Protected Area
SR	Safeguard Requirement (of ADB)
TBM	Tunnel boring machine

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PREAMBLE

This document is the **Project Definition** report for the proposed greenfield Armenian Sisian-Kajaran road section (the Project) of the North-South Road Corridor. It forms **Volume 1** of the Environmental and Social Impact Assessment Report (ESIA) for the Project.

The ESIA Report consists of six 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 (covering *inter alia* 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);
- Volume 7 – Conclusions and Recommendations.

The ESIA was publicly disclosed for the period of over 120 days according to the international lenders' requirements (from 21 July to 1 December 2023). 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 (RF) that guides issues related to Project-induced physical and economic displacement, land acquisition, compensations, 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 of particular conservation value; and
- Environmental and Social Action Plan (ESAP) that contains actions required to implement the Project in compliance with the international lenders' requirements.

Following the public disclosure, the ESIA Disclosure and Consultation Report was prepared to document and summarise the feedback from stakeholders received and engagement activities completed during the ESIA disclosure period.

The current version of the ESIA package captures the feedback from stakeholders collected during the ESIA disclosure and it will be re-disclosed, together with the ESIA Disclosure and Consultation Report, for the Project life-cycle.

1 INTRODUCTION

1.1 Project Context and Rationale

The Road Department Fund (the RD) under the Ministry of Territorial Administration and Infrastructure of Armenia (the MTAI or the Promoter) is the Implementing agency for the construction of the 60 km Sisian-Kajaran road section (the Project) of Armenia's strategic North-South Road Corridor (NRSC) (**Figure 1**).

The Sisian-Kajaran road will be divided into three construction packages[1]:

- Lot 1: 27.1 km Northern road section (from 0+000 km to 27+130 km);
- Lot 2: 8.64 km Bargushat tunnel (from 27+130 km to 35+770 km); and
- Lot 3: 24.2 km Southern road section (from 35+770 km to 60+022 km).

The European Bank for Reconstruction and Development (EBRD) is considering providing a sovereign loan to the Republic of Armenia (the Borrower or the RA) to finance Lot 3: 24.2 km Southern road section (the EBRD Project). The European Investment Bank (EIB) is expected to co-finance the Southern road section (Lot 3).

Lot 1: the Northern road section and Lot 2: Bargushat tunnel are expected to be financed by the EIB, the Asian Development Bank (ADB), and the Government of Armenia.

The NSRC is Armenia's major road connecting the country's southern and northern border through the 556 km-long Meghri - Yerevan - Bavra highway. As Armenia's borders with Turkey and Azerbaijan are closed, the NSRC is the country's key transport artery. Construction and rehabilitation of this highly important and strategic road is expected to improve connectivity throughout Armenia, from its southern borders to the Georgian border and to the Black Sea ports, facilitating passenger and cargo transportation compliant with European standards. The highway is also expected to provide significant development opportunities for communities along the alignment together with a raft of other benefits such as reduced travel time, safer travel and others that will be detailed later in this document.

Development of the NSRC is a key infrastructure priority for the Government of Armenia as stated in the Armenia's Transport Sector Strategy 2020 (2008). A dedicated NSRC Investment Programme (NSRCIP) was established to consolidate the effort of Government and the IFIs for the upgrading of this essential transport corridor. On 14 September 2019, ADB approved a multi tranche financing facility (MFF) of $500 million, for the NSRC, divided into five tranches initially (see **Section 2.3**). Since then, various segments of the road have been co-financed by loans from ADB, EIB, Eurasian Development Bank and EU grant funding.

The 60 km Sisian-Kajaran road section is one of three sections of the former Tranche 4 of the NSRC. The road section will directly connect Sisian and Kajaran in Syunik Region, Armenia's southernmost region (**Figure 1**). The estimated project cost is ca. EUR 986 million (excluding VAT and supervision). The Project section is one of the most technically complex sections of the NSRC due to the mountainous terrain and, as such, requires 27 bridges and 9 tunnels (including the Bargushat tunnel of 8.6 km) to comply with the speed and gradient criteria of the defined road category.

As part of TEN-T network, the Project falls under Flagship 2 of EU's priorities in Armenia (Boosting connectivity and socio-economic development: the North-South Corridor). The Project will shorten the existing road connections (M2 Goris-Kapan and H45 Sisian-Tatev-Kapan) from 130 to 70 km, and will substantially decrease vertical road gradient (compared

[1] The indicated lengths are preliminary. The final lengths of the sections will be determined after the detailed design is split into three sections; it is anticipated that while the length of the Bargushat tunnel remains the same, several kilometres will be added to it at the portals, thus reducing the lengths of the Northern and Southern sections.

to current options) and elevations along the route. Unlike the existing road, the new road section must adhere to international road safety standards and include provision for climate change.

In the aftermath of the 2020 Nagorno-Karabakh conflict, the previously used 130 km connection between Goris and Kajaran can no longer be used by Armenian citizens (**Figure 1**). The M2 Goris-Kapan road is not available for vehicles with Armenian registration plates. Between 2020 and 2022, the road was closed for 31 days and 170 traffic accidents occurred with 26 people killed and 263 people injured. The M2 is also subject to closure in autumn/winter/spring season due to mountainous terrain and harsh weather.

The RD has also rehabilitated an alternative road via Tatev (H-45), which is also about 130 km. The 130 km existing connection between Sisian and Kajaran via Tatev and Kapan has a maximum speed of 90 km/hour, but travel time is 3-4 hours due to steep gradients, tight bends and heavy truck traffic. According to the RD, between 2019 and 2021, there were 15 accidents with 20 people injured. It can be assumed that the road was completely closed for at least a portion of the day on which the accidents happened. The mountainous terrain and acute curves mean that the road does not adhere to modern road safety standards with vertical gradients reaching 13 % in places and limited safety fencing to prevent vehicles from leaving the road. This road is only suitable for low-speed local traffic and should not be used for heavy goods vehicles but nevertheless carries a high volume of trucks due to limited alternatives. The road itself was established to develop tourist potential but after the events of November 2021, this route was the only one available for cargo transportation on the Yerevan - Meghriroute.

Neither the M2 nor the H-45 road provides the level of service expected of a national road.

Source: prepared by the Consultant.

Figure 1. Location of the Sisian-Kajaran Project Road (Syunik Region, Armenia), also showing the existing H45 and M2 routes

The EU Neighbourhood Investment Programme's Technical Assistance grant (managed by EBRD in close coordination with the Lenders) was used to conduct a due diligence, including project feasibility and preparation of the detailed design. Both the Feasibility Study and the Detailed Design were prepared between 2016-2019 and funded by ADB. A national EIA was prepared for the Sisian-Kajaran Road Project in parallel with the preparation of the Feasibility Study and Detailed Design and received a positive conclusion of the State Environmental Review in March 2018. The validity of this conclusion expired in March 2019, and the national EIA process was re-launched in March 2023. The new positive EIA Conclusion was obtained by the RD on 27 November 2023.

Should an update of the detailed design be decided it is expected to be financed by the RD or one of the co-financing Lenders or the contractor, depending on the nature of changes and chosen contracting modality.

1.2 Purpose and Scope of the ESIA

The EBRD has categorised the Project as "A" in line with its Environmental and Social Policy (ESP) (2019) as the Project is a greenfield road, over 10 km long, that may cause significant environmental and/or social impacts. Category A projects are required to conduct a formalised and participatory **environmental and social impact assessment (ESIA)** of the proposed Project and associated infrastructure. Based on the existing ADB Environmental Safeguards Policy (2009), the Project is also Category "A" as it is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented, and that may affect an area larger than the sites or facilities subject to physical works. According to the EIB Group Environmental and Social Policy (2022), the Project is categorized as High Risk as it is likely to have significant environmental, climate and/or social impacts and risks and require a preparation of an ESIA due to the EU Law requirements. A consortium of environmental and social (E&S) consulting companies (the Consultant)[2] has been commissioned to conduct the ESIA (for the list of the engaged experts refer to the cover page of this report).

The first step in the ESIA process was *Scoping* and it served to define the scope of the assessment. The resulting Scoping Report [https://armroad.am/en/news/inner/News_14.04.2022] contained a description of the proposed Project and associated infrastructure, the receiving or affected environment and society and gaps in the baseline information, the anticipated E&S impacts/risks, comments or issues raised in the initial consultation process, and the scope of work for further assessment. The Scoping Report was disclosed by the RD in mid-April 2022 for a 30-day period and extensive scoping consultations were held over April – May 2022 (see **ESIA Volume 4** and Stakeholder Engagement Plan (SEP)).

As the consequent step, this ESIA report was prepared in order to i) verify and assess the potential positive and adverse direct, indirect, cumulative, and induced impacts and risks to physical, biological, socio-economic (including impacts on livelihood through environmental media, health and safety, vulnerable groups, and gender issues), and physical cultural resources in the context of the Project's area of influence, that may arise from the Project and that were identified during the Scoping process, ii) to develop measures to avoid, minimise, mitigate or compensate and/or offset and monitor these impacts, and iii) to assess the residual impacts following mitigation. In addition, measures to enhance beneficial impacts have also been included as an integral part of the ESIA. Reference is made to plans to monitor, manage and evaluate the implementation of mitigation measures and the Project's performance.

[2] The consortium is Ecoline International Ltd. (Bulgaria), SE Solutions Pty. (South Africa) and ATMS Solutions LLC (Armenia) supported by Biotope (France) and Biogeotech (Armenia) for biodiversity component.

In addition to the ESIA report inclusive of an ESMP, the following E&S documents and management plans have been prepared by the ESIA Consultant as stand-alone documents:

- Non-Technical Summary (NTS),
- Environmental and Social Action Plan (ESAP),
- Stakeholder Engagement Plan (SEP),
- Biodiversity Action Plan (BAP), and
- Resettlement Framework (RF).

The above-listed documents, together with the ESIA report, constitute an E&S documentation package that will be disclosed for public consultation for a minimum of 120 days, as per the lenders' requirements. It is expected that the national EIA process will be completed by the time the ESIA disclosure period is over by November 2023.

1.3 Structure of this Volume

This Volume (1) of the ESIA Report is structured as follows:

- Section 1. 'Introduction' – this section, presents an overview of the Project context and rationale, and purpose and scope of the ESIA;
- Section 2. 'The Proposed Project' provides a description of the physical characteristics of the Project and its components;
- Section 3. 'Analysis of Alternatives' describes a 'zero alternative' and the alternatives using the 'hierarchy of alternatives' from higher-level alternatives to options for specific Project components or construction methods and the reasons for choices where they have been made;
- Section 4. 'Legal and Regulatory Framework' describes the applicable national legal requirements and the EBRD, EIB and ADB standards that the Project should comply with; and
- Section 5. 'ESIA Methodology' details the key stages of the ESIA process and approaches and methods used at each stage.

1.4 Acknowledgements

The contributions of the following agencies are recognised and acknowledged with gratitude:

- The Armenian Road Department provided the Detailed Design and associated documents and drawings and participated in multiple meetings geared towards understanding the project.
- The Bernard Gruppe as the appointed Technical Consultant provided a great deal of technical information needed for the project description in the absence of the company that prepared the detailed design. The contributions of Martin Kraft-Fish and James Mathews were enormously helpful.

2 THE PROPOSED PROJECT

2.1 Overview

There is currently a broad range of transport related initiatives across Europe and Asia, aimed at improving country-to-country, region-to-region and continent-to-continent connectivity. These transport initiatives include the Trans-European Transport Network (TEN-T), the Transport Corridor Europe-Caucasus-Asia (TRACECA), the Central Asia Regional Economic Cooperation (CAREC) Program and the Silk Roads Project, (outlined in Section 2.2 below) To capitalise on the trade and mobility benefits of these regional scale initiatives it is necessary to improve in-country connectivity too. For Armenia, the key to the improved in-country connectivity lies in the NSRC. The Sisian-Kajaran Road Project is a component of the NSRC and is described in the following sections.

2.2 Regional Transport Corridor Developments

2.2.1 The Trans-European Transport Network (TEN-T)

The TEN-T policy serves to promote a Europe-wide network of railway lines, roads, inland waterways, maritime shipping routes, ports, airports and railroad terminals. The objective is to close gaps, remove bottlenecks and technical barriers and to strengthen social, economic and territorial cohesion in the EU. The current TEN-T policy is based on Regulation (EU) No 1315/2013. In addition to the construction of new transport infrastructure, TEN-T promotes innovation, new technologies and digital solutions in all modes of transport. The policy objective is improved transport infrastructure use, reduced environmental impact, improved energy efficiency and increased safety.

2.2.2 Transport Corridor Europe-Caucasus-Asia (TRACECA)

The TRACECA is an international transport programme involving the European Union and 12 member States of the Eastern European, Caucasian and Central Asian region. TRACECA would serve to strengthen economic relations, trade and transport in the regions of the Black Sea basin, South Caucasus (Armenia, Azerbaijan and Georgia) and Central Asia.

2.2.3 Central Asia Regional Economic Cooperation (CAREC) Program

The Central Asia Regional Economic Cooperation (CAREC) Program is a partnership of 11 countries and development institutions promoting development through *inter alia* multimodal transportation networks. One of the programme's many achievements has been significant improvement in the region's physical infrastructure such as roads, aviation and rail systems. There are six CAREC transport corridors linking markets in northern People's Republic of China to Azerbaijan in the Caucasus and further to Europe, and from Kazakhstan to Pakistan's warm-water ports of Karachi, Gwadar, and beyond. Although Armenia is not a member of CAREC, the NSRC in Armenia, will connect to CAREC corridors.

2.2.4 The New Silk Road Project

First announced in 2013 by China the New Silk Road Project is a new double trade corridor set to re-establish transport channels between China and its western neighbours namely Central Asia, the Middle East and Europe. According to the Belt and Road Action Plan, the initiative will have east west land routes (the "Belt") and maritime routes (the "Road") with the goal of improving trade relationships in the region primarily through infrastructure investments. The land-based Silk Road Economic Belt is planned to extend throughout Eurasia in six corridors: from East Asia to Western Europe and South through Africa. Two vital corridors; the New Eurasian Land Bridge Economic Corridor and China-Central Asia-West Asia Economic Corridor pivot around Central Asia. Its other tranche - the Maritime Road – extends through the Western Pacific and Indian Ocean.

2.3 The Armenian North South Road Corridor (NSRC)

The NSRC crosses Armenia from South to North and comprises the M2 road Yerevan - Ararat - Yeraskh - Kapan - Meghri and M1 road Yerevan - Ashtarak - Gyumri - Bavra. The North-South Road Corridor Investment Project (NSRCIP) was initiated to upgrade the current road that runs for 560 km from the Armenian border with Georgia at Bavra to Armenia's southern border at Agarak. The planned upgrades include widening parts of the NSRC to a 4-lane cross section (but not for the Project), improving vertical and horizontal alignments, and constructing a new 1st category road (see **Box 1**) link between Sisian and Kajaran.

Box 1: What is a 1st Category Road

Roads in Armenia are classified into four categories, determined according to traffic volumes in passenger car units (PCU), importance for the national economy and administrative value of the road. Principal design elements are defined for all road categories, include horizontal and vertical alignment, grades, cross section elements, super elevation, widening on curves and other elements of geometric design.

The requirements for a Category 1 road are detailed below together with the associated design criteria.

Designed traffic volume			Value of the road
Reduced passenger car unit		Transport unit car/day	
PCU/hr	PCU/day		
More than 2800	More than 18000	More than 9000	Intergovernmental roads that connect RA road network to the roads of neighbouring countries and ensure international transport connections

Criteria	Value	Units
Design speed		
Flat	120	kmh
Hilly	100	kmh
Mountainous	80	kmh
Number of lanes	4	
Width of one lane	3,6	m
Width of shoulders	3,6	m
Width of edge safety lane		
From shoulder side	0,6	m
From median side	0,9	m
Width of median not less than	4,8	m
Width of roadbed.	26,4	m
Minimum radius of horizontal curve*.	425	m
Maximum longitudinal grade**	5	%
Minimum radius of vertical curves**		
Crest	8000	m
Flat	4500	m

*Superelevation 6%, speed 100 kmh; **Speed 100 kmh

Note that superelevation refers to the angle of the road to counter the centrifugal force on a motor vehicle going around a corner as illustrated below:

The new road will reduce the overall travel distance to 470 km and increase the speed limit to 100-110 kmh. The upgrade will mean increased comfort and a decreased travel time for road

users and vastly improve the function of the road in facilitating the movement of people and cargo. The NSRC is presented schematically in **Figure 2** and consisted initially of five tranches as shown in **Table 1**.

Source: Modified after Tranche 4, Section Artashat South - Kajaran, Feasibility Study, February 2016.

Figure 2. Schematic View of the NSRC, Armenia

Table 1. Five Individual Tranches that Make up the NSRC together with Their Length and Current Status

Tranche No	Section	Length, km	Status[3]
1	Yerevan-Ashtarak and Yerevan-Artashat	31	Completed
2	Ashtarak-Talin	42	Construction phase 55% complete, after termination of contractor retendering and ongoing works. (Lot 1); Tender stage (Lot 2)
3	Talin-Lanjik, Lanjik-Gyumri	46.2	Completed (Lot 1); Construction phase (Lot 2).
4	1. Artashat-Sisian	175	Preliminary design
	2. Sisian-Kajaran	**60**	**Detailed design**
	3. Kajaran-Agarak (incl. Kajaran tunnel)	45	Detailed design (both lots). Tender evaluation in progress (Lot 1);
5	Gyumri-Bavra	59	Detailed design.
	TOTAL DISTANCE	**458.2**	

2.4 The Sisian-Kajaran Road Section

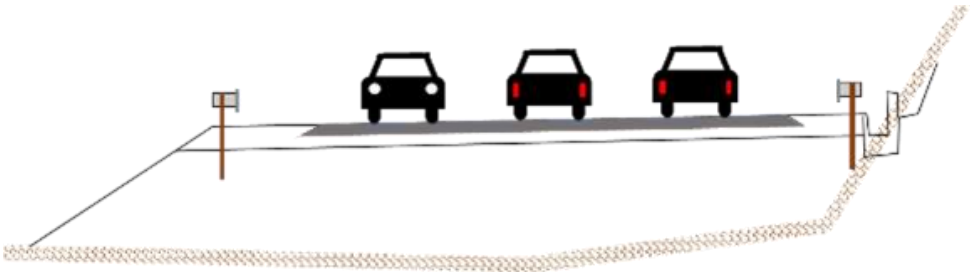
Note: the information in this and next section is based on the "North-South Road Corridor Investment Program, Tranche 4: Section Sisian-Kajaran, Detailed Design, General Report, April 2019" by J/V SPEA Engineering-IRD Engineering, and informed by the technical reports of Bernard Gruppe (Technical Consultant).

2.4.1 Introduction

The initially defined Tranche 4 of the NSRCIP connects the southern border of Armenia with the town of Artashat in central Armenia (**Figure 2**). This is the longest section of the NSRCIP at 340 km. The Armenian Ministry of Transport and Communications commissioned a Feasibility Study for the Sisian-Kajaran road section in 2015, during which three alternative alignments were investigated for the road. The study outcome was to recommend the so-called "C1" alignment for the Sisian-Kajaran section (see **Section 3.4**).

The C1 alignment was seen to offer the greatest benefits namely improving connectivity to a very important part of the country, by replacing an extremely poor existing road and drastically reducing travel time. It is also the least cost option. A preliminary design was completed and approved in 2016 with the road section designed as a single carriageway with climbing lanes on all uphill sections (**Figure 3**) and tunnels as single carriageways in both directions. The length of this alignment is approximately 60 km and has a design speed of 100 kmh. The detailed design was then completed and approved first by the State Expertise and then, in 2020, by the Government of Armenia[4].

[3] The various sections / Tranches of the NSRC projects are financed by Asian Development Bank (ADB), EIB and/or Eurasian Development Bank with financial contribution from the RA Government.
[4] RA government decision No. 870-A dated 27.05.2020 On approval of the conclusion of the special comprehensive expert examination of the detailed design document for Tranche 4 - Sisian-Kajaran road section within the North-South Corridor Investment Program. https://www.arlis.am/DocumentView.aspx?DocID=142958



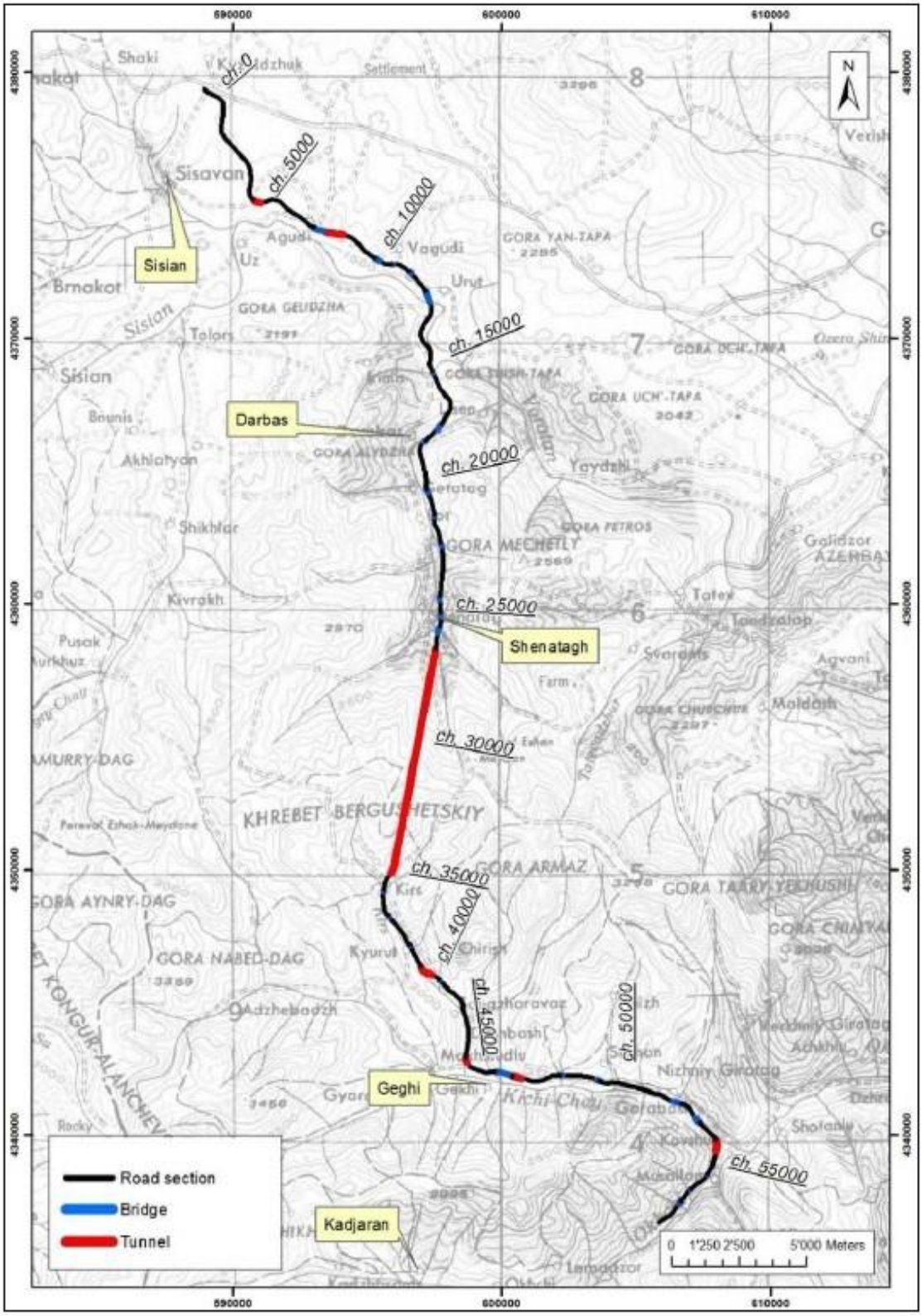
Source: Section Sisian-Kajaran, Detailed Design, General Report, April 2019.

Figure 3. Typical Road Cross Section Showing the Two Lanes and a Passing Lane on uphill sections.

2.4.2 General Description of the Road Section

In addition to the characteristics detailed above the proposed road section would have three main interchanges, 27 bridges and 9 tunnel sections. Of the tunnel sections, the most significant is the proposed Bargushat Tunnel. The tunnel is 8,600m long, more than 3,100m above mean sea level (AMSL), and has an overburden (i.e., material overlying the tunnel section) of as much as 1,200m. This tunnel would provide a connection between the section north of the Bargushat mountain and the section to the south.

The road starts on the plain located north-east of Sisian and runs in south-east direction towards the village of Vorotan and then southwards to the village of Shenatagh. In this sector the road will extend mainly along the left bank valley sides of the Vorotan River and then on the right side of Shenatagh valley, before passing through the Bargushat tunnel. From the southern side of the tunnel the road will descend along the Qirs valley first on the right side and then along its left side, to the junction with the Geghi River in the Geghi valley. From this point the road would turn eastwards to the junction with the Voghji River where it turns west to connect with the existing M2 highway near Kajaran (**Figure 4**).



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

Figure 4. The Proposed Sisian-Kajaran Road together with the Positions of Tunnels and Bridges

Much of the alignment is through mountainous terrain and the road alignment cannot follow the terrain directly and still comply with the Category 1 criteria (see **Box 1**). For example, the road alignment cannot follow the contours where the relief bends at a more acute angle than the allowable criteria. In such circumstances it is necessary to build a bridge or to cut into the

hillside (or both) to create the required minimum radius of curvature as illustrated in **Figure 5**. Those criteria also demand tunnels where the natural gradients exceed the 5% threshold.

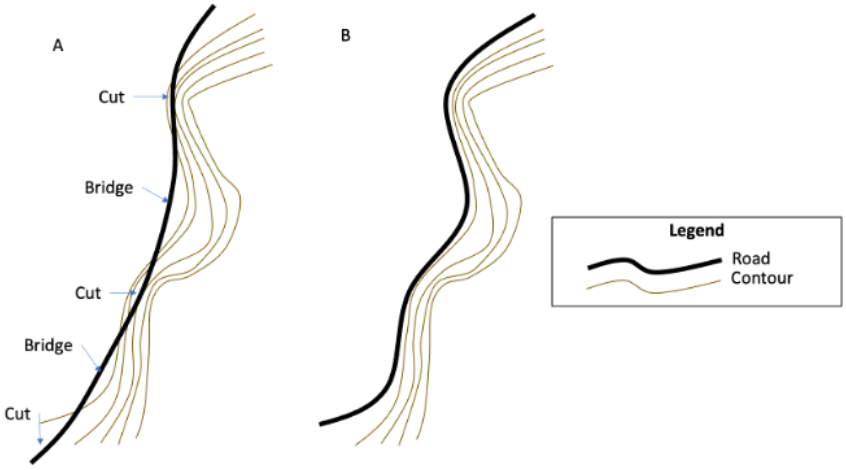


Figure 5. Schematic illustration of the difficulty in following the contours of the landscape whilst complying with the Category 1 criteria (A). In B, the road follows the contours but does not comply with the Category 1 road criteria.

2.4.3 Detailed Description of the Proposed Road

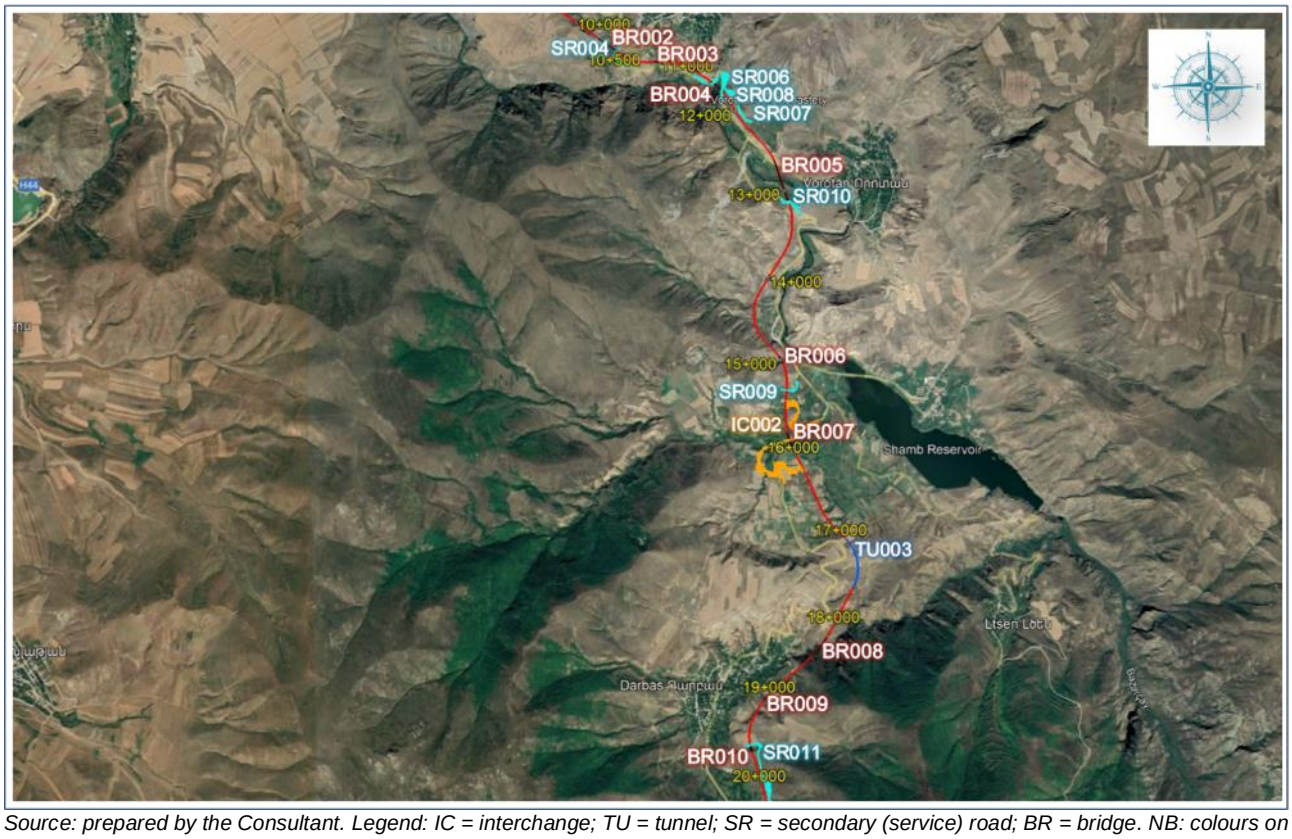
The proposed road is illustrated in the figures that follow and described in detail in **Tables 2-6** below.

Source: prepared by the Consultant. Legend: IC = interchange; TU = tunnel; SR = secondary (service) road; BR = bridge. NB: colours on the map correspond to the colours in the associated table below.

Figure 6. The Alignment Proposed for the Sisian-Kajaran Road Section from km 0+000 to km 10+000

Table 2. Components of the Sisian-Kajaran Road Section from km 0+000 to km 10+000

Road feature	Chainage (km)		Length (m)
	km	+	
The starting point of the project is on the existing M-2 road after the first main junction for Sisian and near the second junction (in the direction of Kapan). The first approximately 500 m will be rehabilitated and improved to meet the new road design standard. Thereafter, the road turns right curving at R=425 m (minimum for this road category) and traverses the left side of an existing open valley that has no major constraints for the next 5 km.	0	0,00	
Interchange 002	0	400,00	
From km 4+840 the alignment turns left with R=450 m cutting into the mountain	4	840,00	
Tunnel 01	4	840,00	420,00
Service road 001	5	550,00	1 170,00
After the tunnel the alignment turns right following the same left bank of the river before crossing a minor existing road (which will be re-aligned in order to maintain functionality).	5	766,50	
Service road 002	6	980,00	1 009,00
Service road 003	7	57,00	200,00
Bridge 001 (Crosses valley)	7	640,95	429,00
Village of Aghitu			
Tunnel 02	8	80,00	680,00

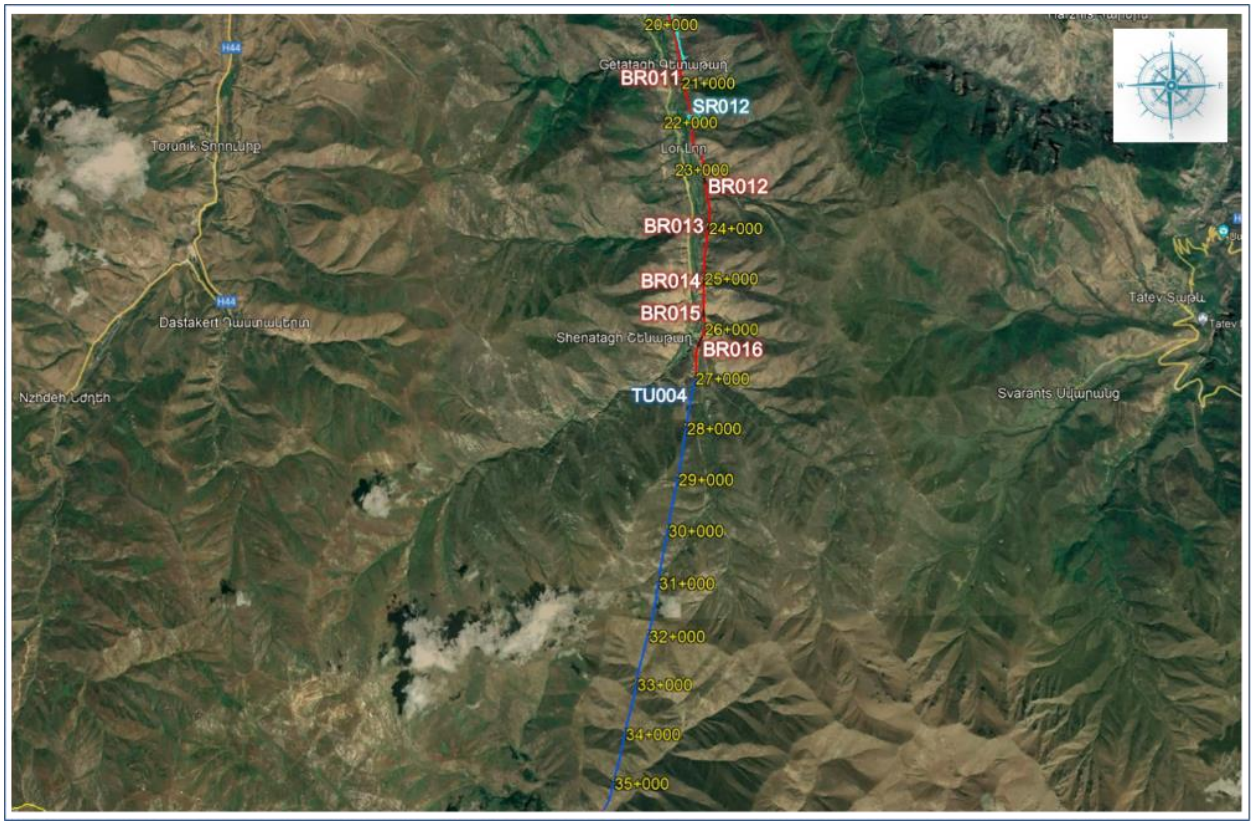


Source: prepared by the Consultant. Legend: IC = interchange; TU = tunnel; SR = secondary (service) road; BR = bridge. NB: colours on the map correspond to the colours in the associated table below.

Figure 7. The Alignment Proposed for the Sisian-Kajaran Road Section from km 10+000 to km 20+000

Table 3. Components of the Sisian-Kajaran Road Section from km 10+000 to km 20+000

Road feature	Chainage (km)		Length (m)
	km	+	
Road runs close to the Vaghatin village on the left side of the river valley	10	0,00	
Bridge 002 (Crosses valley)	10	265,00	246,00
Service road 004	10	450,00	329,00
Bridge 003 (Crosses valley)	10	919,80	66,00
Service road 006	11	390,00	329,00
Passes by the Vorotnavank Monastery (approx. 200 m away)	11	500,00	
Bridge 004 (Crosses valley)	11	583,50	174,00
Service road 007	11	725,64	255,00
Service road 008	11	610,00	657,00
Bridge 005 (over Vorotan River)	12	653,00	486,00
Service road 010	13	20,00	340,00
Runs in cut and fill section following the natural shape of the right valley side	13	382,00	718,00
Bridge 006 (Crosses valley)	14	941,56	84,00
Runs through an agricultural and flat area mostly on embankment on south side of Shamb reservoir	15	0,00	2 000,00
Service road 009	15	310,00	261,09
Interchange 002	15	900,00	
Bridge 007 (Crosses interchange)	15	768,63	246,00
Tunnel 03	17	191,00	359,00
Bridge 008 (over Loradzor River)	18	327,54	250,00
Bridge 009 (Crosses valley)	19	34,00	102,00
Village of Darbas	19	300,00	
Runs on right side of river valley	18	300,00	1 700,00
Bridge 010 (Crosses large valley)	19	623,60	84,00
Service road 011	19	630,00	1 280,00



Source: prepared by the Consultant. Legend: TU = tunnel; SR = secondary (service) road; BR = bridge. NB: colours on the map correspond to the colours in the associated table below

Figure 8. The Alignment Proposed for the Sisian-Kajaran Road Section from km 20+000 to km 35+770

Table 4. Components of the Sisian-Kajaran Road Section from km 20+000 to km 35+770

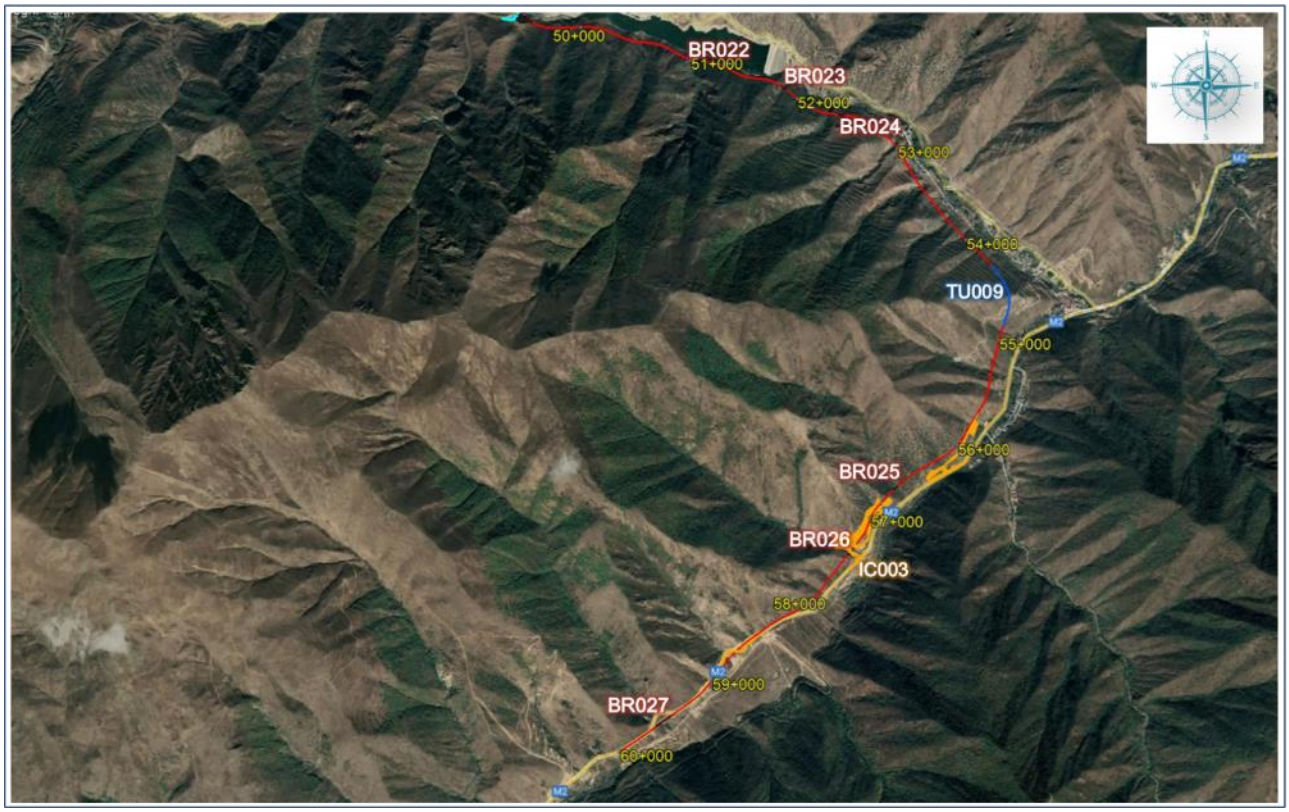
Road feature	Chainage (km)		Length (m)
	km	+	
Alignment runs on the left side of the main valley in cut and fill			
Bridge 011 (Crosses valley)	20	986,35	114,00
Village of Getatagh	21	0,00	
Service road 012	21	794,05	580,00
Village of Lor	22	700,00	
Bridge 012 (Crosses valley)	23	65,22	156,00
Bridge 013 (Crosses valley)	24	41,00	102,00
Bridge 014 (Crosses valley)	25	135,93	114,00
Village of Shenatagh	25	900,00	
Bridge 015 (Crosses valley)	25	729,66	156,00
Bridge 016 (Crosses Loradzor River)	26	257,07	246,00
Bargushat tunnel (Tunnel 04)	27	130,00	8 640,00

Source: prepared by the Consultant. Legend: TU = tunnel; SR = secondary (service) road; BR = bridge. NB: colours on the map correspond to the colours in the associated table below

Figure 9. The Alignment Proposed for the Sisian-Kajaran Road Section from km 35+770 to km 50+000

Table 5. Components of the Sisian-Kajaran Road Section from km 35+770 to km 50+000

Road feature	Chainage (km)		Length (m)
	km	+	
Runs on the right side of the valley mostly in cut and fill section minimizing earthworks quantity, with bridges crossing the minor valleys	35	770,00	
Bridge 017 (Crosses valley)	36	315,53	222,00
Road crosses to other side of valley and then continues to follow Geghi valley			
Bridge 018 (Crosses Karut river)	37	418,08	114,00
Service road 016	38	770,00	1 260,00
Tunnel 05	39	755,00	515,00
Road remains on the left side of the valley in cut and fill section			
Bridge 019 (Crosses valley)	40	592,67	84,00
Tunnel 06	42	58,00	366,00
Tunnel 07	43	919,00	480,00
Village of Geghi	45	0,00	
Bridge 020 (Crosses valley)	45	312,15	434,00
After the village, the road crosses to the other side of the valley to avoid natural vegetation and to limit ice on the road surface during winter by maximising sun exposure.			
Service road 017	45	469,50	209,70
Tunnel 08	45	878,00	521,00
Bridge 021 (Crosses Karut river)	49	341,12	222,00
Service road 018	49	411,00	355,20
Alignment turns right and crosses the valley to minimise the topography and to avoid a dam and associated lake (Geghi reservoir)	50	0,00	



Source: prepared by the Consultant. Legend: IC = interchange; TU = tunnel; SR = secondary (service) road; BR = bridge. NB: colours on the map correspond to the colours in the associated table below.

Figure 10. The Alignment Proposed for the Sisian-Kajaran Road Section from km 50+000 to the end of the Project

Table 6. Components of the Sisian-Kajaran Road Section from km 50+000 to end of the Project

Road feature	Chainage (km)		Length (m)
	km	+	
Bridge 022 (Crosses valley)	51	1,00	102,00
Bridge 023 (Crosses valley)	51	824,60	560,00
Bridge 024 (Crosses valley)	52	390,00	66,00
Tunnel 09	54	410,00	490,00
New road runs parallel to the existing M2 road connecting Kapan to Kajaran. The existing road is closer to the river and lower (in elevation) than the new one.	55	0,00	
Bridge 025 (Crosses valley)	56	640,22	60,00
Bridge 026 (Crosses interchange)	57	271,99	128,00
Interchange 003	57	500,00	
Bridge 027 (Crosses valley)	59	463,00	174,00
The road descends to reach the same elevation as the existing M2. End of new road section is where the new and existing roads meet in horizontal and vertical alignment.	60	22,00	

2.5 Key Components of the Road

2.5.1 Tunnels

2.5.1.1 Introduction

There will be nine tunnels in total ranging in length from 359 m (tunnel 3) to 8.64 km (Bargushat tunnel). All the tunnels will provide for single lane, two-way traffic. Should additional capacity be required later, a second parallel tunnel could potentially be established next to those constructed for this Project. Such second tunnels have not yet been designed though and exist only as concept. The Bargushat tunnel deserves special mention given its size and the important role that it will play in avoiding direct impacts on the Zangezur Sanctuary. The Zangezur Sanctuary is an important protected area and will be completely avoided by tunnelling underneath the sanctuary and having no surface infrastructure in the sanctuary. All the tunnels will have largely the same characteristics and construction requirements but only the Bargushat tunnel exceeds the threshold of 1,000 m and so requires mechanical ventilation and escape routes, which the other tunnels do not.

The Bargushat Tunnel will cross the Bargushat Mountain Range ascending from the Shenatagh portal (1,870m) (northern portal) to the Qirs portal (2,065m) (southern portal). The geology of the tunnel section has been preliminarily characterised as:

1. The first approximately 2.7 km is granites with intercalations of mafic dykes. There are several faults in this section oriented at high angles to the tunnel axis and with variable dip;
2. Thereafter the geology is complex with intercalations of mafic rocks, marbles, limestones, conglomerates, siltstones and quartzite;
3. Some 4.5 km into the tunnel is a large (around 230m) ductile shear zone in sedimentary rock (possibly siltstones, slates, marbles and limestones). These conditions and the high overburden at that point could make this section of the tunnel especially difficult to construct;
4. The next stage of the tunnel has similar geology to (2) above;
5. The last section again consists of intercalations of mafic and granitic rocks, with few stretches in marble-limestones;
6. Both portals are located in areas with a thin (few meters) cover of superficial debris above a medium fractured bedrock;

7. Veins of mineral ores a few meters thick have been observed consist of sulfur and oxides; and,
8. No karst features have been observed within the limestone-marble.

The low average annual precipitation (500-600mm) together with a general impermeability of the rock masses suggest that water inflows should be generally low to absent. Some large inflows could occur in the major fault zones, though with the largest quantities during the spring thaw. Aggressive, hot water resulting from deep fluid circulation and gases may also be present. Based on due diligence findings the Lenders have recommended to the Government of Armenia that more detailed geological investigations be conducted prior to tendering to provide a better assessment of the geology through which the tunnel will pass.

2.5.1.2 Characteristics of the Tunnels

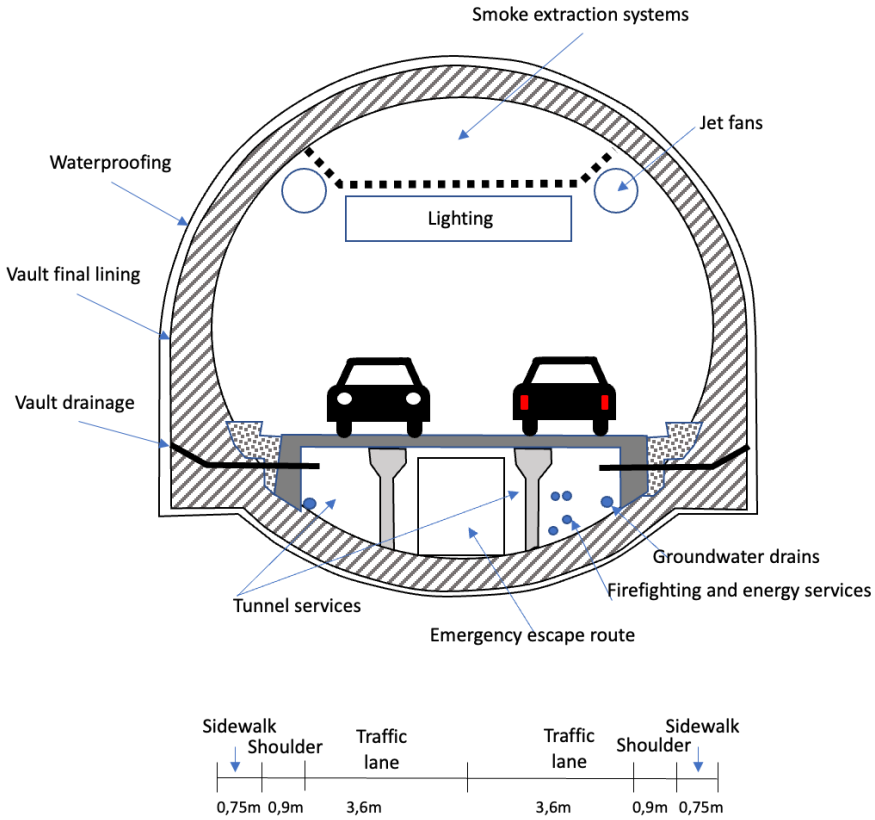
The Bargushat tunnel will have a radius of 5.68m and will be 9.70m high (**Figure 11**) and has been designed to comply with "Safety Requirements for Tunnels in the Trans-European Road Network Regulations" (Directive 2004/54/EC) for bi-directional tunnels of more than 1,000m. This compliance means:

- two fans and one duct in the vault of the tunnel to provide the required capacity of fresh air and exhaust and smoke extraction (semi-transversal ventilation),
- a separate duct under the pavement, between the carriageway and the tunnel invert (the base of the tunnel), provides an escape route in case of fire.

The tunnel is also designed to include:

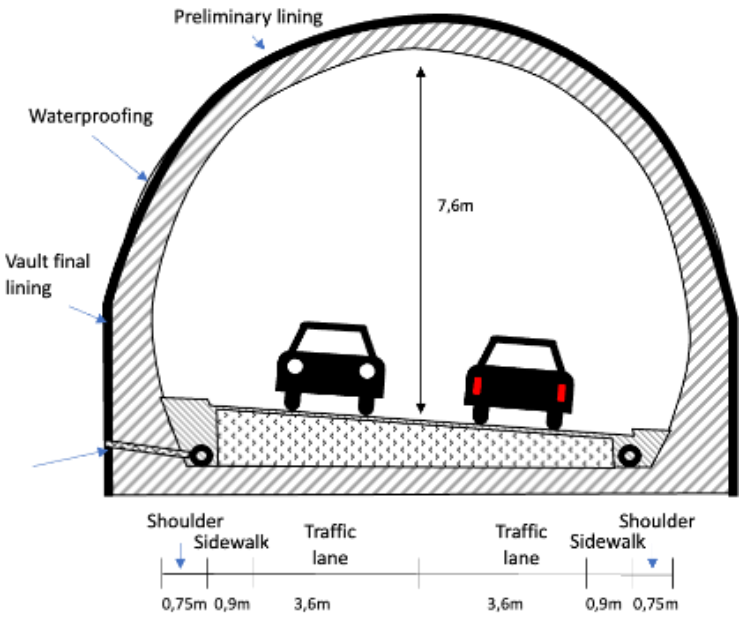
- Widening for emergencies every 1,000m.
- Escape way under the pavement and access to escape way every 500m.
- SOS and fire extinguishers every 250m.
- Fire system with water tanks at portals.
- Longitudinal ventilation with ventilation stations at each portal.
- Strictly as per the EU Directive Annex I Cl. 2.9.2: "A mechanical ventilation system shall be installed in all tunnels longer than 1 000 m with a traffic volume higher than 2 000 vehicles per lane."

All tunnels require dedicated escape routes but in the shorter tunnels the escape route is a raised walkway leading to the tunnel portals with a specified clearance and no trip risks (**Figure 11**). For the shorter tunnels the EU standard can still be applied as it contains many recommendations (including safety requirements). Many countries have their own national interpretation of the EU directive, but this does not appear to be the case for Armenia.



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

Figure 11. Schematic Typical Cross-Section of the Bargushat Tunnel (which exceeds 1 000 m in length).



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

Figure 12. Schematic Typical Cross-section of the Other Tunnels

2.5.1.3 Construction of the Tunnels

Due to the significant overburden depth (i.e., material overlying the tunnel section), it is not possible to accurately and reliably characterise the rock mass along the various tunnel

alignments, and so construction of the tunnel will be based on the so-called "observational design method"[5]. This approach means:

- on site surveying during construction, whereby the rock mass conditions assumed for the design, are confirmed or modified.
- an operating phase, during which stabilizing measures are implemented to control possible deformation;
- a monitoring and design fine-tuning phase during which deformation of the surrounding rock mass/ground for the entire excavation is measured, interpreted and verified and stabilizing measures are optimized.

The tunnel excavation and support system in the current design is based on supporting the tunnel core ahead of the tunnel face with full-face excavation. The approach is feasible but requires specialized techniques, equipment and materials. A more conventional tunnelling method would be less costly and more appropriate for tunnelling in Armenia. Preliminary investigations indicate that the use of a tunnel boring machine may not be possible and so drill-and-blast tunnel excavation has been assumed as a 'worst case' tunnel excavation method.

It is assumed that quarries, concrete batching and asphalt plants existing in the region will be used instead of establishing new ones. The identification of these facilities will be a task of the Construction Contractor as well as subject to approval by the RD. E&S management requirements for quarries, batching and asphalt plants will be detailed in the ESMP, if there is inadequate capacity and new facilities need to be established. The Contractor will establish these facilities, if needed, and secure the due E&S permits.

2.5.1.4 Power Supply to the Tunnels

It is essential to maintain safe and reliable power supply to all the tunnels to ensure the safety of the road users in the tunnel. To that end, the Bargushat tunnel will be equipped with two transformer cabins at the entrances. It is unclear at this stage as to how power will be supplied to all other tunnels whether overhead transmission lines or underground lines. Should new electricity transmission lines be required, these are not part of the Scope of this assessment, and would be treated as associated facilities (see **Section 2.8**).

2.5.1.5 Firefighting System

The firefighting system will be based on water spraying with pressurized water supplied from water storage tanks, via ring-locked piping. The ring-locking prevents water from escaping the system into the tunnel in the event of damage to a pipe. One water tank of sufficient capacity for the firefighting requirements will be provided at each portal.

2.5.2 Interchanges

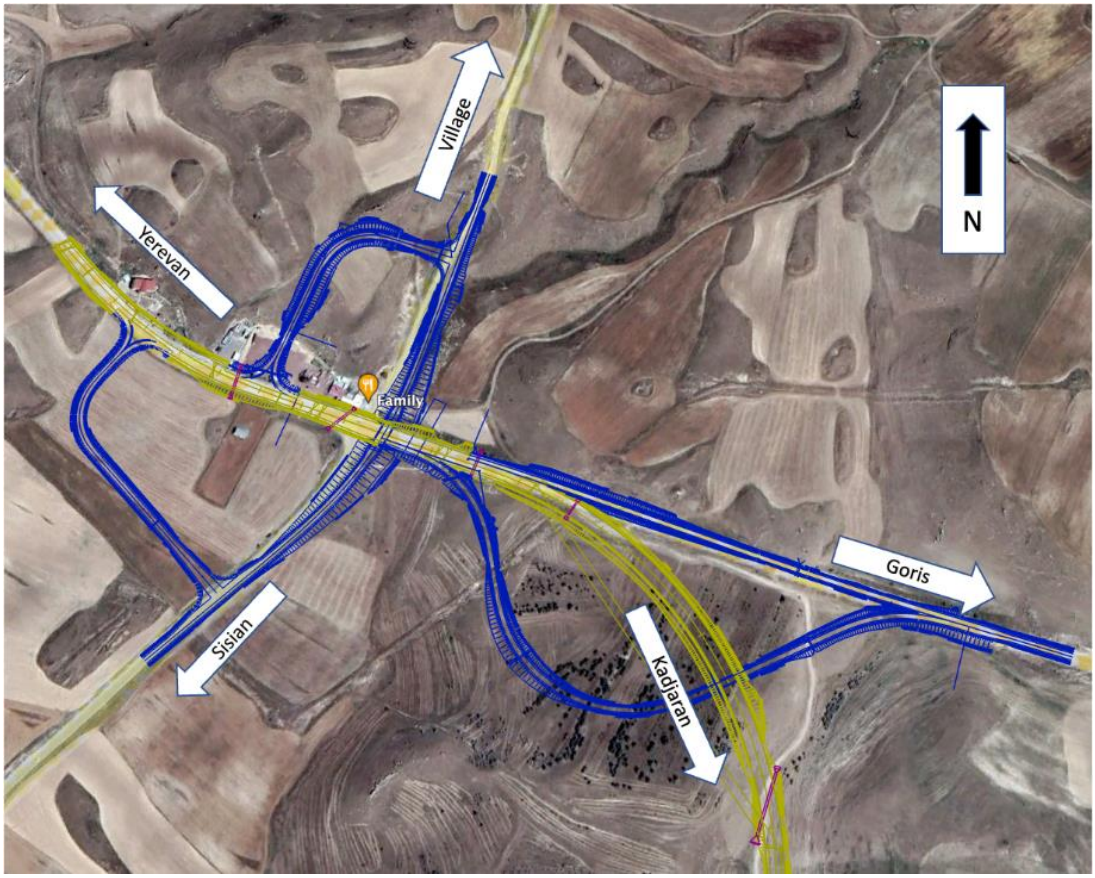
Three interchanges are proposed for the new road:

- IC_01 – Sisian at km 0+400;
- IC_02 – Shamb reservoir Area at km 15+900; and
- IC_03 – Connection with M2 road at end of the project.

Interchange No. 1 connects the new road to the existing M2 in the direction of Goris, with the other minor road access to Kapan and to a separate village (**Figure 13**). The interchange also provides for access to Goris, when arriving in Kajaran from the new roadway by exiting

[5] This means an essential part of tunnelling is monitoring of deformations and decision-making based on those observations. This is common and good practice.

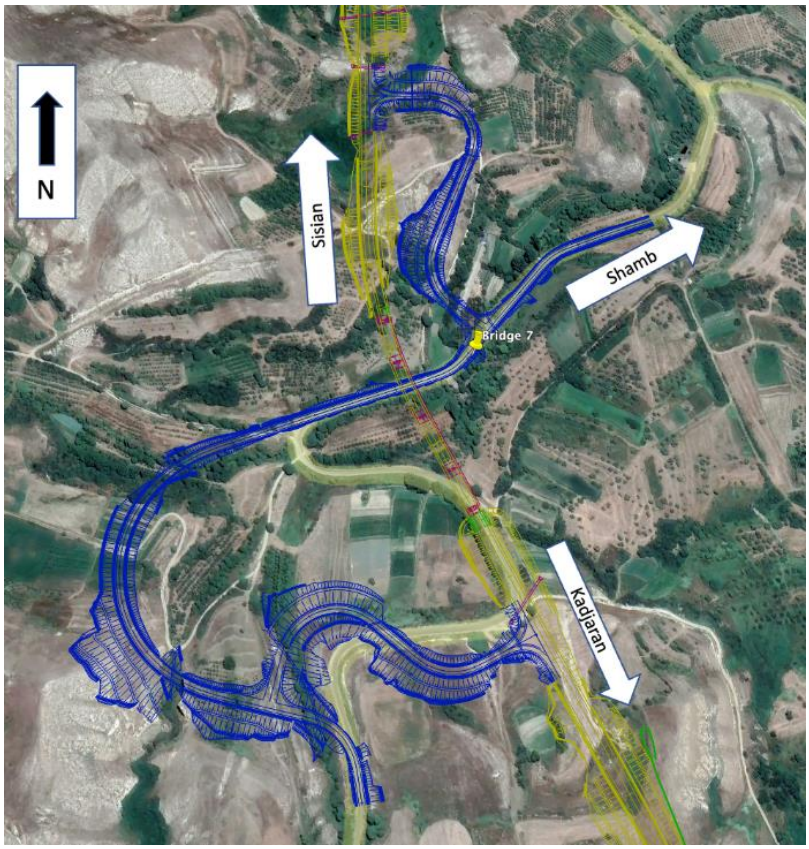
the highway just after the Ishkhanasar-Sisian road, overpassing the highway going through Sisian and then re-entering the highway southbound. A separate ramp with a direct exit to Goris is also feasible and may be included in the interchange.



Source: prepared by the Consultant based on the RD drawing.

Figure 13. Interchange 1 (blue)

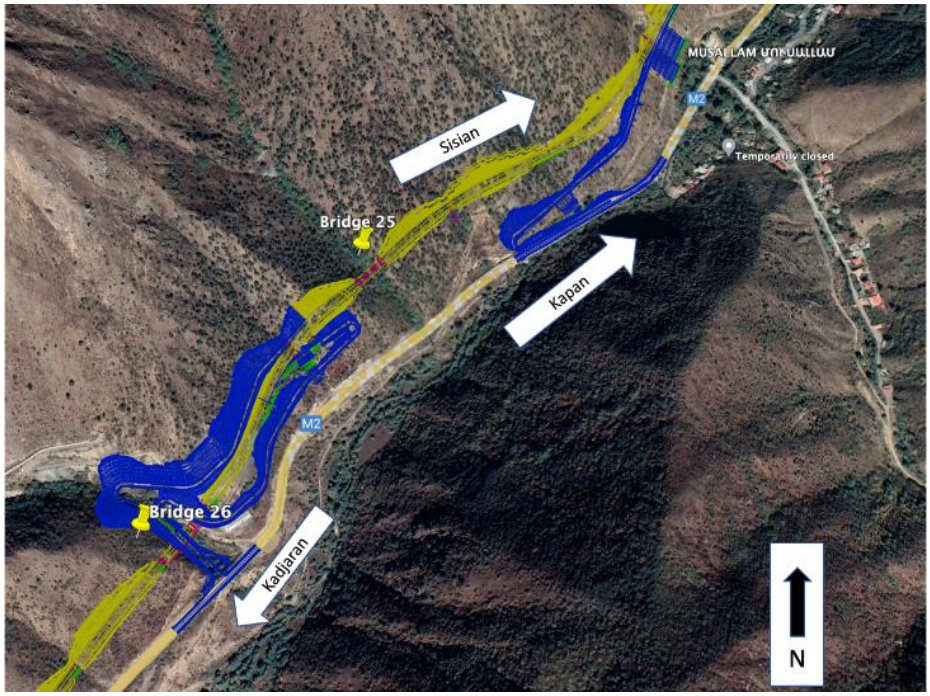
Interchange No. 2 is at km 15+900 to connect the new road to the existing roads around the Shamb Reservoir (**Figure 14**). The interchange will provide access to Vaghatin, Vorotan, Shamb, Ltsen, Tatev, Darbas, Getatagh, Lor and Shenatagh.



Source: prepared by the Consultant based on the RD drawing.

Figure 14. Interchange 2 (blue)

Interchange No. 3 is at approximately km 57+500 to connect to the existing M2 road and the eastern part of Armenia such as Kapan (**Figure 15**). The new road is parallel with the M2 but not the same elevation (the new road will be higher than the M2), making a single interchange impossible and thus the interchange is made up of the two parts that can be seen in the figure.



Source: prepared by the Consultant based on the RD drawing.

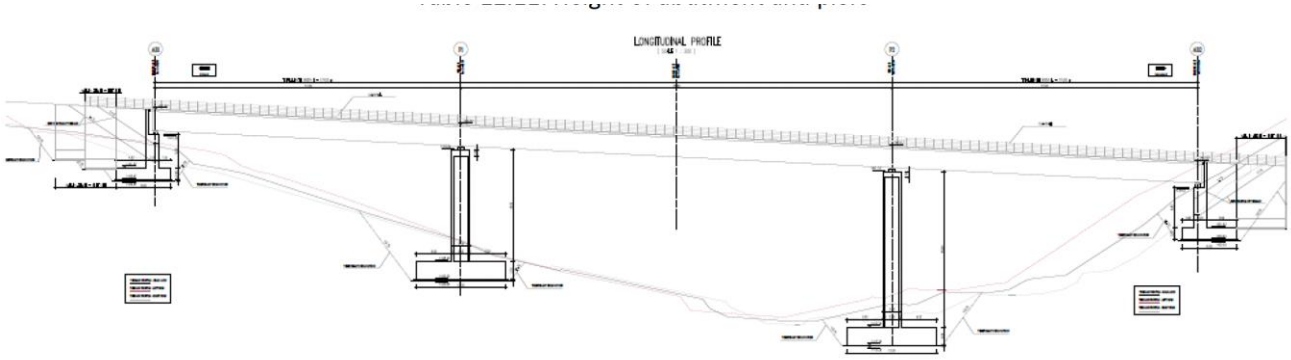
Figure 15. Interchange 3 (blue)

2.5.3 Bridges

There will be 27 bridges on the road section to cross both rivers and valleys and maintain the overall design grade for the road. The bridges range in length from 60 m (Bridge 25) to 560 m (Bridge 23). Two types of bridges will be deployed (see the figures below), namely:

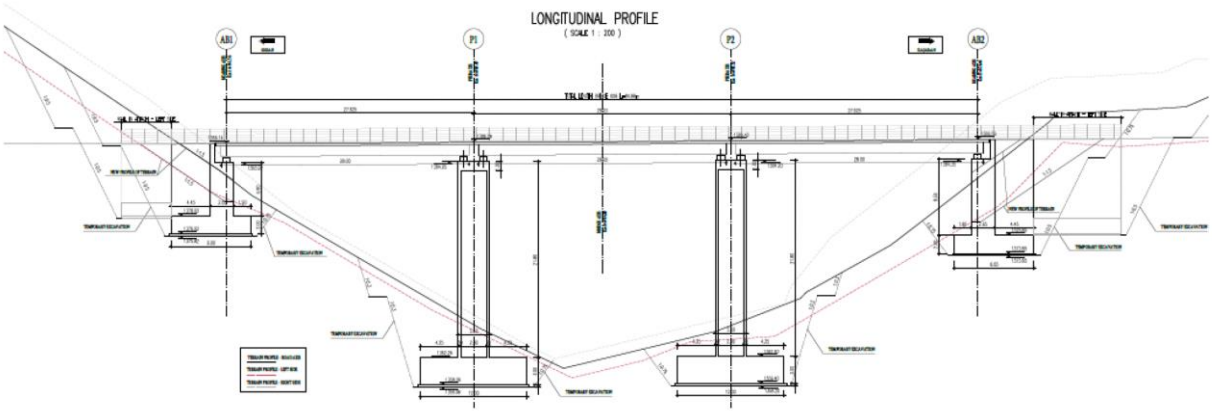
- Steel-concrete bridges: maximum span length up to 72 m;
- Precast concrete bridges: maximum span up to 28 m.

The foundations for the bridge piers will be either flat type (a typical platform foundation), piling and/or micro-piling depending on the geology. Between two and seven piers will be required to support the bridges depending on the length of the bridge. The pier foundations will also result in land transformation as a function of the size of the foundations which are estimated at 150m^2 but may be larger or smaller as a function of the specific footing of the pier. Each bridge will also require abutments on either side of the span of the bridge. An abutment is the 'footing' needed to transition from the natural underlying surface onto the bridge and upon which the bridge rests together with the piers. According to the 2019 Detailed Design, structurally, the bridges are designed to sustain 9.0 magnitude seismic impact.



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

Figure 16. Schematic Presentation of a Steel Concrete Bridge



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

Figure 17. Schematic Presentation of a Precast Concrete Bridge

2.5.4 Passages for Cattle and Agricultural Vehicles

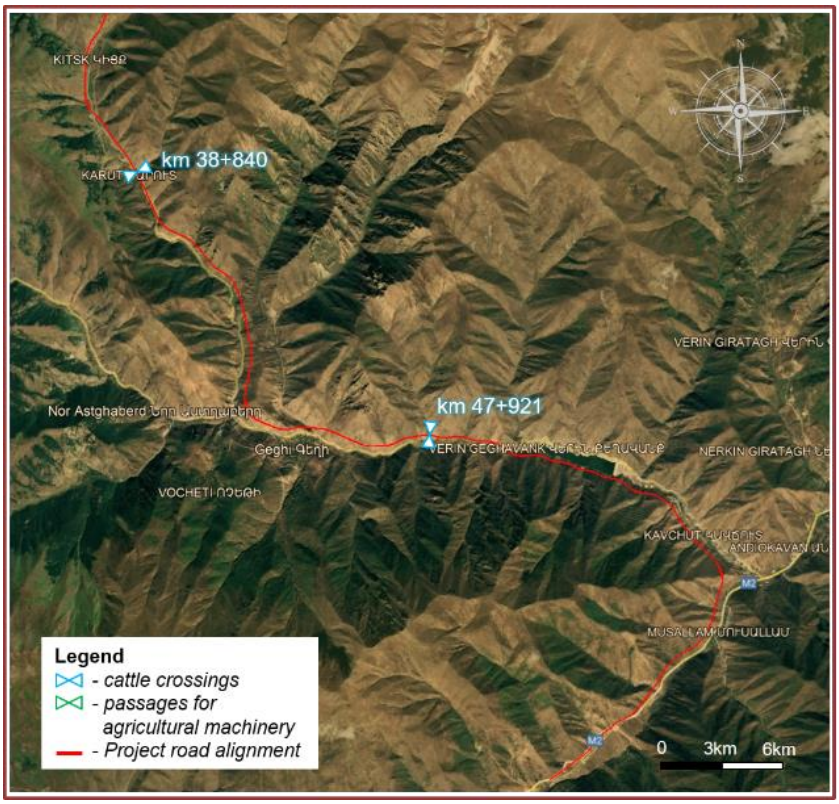
The design includes five cattle crossings and four passages for agricultural machinery relative to the proposed road chainage (**Table 7** and two maps below). Agricultural passages can also serve as cattle crossings.

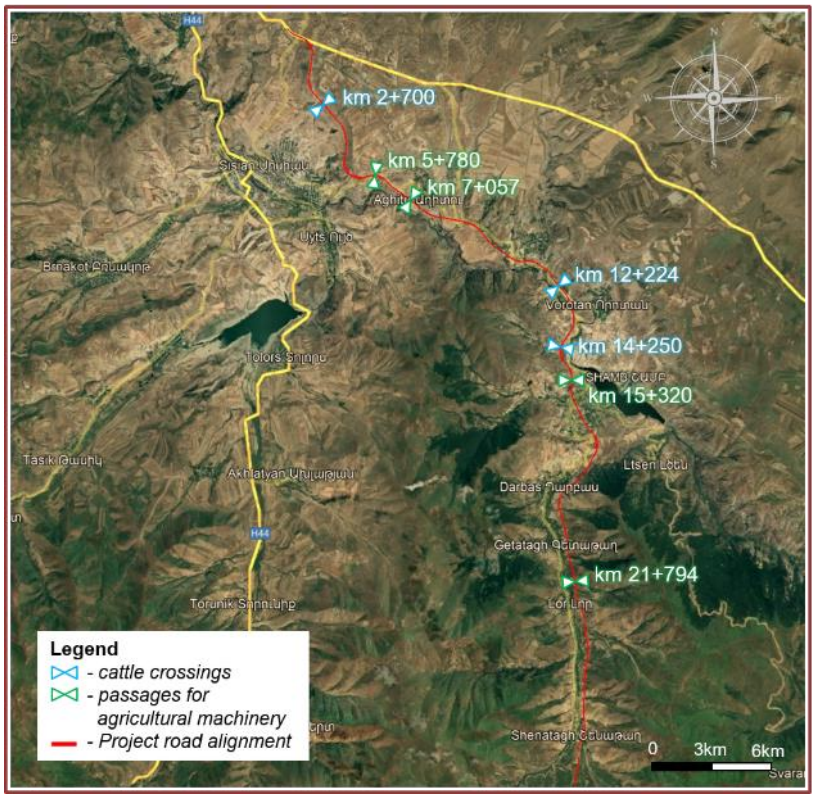
Table 7. Passages for Cattle and Agricultural Vehicles Included in the Design

№	km	+	Location in relation to nearby settlements
Cattle crossings			
1	2	700	1.3 km northeast of Sisian city
2	12	223.8	1.04 km northwest of Vorotan village
3	14	250	1.6 km southwest of Vorotan village
4	38	840	2.3 km south-southeast of the uninhabited Kirs village
5	47	921.38	Uninhabited Verin Geghavank village, 2.8 km east of Gekhi village
Passages for agricultural machinery			
1	5	779.67	1.08 km west of Agitu village
2	7	057	0.65 km west of Vakhatin village
3	15	320	0.8 km northeast of Darbas village
4	21	794	1.7 km south of Lor village

All the above-mentioned crossings will be underpasses of two different types:

- cattle underpass 5m x 3m with length varying from 25m to 50m in order to allow for the passage of animals; and
- agricultural underpass 5.5m x 10m connecting the rural roads on two sides of the proposed road, with the length varying from 40m to 82m.





Source: prepared by the Consultant.

Figure 18. Cattle and Agricultural Passages Envisioned in the 2019 Detailed Design

During the ESIA, additional cattle passages were proposed through the participatory process for further consideration in the updated detailed design (for more information refer to **Section 3.13** below and in **ESIA Volume 4**).

No green bridges or wild animal crossings were included in the detailed design, but the requirement emerged from the biodiversity assessment (see ESIA Volume 2 for the list of proposed wild animal crossings). It should be noted though that much of the alignment will be in large cut sections on the sides of relatively steep slopes limiting the areas where underpasses could be established. It is only where the road is on piers that underpasses would exist or where the road is on the valley bottom (and very limited at that).

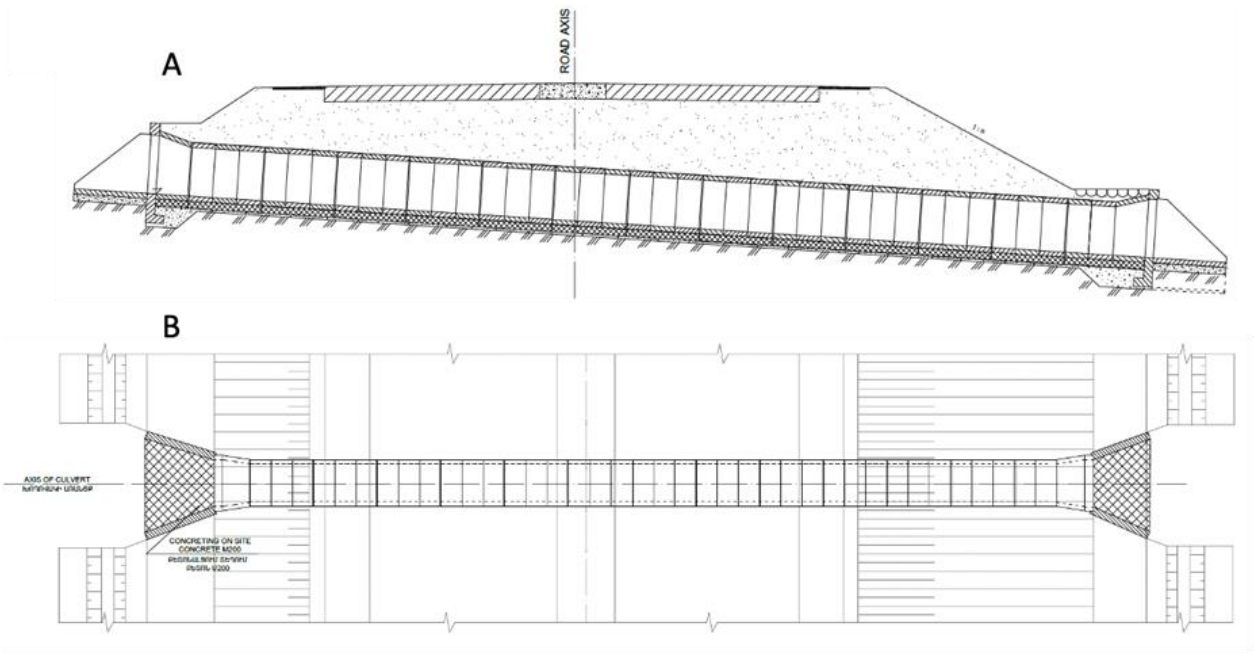
2.5.5 Culverts

The Project design envisages the arrangement of 124 hydraulic box culverts of four different types to cater for the different volumes of stormwater expected:

- 1m x 1m – 1 unit;
- 1.5m x 1.5m – 95 units;
- 2m x 2m – 18 units; and
- 3m x 3m – 10 units.

The culverts would be sized to drain the stormwater likely to occur at the part of the road. A typical design of a culvert is provided below.

The culverts will be either with steps or with a single slope. The dimensions of the cross section of the culvert have been calculated considering the recurrence of 100-year floods.



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

Figure 19. Design of Stormwater Culverts that Would be Used on the Proposed Road. A: a side view of the culvert and B: a plan view (view from the top)

2.5.6 Road Pavement

The road pavement will comprise 10cm of gravel-sand, 30cm of crushed stone sand course C-5, 8 cm of crushed stone asphalt/concrete (a/c) high porosity, 7 cm of course-grained dense a/c I cat B type and 5cm of fine-grained dense a/c I cat A type. Shoulders will be covered with surface dressing. The road has been designed in accordance with (i) Bridge Design Building Code SNIP 2.05.03.84*, Construction Norm of the RA IV11.05.02-99, AASHTO and Eurocodes.

The high risk of seismic activity and flooding has been incorporated in the design of the structural elements of the project. The key design features of the road are as follows:

- Design speed – 100 kph;
- Maximum grade – 5%;
- Number of lanes – 2 but with an additional climbing lane on steep ascents;
- Width of one lane - 3.3m;
- Width of shoulders (called ‘road edges’ in the detailed design) – 3.3m / 0.6m paved;
- Width of two emergency lanes – 3.3m;
- Width of edge safety lane (security strip) from shoulder’s side – 0.7m.

2.5.7 Service (Secondary) Roads

The last component of the Project will be the construction of new roads that would serve to provide a connection between the existing roadways and the new road section. 14 such ‘secondary’ roads were proposed in the Project design (for the details of their location refer to tables in **Section 2.4.3**).

The access roads to the potential spoil disposal areas and future construction camps have not yet been considered or sited. It is assumed that the existing (earth) roads will be used as much as possible and extended as required. The Construction Contractor will oversee arranging these roads as part of the Project and in line with ESMP.

2.5.8 The Road Reserve

For the purposes of the ESIA it is essential to understand the direct footprint of the road. Stated differently, it is necessary to understand where land will be transformed either temporarily for purposes of construction or permanently for the actual road infrastructure.

Armenian legislation also defines an 'alienation zone' of 1m in the settlements, and in areas outside settlements, also protection zones. For Class I roads, the protection zone is 70m on either side of the central axis of the road (Article 13 of the RA Law on Roads). The protection zone would then define an area of restricted development, so that there would not be a clash between proposed developments and the effective and safe functioning of the road. There is no need to acquire the land within the protection zone.

At the same time, the mountainous terrain through which the road will pass, requires cuts into the terrain on the upslope side of the road and embankments on the downslope side of the road. The resultant permanent land transformation would then be from the start of the cut to the toe of the embankment on the downslope side of the road. The width of the road footprint will depend on the slope steepness with steeper slopes requiring greater widths. The cutting on the upslope side of the road may also require benches ('steps') to ensure that the slope is stable resulting in an even greater width.

The Project requires permanently acquiring 2,932,280.88 m^2 (570 land plots) including for embankments and retaining walls. The acquisition will be managed via a Resettlement Plan and no construction work will start on the land plots until the compensation is paid.

2.5.9 Potential Quarries / Borrow Pits

Neither the locations, nor quantities of material from quarries / borrow pits are known now. Some material from the tunnel excavations would be used for infill material such as required for embankments, if it is found to be suitable.

The RD expects that the Construction Contractor will determine the quality and quantities of infill, identifying relevant borrow pits and obtaining permits for their use, if in fact they are required. The ESIA Consultant conducted a desktop search for licenced borrow pits in the Project area to assess related E&S risks to the extent possible and develop relevant E&S mitigation measures for the ESMP. In total, 13 licenced borrow pits and quarries were identified by the ESIA Consultant and these are detailed in **Annex 1**.

2.5.10 Disposal of Residual Excavated Material (Spoil)

The cut-to-fill ratio of material is shown in **Table 8**. It can be seen from the table that there will be a substantial quantity of spoil (material that cannot be re-used on the Project and will need to be disposed of).

Table 8. Cut-to-fill Ratio for the Project

Source	Quantity (m^3)
Excavation	5 671 477
Topsoil stripping*	34 361
Rock excavation	9 147 683
Unsuitable excavation	1 437 295
Sub-total	**16 290 816**
Re-use	-3 311 148
Spoil quantity	**12 979 668**

Note: Positive numbers indicate available material quantities, negative where the material is re-used on the Project.

All topsoil will be reused for landscaping and will require a separate management regime to protect the top soil fertility and fecundity and ensure that it is protected from erosion.

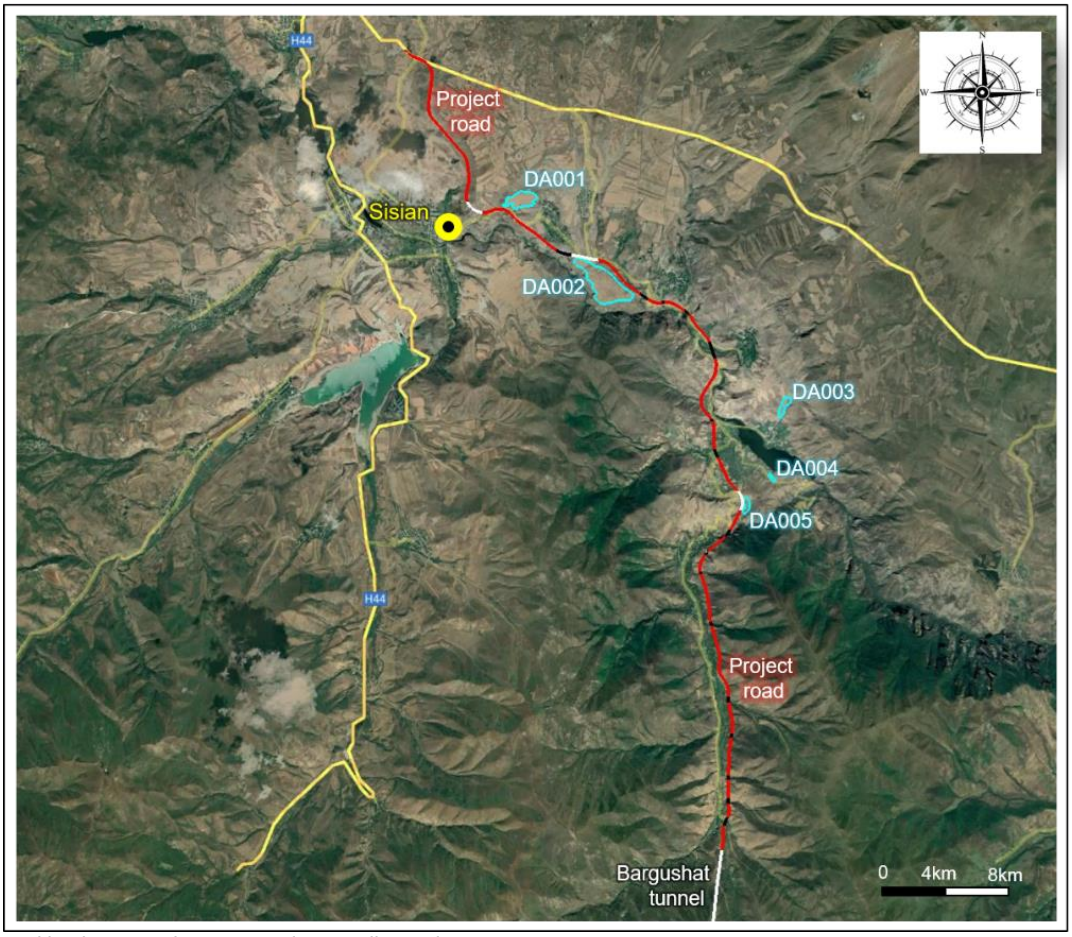
Source: Detailed Design, Final Environmental Impact Assessment Report and Environmental Management Plan (Eng), November 2019.

Eight possible spoil disposal areas (SDAs or DAs) were tentatively proposed for the Project (see **Table 9**, **Figure 20** and **Figure 21**). SDA locations were discussed with and then approved by authorities of respective administrative areas in 2016-2017. At the same time, there were obvious concerns regarding the SDAs, including for example that there was no SDA close to the northern portal of the Bargushat Tunnel, and that the proposed SDAs would not have sufficient capacity for the quantity of spoil to be disposed, as well as other concerns as discussed in **Section 3.9**.

Table 9. SDAs Proposed in the 2019 Detailed Design

SDA	capacity (m3)	Average transportation distance (km)
DA001	1,500,000	3
DA002	1,500,000	2
DA003	1,500,000	6.5
DA004	300,000	9
DA005	500,000	7.5
DA006	1,200,000	7
DA007	4,000,000	3
DA008	4,000,000	4.5
Total:	**14,500,000**	

The RD expects that the Construction Contractor will determine the SDAs, prepare the relevant projects and management plans and obtain permits for their use, if in fact they are required.



Source: prepared by the Consultant. Legend: DA = disposal area.

Figure 20. Location of Five SDAs along the Sisian-Shenatagh Road Section, as Proposed in the Detailed Design

What is contained in the detailed design is the quantity of excavated material (spoil) from the Bargushat Tunnel is estimated at 1.2 million m^3 (excluding expansion). Given that the capacity

of spoil disposal sites on the northern side of the tunnel cannot cater for the volume of spoil excavated from that side of the tunnel (estimated at 0.6 million m^3), it was planned to create a *temporary* storage site (but no location is currently specified), until the tunnel has been completed whereafter the spoil would be transported to a spoil site south of the tunnel for final disposal. The average length of transportation of the material (1.2 million m^3) coming from the Bargushat Tunnel is 7km.

It is also intended to dispose of the main tunnel spoil at site DA006 (chainage - 36.2 km) which is a big valley to the west just after the southern portal of the Bargushat Tunnel. The valley can provide a capacity of 1.2 million m^3. The remaining ca. 11.8 million m^3 is expected to be spread over the other seven potential disposal sites, as a function of optimising the distance of transporting the spoil. The southern part of the road would of course only be accessible from the northern part once the Bargushat Tunnel has been fully excavated. The arrangement of the SDA is sub-optimal for several reasons including the biodiversity value of the sites selected and an apparent failure to minimise the distance over which the spoil must be transported (refer to **Section 3.9**).

Source: prepared by the Consultant. Legend: DA = disposal area.

Figure 21. Location of Three Spoil Disposal Areas along the Qirs-Kajaran Road Section, as Proposed in the Detailed Design

The design of the spoil area envisages:

- Removal and temporary storage of topsoil (thickness 30 cm);
- Installation of a drainage pipe (diameter 3 m) at the bottom of the valley covered with drainage material;

- Geotextile layer on top of the drainage material to separate the spoil from the drainage material;
- Deposition of the spoil;
- Placing of topsoil on the spoil dump and grass seeding; and,
- Drainage of surface water via ditches.

A separate detailed design for the spoil disposal areas is expected to be prepared by the Construction Contractor to be approved by the Client and relevant authorities. Although not included in the detailed design an additional large disposal area has been identified for further investigation, as detailed later in this report (**Section 3.9.3**).

2.5.11 Retaining Walls

Some 104 concrete retaining walls are envisioned along the proposed road, with a total length of about 5,000 m. The walls will be between 1 m and 11 m high. Retaining walls less than to 2.5 m high are designed as gravity walls without reinforcement, and those higher than 2.5 m with reinforced concrete. An example of a retaining wall is shown in **Figure 22**.

Source: own photomontage of the Project road element (other photomontages for selected sections are presented in Volume 3).

Figure 22. An Example of a Retaining Wall Required to Support the Proposed Road, this at the Northern Tunnel Portal

2.5.12 Relocation of Utility Facilities

Currently it is known that the proposed road will affect gas pipelines, irrigation water pipe, overhead transmission lines, and various underground telecommunication, power, and other cables (for additional information refer to Volumes 4 and 5). For each facility so affected, the Contractor will prepare a detailed design based on the technical conditions prescribed by the utility operators. The final relocation designs will be approved by the utility operators and state regulators, and the relevant environmental and construction permits will be secured. The costs of relocating utility facilities are included in the Project budget but no further information is available now.

2.6 Resources Required for the Project

2.6.1 Construction

The resources required for construction include water, liquid fuels, electricity (typically self-generated), concrete and asphalt, land and labour force. The exact resource requirements are still to be determined and will be calculated by the appointed Contractor. That includes determining the exact labour resources required and the structure of that labour force. Provision also needs to be made for rehabilitation of project effected areas including borrow pits, spoil dumps and the road embankments. However, some estimates are provided below.

Asphalt is petroleum in a viscous liquid or semi-solid form in the form of a composite material, asphalt concrete. Asphalt concrete (a/c) is about 70% asphalt and 30% aggregate particles. Recycling used asphalt provides mixes that are stronger, longer-lasting, and more rut resistance than fresh asphalt mixes. **Concrete** is used for the various structures that are required including bridges, retaining walls, culverts, tunnel portals and tunnel linings and so forth because of its low maintenance cost and extended service life.

According to the Investment Programme[6], the approximate volumes of construction materials to be used during the Project implementation are as follows:

- Hot asphalt pavement (h=7 cm) - 0.6 mln. m3,
- Hot asphalt pavement (h=5 cm) - 0.7 mln. m3,
- Concrete - 0.7 mln.m3.

Water will be used for dust suppression but also plays an important role in compaction of the underlying road materials. Water would also be used for concrete and cement, and for domestic purposes at the construction camps. No water estimates are provided in the detailed design and in the Investment Programme.

Drinking water demand for the Project depends on:

- Project implementation (construction) period,
- Number of employees (engineers, officers and field workers) to be engaged in the road construction works / to be accommodated at construction camps,
- Working schedule for the construction period (employee ramp up and ramp down),
- Water consumption norms, including employees' water consumption, water consumption in canteen and water used in shower rooms.

The exact number of workers is unclear at this stage, however, according to the North-South road around 400-500 staff will be required. The Consultant has estimated[7] drinking water needs based on the Construction Norms and Rules (SNiP) 2.04.01-85 "Internal water supply and sewerage of buildings" and 2.04.02-84 "Water supply, external pipelines and structures". The extraction from the SNiPs relates to the employees' water consumption norms, water consumption in canteen and water used in shower rooms, as summarized in **Table 10**.

[6] North-South Road Corridor Investment Programme, Tranche 4. Bidding Document. https://www.e-gov.am/u_files/file/decrees/kar/2021/09/1564_2.pdf.

[7] As the working schedule (number of shifts per day, number of working days per week, etc.) for the construction period has not been defined yet, the Consultant, based on own expertise and experience, assumes that the road construction will be implemented in "one shift per day" and "six days a week" mode, hence the annual number of working days (including holidays) will be 300.

Table 10. Water Consumption Standards of Armenian for Construction

No.	Item	Norm
1	Water consumption for engineers and officers	16 liter/day
2	Water consumption for field workers	25 liter/day
3	Water use in canteen (per employee)	12 liter/day
4	Water consumption per shower Water consumption in shower room (per employee)	500 liter/hour 83.3 liter/day

The calculations of drinking water demand at working sites are presented in **Table 11**.

Table 11. Estimated Drinking Water Demand for the Project Construction Stage

No.	Water demand	Water consumption norms for				Total
		Engineers and officers	Field workers	Canteen needs	Shower room	
1	m^3/day	1.232	10.575	6.0	41.65	59.457
2	m^3/year	369.6	3172.5	1800	12495	17837.1
3	m^3/ construction period	2217.6	19035	10800	74,970	107 022.6

Additional water will be required for the use of workers at the construction camps, perhaps roughly a half of the total in **Table 11**.

The 2021 Investment Programme predicts that about 400-500 construction staff will be engaged during the Project's construction stage. Accommodation strategies have not been determined in the detailed design. There are no details about skill categories in the project design. The Consultant's estimate, based on the Document MDS 12-46.2008 "Methodological recommendations for the development and design of Plan for organization of construction, Plan for organization of demolition (dismantling) works and Plan of work's implementation", is provided below in terms of the ratio between engineers, officers (managers) and workers specifically for the construction projects.

Table 12. Estimated Ratio Between Construction Engineers, Officers (Managers) and Workers

Engineers	Officers	Workers	Total
11	4.5	84.5	100%
55	22	423	500 employees

No information is provided in the detailed design about **waste generation**, apart from spoil. According to the ESIA Consultant's estimate, the Project is expected to generate about 37.5 tonnes of household waste per year which would translate into 225 tonnes per six years of construction works (see below). The following types of **construction waste** will be generated during the Project road construction works:

- Residual excavated materials (spoil) that will be generated as a result of drilling, excavation and other earthworks,
- Construction waste (mixture of concrete and asphalt) that shall be disposed of in landfills,
- Hazardous waste generated in construction camps, concrete and asphalt plants (such as used oil and lubricants, tires, batteries, ferrous and non-ferrous scrap, used welding electrodes, oily rugs, contaminated soil, empty fuel, lubricants and chemicals containers, etc.) and can be recycled/retreated/utilized where possible or properly disposed of as per national regulations,
- Household waste that will be generated in the Construction camp and shall be disposed of regularly in the nearby communal landfill,

- Non-hazardous waste (packaging materials, such as cardboard, paper, wood, etc.). These wastes shall be recycled. Timber waste from tree felling and other organic substances from site clearing are also considered as non-hazardous waste. Such waste can be used by locals as fuel.

According to the methodology for calculating waste generation quantities during construction of buildings and rehabilitation works (2004), the amount of construction waste depends on the volumes of used construction materials. Based on the "used construction materials - generated construction waste" ratio (Waste generation norm) set by the methodology as well as specific weights of construction materials (asphalt and concrete), the amounts of construction waste that would be generated during the Project are summarized below.

Table 13. Summary of Estimation of the Construction Waste Quantities

No.	Construction materials	Volume, mln. m^3	Waste generation norm, %	Specific weight, tonne/m^3	Transformed into construction waste, tonnes
1	Asphalt	1.3	1.5-2.0 (~1.75)	1.5	34125
2	Concrete	0.7	1.5	2.2	23100
				Construction waste (total)	**57225**

As per the Manual «Assessment of the amount of generated manufacturing and consumption waste (1997)», the norm (limit) of household waste generation per employee is 0.3 m^3 per year at the working site, where the household waste density equals 0.25 tonne/m^3. Taking into account that 500 workers would be engaged in construction works, it can be assumed that the annual amount of 'household' waste will be 0.3×0.25×500=37.5 tonnes. For the whole road construction period (6 years × 37.5 tonnes), 225 tonnes of household waste will be generated. Roughly, about half of this may be generated additionally by workers residing at construction camps.

At this stage, the amounts of other hazardous and non-hazardous wastes cannot be determined specifically. The ratio of the two waste types depends on many factors, such as the number, types and technical conditions of the construction machinery and equipment to be used by the Construction contractor, methodologies/technologies of road, bridges and tunnels constructions, types of containers used for the transportation of oil products and other chemicals, etc. The amount of waste to be generated as a result of Project site clearance (timber waste, other organic substances) can be tentatively determined during the national EIA study after inventory of trees and vegetation to be cut.

The **Waste management hierarchy** (Reduce, Reuse, Recycle, Recover and Landfilling) shall be used for the Project, meaning that the option of waste disposal to landfill can be applied only if recycling is not possible (because there is no recycling method or if there is one it is too expensive or not applicable). The codes, hazard classes and where relevant amounts determined/calculated pursuant to the national legislation[8], as well as proposed waste handling measures are set out in **Table 14**. In general, the most acceptable options of waste recycling / reuse / disposal from the Project activities are as follows:

- Reuse of excavated materials (spoil) from the earthworks. Approximately 4.0 mln.m^3 of spoil materials will be reused for backfilling and embankments and 12 979 668 m^3 (see **Section 2.5.10**) shall be dumped in spoil disposal areas,
- The remains of concrete and asphalt waste (construction waste) can be used as a filling material or for other construction needs. This option is preferable in order to

[8] https://www.arlis.am/documentview.aspx?docid=163726

avoid long distance transportation to the landfills as well as using airspace in the landfills.

- Used oil, tires, accumulators, ferrous and non-ferrous scrap, oily rags and contaminated soil shall be separately collected and periodically delivered/passed to the licensed waste handling companies. Licensed companies in the field of waste recycling and treatment are listed on the web-site of the RA Ministry of environment via http://mnp.am/shrjaka-mijavayr/vtangavor-taponneri-licenzianer,
- Containers (drums) of oil products and chemicals might be reused. Otherwise, shall be delivered to the licensed waste handling companies.
- Non-hazardous waste, such as used wood materials, paper and cardboard, plastic and rubber wastes also can be delivered to the specialized companies or landfilled (the least preferable option),
- Vegetation stripping waste (timber waste, etc.) can be provided to the population of the affected rural settlements as a fuel,
- Household and construction wastes (it is assumed that most part of the construction waste will be used as fill materials) shall be landfilled. There are two authorized communal landfills in the Project region. The first one is located in the vicinities of Sisian Town (can be used to dispose the waste generated in the Project's northern section), the second is within the administrative boundaries of Kapan Community, in Syunik rural settlement (can be used for works at the Project's southern section).

Table 14. Types, Hazardous Classes and Amount of Waste (Where Estimatable)

No.	Types of waste	Code	Hazardous class	Calculated amount, tonnes or m3	Proposed handling option
1	Remains of concrete and asphalt mixture (construction waste)	3140120001004	4	57225	1) reuse 2) disposal
2	Excavated materials	3140110101005	5 (non-hazardous)	12979668m^3	1) reuse 2) disposal
3	Used engine oil	5410020102033	3		1) treatment 2) use as fuel
4	Used hydraulic oil	5410021302033	3		1) treatment 2) use as fuel
5	Used industrial oil	5410020502033	3		1) treatment 2) use as fuel
6	Used diesel oil	5410020302033	3		1) treatment 2) use as fuel
7	Used lead accumulators	9211010013012	2		1) treatment
8	Remains of welding electrodes	3140480001994	4		1) disposal together with household waste
9	Used tires	5750020013004	4		1) treatment 2) disposal
10	Ferrous scrap	3513110001004	4		1) treatment/ recycling
11	Cu scrap	3531030101013	4		1) treatment/ recycling
12	Al scrap (Al wires and cables)	3531010501995	5 (non-hazardous)		1) treatment/ recycling
13	Soil contaminated with oil products (oil content <15%)	3140230301034	4		1) recycling
14	Oily rags	5820060001014	4		1) utilization
15	Household waste	9120040001004	4	225	1) landfilling
16	Cardboard waste	1871020201005	5 (non-hazardous)		1) recycling 2) landfilling
17	Used paper and cardboard from office facilities	1871030001005	5 (non-hazardous)		1) recycling 2) landfilling
18	Wooden waste	1711060101005	5 (non-hazardous)		1) use as fuel

					2) landfilling
19	Plastic waste	5710180013005	5 (non-hazardous)		1) recycling
20	Rubber waste	5750010201005	5 (non-hazardous)		1) recycling

2.6.2 Operations

The primary resource use during road operations will be electricity required for lighting and ventilating the tunnels and lighting the roadway. It will be the Contractor who is required to determine where the electricity would be sourced (from transmission infrastructure) and so such information is not yet available. The same materials required for construction would be used where road repairs/resurfacing is required during operations.

2.7 Construction Programme

The 2021 Investment Programme includes an estimated duration of construction of six years.

Construction is expected to occur simultaneously at multiple sites from Lernadzor to Sisian implying a large construction footprint. Higher intensities of works are foreseen for the middle years, whereas the first and last half-years would be largely devoted to preparatory works and final pavement, marking and finishing works, respectively.

Most of the construction time will be required for the longest tunnel (around five years). Construction of each of other tunnels requires between 8 and 18 months. Earth works will start almost simultaneously at four locations of the road. Earth works for one km of the road are expected to take around 3-4 months.

2.8 Associated Facilities

The only associated facility[9] to the Project as a whole identified at the time of this writing was a power supply system to service the operation of the planned road.

The EBRD considers the Bargushat tunnel and the Northern road section to be associated facilities relative to the Southern road section under its Environment and Social Policy (ESP) 2019.

2.8.1 Power Supply to the Tunnel

The availability of reliable electricity is an essential requirement for operations of the tunnels in terms of ventilation, lighting and other features. It is unclear now whether this will involve the establishment of new electricity transmission lines to the tunnel portals and if so the routing of such transmission lines. The installation of new electricity transmission lines is not part of the current Project scope. A separate ESIA or an addendum to the ESIA will be completed for the transmission line(s) once their routes and other characteristics are determined. This action is included in the ESAP.

[9] As per the EBRD's ESP (2019), "associated are facilities or activities that are not financed by EBRD as part of the project but which in the view of EBRD are significant in determining the success of the project or in producing agreed project outcomes. These are new facilities or activities: (i) without which the project would not be viable, and (ii) would not be constructed, expanded, carried out or planned to be constructed or carried out if the project did not exist". ADB (2009) has a similar definition, whereas the EIB's definition is wider in scope and includes both the above definition and ancillary activities / facilities that can be integral to the project. This report applied the EBRD and ADB definition, and EIB's definition is split between the fitting of the other lenders and matching the components of the road.

3 ANALYSIS OF ALTERNATIVES

The following alternatives have been considered at this ESIA stage:

- The “Zero” alternative;
- Upgrade of existing Roads;
- Railway;
- Alternative corridors;
- Optimising alignment within the main corridor;
- Alternative pavement;
- Changing the position of the southern tunnel portal;
- Alternative tunnel design and construction methods;
- Alternative / additional locations of SDAs; and
- Additional / alternative cattle and agricultural and pedestrian crossings.

The review of alternatives followed a ‘hierarchy of alternatives’ approach, where following a higher-level (conceptual) alternatives, lower-level alternatives were considered and/or proposed in relation to the locations of some road elements, technological methods or optimization proposals for some road sections.

On top of this, proposals were developed to address perceived gaps in the detailed design, in particular the locations of passages for wild animals / green bridges (for details refer to ESIA Volume 2 – wild animal passages, and ESIA Volume 4 – cattle crossings and pedestrian passes).

3.1 “Zero” Alternative

The “Zero” alternative is not considered viable as current travel time is long, costly and dangerous. On the H-45 from Halidzor to Devil’s Bridge and from Devil's Bridge to the Tatev Monastery complex, the road gradient is approximately 13%. The route is heavily trafficked with many articulated HGVs and pedestrians and livestock use the road especially where there are settlements. Several dwellings access directly onto the road. The road contains multiple hair pin bends and tight curves forcing HGVs to straddle the center line as they navigate the turn. This causes a hazard for oncoming vehicles. These tight bends do not provide the driver with sufficient forward stopping sight distance around the corner. This means that oncoming drivers are unaware of stationary or slow-moving vehicles, livestock and pedestrians which are in the road ahead, around the corner.

In winter, when the temperature is below -7^{o}C, strong winds (blizzards) occur in some parts of the route in February-March during which traffic is stopped. Traffic police frequently stop the traffic at night due to safety concerns. About 72% of the road is newly paved with the rest in poor condition. There are sections of the road without asphalt meaning insufficient grip in wet weather. This, combined with the steep longitudinal gradients can be hazardous for heavy vehicles descending these steep gradient sections. The road has very steep drops and rock faces immediately adjacent to the running lanes and the safety fencing along this road is piecemeal. The quality of the safety fencing is often poor and unlikely to prevent an HGV from leaving the carriageway and plunging down the steep slopes. Many vehicles are forced to stop on the road especially in winter when some sections of the road are closed in one direction.

According to the RD, between 2019 and 2021, there were 15 accidents with 20 people injured. It can be assumed that the road was completely closed for at least a portion of the day on which the accidents happened. Despite its strategic importance, the road does not comply with the technical requirements for international cargo transportation. The road itself was established to develop tourist potential but after the events of November 2021, this route was the only one available for cargo transportation on the Yerevan - Meghri route.

The M2 Goris-Kapan road is not available for vehicles with Armenian registration plates. Other vehicles can use the route, but they are forced to pay customs duties adding to the costs of travelling on that route. Between 2020 and 2022, the road was closed for 31 days and 170 traffic accidents occurred with 26 people killed and 263 people injured. The M2 is also subject to closure in autumn/winter/spring season due to mountainous terrain and harsh weather. Neither the M2 nor the H-45 provide workable national roads and both are ill-suited to tie in with the national roads of neighboring countries.

In comparison, the new road includes wider running lanes, shallower radius bends with sufficient stopping sight distance, safety fencing which complies with standards, shallower longitudinal gradients and has no dwellings access directly onto it. The "Zero" alternative would also be counter to the objectives and initiatives planned under transport development corridors and development plans of the region (see earlier sections on regional transport initiatives).

3.2 The Upgrade of the Existing Roads

The option exists to upgrade the existing roads from Sisian to Shenatagh and from Qirs to Kadaran. The difficulty faced in so doing is that the design criteria for the desired road class (speed, gradient and turns) cannot be met using the layout provided by the existing roads. The constructability of upgrading existing roads is limited by the fact that the existing roads provide the only access to the area.

In addition, the existing road runs through residential areas (please specify the number of dwellings along the route; also account for narrow roads (local road standard) and nearby social facilities (schools), especially in the Northern section. rather than bypassing them, which will also create limitations in design speed and increase risk of injury to pedestrians. Several cultural heritage sites would also be negatively affected by simply upgrading the existing road as the existing road is very close to such cultural heritage buildings in use and in some instances would directly impact on the buildings themselves.

Finally, but importantly, the existing road does not span the full distance from Sisian to Kajaran and there would still be a need to tunnel for some 8 km to connect the two sections of the existing roadway. The cost of such a tunnel could only be warranted beyond a defined number of road users per day. That defined number would be severely curtailed by the space limitations on the existing road.

3.3 Railway

Given the projected doubling of transport demand over the next several decades public transport and particularly rail, offer opportunities for transformative climate action in transport whilst creating multiple new job opportunities. The question to be asked is whether rail does not offer a viable alternative to a new road.

For the Sisian-Kajaran road, however, the topography is mountainous rendering rail especially expensive to build. Motor vehicles are far more capable of dealing with steep slopes than trains and so through mountainous terrain, roads can be steep. In general terms rail cannot exceed slopes of 3% without significant reductions in loads. To limit the rail slope to 3% would mean multiple tunnels and bridges would need to be built substantively increasing the costs and impacts of this transport option.

3.4 Alternative Routes[10]

Three alternative road routes (**Figure 23**) were considered during the feasibility study and the EIA completed in 2016-2017. Key criteria for comparing the alternatives included:

- Cost;
- Traffic forecast;
- Geology, geotechnical issues and hydrology;
- Environmental and social impacts (including: air quality, land use, water, ecology, cultural heritage, natural resources (materials, water, energy and land utilization) social inclusion, amenity, access to social facilities, form and space, user comfort / satisfaction, health and welfare, and cross-cutting issues); and
- Cost effectiveness.

Summary parameters of the three alternative routes are shown in **Table 15**. It can be seen from the table that the C1 route is the shortest at 60.1 km but will require significant embankments to support the road (42.5 km) and the same number of two-level junctions as options C2 and C3. The C1 route has more tunnels and bridges than C3 and fewer than C2, however their total length is the shortest. The tunnels serve to materially reduce the surface footprint of the road and thus the surface disturbance and in so doing reduce the overall cost and scale of environmental impacts. The C1 corridor is accordingly the cheapest option at around 0.8 billion USD, with C2 at more than a billion USD and C3 at more than 1.6 billion USD (2018 financial estimates).

Table 15. Comparison of Technical Parameters for the Three Alternative Routes for the Sisian-Kajaran Road Section

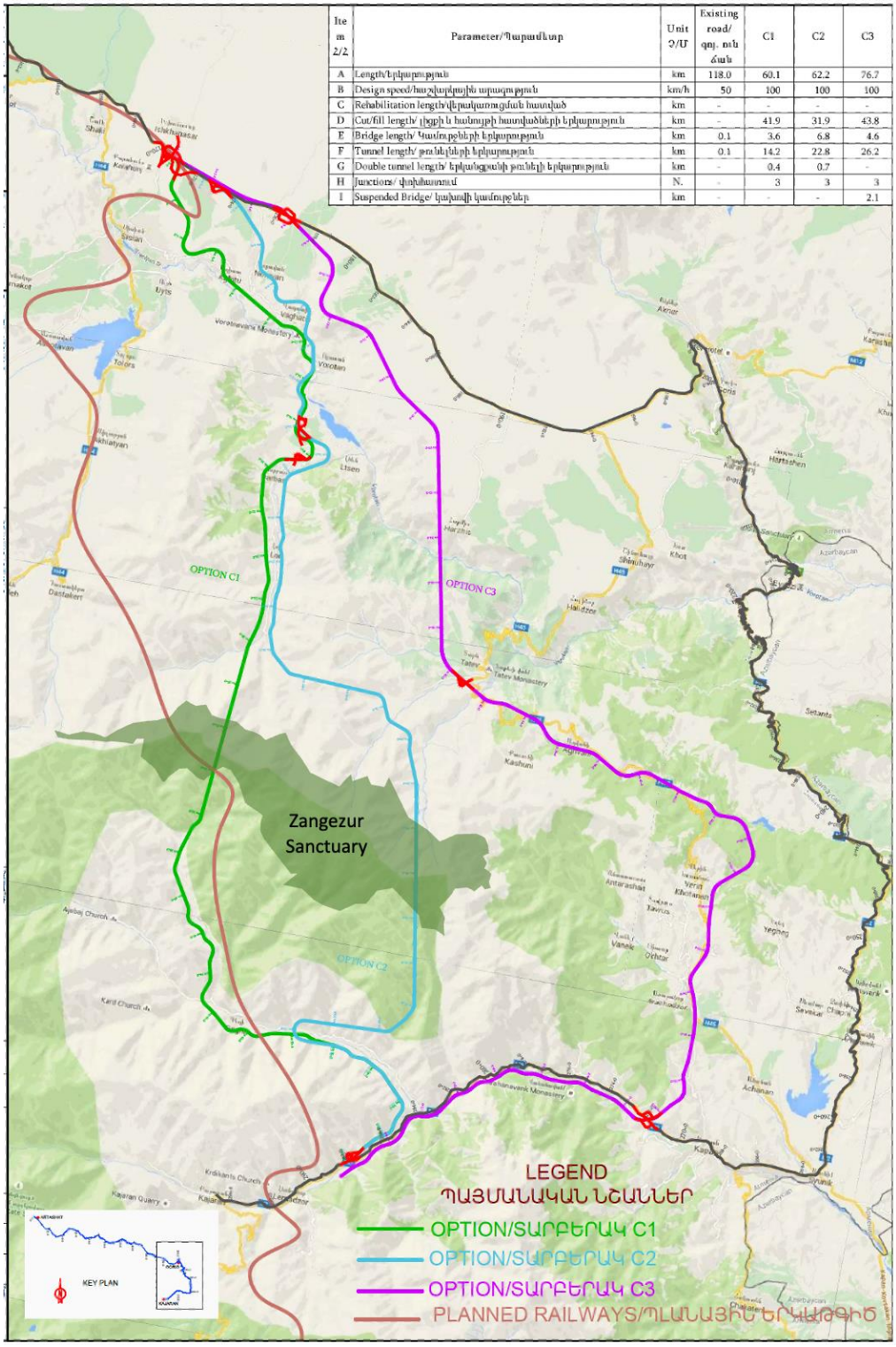
Item	Parameter	Unit	C1	C2	C3
A	Length	km	60.1	62.2	76.7
B	Rehabilitation/widening	km	0.0	0.0	0.0
C	No of tunnels	No	13	19	12
D	Total tunnel length	km	14.1	22.7	26.2
E	Tunnel length > 250m	km	13.8	22	26.2
F	Tunnel length < 250m	km	0.3	0.7	0
F	Maximum tunnel length	km	8.0	9.7	5.4
G	No of bridges	No	7	22	6
I	Length of bridges	km	3.5	6.8	4.6
J	Maximum bridge length	km	1.2	0.9	2.1
K	Length of embankments/excavation	km	42.5	32.7	45.9
L	Two level junctions	No	3	3	3

All the data were processed using a multicriteria analysis model that incorporates 75 sustainability indicators for transport infrastructure appraisal (United Nations Environmental Programme and the Global Reporting Initiative). The tool is based on recognising the linkages between economic, social, natural resources and environmental systems and allows the sustainability of a project to be measured and illustrated graphically.

The C1 route for the Sisian-Kajaran section emerged as the preferred option (**Figure 4** and **Figure 23**). The C1 route offered the greatest benefits, namely improving connectivity to a very important part of the country, by replacing a poor existing road and drastically reducing travel time. This alternative was preferable in terms of its comparatively lower potential requirement for land acquisition and resettlement and E&S impacts (less disturbance to

[10] The term 'route' is used to indicate the general routing of the road, whereas the term 'alignment' is used to indicate the specific alignment within the general route.

forests, soil and arable land, better access to social infrastructure for a wider range of local communities, greater contribution to developing potential for local tourism and so on). The long tunnel (Bargushat) means that the land surface footprint of the road, and associated land transformation potential, is comparatively less for this corridor, and it is the least cost option. Furthermore, the preferred alternative is not expected to directly impact the Zangezur State Sanctuary (for details see **ESIA Volume 2**) due to the decision to route via the Bargushat Tunnel.



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

Figure 23. The Original Alternative Routes Proposed for the Sisian-Kajaran Road

During the FS consultation meetings in 2016, the road route alternatives identified within the feasibility study and potential environmental and social/resettlement impact for each option were presented to representatives of affected local communities, local NGOs, civil societies and other interested parties[11]. The stakeholders excluded option C3 and focused on detailed consideration of options C1 and C2.

A positive conclusion was issued for the C1 alignment by the State Environmental Review in 2018 (currently expired, see **Section 5.1**). That constitutes the C1 corridor that formed the basis of the detailed design updated in 2019 and described in this Report.

During the ESIA inception meetings in 2021, the authorities of the administrative units and community confirmed that they had had several opportunities to consider the alternative corridors and preferred C1. Further consultations on alternatives took place during the scoping process and a socio-economic study conducted in April-May-June 2022. While not expressing concerns about the selected route, stakeholders identified alternative locations for the cattle passages and spoil disposal sites and re-alignment proposals to avoid sensitive biodiversity areas (see the sections below).

3.5 Optimising Alignment[12] within the Selected Route

3.5.1 Connecting to the M2 on the Northern Side of the Corridor

Several opportunities exist within the preferred C1 alignment, for optimising the final road route. The first of these opportunities is to connect to the M2 more directly on the northern side of the alignment, passing to the east of Norovan on a more northern routing rather than diverting north-westward and joining the M2 close to Sisian. The net effect would be to reduce the overall project footprint with associated environmental and social benefits. The Norovan routing would reduce economic and physical displacement and the number of cultural heritage assets affected including the Armenian 'Stonehenge' (Zorats Karer).

The difficulties associated with this alternative relate principally to the height difference between the new road and the M2 which would mean that a tunnel would need to be constructed for this alternative. At the same time the alignment would be close to Norovan and would potentially have additional land take requirements. This alternative is unlikely to be pursued by the RA.

3.5.2 Biodiversity Considerations

There are important biodiversity areas, especially in the southern part of the alignment where sections of the proposed road appear to be unnecessarily in sensitive biodiversity areas. In the Vaghatin area (KM 8+500 -10+000) the proposed road alignment passes through the canyon (natural habitat), whereas the top of the plateau has degraded habitat. As such it is recommended that the road be re-aligned to cross the plateau as illustrated in **Figure 24**. The technical consultants view this change as technically difficult due to the gradient requirements of a Category 1 road.

[11] The copies of the protocols of the 2016 meetings are kept at the RD and are available upon request.

[12] The term 'route' is used to indicate the general routing of the road, whereas the term 'alignment' is used to indicate the specific alignment within the route.

Source: Biotope photo and graphics.

Figure 24. Alternative Proposed Routing of the Road through the Degraded Habitat on the top of the Plateau, rather than the Natural Habitat of the Canyon Wall

In the Shenatagh area a preferable alignment would be the gas pipeline (Iran- Yerevan) servitude to avoid destruction of the cave houses and decrease the impacts on natural areas by using an already degraded area. The gas pipeline has already created a significant visual scar on the landscape and if that could be used for the road there would be a win-win circumstance in both ameliorating the visual impact of the gas line and minimising the loss of natural habitat. Unfortunately, a preliminary review of this alternative is that there would be significant geohazards for the road to follow the gas pipeline and so it is not a technically feasible option.

Source: Biotope photo and graphics. Note: The proposed road route runs on the opposite side of this valley.

Figure 25. Alternative Proposed Routing of the Road Following the Alignment of the Iran-Armenia Gas Pipeline in the Shenatagh Area

In the Geghi valley the preferred alternative routing would be the existing road alignment rather than the currently proposed new alignment through the *Juniperus* habitat on the northern side of the mountain ridge (**Figure 26**). The technical consultant views this option as having to

wide-ranging re-design implications but not necessarily being constrained by the road category.

Source: Biotope photo and graphics

Figure 26. Alternative Proposed Routing of the Road to Follow the Existing Road Alignment and thereby Minimise the Impact on the Juniperus Habitat that Would Occur Using the Currently Proposed Alignment

3.6 Alternative Pavement

The strength of the road pavement design and the thickness of the binder course layer is possibly inadequate for the projected volume of traffic. The pavement design report (2017) shows projected future traffic growth and calculates the pavement design based on a 20-year design life. The design year shown in the report is subsequently calculated as 2037. However due to the time since the report, the design year should now be recalculated to year 2042. This would be an increase in design traffic from 1191 to 1283 (8%).

The above implies that the pavement design be recalculated for a design life of 20 years and traffic figures for 2042. The design should also be updated to include future traffic projections and the ratio of heavy vehicles to light passenger vehicles. Axle loading factor (the weight on the axles of vehicles) indicates that large busses, 3 and 4 axle trucks are significantly more damaging to the road pavement than passenger vehicles, and so such classes of vehicles should be included in the design. The ratio of heavy vehicles to light passenger vehicles used in the pavement design calculations does not reflect the anticipated number of heavy vehicles, and as such needs to be redesigned for a minimum of 20% of heavy vehicles that will use the new road.

These updates are expected to be made upon receipt of updated traffic data and update of the traffic forecasts.

3.7 Changing the Position of the Southern Tunnel Portal

The vertical profile of the current design of the road does not follow the contours of the existing ground. Optimising the vertical and horizontal profile would reduce required excavation and fill material and so, the carbon footprint of the project. Because of the design height of the southern portal of the Bargushat tunnel, the next 13 kms or so of road (travelling south), is at a gradient of 5% (the maximum allowed for this class of road). That design gradient significantly reduces the flexibility to follow the existing contours of the valley with the road alignment. If the southern tunnel portal was relocated to a lower elevation by moving the portal eastwards, the road gradient could be reduced to less than 5%. The reduced road gradient would provide in turn, greater flexibility to optimise the vertical and then horizontal alignment thereby improving the cut to fill ratio and reducing the amount of spoil.

3.8 Alternative Tunnel Design and Construction Methods

3.8.1 Excavation

The tunnel excavation and support system in the current design is based on supporting the tunnel core ahead of the tunnel face with full-face excavation. The approach is feasible but requires specialized techniques, equipment and materials. A more conventional tunnelling method would be less costly and more appropriate for tunnelling in Armenia. The height of the tunnel means that full face excavation would require machinery capable of 10m or more, i.e., excavators, drilling machines, sprayed concrete equipment and so forth.

The current tunnel design also requires the tunnel face to be supported by fibre-glass which is a specialized item most likely not available locally or in the region. Contractors could struggle to bid for the work, especially for the shorter tunnels. Fibre-glass would also contaminate the material excavated from the tunnel and so there would need to be separation of the fibreglass from the natural material.

There are several different ways of tunnelling including cut and cover, pipe jacking (small diameter only) and others. For the proposed road, the two primary options are tunnel boring using a tunnel boring machine (TBM) or drill and blast. The appointed contractor will ultimately decide on the tunnel excavation method but in the interests of highlighting the environmental risks associated with the two options a high-level summary is provided in the below table. In general, a TBM is better in respect of environmental and social risks but it should be recognized that TBM may not be suitable for tunnelling through hard rock.

Table 16. Qualitative Comparison between Using a Tunnel Bring Machine (TBM) and Drill-and-blast to Excavate the Tunnels

E&S aspect	TBM	Drill and Blast	Comments
Atmospheric emissions traffic	-	---	Drill-and-blast requires significantly more traffic movement in the tunnel with drilling machines, personnel transport, concrete spraying and so forth, all of which needs to be moved away from the tunnel face prior to a blast and then moved back again for the next drilling shift
Atmospheric emissions blasting		-	Obviously the TBM has no atmospheric emissions from blasting, whereas drill-and-blast does.
Noise and vibration	-	---	Blasting has significant noise and vibration risks, whereas those associated with the TBM are far less.
Greenhouse gas emissions	---	-	By virtue of its electricity use TBM will emit more greenhouse gas emissions than drill-and-blast.
Wastewater	-	---	Drill-and-blast require tunnel stabilization which requires concrete spraying which affects the quality of water in the tunnel. TBM typically uses pre-cast concrete structures. Explosives (such as ammonium nitrate) also have an impact on water quality.

E&S aspect	TBM	Drill and Blast	Comments
Waste	--	---	Both options generate significant quantities of waste spoil from the tunnel excavations, but drill-and-blast is less precise in excavating and so generates more excavation waste.
Electricity	---	-	TBM uses significantly more electricity than drill-and-blast.

3.8.2 Tunnel Thickness

The current excavation and support system for the Bargushat tunnel specifically, requires a very thick tunnel lining. The thickness of the lining could be significantly reduced if a different method of excavation and support is utilised considerably decreasing excavation and concrete quantities, and construction time and cost. For similar cross section sizes for comparable international projects, lining thicknesses are mostly in a range of 0.35 – 0.40m, maximum 0.45m in comparison to a minimum thickness as per detailed design of 0.50m in the best case and 0.80m in the worst case. Reducing the lining thickness to 0.40m would mean 18 – 20% less concrete and excavation materials, while a lining thickness of 0.35m would mean 27 – 28% less concrete and excavation materials. The production of concrete results in significant CO_2 emissions and so a reduced lining thickness would also prevent greenhouse gas emissions due to the Project.

3.9 Alternative Locations of SDAs

3.9.1 Link from the SDAs Proposed in the Detailed Design

The current design makes provision for several SDAs along the proposed road alignment (see **Section 2.5.10**). During consultations in December 2021, however, the local authorities requested that locations of all SDAs should be re-assessed as the Project progresses and SDAs 7 and 8 be excluded (which was also supported by the biodiversity reasoning). These locations are not ideal in all cases, notably south of the proposed Bargushat tunnel where there are important large mammal (bezoar goats, wolves, lynx, foxes, jackals, and else, of which some are protected species) movement paths that would be blocked by some of the proposed spoil dumping sites. At the same time, there is a large spoil disposal area proposed just to the south of the Bargushat tunnel but nothing on the northern side. It is considered highly unlikely that the tunnel would only be excavated from one side meaning that spoil disposal is required on both sides of the tunnel to prevent double-handling of spoil. While it is understood that the appointed contractor would be expected to finally determine the positions and sizes of the spoil dumps, the dumps pose important potential E&S risks and will require very careful planning to prevent such risks. These risks will be assessed by the Contractor as required in the ESMP and due permits will be obtained, where required.

The locations of eight SDAs that were tentatively proposed in the Project design (**Figure 20** and **Figure 21**) were discussed with the local authorities in December 2021 and considered from the biodiversity, social and cultural heritage perspectives. According to the local authorities, the locations of all SDAs should be revisited and reconfirmed as the Project progresses, though DA006, 007 and 008 were requested to be considered for exclusion. Spoil disposal areas DA006, 007 and 008 would negatively affect terrestrial animal connectivity, of these DA006 and 008 should be significantly reduced (which makes using them inefficient and thus they could be excluded from consideration), and DA007 is a 'no-go' area (see the below sections also).

3.9.2 Voghji Tailing Management Facility

In late June 2022, the ESIA Consultant visited the Project area to identify alternative sites for SDAs in the southern section of the proposed road. One suitable alternative is a recently rehabilitated ca. 50ha Voghji tailing management facility (state-owned), located between 58+500 and 59+500m chainage of the proposed road (**Figure 27**). It is a large, disturbed area.

Informal land use is minimal and the site has no value in terms of cultural heritage or biodiversity. This site would reduce resettlement, biodiversity and cultural heritage impacts and is a good option for dumping spoil. The downside of this site is the distance that would need to be travelled to dump the spoil there. In 2023, the RD hold consultations with the RA Ministry of Environment (a body in charge of this tailing facility) and preliminarily agreed that the use of the facility as a SDA would be possible and that this topic would be revisited as the Project progresses.

Source: the Consultant's photo and map.

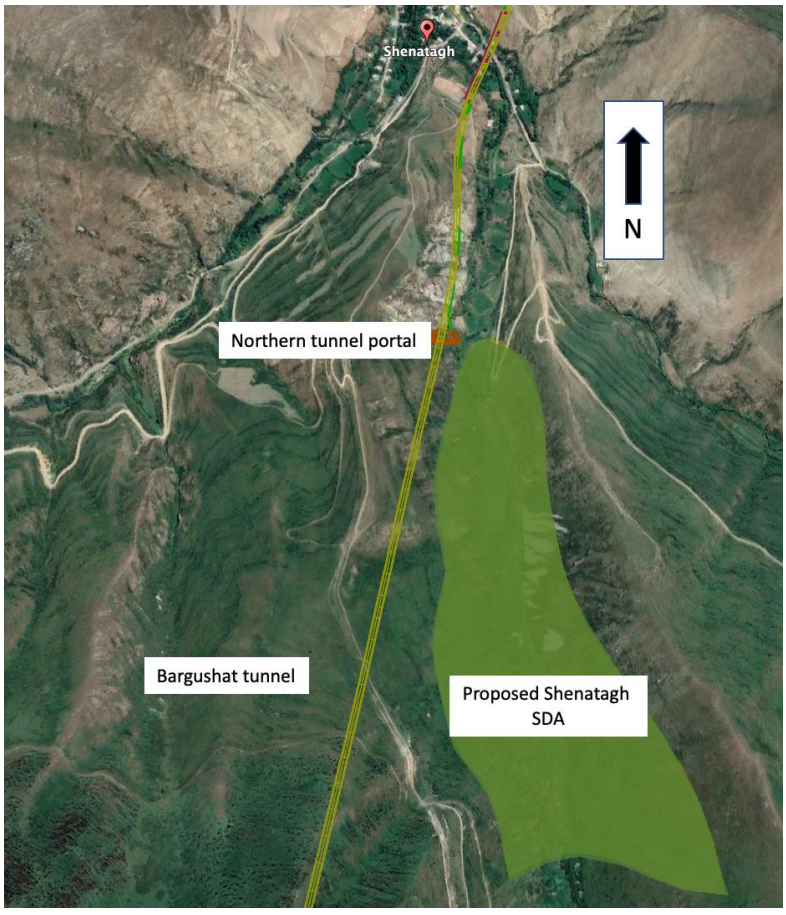
Figure 27. Location of a Proposed Alternative SDA - Voghji Tailing Management Facility (Upper – Google Earth Map, Lower – Actual Site Photo in June 2022)

3.9.3 Shenatagh SDA and Qirs SDA

Cost effectiveness requires establishing SDAs as close to the sources of the spoil as possible. At the same time, establishing the SDA close to the source of the spoil reduces the movement of the spoil, typically by truck, and the associated negative impacts of the truck movement. If the spoil was to be transported even a few kms from the source this would require multiple trucks travelling between the source and the SDA with negative impacts on other road users, noise, traffic disruptions and very importantly, atmospheric emissions of especially greenhouse gasses. A key objective is avoiding or at least minimizing the number of trucks and the distance they would travel for spoil disposal.

There is a potential SDA location in the Shenatagh area (**Figure 28**). Given its location the SDA would have many important benefits, of which the most important is that the spoil material could be transported to the SDA by conveyor, thus significantly reducing the number of trucks needed to move the spoil. The area itself is acceptable in respect of biodiversity and is not frequented by large mammals. There is a similar arrangement in Austria (in the Tirol) where a very large SDA has been established to dispose of spoil being excavated from the rail tunnel. That SDA has been established in an area of environmental and cultural sensitivity but operated in a way that does not result in significant impacts on either.

The possibility of arranging the SDA in Shenatagh valley was discussed with the local authorities and a formal inquiry letter was issued to Sisian Community Authorities to obtain their opinion (March-April 2023). The municipality has concerns about the river in the valley, the privately-owned arable land plots and cultivated agricultural community land. It has been communicated to the authorities that the GIP technical solutions regarding the river exist (e.g., carefully diverting the stream and then restoring it) and any land acquisition would be subject to a separate Resettlement Plan with due impact assessment, compensations, livelihood restoration actions, and hand-back provisions (where applicable). Further consultations are ongoing. The Contractor will need to undertake further studies such as a cultural heritage screening, and mitigation measures in relation to the red-listed butterfly Lesser Marbled Fritillary (*Brenthis ino*) present in this area.

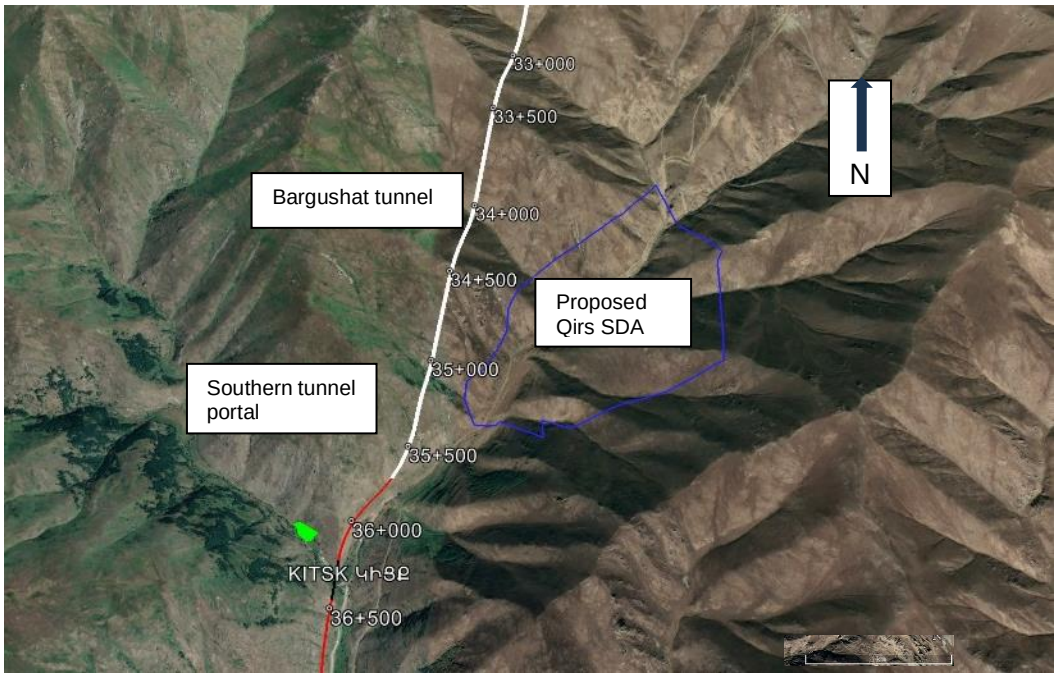


Source: prepared by the Consultant.

Figure 28. Location of the Proposed Shenatagh SDA to the South of Shenatagh (Indicative Sketch)

Another potential SDA location could be in the Qirs valley, near the southern portal of the Bargushat tunnel (**Figure 29**), Its benefits are similar to those listed for the proposed Shetanagh SDA, though without the use of conveyors. According to biodiversity experts, the exact boundaries of this SDA are to be determined with caution as the proposed SDA may

border, in the west and south-west, on the no-go biodiversity area due to butterfly and reptile species (for details refer to Figure 28, Volume 2 of this ESIA).



Source: prepared by the Consultant.

Figure 29. Location of the Proposed Qirs SDA to the North of Qirs (Kitsk) (Indicative Sketch)

3.9.4 Other SDA Alternatives

DA007 and the valley where it is located is a no-go zone, as this area is very important for resident Bezoar Goats and other wildlife and it is used by Armenian Mouflons during seasonal migration; the importance of leaving this area intact was stressed by the Director of Zangezur Biosphere Complex and Head of Kapan Forestry during the consultations held by the ESIA team (**Figure 30**).

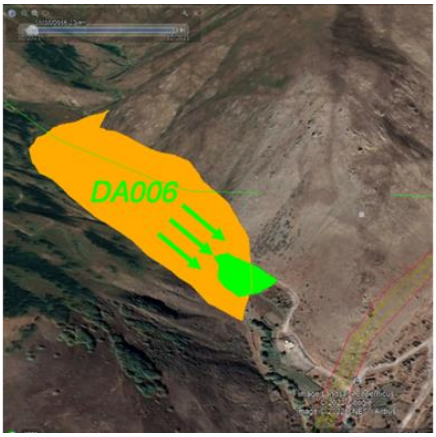
Should additional disposal areas be required the following could be explored too (**Figure 30**):

- The area of DA006 should be significantly decreased;
- The area for DA008 should be decreased and an additional SDA might be located downstream of the weir in degraded area;

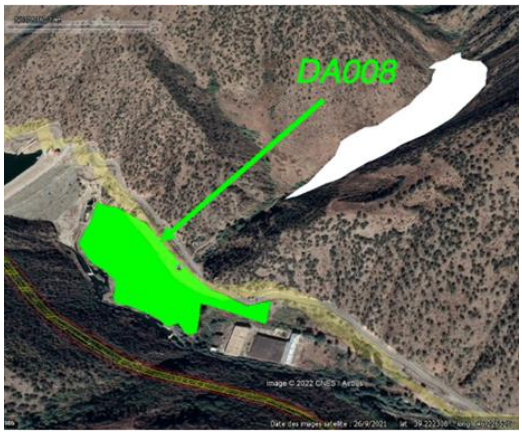
In addition, an alternative approach to managing the unneeded spoil was proposed by the national biodiversity stakeholders, that is to coordinate with the Ministry of Defence and explore the opportunities to use the spoil for fortifying border areas or other purposes. In early 2023, the RD reached out to the Ministry of Defence and agreed on considering this question in the future, once the construction starts.

3.9.5 Viaducts rather than Bridges

Another means of spoil disposal is changing bridges to viaducts where the spoil can be used as material infill. Four bridges located to the south of the Bargushat tunnel's southern portal (the bridges with the length of 222m, 114m, 85m, and 434m) could be designed and constructed as 'optimised viaducts' (**Figure 31**). In addition, five green bridges are proposed along the route. Two of the proposed wild animal crossing/ green bridges (A 39.247156° 46.142476° and B 39.261909°, 46.123741°) located close to the tunnels could be designed as 'ecoducts' (**Figure 31**). Finally, there may be other bridges along the route that could be so optimised (for details about the proposed wild animal crossings refer to ESIA Volume 2 Biodiversity and for the proposed cattle and pedestrian crossing to ESIA Volume 4. Social).



Green shape is the maximum tolerable size of the dumping area



Green shape shows the area where the DA008 can be potentially moved

Source: prepared by the Consultant (Biotope and Biogeotech maps and graphics). 1 – breeding area for bezoar goats

Figure 30. Recommendations on DA006, DA007 and DA008 and Alternatives Proposals (Southern Section of the Road)

- Recommended width = 15 x 3.5 m
- Openness index (B*C/A) > 0.75
- Piles must be located outside the river channel to preserve the continuity of the riparian corridor
- Revegetation and a perimeter fence must be installed to guide wildlife from the surrounding habitats to the viaduct where necessary

- Largest infrastructure
- Minimum width = 80 m

Source: Biotope.

Figure 31. Types and Characteristics of Recommended Wildlife Underpasses (left: Optimised Viaduct, and right: ecoduct)

3.9.6 The need for Additional/Larger SDAs

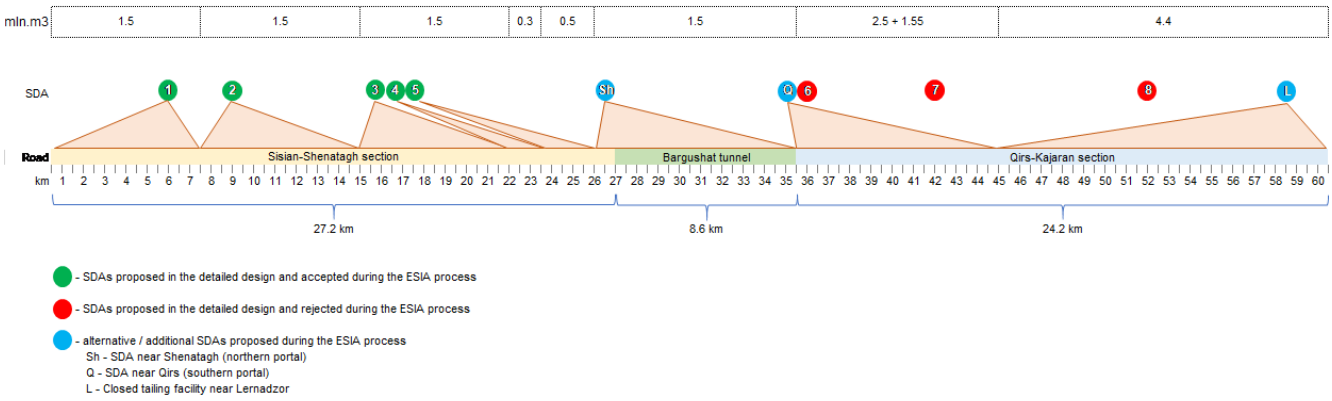
The combined capacity of the originally proposed eight SDAs was 14.5 million m^3 (uncompressed) (**Table 17**) but this is on the assumption that each SDA would be a single stockpile. There are various references in the detailed design to the need to store different materials and aggregates separately, and meeting this requirement would significantly reduce the disposal capacity of the SDAs due to the space required between the separate stockpiles. From **Table 8** just less than 13 million m^3 would require disposal. There is no requirement in the detailed design, however, for compacting the spoil and so an expansion factor 1.3 must be considered which implies a volume of 16,9 million m^3. The contractor could be compelled to compact the spoil but it is very difficult to match the expansion at about 30%, with compaction which reduces the volume by between 10 and 15%.

At the same time the disqualification of some of the proposed SDAs, would further reduce the storage capacity by some 9.2 million m^3. That loss of capacity could potentially be offset by the various capacities of additional possible SDAs identified as part of the ESIA. If the capacities can all be fully realized, there would potentially be some 4.4 million m^3 excess capacity. That excess capacity may be used in having to separate materials into different stockpiles. The estimated spatial distribution of spoil among the potential SDAs is presented on **Figure 32**. For the project it will be necessary to accurately quantify the spoil quantities, assess whether the SDAs are viable by assessing also the distance that would need to be travelled to dump the spoil. The contractor would also be required to obtain all necessary permits for the spoil disposal areas. The current assessment is preliminary and cannot be viewed as confirmation of the suitability of the SDAs.

Table 17. Summary of SDAs Assessed as Part of the ESIA for the Sisian-Kajaran Road

	Name	Location	Capacity, m^3	Construction service area	
Originally proposed SDAs	DA001	km 6	1 500 000	km 0 - km 7.4	
	DA002	km 9	1 500 000	km 7.4 - km 14.8	
	DA003	km 16	1 500 000	km 14.8 - km 22.2	
	DA004	km 16.7	300 000	km 22.2 - km 23.7	
	DA005	km 17.5	500 000	km 23.7 - km 26.2	
	DA006	km 36.2	Originally planned to accommodate 1.2mln m^3, but significantly reduced due to biodiversity constraints. This reduced size makes it inefficient for usage and thus it is suggested not to consider this site (unless absolutely needed).		
	DA007	Originally planned to accommodate 4mln m3, but disqualified due to biodiversity issues and concerns of the local authorities			
	DA008				
Additional SDA options	Shenatagh valley *	km 27	9 000 000	Can accommodate spoil from km 26.2 to km 27.2 and Bargushat tunnel (1.2 mln.m^3) => **1.5 mln.m^3** **Potentially can also accommodate spoil from southern section - 7.5 mln.m^3 (if feasible)**	
	Qirs valley **	km 36.0	2 000 000	km 35.8 - km 44.6 Could also be temporary storage area for the km 44.6 - km 50.0 section provided feasible to transport spoil through the tunnel to Shenatagh SDA. It is about 1.55 mln. m^3	
	Tailings facility - Lernadzor ***	km 58.5-59	5 000 000	It can accommodate the spoil from km 44.6 to km 60, approximate quantity - 4.4 mln.m^3	
	Provisional capacity		**21 300 000**	Excess capacity	**4 426 432**

*Assumed area of 45ha and height of 20m, **Assumed area of 10ha and height of 20m, ***Assumed area of 50ha and height of 10m.



Source: prepared by the Consultant.

Figure 32. Estimated Spatial Distribution of spoil among the Potential SDAs

3.10 Reduction in Design Speed

The detailed design of the road is based on a defined 'design speed' (of 100 km/hr) to comply with the Category 1 Road criteria (see **Box 1**). That design speed implies that the road must be designed to allow vehicles to maintain that speed the full length of the roadway. Were design speed to be reduced to say 80 kmh, there would be significant reductions in cut volumes (excavations).

3.11 Road Safety Assessment

A road safety assessment was conducted by the technical consultant on the current Detailed Design. The assessment concluded that "ca. 36 % of the road achieves the desired level of the international traffic safety (iRAP 3 Star Rating[13]), while the rest of the road does not achieve the desired level of traffic safety"[14].

The technical consultant proposed the installation of guardrails on both sides of the road which would significantly improve traffic safety. The technical consultant further proposed a speed reduction to 80 km/h in the curves, in the approaches to the curves and at the exit of the tunnels (~300 m from their exit). The combination of barriers on both sides of the road for the entire length of the road and the speed limits would contribute to a significant increase in road safety ensuring that all road sections achieve at least a 3 Star Rating[15].

3.12 Climate Adaptation Review

A climate adaptation review of the Detailed Design was conducted Bernards technical team[16]. The review "noted that the road project is situated in a particularly challenging context with

[13] The iRAP star rating is a tool that objectively assesses the safety standard of a road. The star ratings are based on independently-gathered road inspection data, and provide a simple and objective measure of the level of safety which is 'built-in' to the road. Star Ratings reflect the risk as it relates to an individual road user. 1-Star roads have the highest risk and 5-Star roads the lowest risk. (https://irap.org/). Using the iRAP star rating helps meet the requirements of EU Directive 2019/1936 on Road Infrastructure Safety Management (that is amending Directive 2008/96/EC on road infrastructure safety management).

[14] Bernard Gruppe Sisian-Kajaran (North-South Corridor) Road Project, Report No. 2: Executive Summary, 16.09.2022

[15] Ibid. It must be noted that the analysis, although performed by a certified iRAP practitioner, has not been verified by an external audit. The analysis would be re-visited based on accepted changes which are to be implemented in the Project's design, after which the external audit will be carried out to ensure that the road design to be implemented will achieve the 3 Star Rating.

[16] Bernard Gruppe. Sisian-Kajaran (North-South Corridor) Road Project. Report No.2 Task 4 Climate Adaptation Review. 15.09.2022.

regards to the effects of climate change. The occurrence of natural hazards along the proposed trajectory of the road is already high today and will be most likely further exacerbated in the future. A number of climate risks were identified as being of particular importance for both the construction and operational phases of the road, including increases in heavy precipitation, soil erosion, gravitational mass movements, freeze-thaw cycles, avalanche risk, and increased heat and cold stress for workers and materials".

The review did not "identify of rock fall mapping and rock fall protection being considered so far." Therefore, the review recommended "to conduct a thorough investigation of potential exposure which would include rockfall modelling and design of protection measures."

It also noted that "a range of good-practice activities to be implemented at no or additional cost were identified, concerning for instance the appropriate maintenance of drainage systems or appropriate equipment and work schedules for road construction workers".

The review concluded that "in order to enhance the climate resilience of the road project, also some changes to the detailed design will be required. The design of the drainage systems should consider additional precipitation due to climate change and an evaluation of rockfall and slope support measures at certain locations is recommended. Equally, the avalanche risk needs to be thoroughly investigated and appropriate avalanche protection measures designed and implemented. The selection of adequate construction materials to withstand extreme heat, heavy precipitation and increased freeze-thaw cycles is key to a climate resilient design. Firefighting units need to be put in place during construction to account for the increase in forest fire risk along the southern section of the road".

The detailed investigations and design of relevant geohazards (incl. rockfall and avalanches) prevention measures – as well as supervision of their implementation into the updated Detailed Design - are expected to be financed by the EBRD technical assistance funds.

3.13 Additional/Alternative Cattle and Agricultural and Pedestrian Crossings

Socio-economic studies, consultations and/or interviews were held with the local farmers in all villages located along the proposed road in May-July 2022. During this engagement, passages included in the design for cattle (five locations) and agricultural vehicles (four locations) were shown to the farmers (**Section 2.5.4**). The farmers indicated additional locations for pedestrian crossings and cattle passages to ensure that their agricultural activities and livelihoods would not be interrupted (see **ESIA Volume 4** for details).

3.14 Conclusions on the Alternatives

3.14.1 Overview

From the preceding sections multiple alternatives have been identified that would serve to prevent or at least reduce E&S impacts from the proposed road project. In some instances, an alternatives analysis has highlighted a preferred option, notably the choice of corridor for the road. The acceptance of the other proposed alternatives is still to be decided by the RD. As with all alternatives it is necessary to determine whether the alternatives are feasible by ascertaining whether they are technically possible and affordable and the RD is still reviewing those options. The RD faces the following constraints in that review process:

- There is an existing, detailed design which has undergone a review and received State expertise approval. That means that if alternatives are accepted, the detailed design would need to be amended with cost and schedule implications for the Project; and
- The road has been categorized as 1st and the categorization defines design speed, maximum gradients, tightness of radius bends, safety class and a range of others that the design must uphold.

3.14.2 Road Class Category

Acceptance of the more significant alternatives proposed are a function of whether the road class category can be amended. The design speed and the maximum gradient allowed under the sought technical class of the road force the design to be sub-optimal in respect of environmental and social considerations. Perhaps the best example of this sub-optimal circumstance is that the road does not follow the natural contours of the topography because the design cannot meet both criteria (viz. follow contours and maintain design speed). Not following the contours means significant excavations and embankments and bridges to span the contours (see **Figure 5**).

For several alignment changes that have been proposed as alternatives, there would need to be a change to the road category or some other form of dispensation that would allow reductions in speed, increases in gradient or other alignment changes. Such a change would obviously have to be facilitated through the highest political echelons and cannot simply be exercised by the RD. There is no decision yet as to whether such road category/criteria can be changed on the Sisian-Kajaran road and this class of change is nominated as 'Category 3 change'. The likelihood of this is low. The remaining alternatives fall into another two categories, namely:

- Category 1: No change to road category required but alignment must change; and,
- Category 2: No change to road category required and no change to alignment.

All the alternatives proposed for the Project have been placed in one of the three classes and these proposed alternatives and the selected categories are listed Volume 2 (for wild animal crossings/green bridges) and Volume 4 (for cattle passes and pedestrian crossings). The RD will in time review and decide which of the alternatives they can accept. As a minimum, it is expected that the RD will accept Categories 1 and 2, but even here, the changes will require changes in detailed design with time and costs implications.

To date, the Government's position is that those design changes which are required from the E&S perspective will be incorporated. With the exception of those, the Government is not open to change the current technical standard / categorisation of the road with a view to construct a competitive passage route allowing for a fast and efficient transit passage.

3.15 Project Information that is not yet Available

Despite the considerable information that is contained in the Detailed Design there are multiple facilities required for the project that are not yet defined. The reason that the facilities are not yet designed is because it is expected that the contractors would define these facilities and their locations. The facilities include, but are not limited to:

- Construction camp(s);
- Quarries or borrow pits;
- Temporary disposal areas, if needed;
- Asphalt plant;
- Areas for temporary storage of removed topsoil;
- Locations of the water tanks for the tunnel's fire-fighting system;
- Temporary power supply for construction; and,
- Permanent power supply for road operations (notably tunnels).

Such facilities, even if only established temporarily, have the potential to result in potentially significant E&S impacts. As they have not yet been defined, they obviously cannot be assessed within this ESIA. Given the timing of the completion of this ESIA and the bidding and contractor appointment process, such information is also not going to become available

in time for the completion of this document. To that end, for each of the facilities identified as necessary for the project but that are not yet defined, the ESMP includes a list of such facilities and for each the E&S aspects and risks. Then an objective will be prescribed as an outcome that must be achieved in establishing that facility. In addition, a **Change Management Procedure** is required in the Project's ESAP that would aim at screening and assesses E&S impact of any change to the Project or of any of its components that becomes clarified.

For each objective design requirements and criteria are be specified. By design requirements and criteria is meant elements that must be included in the design together with the required performance of those elements. No-go areas will also be defined as a function of biodiversity, cultural heritage, social and other conditions.

4 LEGAL AND REGULATORY FRAMEWORK

In addition to complying with the EBRD, ADB and EIB requirements, the ESIA also recognises and complies with Armenian legal requirements. These legal requirements are detailed below.

4.1 Armenian Legal Requirements

According to the ***Law on Environmental Impact Assessment and Expert Examination (2014)***[17], there are two types of documents, which are subject to environmental impact assessment (EIA) and expert examination. These documents are: (i) Framework Document – a policy, strategy, concept, scheme of utilization of natural resources, program, master plan, urban development document, which are likely to affect the environment; and (ii) Design Document - technical report, feasibility study and construction-engineering design of intended activity. According to Article 14 of the Law, the types of activities, which should undergo EIA are divided into A, B and C categories depending on their expected environmental impact. As per section 10 "Infrastructure activities" of Article 14.4 of the noted Law, the construction and reconstruction of roads having 4 or more traffic lanes or widening of roads from 2 to 4 and more traffic lanes provided that the constant length of road is 10 km and more is classified as "A" category activity[18] and is subject to a two-stage EIA (preliminary and main) and a state expert examination procedure. The procedure for public notification and public discussions is outlined in the RA Government Decree No.1325-N dated 19.11.2014.

The ***Water Code (2002)***[19] provides the legal basis for protection of water resources, the provision of water for people and economic sectors through effective management of water resources and ensuring the protection of water resources for future generations. The Water Code includes the following: responsibilities of state/local authorities and public, development of the national water policy and national water program, water cadastre and monitoring system, public access to relevant information, water use and water system use permitting systems, trans-boundary water resources use, water quality standards, safe operation of hydraulic facilities, protection of water resources and state supervision. The quality of surface water in Armenia is monitored as per the principles of EU Water Framework Directive adopted by the RA Government Decree No. 75-N dated 27.01.2011.

The ***Land Code (2001)***[20] defines the key provisions for land-use in Armenia. Land is classified as per designated purposes (categories) into: 1) agricultural land, 2) settlement land, 3) industrial, mining and other production designation land, 4) land for energy, transport, communication, utility infrastructure facilities, 5) land for specially protected areas, (6) special designation land, 7) forest land, 8) water land, and 9) reserve land. The Land Code also specifies soil preservation principles, objectives and regulations via the following RA Government decrees:

- The procedure for topsoil use, approved by the RA Government Decree No. 1396-N dated 08.09.2011[21],
- The requirements for determination of topsoil stripping norms and for stripped topsoil preservation and use, approved by the RA Government Decree No. 1404-N dated 02.11.2017[22,]

[17] https://www.arlis.am/documentview.aspx?docid=140512
[18] The category will be confirmed by the RA Ministry of Environmental during the national EIA procedure that is ongoing.
[19] https://www.arlis.am/DocumentView.aspx?docid=148955
[20] https://www.arlis.am/documentview.aspx?docid=150513
[21] https://www.arlis.am/documentview.aspx?docID=71439
[22] https://www.arlis.am/DocumentView.aspx?docID=117360

- The procedure for soil excavation, approved by the RA Government Decree No. 572-N dated 10.05.2019[23].

The ***Law on surveillance over the land use and land conservation (2008)***[24] 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.

The ***Law on Waste (2004)*** [25] provides the legal and economic basis for collection, transportation, disposal, treatment, re-use of wastes as well as prevention of negative impacts of waste on natural resources, human life and health. It defines the roles and responsibilities of state authorities as well as of waste generator organizations in waste management activities.

The ***Law on alienation of property for overriding interests of the public (2006)***[26] defines procedures for determining the overriding public interest, for alienating property in order to ensure public interest and for compensation for the alienated property. This law applies to all land ownership (real or movable estate, property rights, equities, etc.) located and registered in Armenia and belonging to physical persons, legal entities and communities. The constitutional conditions for the alienation of property in order to ensure overriding interests of the public are: (i) the alienation must be carried out in exceptional cases defined by the law and in accordance with the procedure established by the law; and (ii) adequate compensation must be paid for the alienated property.

The ***Law on Atmospheric Air Protection (1994)***[27] regulates air quality as well as public relations in the field of prevention and reduction of adverse chemical, physical and biological impacts on air. The Law also regulates emission permits and provides permissible limits/concentrations for atmospheric air emissions. The RA Government Decree No.160-N dated 02.02.2006 defines maximum permissible concentrations of ambient air pollution in residential areas.

The ***Law on Flora (1999)***[28] and ***Law on Fauna (2000)***[29] 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. The RA Government Decrees No.71-N and No.72-N on approval of the **RA Red Book of Animals**[30] and **RA Red Book of Plants**[31] respectively define the biology of threatened (rare, threatened, endangered, vulnerable) species of flora and fauna as well as their quantity, habitats and variety. The Law of Fauna was materially updated in 2022 to introduce the new concepts in order to complete Armenia's commitments under the 2018 Partnership Agreement with the EU[32] and align with the EU legislation. The amendments

[23] https://www.arlis.am/documentview.aspx?docid=130889
[24] https://www.arlis.am/DocumentView.aspx?docid=144520
[25] https://www.arlis.am/documentview.aspx?docid=140521
[26] https://www.arlis.am/documentview.aspx?docid=153844
[27] https://www.arlis.am/documentview.aspx?docid=146626
[28] https://www.arlis.am/documentview.aspx?docid=120784
[29] https://www.arlis.am/documentview.aspx?docid=176441
[30] https://www.arlis.am/DocumentView.aspx?DocID=56347
[31] https://www.arlis.am/DocumentView.aspx?DocID=56348
[32] Comprehensive and enhanced Partnership Agreement between the European Union and the European Atomic Energy Community and their Member States, of the one part, and the Republic of Armenia, of the other part (https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:22018A0126(01)).

included such notions as fauna monitoring, definition of invasive species, use of the fauna objects for health, protection and industrial use, Important Bird Areas (as areas of special environmental interest separated for conservation of birds (outside of specially protected nature areas or included therein), serving for nesting, wintering or rest, and others.

Draft amendments to the Law on Flora have been proposed and are under discussion among the state authorities and disclosed to the public at https://www.e-draft.am.

The ***Law on Special Protected Areas of Nature (2006)***[33] 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. The Law defines four categories of protected areas in Armenia: (i) State Reserves; (ii) National Parks; (iii) Sanctuaries; and (iv) Nature Monuments. The list of the nature monuments is approved by the RA Government Decree No. 967-N dated 14.08.2008[34].

The ***Law on Protection and Use of Immovable Cultural and Historic Monuments and Historic Environment (1998)***[35] provides the legal and policy basis for the protection and use of such monuments in Armenia. Article 15 of the Law describes procedures for discovering and registering monuments, establishing protection zones around them and creating historical and cultural reserves. Article 22 stipulates that the 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, approved by the RA Government Decree No. 438 dated 20.04.2002[36]. The RA Government Decree No. 2322-N dated 29.12.2005 defines the State list of immovable historical and cultural monuments in the RA Syunik region[37], while the Government decree No. 385-N dated 15.03.2007 approves the list of State owned immovable historical and cultural monuments that are not subject of alienation/acquisition[38].

The ***Law on Intangible Cultural Heritage (2009)***[39] 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. Several legal acts have been adopted by the RA to promote the administration of the legal framework of the sector which enables to regulate relations pertaining to preservation, safeguarding, and development of intangible cultural heritage; the activities of communities that create, preserve and transmit intangible cultural values; international cultural cooperation, including: (i) Government Decision No. 310-A "On Defining the Criteria for Preparing the Lists of Intangible Cultural Values and Approving the List of Intangible Cultural Heritage Values"[40], (ii) Government Decision No. 36-N "On the Criteria for Preparing the Lists of Intangible Cultural

[33] https://www.arlis.am/documentview.aspx?docid=140513
[34] https://www.arlis.am/documentview.aspx?docid=157090
[35] https://www.arlis.am/DocumentView.aspx?docid=107521
[36] https://www.arlis.am/documentview.aspx?docid=137204
[37] https://www.arlis.am/DocumentView.aspx?DocID=36406
[38] https://www.arlis.am/DocumentView.aspx?docid=55737
[39] https://www.arlis.am/DocumentView.aspx?docid=121003
[40] https://www.arlis.am/DocumentView.aspx?docid=151791

Heritage in Need of Urgent Safeguarding, and the List of Intangible Cultural Heritage Values Based thereon"[41], (iii) Government Decision No. 241-N "On approving the criteria for defining cultural spaces and published the list of cultural spaces"[42], etc.

The ***Code on Subsoil Resources (2011)***[43] contains the main provisions in the area of use and protection of mineral resources and underground water, including sanitary protection zones for underground water resources.

The ***Law on Road Safety Provision (2005)***[44] regulates road safety, establishes the principles and the directions of Armenia's policy on traffic safety, the legal basis for traffic safety provision as well as defining the powers and responsibilities of State and local self-governmental bodies and other traffic related participants.

The ***Forest Code (2005)*** [45] regulates 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.

The ***Law on Environmental Oversight (2005)***[46] regulates the organization and enforcement of oversight of national environmental legislation and defines the legal and economic basis underlying the specifics of oversight over the fulfilment of environmental requirements and relations between the parties. The existing legal framework relating to natural resources and environmental includes a range of legal tools. Government decrees are the key legal instruments for implementing environmental laws. The other tools are Presidential orders, Prime-Minister's resolutions, and ministerial decrees.

The RA ***Law on Sanitary and Epidemiologic Security of Population (1992)***[47] 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. In addition, there are sanitary-hygienic norms and standards approved by the RA Minister of Health and regulating the sanitary hygienic conditions in public and residential areas viz.:

- Sanitary Norms ("SN") No.2-III-11.3. Noise in workplace, residential and public buildings and in the residential construction areas,
- Hygienic Norms ("HN") No.2.2.4-009-06. The hygienic norms of the vibration in the workplace, residential and public buildings.

The ***Labour Code (2004)***[48] regulates collective and individual employment relationship; defines the basis and procedure of implementation for the establishment, revision and cessation of that relationship; assigns duties, authorities and responsibilities of the parties of employment relationship, as well as defines conditions for occupational health and safety (OHS). The Labour Code also 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. Key principles related to ensuring the equal rights and opportunities for men and women are set out in the ***Law No HO-57-N (20.05.2013) On ensuring of equal rights and equal opportunities for men and women***. As per Article 6 of

[41] https://www.arlis.am/DocumentView.aspx?docID=157499
[42] https://www.arlis.am/DocumentView.aspx?docID=134827
[43] https://www.arlis.am/documentview.aspx?docid=146898
[44] https://www.arlis.am/documentview.aspx?docid=140522
[45] https://www.arlis.am/DocumentView.aspx?docid=121312
[46] https://www.arlis.am/documentview.aspx?docid=146636
[47] https://www.arlis.am/documentview.aspx?docid=145840
[48] https://www.arlis.am/documentview.aspx?docid=152137

this Law, gender discrimination is prohibited, *inter alia*, via setting different levels of wages, changing wages as well as worsening working conditions conditioned by gender. Armenia has ratified 29 Conventions of the International Labor Organization (ILO), including eight fundamental ones.

The ***Law on Fire Safety (2001)***[49] regulates the relations of the state bodies and local self-governing bodies of Armenia, organizations/companies and people in fire safety-ensuring sphere. It defines the basic ways of shaping the state fire safety policies, as well as legal mechanisms of their implementation, such as provision of the populations with effective and reliable fire protection systems. The Law is supplemented by the Fire Safety Rules (Order No.595-N of the RA Minister of Territorial Administration and Emergency Situations (2015)).

Armenia is a signatory/party to a few **international agreements** related to the protection and management of the natural environment, communities, cultural heritage and labour issues (refer to the below table for those pertinent to the Project).

Table 18. International E&S Conventions and Agreements pertinent to the Project[50]

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 Wildlife and Natural Habitats, Bern (1979)	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 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.

[49] https://www.arlis.am/documentview.aspx?docid=144513

[50] The Convention on Environmental Impact Assessment in a Transboundary Context (Finland, Espoo, February 1991) (the Espoo Convention), ratified by the RA in 1997, is not triggered by the proposed Project as no significant adverse transboundary impacts are expected.

International Convention or Protocol	Description
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 Désertification, 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: • 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).

4.2 Applicable International Lenders' Requirements

4.2.1 European Bank for Reconstruction and Development (EBRD)

The main requirements of the EBRD for its own activities are formulated in the Bank's ESP (2019), and the requirements for the E&S aspects of the Client-borrower's activities are set out in the Performance Requirements (PRs)[51]. The ESP sets E&S requirements for the EBRD clients' activities to achieve sustainable results. The following is a summary of the PRs applicable to this Project[52]:

[51]EBRD. 2019. ESP. https://www.ebrd.com/news/publications/policies/environmental-and-social-policy-esp.html.
[52]PR 7: Indigenous peoples and PR 9: Financial Intermediaries are not applicable to this Project.

PR 1: Assessment and Management of Environmental and Social Risks and Impacts requires the EBRD client (borrower) to conduct an E&S assessment and / or audit. Assessment is carried out for all stages of the project (construction, operation, decommissioning). Based on the assessment and audit, an ESAP, an Environmental and Social Management Plan (ESMP), and other plans are developed. An important feature of the EBRD's requirements is the concept of associated facilities that are not financed by the Bank, and therefore are not part of the project, but which are significant in determining the success of the project[53]. These associated facilities may be carried out by both the client of the Bank and other parties. However, they should be part of the E&S assessment. PR 1 is also applicable to contractors involved in project implementation. EBRD also requires borrowers to implement an E&S Management System (ESMS) appropriate to the nature of the project, as well as reporting to EBRD on the project's E&S performance, including compliance with the relevant PRs and the approved ESMS, ESMP, ESAP, SEP and other documents or commitments.

PR 2: Labour and Working Conditions establishes requirements in terms of labour and working conditions, including the prohibition of forced and child labour in the project. The PR 2 requirements are based on the conventions of the ILO.

PR 3: Resource Efficiency and Pollution Prevention and Control requires efficient use of energy, water and resources, and minimisation of waste, as well as compliance with good international practice (GIP), and application of a mitigation hierarchy. This PR is based on the principles of the EU Industrial Emissions Directive (Integrated Pollution Prevention and Control)[54] and calls for the implementation of EU requirements on the use of Best Available Techniques (BAT) and related standards for emissions and discharges.

PR 4: Health, Safety and Security requires the client (borrower) to identify and assess community and occupational health and safety risks and implement preventive measures. The focus is on preventing and eliminating risks rather than reducing and minimising them.

PR 5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement defines requirements related to project-induced land acquisition, including restrictions on land use and access to assets and natural resources, which may cause physical displacement (relocation, loss of land or shelter), and/or economic displacement (loss of land, assets or restrictions on land use, assets and natural resources leading to loss of income sources or other means of livelihood). The key requirement of PR5 is to avoid or, when unavoidable, minimise, involuntary resettlement via feasible alternative project designs/sites. A resettlement framework (RF), including livelihood restoration where needed, is developed in an early stage of the project to detail resettlement principles and organisational arrangements.

PR 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources determines the requirements for the conservation of biological and landscape diversity in the development area. PR 6 requires the borrower to characterise the state of biodiversity, identifying sensitive species and habitats, and developing measures to avoid / reduce impacts. PR 6 defines criteria for critical habitat screening and requires developing a Biodiversity Action Plan (BAP) where significant adverse impacts on biodiversity are expected.

PR 8: Cultural Heritage defines the requirements for the preservation of both tangible and intangible cultural heritage. PR 8 requires exploring the presence / possibility of the presence of objects of cultural heritage in the project's area of influence. Where the assessment

[53]"These are new facilities or activities: i) without which the project would not be viable, and ii) would not be constructed, expanded, carried out or planned to be constructed or carried out" (EBRD ESP. 2019. Section II. Definitions).
[54]Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on Industrial Emissions (Integrated Pollution Prevention and Control). https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32010L0075.

identifies that the project may have material risks and impacts on cultural heritage, the client is required to develop a cultural heritage management plan.

PR 10: Information Disclosure and Stakeholder Engagement. The EBRD requires careful and systematic stakeholder identification, including communities that may be affected by project impacts (affected groups) and groups whose vital interests may be affected by projects (vulnerable groups). The EBRD requirements for organising stakeholder engagement are also set out in its Access to Information Directive[55]. Meaningful stakeholder consultations are viewed by the EBRD as an ongoing process throughout the project lifecycle. The EBRD's stakeholder engagement requirements are detailed in the draft Stakeholder engagement Plan (SEP) for the Project.

4.2.2 European Investment Bank (EIB)

The 2022 EIB's Environmental and Social Policy [56] sets the policy context for the protection of the environment and human well-being. The Policy is operationalised via 11 EIB Environmental and Social Standards (ESSs) that EIB's clients / projects should comply with. Of these, the following are applicable to the Project:

Standard 1: Environmental and social impacts and risks;

Standard 2: Stakeholder engagement;

Standard 3: Resource efficiency and pollution prevention;

Standard 4: Biodiversity and ecosystems;

Standard 5: Climate change;

Standard 6: Involuntary resettlement;

Standard 7: Vulnerable groups, Indigenous Peoples and Gender;

Standard 8: Labour rights;

Standard 9: Health, safety and security; and

Standard 10: Cultural heritage.

The EIB ESSs are largely aligned with the EBRD PRs.

4.2.3 Asian Development Bank (ADB)

The ADB's Safeguard Policy Statement (ADB, 2009)[57] sets out the bank's specific safeguard requirements that the borrowers are expected to meet when addressing E&S impacts and risks. The document includes Safeguard Requirements (SRs) 1 to 3 that implement a structured process of impact assessment, planning, and mitigation to address the adverse effects of projects throughout the project cycle.

The following SRs are anticipated to be relevant[58] to the Project:

- SR 1: Environment (The objectives of SR 1 are to ensure the environmental soundness and sustainability of projects, and to support the integration of

[55] EBRD. 2019. Access to Information Directive. www.ebrd.com/documents/strategy-and-policy-coordination/access-to-information-policy-directive.pdf?blobnocache=true.
[56] EIB. 2022. https://www.eib.org/en/publications/eib-group-environmental-and-social-policy. .
[57] https://www.adb.org/documents/safeguard-policy-statement https://www.adb.org/documents/safeguard-policy-statement
[58] SR 3: Indigenous Peoples was scoped out as no social and/or cultural group that would be distinct from dominant groups within the Armenian society was expected to be affected by the Project or were found in the Project area.

environmental considerations into the project decision-making process. It covers 11 'Policy Principles' including an E&S screening of the projects, assessment and mitigation of risks and impacts, examining alternatives, conducting meaningful consultations, disclosing ESIA and ESMP, creating safe and healthy working conditions, use of chance finds procedure and others).

- SR 2: Involuntary Resettlement (The objectives of SR 2 are to avoid involuntary resettlement wherever possible; to minimize involuntary resettlement by exploring project and design alternatives; to enhance, or at least restore, the livelihoods of all displaced persons in real terms relative to pre-project levels; and to improve the standards of living of the displaced poor and other vulnerable groups. It covers 12 Policy principles that detail the listed objectives and requires a preparation of a resettlement plan).

ADB's Access to Information Policy (2018)[59], which went into effect on 1 January 2019, reflects ADB's ongoing commitment to transparency, accountability, and participation by stakeholders and the obligation of projects in this regard.

4.3 Good International Practice (GIP) Guidelines

Specific E&S requirements applicable to the Project are set out in the EBRD's Sub-sectoral Environmental and Social Guidelines: Building and Construction Activities (2010)[60]. They elaborate on typical E&S risks related to construction, operation, maintenance and decommissioning of facilities. Other relevant EBRD guiding documents[61] used in the ESIA relate to resettlement; forced labour; gender issues, non-discrimination and equal opportunity; workers' accommodation; and other E&S topics. **They include but are not limited to:**

- EBRD's Resettlement Guidance and Good Practice (2016);
- EBRD's Briefing notes BN01-BN05 on Occupational Health and Safety (OHS) for temporary construction projects (2021);
- EBRD's Grievance Management: Guidance Note (2012);
- EBRD's Family friendly working and the work-life balance: Good Practice Notes. (2008);
- EBRD's Human resources policies and employee documentation: Guidance note. EBRD Performance Requirement 2. Labour and working conditions. (2017);
- EBRD's Guidance: Addressing Gender-Based Violence and Harassment in the Construction Sector (2020), as well as guidance: Addressing Gender-Based Violence and Harassment – Emerging Good Practice for the Private Sector (2020);
- EBRD/IFC Guidance Note on Worker Accommodation: Processes and Standards (2009);
- EBRD's Guidance Note 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources (draft of 2020);
- EBRD's additional requirements in the context of the COVID-19 pandemics, namely 2020 briefing notes [62] on OHS, working conditions, interaction with the public, placement of workers, etc.

[59] ADB. 2018. https://www.adb.org/documents/access-information-policy.
[60] https://www.ebrd.com/downloads/policies/environmental/construction/buidling.pdf
[45] All guidance documents are available at the following link (unless another link is provided) https://www.ebrd.com/who-we-are/our-values/environmental-and-social-policy/implementation.html.
[62] https://www.ebrd.com/sustainability-covid.html.

Another useful reference is the International Finance Corporation's (IFC) General Environmental, Health and Safety Guidelines (2007)[63] and IFC: Environmental, Health, and Safety Guidelines for Toll Roads (2007)[64] that contain general and industry-specific examples of GIP.

4.4 Applicable EU 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, and Directive 2004/54/EC Minimum Safety Requirements for Tunnels in the Trans European Network will be used to some extent as a reference source. In addition, the applicable provisions of the EU 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, Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora, Bern Convention (1979), EU Water Framework Directive (2000/60/EC), Directive 2008/98/EC on waste and repealing certain Directives, Council Directive 2009/147/EC on the conservation of wild birds, EU Directive 2008/50/EC on ambient air quality and cleaner air for Europe, and other relevant international treaties were applied during the ESIA study.

4.5 High Level E&S Legal Gap Analysis and Actions to Address Gaps

4.5.1 Comparative overview of Lenders' E&S Safeguard Policies

The IFIs' safeguard policies cover a range of common themes relating E&S impacts and risks. In 2015, World Bank completed a comparative review of the different IFIs' safeguard systems, including EBRD (2014), EIB (2013) and ADB (2009)[65]. It demonstrated the consistency across the E&S themes covered by the different safeguard systems. Since then, some of the IFIs, including the EBRD and EIB, have updated their E&S standards towards better harmonisation and higher detalisation among the safeguard system, though there are some differences in definitions, details and approaches. A summary of the current themes in the safeguards is presented in the below table.

Table 19. Comparative Thematic Coverage of the IFIs' Safeguard Policies

Safeguard Theme	EBRD (2019)	EIB (2022)	ADB – SRs (2009)
Environmental and social assessment and management	PR 1	ESS 1	SR 1
Core labour standards	PR 2	ESS 8	no direct reference; however, included in the SPS Prohibited Investment Activities List
Pollution prevention and resource efficiency	PR 3	ESS 3	SR 1
Climate change	PR 1 and 3	ESS 5	SR 1
Community health, safety and security	PR 4	ESS 9	SR 1

[63] https://www.ifc.org/wps/wcm/connect/29f5137d-6e17-4660-b1f9-02bf561935e5/Final%2B-%2BGeneral%2BEHS%2BGuidelines.pdf?MOD=AJPERES&CVID=jOWim3p

[64] https://www.ifc.org/wps/wcm/connect/9c8cfb24-abbd-4ab4-ba63-84f94da02af7/Final%2B-%2BToll%2BRoads.pdf?MOD=AJPERES&CVID=nPtjJOQ&id=1323162564158

[65] Himburg (2015). https://consultations.worldbank.org/sites/default/files/consultation-template/review-and-update-world-bank-safeguard-policies/en/related/mdb_safeguard_comparison_main_report_and_annexes_may_2015.pdf

Safeguard Theme	EBRD (2019)	EIB (2022)	ADB – SRs (2009)
Occupational health and safety	PR 4	ESS 9	SR 1
Land acquisition, resettlement, compensation and tenure	PR 5	ESS 6	SR 2
Biodiversity	PR 6	ESS 4	SR 1
Indigenous peoples**	PR 7	ESS 7	SR 3
Physical cultural resources and heritage	PR 8	ESS 10	SR 1
Gender and vulnerability	Cross-cutting and additional guidance (see ESIA Volume 3. Gender Impact Analysis)	ESS 7 and cross-cutting	Cross-cutting and additional guidance (see ESIA Volume 3. Gender Impact Analysis)
Stakeholder Engagement	PR 10 and cross-cutting; also, EBRD's Access to Information Directive (2019) and specific guidance note (see the SEP for details)	ESS 2 and cross-cutting; also, Transparency Policy (2011) and specific guidance note (see the SEP for details)	Cross-cutting and ADB's Access to Information Policy (2018)

*Building on the methodology adopted in Himburg (2015), ** Scoped out of the ESIA as no social and/or cultural group that is distinct from dominant groups within Armenian society is expected to be affected by the project.

4.5.2 High-level Summary of Gap Analysis and Recommendations for Addressing the Identified Gaps

A high-level E&S gap analysis has been performed to define a convergence level between the current Armenian legislation and Lenders' standards that are applicable to the Project. This analysis also helps to determine the degree by which the national laws can support the delivery of Lenders' standards. The gap analysis revealed several gaps between the Lenders safeguard policies and national legislation, some of those related to partial compliance, while others constituted non-compliance (largely due to the absence of equivalent requirements). To address partial compliance and non-compliance cases, specific recommendations were developed and applied within the framework of this ESIA (for the summary of the gap analysis and response action refer to the below table).

Table 20. Armenia E&S Gap Analysis: Key Gaps and Response Actions

Legend:	Partial conformance	Some of the aspects of the requirement are similar
	Inconformity	The requirements substantially differ or are absent

Key gaps	Action undertaken within the ESIA process to bridge gaps
Assessment and Management of Environmental and Social Risks and Impacts	
There is no requirement in Armenia's legislation to establish a formal ESMS, EMS or OHS MS by projects/companies while Lenders directly require an ESMS from the clients implementing Category A projects.	The ESAP requires to establish and maintain a functional ESMS for the Project in line with EBRD, EIB and ADB requirements, and to maintain an organizational structure that defines roles, responsibilities, and capacities to implement the ESMS.
In terms of scope and coverage, both national legislation and Lenders' standards require that largely the same themes be considered in the E&S impact assessments. Stakeholder engagement is also viewed to be an integral part of the EIA process. Nonetheless, there are aspects that are not fully envisioned by the national EIA&ER Law, namely: limited social impact assessment with no field social studies underpinning it; ecosystem services, risks that project impacts fall disproportionately on individuals and groups / vulnerable people, impacts on public health and safety, gender aspects, and climate change impacts.	The ESIA relies on the social baseline that included an extensive field socio-economic study (see ESIA Volume 3 for details and methodologies). The ESIA covers the relevant baseline for and analysis of: discrimination toward individuals/groups in providing access to development resources/project benefits, where relevant; ecosystem services; impacts that may fall disproportionately on individuals and groups / identification of vulnerable people (in the context of project development) and impact on them; impacts on public health and safety; gender aspects; and climate change impacts.

Key gaps	Action undertaken within the ESIA process to bridge gaps
In addition, no clear provisions are in place that would require to identify project's areas of influence (AoI).	The ESIA also utilizes the results of the climate adaptation study for the Project completed by the EBRD-commissioned Technical Consultant, and relies on the preliminary findings of the Paris Alignment assessment (refer to ESIA Volume 1). The ESIA defines the areas of influence for the E&S receptors taking into account the extend of potential risks and impacts (see impact assessment sections in ESIA Volumes 3 and 4 for detailed descriptions of the AoI).
In contrast to the Lenders' requirements, associated facilities are not defined by the national EIA legislation and not assessed in the EIAs.	Within the ESIA, the EBRD's and ADB's definition of Associated Facilities was used (EIB has a wider definition that overlaps with the Project components). A power line to serve the Project operations was identified as an associated facility (see ESIA Volume 1). As no details were available about the powerline to assess its impacts, a provision was included in the ESAP to develop a separate ESIA for the power line, as well as other associated facilities, if such appear as the Project is advanced.
A mitigation hierarchy principle is not defined by the national EIA legislation, however indirectly referred to in the EIA&ER Law (clauses 17 and 18 regarding the content of the E&S management and monitoring plans and enhancement measures).	When preparing the ESIA, mitigation measures have been developed in line with the mitigation hierarchy and GIP references.
E&S risks and impacts associated with the primary suppliers / third parties are not required to be identified and assessed by the national EIA legislation.	Primary suppliers will be determined via a tendering process. E&S requirements to their capacities and management systems will be included in the tender documents and then in the contracts. Provisions for the RD to identify and assess E&S risks and impacts associated with the project's primary suppliers and to monitor their E&S performance via a contractor management process are included in the ESAP.
Lenders require that an ESAP be developed which will set out actions required for the project to achieve compliance with Lenders' requirements over an agreed timeframe. The ESAP will form part of the financing agreements between the borrower and Lenders. Obviously, the ESAP is not part of the national legislations (ESAPs are prepared when the project is funded by the IFIs; otherwise, only the ESMPs are prepared per national law).	The ESAP has been prepared for the Project.
Lenders require that the client to promptly notify them of any changes to the project's scope, design or operation that is likely to materially change its E&S risks or impacts, to carry out any additional assessment and stakeholder engagement and to amend the ESMP or ESAP accordingly as agreed with Lenders. The RA EIA&ER Law states that the Authorized State Body should be informed about the changes in the Project, which can potentially influence the environment. However, there is no procedure on how this should be performed or whether the changes should be subject to EIA and expert review procedures / expertise again.	The ESAP contains a requirement to develop and implement a Change Management Procedure with the obligations to i) notify Lenders about any proposed changes to the scope, design, implementation or operation of the project that may adversely change the environmental or social risks and impacts of the Project; ii) carry out additional assessment and stakeholder engagement, as needed, and iii) propose due changes to the Project's management plans
The internal monitoring of E&S actions is performed based on the *conditions* in the expert review conclusion. There are no direct linkages to updating the ESMP or developing corrective actions in case risks/ impacts appear to be different from the expected ones or if the E&S performance are off-track. The procedure of accidents / incidents investigation is defined by the RA Government Decree No. 458-N,	As part of the ESMP and ESAP, the Client is required to: • Monitor and record the E&S performance of the Project; • Evaluate the results of the monitoring and identify and implement any necessary corrective actions (incorporate these in the project's management plans);

Key gaps	Action undertaken within the ESIA process to bridge gaps
including the provision of information to the relevant bodies. The initiator can provide the same information to the IFIs as well. The RA legislation does not define the mechanism for engaging third parties in monitoring of E&S performance of the planned activities/projects.	• Report to Lenders via regular E&S monitoring reports.
Labour and Working Conditions	
Armenia has a detailed Labour Code and by-laws aligned with the 29 ILO Conventions, including eight fundamental ones, that it has ratified. However, there are no provisions in the national labour legislation requiring project initiators to develop and implement the human resources management system / procedures.	The ESAP contains provisions to: • Develop and implement labour management policies and procedures applicable to the project, in line with the national and Lenders' requirements. • Ensure these management policies and procedures are integrated into the Project's ESMS.
No legal regulations require establishing and maintaining grievance mechanisms for employees under the individual projects.	The ESIA and ESAP contains provisions to establish and maintain an effective worker grievance mechanism in line with Lender requirements (including accessibility to for direct and non-employee / contracted workers and confidentiality).
The national labor legislation does not set requirements for managing and monitoring of the third parties' (contractors) performance in terms of labour issues.	The ESIA and ESAP contain provisions to: • Establish procedures for managing and monitoring the performance of the project's contractors in terms of labour conditions and OHS. • Incorporate the relevant labour requirements of Lenders into contractual agreements with contractors, together with appropriate noncompliance remedies.
The national labour legislation does not set out the requirements for monitoring of primary suppliers' performance in terms of labour issues.	Based on the RD's experience with similar projects undertaken over the last ten years, no potential risks of child labour and forced labour in primary suppliers are expected.
Armenia has national regulations regarding arrangement of construction camps with some differences against Lenders' requirements.	The ESIA and ESAP contain provision to arrange and manage accommodation for workers in compliance with the EBRD/IFC Guidance Note (2009) and ILO Workers Housing Recommendation 1961 (No 115).
Resource Efficiency and Pollution Prevention	
The RA legislation does not set requirements for the companies to optimize their energy use and implement energy efficiency/saving measures, though this is encouraged by the State. The laws require effective use of water resources, improved monitoring and reduction and prevention of water contamination. There are no clear provisions to implement efficient use of raw materials. The Cleaner Production Concept was approved by the RA Government; however, its principles are voluntary. Quality standards for the air, water, and wastewater are in place (refer to impact assessment sections in ESIA Volume 3 for thresholds), as well as requirements to obtain dedicated permits.	The ESIA looks into the Project-related risks and impacts associated with resource use, and the generation of waste and emissions to the extent enabled by the available design decisions. Where uncertain, recommendations and prescriptions about efficient consumption of water, raw materials, and other resources, during the project planning/delivery are included in the ESMP and/or ESAP. The Project will need to secure the necessary environmental permits, such as EIA Conclusion (Permit), water use permit, topsoil removal approval, waste generation and disposal permits/limits, emissions permit, etc. the precondition for which would be the demonstration that the Project has deployed reasonable and realistic mitigation actions.
Lenders' standards place more emphasis on the application of basic waste management principles, such as a sustainable waste management hierarchy (prevention, recycling and reuse, treatment and disposal), good housekeeping, application of GIP, etc. The national requirements on these aspects are "lighter" and largely concentrate on proper waste handling.	The ESIA applies a sustainable waste management hierarchy when considering alternatives and proposing mitigation measures (see Volume 3).
Despite extensive standards for preservation/storage and transportation of hazardous substances and chemicals, no clear provisions that, for individual projects, would define risks of operations involving	The ESIA requires to develop and implement the Hazardous Materials Management Plan that would set out procedures

Key gaps	Action undertaken within the ESIA process to bridge gaps
hazardous materials and require management controls.	for handling and management of chemical and hazardous substances (see ESIA Volume 4).
Greenhouse gases reduction and control regulations are not defined. Regulations on ozone-depleting substances are well developed.	An additional study is undertaken as part of the Paris Alignment Assessment for the Project. As part of it, greenhouse emissions are estimated; the results of the study will be disclosed once available, in line with Lenders' policies.
Community Health, Safety and Security	
Requirements to consider community health and safety that are set out in the RA legislation and Lenders standards are largely aligned. However, there are some differences, i.e., there are no provisions to: i) assess the risks/impacts of projects on the community safety (only health is mentioned in the law); ii) consider vulnerable groups / individuals when assessing community health and safety risks/ impacts; and iii) assess community health and safety during the whole life-cycle of the project and take corrective actions, if needed.	The ESIA assesses community health and safety risks including for vulnerable groups (see ESIA Volume 4). The ESIA and ESAP envision assessing the risks and impacts of the Project on the health and safety of the affected communities during the Project life cycle, especially in relation to the currently undetermined Project components and associated project (power line), including for vulnerable groups/individuals, and implement mitigation measures, as relevant.
No requirement is set out for a commensurate OHS management system, though the OHS legislation is well developed and extensive.	The ESAP requires to establish and maintain a functional OHS management system that will be commensurate with the potential OHS risks / impacts of the Project. The ESIA and ESMP contain a provision for a major accident investigation.
The national legislation and Lenders' standards related to the infrastructure and equipment design and safety are mostly similar. However, there is no national requirement to integrate climate change considerations during the design stage.	The EBRD has commissioned a Technical Consultant to audit the 2019 detailed design, including the Project's infrastructure and equipment design and safety. The ESIA relies on the information in the detailed design and advice of the Technical Consultant.
The national traffic and road safety legislation partially complies with the Lenders' requirements, e.g., the project developers are required to take actions to plan and ensure a safe traffic flow during project implementation. However, neither the E&S, nor road safety laws require to identify and assess the potential traffic and road safety risks. At the same time, road safety laws oblige the responsible persons to equip the working areas (including construction sites) with safety signs, fences, etc.	The ESIA identifies and assesses the potential traffic and road safety risks to workers, affected communities and road users for construction and operation phases and, where appropriate, requires to implement mitigation and monitoring measures.
Assessing the risks and impacts related to ecosystem services is not envisioned by the national legislation.	The ESIA analyses the Project's potential risks and impacts related to ecosystem services in the biodiversity Volume 2, and in terms of livelihood dependence on ecosystem services and natural resources use in Volumes 4 and 3. Appropriate mitigation measures are developed.
The national legislation requires safe handling (production, use, storage, transportation, release, removal, utilization) of chemical materials. However the by-laws lack detail in relation to managing hazardous materials and substances so that the related potential risks and exposure on communities during the project implementation could be minimized.	The ESIA looks into potential risks and requires to develop and implement the Hazardous Materials Management Plan that would set out procedures for handling and management of chemical and hazardous substances (see ESIA Volume 4).
The national legislation does not set requirements for the assessment of risks connected with interaction between direct or contracted security personnel and the people within and outside the project site.	The ESIA reviews the risks related to security arrangements on personnel and community and suggest the relevant mitigation measures (see ESIA Volume 4).
Land Acquisition, Restrictions on Land Use and Involuntary Resettlement	

Key gaps	Action undertaken within the ESIA process to bridge gaps
Armenia has extensive land acquisition related legislation, however there are several gaps against Lenders' requirements.	A detailed gap analysis has been prepared and documented in the Project's Resettlement Framework and is not repeated here.
Biodiversity	
The national legislation envisions the assessment and expert review of project-related impacts on flora and fauna. However, the regulations are quite general regarding the scope and approach to the assessment. The national laws require to assess project impacts on specially protected areas of nature / areas of high biodiversity value and to develop relevant management measures, but no Appropriate Assessment	As the Project is expected to affect biodiversity, the ESIA identifies all types of habitats that can be potentially affected, considers potential risks to / impacts on the ecological function of the habitats, and suggests mitigation measures (see ESIA Volume 2. Biodiversity, with its annexes on Critical Habitat Assessment and Appropriate Assessment).
The national legislation does not envision differentiated risk management approach to habitats, habitat categorization (modified habitat, natural habitat and critical habitat) and biodiversity offsets.	The ESIA applies a differentiated risk management approach based on the sensitivity and value of habitats, categorizes them as 'modified', 'natural', and 'critical', also noting their 'legally protected' status, assesses the impacts on them, and proposes focused mitigations, including biodiversity offsets as a last resort [NB: EIB prohibits offsets in critical habitats].
The national legislation does not define critical habitats and correspondingly does not regulate activities related to them.	The ESIA defines critical habitats and contains assessment of Project's impacts on them, as well as mitigation measures (see the Critical Habitat Assessment annexed to ESIA Volume 2. Biodiversity, and BAP). In addition, the Construction Contractor will develop and implement a Biodiversity Management Plan for the Project.
The national flora and fauna laws set provisions for conservation and protection of flora and fauna objects and species. However, no regulations consider the 'no net loss' and 'net gain' of biodiversity as criteria for defining mitigation hierarchy and selecting mitigations.	The ESIA predicts that impacts on natural habitats cannot be fully avoided and thus suggests mitigation measures as per the mitigation hierarchy to achieve 'no net loss', and where feasible, 'a net gain' of biodiversity over time, and biodiversity offset actions (see ESIA Volume 2).
The national legislation recognizes the problem of alien species and genetically modified organisms at the level of government decrees, but a "toolbox" for alien species intrusion prevention and control is yet to be developed.	The ESIA Volume 2 contains measures to avoid accidental or unintended introductions of alien / invasive species.
The national legislation does not contain provisions for evaluation and verification of activities of primary suppliers' natural resource commodities.	The ESIA has not identified risks related to primary suppliers purchasing natural resource commodities that are known to originate from areas where there is a risk of significant conversion or degradation of priority biodiversity features and/or critical habitats.
Cultural Heritage	
Armenia's legislation (that is rather stringent and harmonized with the UNESCO conventions) defines a 'chance find procedure' similarly to Lenders' standards. However, there is no requirement that a chance find procedure should be project-specific.	The ESMP and ESAP contain a provision to develop and implement a chance finds procedure, i.e., a project-specific procedure to be followed if previously unknown cultural heritage is encountered during project implementation activities. The EBRD's template is expected to be used for developing a Project specific procedure (see ESIA Volume 4).
The cultural heritage legislation identifies key stakeholders whose opinion should be considered when implementing projects having cultural heritage components. However, there is no requirement to consult local stakeholders in order to identify cultural heritage or locally valued sacred places, as well as extent of their use.	The ESIA baseline studies included consultations with the Project-affected communities about the cultural heritage sites / items or sacred / religious places/items of importance and the local value attached to it. The results were considered in the impact assessment. For details refer to ESIA Volume 4. The SEP envisions further consultations on cultural heritage matters.
The issue of confidentiality of information regarding the cultural heritage is not regulated by the national	The information about all identified sites was publicly disclosed in 2016-2017, during the previous EIA process. As

Key gaps	Action undertaken within the ESIA process to bridge gaps
legislation. Lenders' standards require that sensitive information may be omitted from public disclosure if it can jeopardize the safety or integrity of cultural heritage.	there is low risk of compromising the known (registered) and discovered (unregistered) cultural heritage sites, thus the information would be disclosed as well in the ESIA.
The provision to allow continued access or provide alternative access route for stakeholders to the project site that contains previously accessible/used cultural heritage is not regulated by the national legislation.	The ESIA and ESMP envisions providing either a continued access or an alternative access route to the sites used locally, based on consultations with users of the site. A specific Cultural Heritage Management Plan will be developed to address this requirement.
Stakeholder Engagement and Information Disclosure	
The national legislation envisions four rounds of stakeholder consultations during the EIA process. The process is largely consistent with Lenders' requirements, though may lack details on addressing and responding to inquiries and grievances and reporting to stakeholders.	The SEP requires to maintain a stakeholder engagement database that will include the records of communication events, lists of participants, summaries of the feedback received, and an explanation of how the feedback was considered, or why it was not during the project lifetime.
Different types of stakeholders (project-affected parties and other interested parties) defined in Lenders' standards are captured by the national legislation via the terms "the public", "concerned community" and "public concerned" and "participants of the process". The regulations do not contain specific requirements with respect to disadvantaged and vulnerable stakeholders and accounting for gender considerations. It should be mentioned also that there are no requirements to provide translation for national minorities or to undertake any differentiated engagement measures.	The SEP has identified and grouped the stakeholders (including vulnerable and disadvantaged); it analyzed their concerns and suggested actions for engaging with vulnerable and female groups. The SEP has also reported that the ESIA's and resettlement plan's socio-economic surveys verified that there are no literacy issues and no translation of Project information is required in other languages.
National laws do not require the preparation of a SEP or a 'framework engagement approach'. As for the methods of engagement, the Governmental Decree N-1325N envisages only public discussions and submitting written comments during the discussion period. EIA&ER Law 110-N and the Decree 1325-N include basic provisions for public authority and the initiator responsible for conducting notification and public discussions. The range of information to be communicated to the project-affected parties is defined for each stage of EIA and expert review.	The preliminary SEP has been developed and delivered for the Project's ESIA scoping stage. The updated SEP covering the ESIA disclosure, pre-construction, construction and operation has been developed as well to be disclosed as part of the ESIA disclosure package.
There is no requirement for stakeholder engagement throughout the lifecycle of the project. This does not preclude an opportunity of stakeholders to submit claims or request information, but the initiator is not legally obliged to respond and provide records. Significant changes to the project are not subject to mandatory public notification and consultations, unless the extent and the nature thereof qualify for triggering an EIA and expert review process again, including its four-round public consultations.	The SEP contains provisions to: • Engage with, and provide information to, stakeholders during the project lifecycle; • If there are significant changes to the Project that result in additional risks and impacts to project-affected parties, conduct additional consultations about how these risks and impacts will be mitigated.
There is no specific regulation about the grievance mechanism in the national legislation (especially within a framework of a project),	The SEP, ESAP and ESIA contain provisions to: • Implement a grievance mechanism in line with Lenders' requirements; • Document grievances and results of their review.

5 ESIA METHODOLOGY

5.1 ESIA Process

The key stages of the ESIA process are: screening, scoping, baseline collection and analysis, analysis of alternatives, impact assessment, mitigation and enhancement planning, management and monitoring, and stakeholder consultations. The ESIA process is being undertaken in accordance with the EBRD, ADB and EIB E&S policies and national legislation.

A national EIA was prepared for the Sisian-Kajaran Road Project and **received a positive conclusion of the State Environmental Review in March 2018**. The validity of this conclusion expired in March 2019. The national EIA procedure was re-launched in March 2023, using the assessment that are presented in this ESIA. It should be noted that the E&S requirements of the EBRD, ADB and EIB and Armenian legislation have important differences but that the core assessment principles are the same. For this Project this assessment is packaged to meet the EBRD, ADB and EIB requirements.

5.2 Screening

Screening serves to establish the likely degree of difficulty and/or risks, based on which the need for an ESIA is determined. EBRD and ADB have assigned Category A to the Project as per their E&S policies of 2019 and 2009, respectively. EIB also considered that the Project was likely to have significant E&S impacts as per its 2022 E&S Policy. This means that a comprehensive ESIA must be prepared, alongside the associated E&S documents and management plans, followed by their public disclosure for a minimum of 120 days prior to approval of the Lenders' Boards.

5.3 Scoping

Scoping (as detailed in this document) is one of the major parts of the ESIA process. Scoping involves the preliminary identification of **aspects** of the Project and related **E&S impacts/risks**[66]. Specific components of the natural or social environment that might be affected by the Project are referred to as **environmental or social receptors**[67].

The potential interactions are identified by cross-referring the Project (i.e., construction, operation and decommissioning activities) to the surrounding baseline E&S conditions. The interactions and potential impacts are identified using scoping matrices, checklists and "impact trees", as well as expert opinion and consultations and accordingly are scoped into or out of the subsequent ESIA process as follows:

- No identified (or discernibly important) interaction, so no (discernible) impact - scoped out of the ESIA process.
- Identified interaction and potentially moderate to significant negative or positive impact - scoped into the ESIA process.

During impact identification, the following types of potential impacts / risks are considered:

- Direct impacts: impacts of the Project that occur in the same space and time. Also known as primary impacts, they are the direct consequences on the natural or social environment;

[66] The term 'impact' refers to any change in the state of natural or social environment attributed to the Project.
[67] Example environmental receptors are habitats disturbed as a result of earthworks / construction activities; example social receptors are residents of houses located next to the existing roads to be rehabilitated or connecting roads to be constructed (extended).

- Indirect impacts: impacts of a chain of activities associated or induced by the Project that often occur later in time, affecting a broader area, but that are nevertheless reasonably foreseeable.
- Cumulative impacts: these impacts can result from the interaction amongst impacts of the Project, or from the interactions amongst impacts of several projects within a same area. They may also result from the incremental effects of an action when added to other past, present and reasonably foreseeable future actions.
- Residual impacts: the impacts that remain after implementation of the Project-associated mitigation / enhancement and other E&S management measures have been applied in line with the principle of a mitigation hierarchy.

5.4 Baseline Study Areas and Baseline Analysis

The **environmental baseline study area** for the Project includes:

- Sisian-Shenatagh and Qirs-Kajaran road sections and the Bargushat tunnel and the adjacent areas of direct and indirect impact, including the connecting roads;
- The potential locations of the spoil disposal areas as proposed in the design;
- The southern portal of the Bargushat tunnel and adjoining section of the road that is mostly located in a mountainous area, with high biodiversity and landscape value;
- An initial 1000m corridor centred on the proposed road as a priority for the biodiversity surveys and then widened to various extents depending on the biodiversity streams (e.g., greater for birds and smaller for flora) and the relevant ecologically appropriate areas of analysis (EAAAs) for potential biodiversity priority features[68] (**Figure 33**);
- The areas along the proposed road for physical parameters (see Volume 3), as well as for the existing roads that are assumed to be used by construction transport:
    - Water quality in the water bodies/water channels that flow parallel to and/or cross the proposed road or are located in its vicinity and which may be affected by construction or operational activities;
    - Drinking (plain and mineral) water springs within 500m on both sides of the tunnels (blasting activity) and 300m on either side of the road (possible risks from blasting).
    - Prevailing noise (at selected areas within 250 m on either side of the proposed road corridor);
    - Prevailing vibration (at selected areas within 100 m on either side of the proposed road);
    - Prevailing air quality (at selected areas within 250 m on either side of the proposed road corridor); and
    - Prevailing soil quality (limited campaign sampling).
- Cultural and historical heritage objects within the footprint of the Project facilities and up to 500m to both sides of the proposed road (subject to complexity of local terrain);
- Residential areas that may experience construction traffic and visual impact due to the Project activities.

[68] This is a specific landscape approach in the framework of the Critical Habitat Assessment. In the Project's mountainous context, the landmarks that helped define the larger area of influence and EAAAs were ridges, water catchments, protected areas and main vegetation units (e.g. forests). Larger areas of influence were defined further for >1km buffer based on the literature review, stakeholder consultations and focused surveys.

- Public roads that may be used to transport the construction materials.

To note: some of the Project facilities such as a construction camp, quarries, borrow pits, disposal areas, asphalt plant, areas for temporary storage of removed topsoil, locations of the water tanks for the tunnel's fire-lighting system, etc. are not currently defined and will be determined by the Construction Contractor.

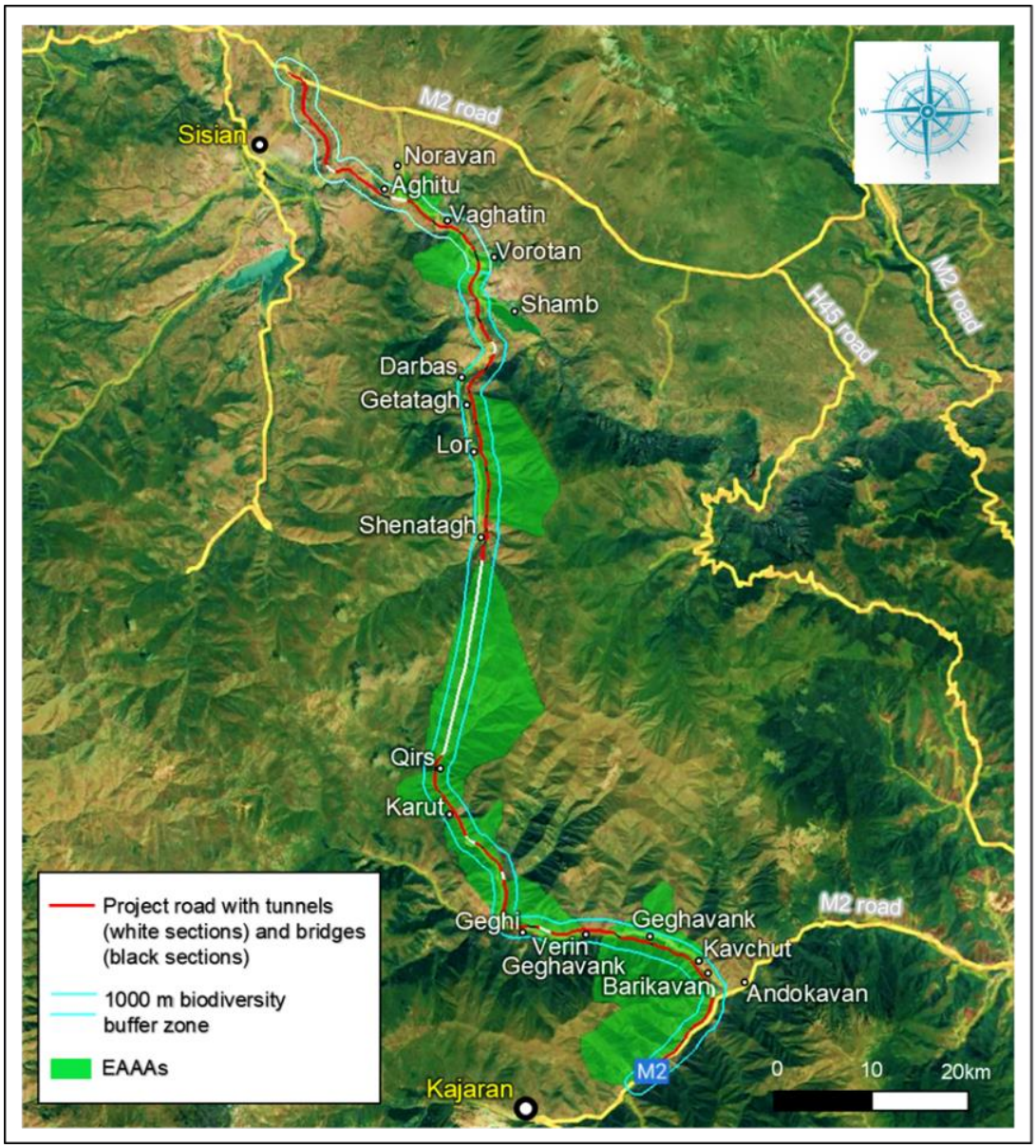


Figure 33. Biodiversity Study Area

The social baseline study area, as aligned with the Project's potential socio-economic areas of Influence,[69] for the Project comprises (**Figure 34**):

[69] The socio-economic study area is aligned with the socio-economic areas of influence:

- **Core socio-economic area of influence** (study area): this area comprises the territories of the rural settlements (administrative units) that are adjacent to or crosses by the proposed route, existing roads to be used by construction transport, and potential connecting roads and where the socio-economic receptors are exposed to impacts related to land acquisition, restricted access, and other local impacts.

- Persons and facilities that may be affected by land acquisition and land use restrictions related to the arrangement of the Project facilities (the road, tunnels, bridges, etc.) and associated facilities, if known (e.g., transmission lines).
- Villages located along the proposed road and connecting (secondary) roads (for all social parameters);
- Sisian and Kajaran Communities (municipalities) of the Syunik Region where the proposed Project is located (for demography, ethnicity, religion, and language use, employment, incomes and expenditure, and less socially protected and vulnerable groups, gender issues, public infrastructure, households' engagement in the tourism sector);
- Syunik Region (for demography, ethnicity, religion, and language use, structure of local economy, employment, incomes and expenditure, gender issues and existing transport infrastructure and tourism);
- Armenia (for demography, ethnicity, religion, and language, employment, incomes and expenditures, and gender issues).

- **Socio-economic area of influence** (study area): this area includes the territories of Sisian and Kajaran Communities (municipalities), as well as the Syunik Region, where the socio-economic receptors are exposed to direct impacts of municipal level, including employment opportunities and related impacts, tax revenues, and impacts of the associated projects and transport operations. Some benefits also extend further to the country's level, such as road safety and economy.

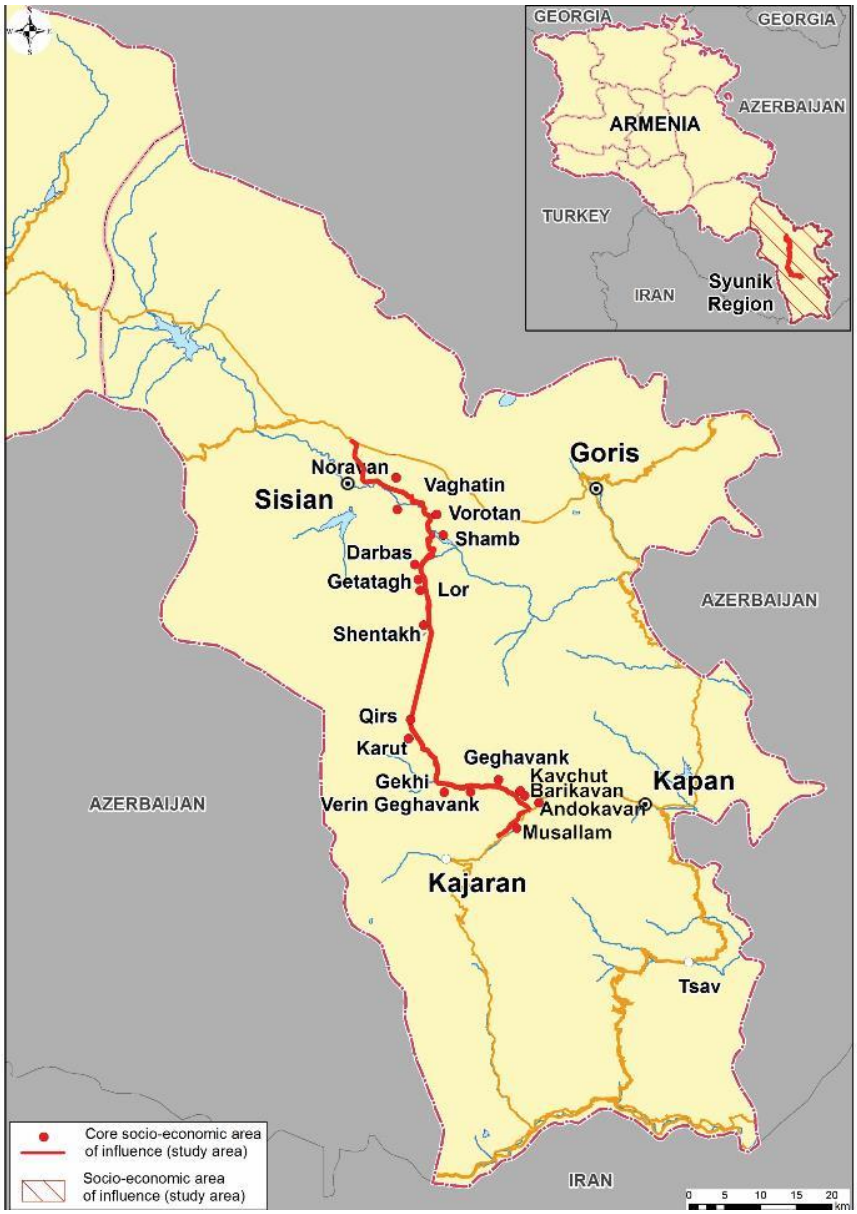


Figure 34. Socio-economic Study Areas (Areas of Influence)

To provide a context within which the impacts of the Project can be assessed, a description of physical, biological, social, economic, and health and safety conditions is presented. In this respect, it was necessary to have comprehensive data pertaining to baseline E&S conditions. The baseline chapters (**ESIA Volumes 2, 3** and **4**) provide an overview of baseline conditions. Further information is gathered from secondary and primary sources (field surveys and interactions with Project stakeholders). Secondary data have been sourced from studies conducted for the ADB-funded feasibility study and national EIA process (national EIA report and State Environmental Review conclusion for the Project) provided by the RD, as well as from the publicly available sources (official statistics, national environmental reports, online databases, websites of municipal and regional authorities, and so forth).

5.5 Assessment of Impacts/Risks

Impact significance is determined as a function of a receptor's sensitivity (environmental or social value) and the magnitude (extent of change to the natural or social environment) of the impact. This section sets out the approach to determining impact significance through:

- Assigning receptor sensitivity (environmental or social value);

- Assigning impact magnitude;
- Assigning significance;
- Assessing residual impacts; and,
- Assessing cumulative impacts.

5.5.1 Assigning Receptor Sensitivity

The proposed descriptors and criteria for the sensitivity of a receptor are given below. Detailed judgements and explanations about vulnerability and sensitivity are presented in the specialist impact assessment sections, as they differ for various receptors.

Table 21. Definitions for Sensitivity of Receptors

Sensitivity	Typical Criteria Descriptors
High	High or very high importance and rarity, international or national scale and very limited to no potential for substitution; for social also – a highly vulnerable receptor with very little capacity and means to absorb socio-economic shocks and take advantage of opportunities
Medium	Medium importance and rarity, regional scale, limited potential for substitution; for social also- a vulnerable receptor with some capacity and means to absorb socio-economic shocks and take advantage of opportunities
Low	Low importance and rarity, local scale; for social also - a non-vulnerable receptor with limited capacity and means to absorb socio-economic shocks and take advantage of opportunities
Very low	Very low importance and rarity, local scale; for social also - a non-vulnerable receptor with plentiful capacity and means to absorb socio-economic shocks and take advantage of opportunities

5.5.2 Assigning Impact Magnitude

Magnitude refers to the ‘size’ or ‘amount’ of an impact. It is a function of various magnitude criteria including:

- the impact’s extent (i.e., the spatial dimension of the impact),
- duration (i.e., the temporal dimension of the impact). In particular, temporary are short impacts, on the order of hours to weeks; short-term are impacts predicted to last during site preparation and construction operations (up to about two-three years at specific locations); medium-term are impacts predicted to last over two years and up to 5-10 years, long-term are anticipated impacts of a longer duration than medium-term impacts but which will cease in time, and permanent are impacts causing a permanent change on the receptors and extending well beyond the lifetime of the project, and
- reversibility (i.e., whether the impact is temporary (within a reasonable timescale) or permanent leaving a possibility to the receptor to restore or not.

In order to help define the range of impact magnitudes, the definition given in the table below are used.

Table 22. Definitions for Impact Magnitude

Magnitude Category	Typical Criteria Descriptors
High	Loss of resource and/or quality and integrity of resource that is highly probable; severe damage to key characteristics, permanent / irreversible change, features or elements (Adverse)
	Large scale or major improvement of resource that is highly probable; extensive restoration or enhancement, permanent change/major improvement of attribute quality (Beneficial)
Medium	Loss of resource, but not affecting integrity, partial loss of/damage to key characteristics, features or elements that is likely to occur (Adverse)
	Benefit to, or addition of, key characteristics, features or elements; improvement of attribute

Magnitude Category	Typical Criteria Descriptors
	quality that is likely to occur (Beneficial)
Low	Some measurable change in attributes, quality or vulnerability, minor loss of or alteration to one (possibly more) key characteristics, features or elements that is likely to occur (Adverse)
	Minor benefit to, or addition of, one (possibly more) key characteristics, features or elements, some beneficial impact on attribute or a reduced risk of a negative impact occurring that is likely to occur (Beneficial)
Negligible	Very minor loss or detrimental alteration to one or more characteristics, features or elements that may occur at some point (Adverse)
	Very minor benefit to or positive addition of one or more characteristics, features or elements that may occur at some point (Beneficial)
No change	No loss or alteration of characteristics, features or elements, no observable impact in either direction.

5.5.3 Assigning Impact Significance

Assigning impact significance relies on reasoned argument, professional judgement and consideration of views and advice of stakeholders. Predicted impacts for some topics may be assessed by using quantitative thresholds and scales in the determination of significance. Assigning each impact to one of the significance categories enables different topic issues to be placed within the same scale to allow a direct comparison. The four significance categories are given in **Table 23**.

Table 23. Definitions for Impact Significance

Significance Category	Typical Criteria Descriptors
Major	Very large or large magnitude of change in environmental or socio-economic conditions. Impacts, both adverse and beneficial, which are likely to be important considerations at a national and regional level or could result in breaches of legally enforceable environmental protection mechanisms.
Moderate	Intermediate magnitude of change in environmental or socio-economic conditions. Impacts that are likely to be important considerations at a regional and local level.
Minor	Small magnitude of change in environmental or socio-economic conditions. Impacts may be raised as local issues but are unlikely to be of importance in the project's permitting process.
Negligible	No discernible change in environmental or socio-economic conditions. Impacts that are likely to have a negligible or neutral influence, irrespective of other impacts.

It is important to note that significance categories are required to be determined for both positive (beneficial) and negative (adverse) impacts / risks.

The greater the receptor sensitivity and the greater the impact magnitude, the more significant the impact. The consequence of a highly sensitive receptor suffering a major detrimental impact would be a very large significant adverse impact. The determination of impact significance is shown below in the impact significance matrix (**Table 24**).

Table 24. Impact Significance Matrix

Impact Magnitude	Receptor Sensitivity / Value			
	High	**Medium**	**Low**	**Very Low**
High	Major	Major	Moderate	Minor
Medium	Major	Moderate	Minor	Minor
Low	Moderate	Moderate	Minor	Negligible
Negligible	Moderate	Minor	Negligible	Negligible

The results of the assessment are summarised in the format provided below (arbitrary colouring).

Table 25. Template for Summarising the Impact Assessment Results

Impact of [aspect] on [receptor] due to [project stage]					
Impact Nature	Positive			Negative	
	Explanation				
Impact Type	Direct	Indirect		Reversible	Irreversible
	Explanation				
Impact Duration	Temporary	Short-term	Medium-term	Long-term	Permanent
	Explanation				
Impact Extent	Local	Municipal (Community)	Regional	National	International
	Explanation				
Impact Magnitude	Negligible	Low		Medium	High
	Explanation				
Receptor Value / Sensitivity	Negligible	Low		Medium	High
	Explanation				
Impact Significance	Negligible	Minor		Moderate	Major
	Explanation				

5.5.4 Assessment of Residual Impacts

Significance of r**esidual impacts is** assessed using the same approach as described above. Residual impacts should be environmentally and socially acceptable. Typically, negative residual impacts assessed as being either of minor (or negligible) significance are considered to be environmentally and/or socially acceptable. Negative residual impacts assessed as major or moderate are environmentally and/or socially unacceptable unless they can be offset by other positive impacts of the project or controlled through the imposition of permitting conditions and/or specific actions implemented through the project's E&S management and monitoring plan.

5.5.5 Assessment of Cumulative Impacts

Cumulative effects are assessed where they are predictable both within the project and in combination with existing and reasonably foreseeable future projects. Cumulative effects are considered as either additive or interactive effects. Additive effects are those effects for which a change in a receptor may be added to (or subtracted from) a similar change to the same receptor (e.g., the combination of several similar impacts on one receptor). Interactive effects are those effects for which a change in a receptor may be added to (or subtracted from) a different change to the same receptor (e.g., the combination of different impacts on one receptor).

Cumulative impact assessment is based on the stepped process described in the IFC's Good Practice Handbook[70]. Any additional mitigation and/or management measures required for cumulative impacts are included in the ESMP for the Project.

[70] IFC. Good Practice Handbook - Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets" (2013). https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/publications/publications_handbook_cumulativeimpactassessment.

5.6 E&S Management and Monitoring

Based on the assessment, mitigation is developed to avoid, reduce or manage the potential negative impacts and enhance positive impacts. Mitigation measures are translated into clear, practical measures applicable to the local conditions and are based on GIP.

The various mitigation, monitoring and management measures identified through the impact assessment process are compiled in an **ESMP (ESIA Volume 6).** The ESMP is split into the construction and operational stages. The ESMP also contains a management framework, that serves to ensure E&S risks are included in decision-making and day-to-day operations. It sets a framework for tracking, evaluating and communicating E&S performance and help ensure that E&S risks and liabilities are identified, minimised and managed. The ESMP includes guidance for the Construction Contractor to develop further specific ESMPs, such as Air Quality Management Plan, Waste Management Plan, Spoil Management Plan, Worker Camp Management Plan, Health and Safety Management Plan and/or other plans determined during the ESIA process. The framework ESMP for the construction stage will be included in the bidding documents and Construction Contractor's contract.

5.7 Stakeholder Engagement and Public Consultations

Within the framework of this ESIA, a SEP has been developed, including a grievance mechanism. The SEP summarises the engagement processes and events that have been completed so far for the Project and details a structured and systematic approach for stakeholder engagement during the Project planning and implementation stages. Further details are provided in **ESIA Volume 4** and the SEP.

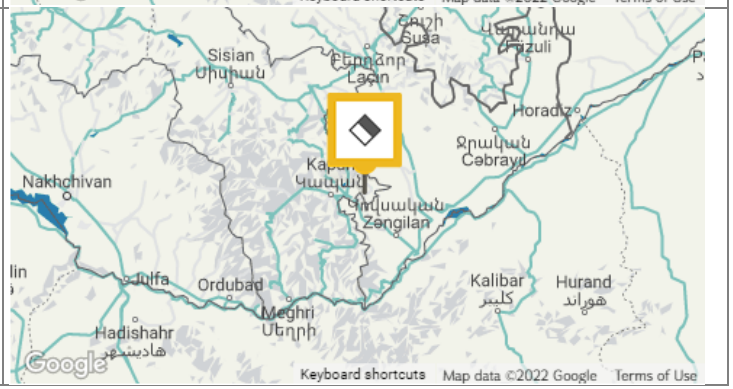
5.8 Data Availability, Assumptions and Limitations

Because ESIAs are predictive processes, there is always data uncertainty. Furthermore, a fully comprehensive suite of E&S information is seldom available. Where data do exist, they are sometimes outdated. Where information is not available or too outdated to be used with confidence, assumptions and estimates need to be made and this is clearly indicated in the ESIA. E&S topic-specific assumptions are provided, as needed, in the relevant sections of Volume 2 (Biodiversity), Volume 3 (Physical Environment), Volume 4 (Social Environment), Volume 5 (Cumulative Impact Assessment) and Volume 6 (ESMP).

Socio-economic studies and any engagement during the ESIA process is undertaken with respect of rights to privacy and data protection [71], e.g., details of respondents are kept in the internal Project databases, disclosed photo materials are presented so that to prevent identification of individuals (unless they provided their consent for this) and so on.

[71] In line with the EU Charter of Fundamental Rights and where applicable, Regulation (EU) 2016/679 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC, General Data Protection Regulation (GDPR).

Annex 1. MAPPING OF THE IDENTIFIED LICENSED QUARRIES IN THE PROJECT AREA

№	Name and characteristics	Type	Company	Permit №	Issued in	Valid until	Other info	Map
1	Qirs-Qyurut gravel sand quarry Total area: 1.65ha Total capacity: 115000m3 Annual capacity: 5000m3	Sand, send-gravel mixture	"Tunnel" CJSC	ՇԱԹՎ-29/217	2012	2034	Contract: ՊՎ-217, 20.10.2012 Mining act՝ ԼՎ-217ա, 20.02.2013	
2	Voxchi sand-gravel mixture quarry Total area: 0.82ha Total capacity: 33700m3 Annual capacity: 5000m3	Sand-gravel mixture	"Kapani Norogshin" LLC	ՇԱԹՎ - 29/271	2013	2036	Contract: ՊՎ-271, 20.02.2013 Mining act: ԼՎ-271, 20.02.2013	
3	Karachiman sand-gravel mixture quarry Total area: 1.39ha Total capacity: 495600m3 Annual capacity: 4130m3	Sand-gravel mixture	"Vaibl" LLC	ՇԱԹՎ-29/446	2013	2023	Contract: ՊՎ-446, 21.01.2013 Mining act: ԼՎ-446, 21.01.2013	

№	Name and characteristics	Type	Company	Permit №	Issued in	Valid until	Other info	Map
4	Hacavan sand gravel quarry Total area: 1.97ha Total capacity: 695000m3 Annual capacity: 27800m3	Gravel sand	"Sisian-Shik" CJSC	ՇԱԹ-29/610	2019	2044	Contract: Պ-610, 08.11.2019	1.X=4367816 Y=8582047 2.X=4367847 Y=8582032 3.X=4367905 Y=8582100 4.X=4367951 Y=8582176 5.X=4367992 Y=8582280 6.X=4367957 Y=8582295, 7.X=4367918 Y=8582238, 8.X=4367834 Y=8582194
5	Kapan sand gravel quarry Total area: 0.69ha Total capacity: 556243m3 Annual capacity: 25423m3	Gravel sand	"Vikart" LLC	ՇԱԹ-29/630	2020	2047	Contract: Պ-630, 17.11.2020	1.X=4341766 Y=8623400, 2.X=4341787 Y=8623467, 3.X=4341800 Y=8623535, 4.X=4341809 Y=8623632, 5.X=4341795 Y=8623640, 6.X=4341769 Y=8623596, 7.X=4341753 Y=8623399
6	Qar Tapi basalt quarry Total area: 1.06ha Total capacity: 75000m3 Annual capacity: 3000m3	Bazalt	"Akner" LLC	ՇԱԹՎ-29/291	2012	2036	Contract: ՊՎ-291, 23.11.2012 Mining act: ԼՎ-291, 23.11.2012	
7	Angeghakot basalt quarry (Chor Dzor site) Total area: 1.28ha Total capacity: 166700m3 Annual capacity: 3334m3	Bazalt	"Chor Dzor" LLC	ՇԱԹ-29/473	2013	2063	Contract: Պ-473, 12.08.2013 Mining act: ԼՎ-473, 12.08.2013	
8	Angeghakot basalt quarry Total area: 1.99ha Total capacity: 200000m3 Annual capacity: 4000m3	Bazalt	"Jayrakot" LLC	ՇԱԹ-29/461	2013	2063	Contract: Պ-461, 22.04.2013	1.X=4383300 Y=8579116, 2.X=4383355 Y=8579240, 3.X=4383229 Y=8579294, 4.X=4383166 Y=8579153
9	Angeghakot basalt quarry Total area: 2.33ha Total capacity: 223752m3 Annual capacity: 4952m3	Bazalt	"Bazalt-7" LLC	ՇԱԹ-29/604	2019	2064	Contract: Պ-604, 15.08.2019	1.X=4383400 Y=8579026 2.X=4383431 Y=8578997 3.X=4383482 Y=8578991 4.X=4383573 Y=8579013 5.X=4383580 Y=8579014 6.X=4383588 Y=8579106 7.X=4383494 Y=8579142 8.X=4383400 Y=8579121

№	Name and characteristics	Type	Company	Permit №	Issued in	Valid until	Other info	Map
10	Artsvanik volcanic slag quarry Total area: 1.95ha Total capacity: 460000m3 Annual capacity: 20000m3	Volcanic slag	"Kapani TchShSh" LLC	ՇԱԹՎ-29/178	2012	2032	Contract: ՊՎ-178, 06.11.2012	
11	Shinuhayr volcanic slag quarry Total area: 1.72ha Total capacity: 250000m3 Annual capacity: 5000m3	Volcanic slag	"Avchi" LLC	ՇԱԹ - 29/361	2012	2062	Contract: Պ-361, 28.12.2012	1.X=4367377 Y=8612917 H=1557.0 h-27.0, 2.X=4367492 Y=8613026 H=1564.0 h-34.0, 3.X=4367428 Y=8613113 H=1535.0 h-5.0 4.X=4367308 Y= 8612993 H=1557.0 h-27.0)
12	Aghitu basalt quarry Total area: 2.53ha Total capacity: 464900m3 Annual capacity: 18596m3	Bazalt	"Salbeka" LLC	ՇԱԹՎ-29/204	2012	2035	Contract: ՊՎ-204, 20.10.2012	1.X=4375694 Y=8593392 H=1513.6 (-16.8) 2.X=4375851 Y=8593387 H=1538.5(-10.9) 3.X=4375940 Y=8593342 H=1537.0(-7.6) 4.X=4375973 Y=8593423 H=1567.5 (-14.8) 5.X=4375822 Y=8593497 H=1598.0 (-17.9) 6.X=4375692 Y=8593471 H =1570.0 (-25.1)
13	Shaqi gravel sand mixture quarry ("Aghidzor" quarry)	Gravel sand mixture