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NON-TECHNICAL SUMMARY (NTS) of the ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) for SISIAN-KAJARAN (NORTH-SOUTH CORRIDOR) ROAD PROJECT, ARMENIA



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-dgAwjSsUJ>]

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Prepared for:

**The “Road Department” Fund under the Ministry of Territorial
Administration and Infrastructure of the Republic of Armenia**

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2	14.06.2023	Final Draft for approval by Lenders and the Client, translation into Armenian and public disclosure
4	25.03.2024	Final report updated after disclosure and the split of the planned road into three sections

DISCLAIMER

A Non-Technical Summary (NTS) summarises the results of the Environmental and Social Impact Assessment (ESIA) completed for the Sisian-Kajaran Road Project, Armenia. An 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 respectfully 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

AASHTO	The American Association of State Highway and Transportation Officials
ADB	Asian Development Bank
AMSL	above mean sea level
CH	Cultural heritage
E&S	Environmental and social
EBRD	European Bank for Reconstruction and Development
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
EU	European Union
GIP	good international practice
ha	hectare
IBA	Important Bird Area
KBA	Key Biodiversity Area
km/h	kilometre per hour
m	metre
m ³	cubic metre
mln	million
MTAI	Ministry of Territorial Administration and Infrastructure of Armenia
MoE	Ministry of Environment of Armenia
NSRC	North-South Road Corridor
NTS	Non-Technical Summary
OHS	Occupational Health and Safety
RA	Republic of Armenia
RD	Road Department Fund
SDA or DA	(Spoil) disposal area
SEP	Stakeholder Engagement Plan
SPA	Special Protected Area
UNESCO	United Nations Educational, Scientific and Cultural Organization
VAT	Value Added Tax
WHO	World Health Organisation

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1 INTRODUCTION

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 packages¹:

- 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).



Source: prepared by the Consultant.

Figure 1. Location of the Sisian-Kajaran Project

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 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.

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.

Having categorised the Sisian-Kajaran road construction as Category A according to the international lenders' requirements (EBRD, EIB, and ADB), an Environmental and Social Impact Assessment (ESIA) has been completed for the Project. This document is a **Non-Technical Summary** (NTS) of the ESIA.

The NTS, together with other Project's environmental and social (E&S) documents, was disclosed for over 120 days according to the international lenders' requirements (namely, from 21 July to 1 December 2023). 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 Project's E&S documents, including this NTS, were updated to capture the feedback from stakeholders collected during the ESIA disclosure and will be re-disclosed, alongside the ESIA Disclosure and Consultation Report, for the Project life-cycle.

2 PROJECT CONTEXT AND RATIONALE

As part of the Trans-European Transport Network (TEN-T), the Project falls under Flagship 2 of the EU's priorities in Armenia to boost connectivity and socio-economic development. A broad range of transport related initiatives have been initiated across Europe and Asia, to improve country-to-country, region-to-region, and continent-to-continent connectivity. These include the (TEN-T), the Transport Corridor Europe-Caucasus-Asia (TRACECA), the Central Asia Regional Economic Cooperation (CAREC) Programme and the Silk Roads Project. Improving in-country connectivity is required to capitalise on the trade and mobility benefits of these regional scale initiatives. For Armenia, improved in-country connectivity lies in the NSRC, of which the Sisian-Kajaran Road Project in Armenia's southernmost region, is a component (**Figure 1**). The estimated project cost is ca. EUR 986 million (excl. VAT and supervision).

The proposed Project is essential to unlocking the connectivity required of the NSRC because it will replace two largely inadequate road sections that currently have to be used. Firstly, the M2 Goris-Kapan road, which cannot presently be used by vehicles with Armenian registration plates. The only remaining route is therefore the 130km road via Tatev (H-45) that features steep gradients and tight bends and is overloaded with heavy vehicle traffic, for which it was not designed. Both the M2, and the M2-Tatev-Aghvani-M2(Syunik) (H-45) are far below the level of standard expected of a national road. A new, shorter and more direct road with limited gradients and gentler bends adhering to modern international road safety standards is essential.

A Feasibility Study and the Detailed Design for the Project were prepared between 2016-2019 and funded by ADB. A national Environmental Impact Assessment (EIA) was prepared for the Sisian-Kajaran Road Project in parallel with the Feasibility Study and Detailed Design, and received a positive conclusion of the State Environmental Review in March 2018. However, the validity of this conclusion expired in March 2019, and as such the national EIA process was re-launched by the RD in March 2023. The new positive EIA Conclusion was issued to the RD on 27 November 2023.

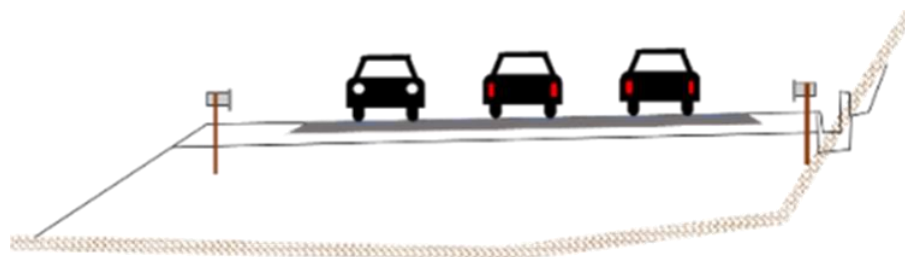
3 PROJECT DESCRIPTION

3.1 The Sisian-Kajaran Road Section

3.1.1 General Information

The proposed Sisian-Kajaran road section will shorten the existing journey by road (via the M2 Goris-Kapan and H45 Sisian-Tatev-Kapan) by 60km (from 130 to 70 km) and substantially improve the vertical road gradient and elevations. The new road section will adhere to international road safety standards and provide for climate change risks. The proposed road will be a single carriageway with additional climbing/passing lanes on all uphill sections (**Figure 2**)

and tunnels as single carriageways in both directions. The road section is approximately 60 km in length, with a design speed of 100 km/h specified by its Category 1² status.



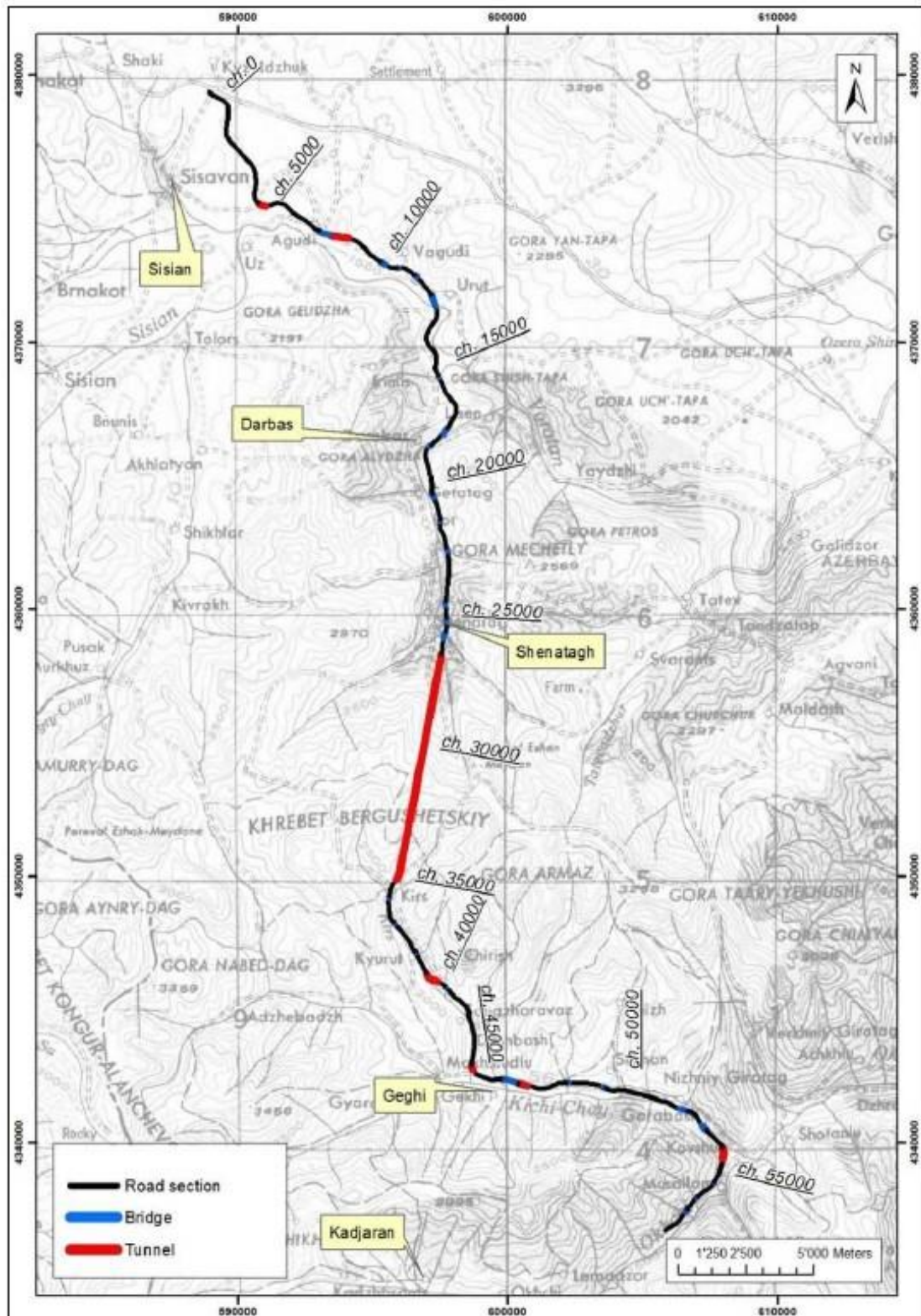
Source: Section Sisian-Kajaran, Detailed Design, General Report, April 2019.

Figure 2. Typical Road Cross Section Showing the Two Lanes and a Passing Lane on uphill sections

3.1.2 Key Components and General Alignment

The proposed road section has three main interchanges, 27 bridges and 9 tunnels. The main Bargushat Tunnel is 8,600m long, and critically connects the new road sections to the north and south of the Bargushat mountain. The road starts to the north-east of Sisian Town and extends south-eastwards towards the village of Vorotan and then southwards to Shenatagh Village, mainly following the left bank of the Vorotan River. The road then crosses to the right side of the Shenatagh valley, before passing through the Bargushat tunnel. South of the tunnel the road descends 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 here the road turns eastwards to the junction with the Voghji River then west to connect with the existing M2 highway near Kajaran (**Figure 3**).

² Roads in Armenia are classified into four categories, determined according to traffic volumes in passenger car units, 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. As a Category 1 road, the planned Project can accommodate 9000 cars per day, it will allow for 100km/h speed, will belong to the intergovernmental roads that connect RA road network to the roads of neighbouring countries and ensure international transport connections, and will comply with many design and safety criteria.



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

Figure 3. The Proposed Sisian-Kajaran Road Route together with the Positions of Tunnels and Bridges

3.1.3 Other Components

The road includes passages for cattle and agricultural vehicles in response to stakeholder requests. Drains and culverts, sized for future possible storm events will keep the road from

flooding. The road will have an asphalt surface (pavement) complying with Armenian, AASHTO³ and Euro Standards. Service (secondary) roads will be built to connect to existing roads.

3.1.4 The Road Footprint

The nominal road width is approximately 16m but the exact footprint will be defined by cuts into the hillsides (which may also need to be stepped) and supporting embankments on the downslope side of the road. In many areas retaining walls will also be needed to support the road. Some 2,932,280.88 m² of land will be permanently acquired for the road footprint, including 570 land plots (of which 276 are privately used or owned).

3.1.5 Construction spoil

The extensive tunnel excavations means that there will be excess spoil (material that cannot be reused for the road construction) and therefore, spoil disposal sites are needed for the residual/waste material. Spoil disposal areas (SDAs) have been preliminarily identified for that purpose but still require technical verification, design, and authority approval. Despite the excess spoil, quarries or borrow pits may still be needed to provide specific soils or stone.

3.2 Associated Facilities to the Project as a whole

A reliable power supply is needed for lighting the tunnels and particularly for ventilation of the Bargushat Tunnel. Technical solutions for operational power supply are yet to be determined. Should there be the need for new electricity transmission lines, they will be considered as an associated facility to the Project and as such, will be subject to an assessment, either as an Addendum to this ESIA or in a separate ESIA.

3.3 Overview of Project Implementation

3.3.1 Construction Works

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 by the appointed Contractor. Limited estimates of the resources required include 1,3 million m³ of hot asphalt, 0,7 million m³ concrete, and 107 thousand m³ of water. Approximately 60 thousand tonnes of waste are expected to be generated, excluding the excess spoil. A workforce of 400 to 500 people is envisaged. Construction of the entire road section is expected to take 6 years with the Bargushat tunnel requiring about 5 years.

3.3.2 Operation and Maintenance

The road is designed for 25+ years of operation. The RD will engage a maintenance consultant, as needed.

3.4 Project Alternatives

Alternative ways of achieving the same broad project objective have been identified and assessed to ascertain whether any would provide lesser potential environmental and social impacts as detailed below.

3.4.1 Previously Investigated Alternatives

- The “Zero” or no-Project alternative is not considered viable, as this would not change the current situation, leaving only the existing poor-quality roadways, which are

³ The American Association of State Highway and Transportation Officials.

dangerous, lead to longer journey distances/times and are susceptible to bad weather making them impassable.

- Upgrading existing roads would not meet the Category 1 road requirements and would be extremely disruptive during the construction phase. The Bargushat tunnel would still need to be built to connect the northern and southern road sections;
- Railway cannot replace the road as the slopes are too severe. Rail transport could be used elsewhere to complement the road function by facilitating the transport of goods;
- Three alternative routes were investigated during the Feasibility Study and EIA process with the option emerging as the optimal route being assessed in this ESIA.

3.4.2 Alternatives that Emerged from the ESIA

The application of the mitigation hierarchy during the ESIA highlighted several additional alternatives⁴ that, if feasible, would prevent or at least reduce impact intensity.

- Optimising alignment within the main route is the key mechanism for preventing potential impacts and multiple suggestions have been made in the ESIA. Such changes would only be possible if the Category 1 design criteria notably design speed and gradient were relaxed.
- Alternative pavement needs to be investigated for technical rather than environmental and social reasons. Updated traffic projections will be used to reevaluate the choice of pavement.
- Changing the position of the southern tunnel portal would potentially reduce the amount of material to be excavated from the tunnel with transport and disposal benefits. This alternative is also dependent on a relaxation of the Category 1 criteria.
- Alternative tunnel design and construction methods may further reduce potential impacts. Drill-and-blast has been assumed for the ESIA as the more impactful (conservative assumption). Should using a tunnel boring machine prove feasible this would have lesser impacts.
- Alternative / additional locations of SDAs have been explored because biodiversity risks have disqualified some of the preliminarily identified SDAs and reduced the size of others. Two new SDAs have been preliminarily identified but still more potential sites need to be identified to provide adequate excess spoil disposal capacity.
- Additional / alternative cattle/agricultural and pedestrian crossings emerged from the consultation process for incorporation in the design.
- Adjustments / micro-siting to avoid some cultural heritage sites along the proposed road.

4 LEGAL AND REGULATORY FRAMEWORK

The ESIA for the Project has been conducted in line with:

- Applicable **Armenian legislation** on environmental assessment, protection and nature resource management, occupational health and safety, labour management, biodiversity conservation, country's climate commitments, culture heritage protection,

⁴ The RA Government intends to incorporate those design changes which are required from the E&S perspective. Apart from those, the Government is not open to change the current technical standard /category of the proposed road with a view to construct a competitive route allowing for a fast and efficient transit passage.

etc; and relevant international conventions and treaties ratified by Armenia and transposed into the national legislation⁵.

- Relevant **Lenders' E&S safeguards**: applicable Bank policies governing operations and standards regulating Client's operations and activities. The standards provide guidance on identification of E&S impacts and risks and impact/risk prevention, mitigation/enhancement, and monitoring actions. Such actions are detailed in the E&S management plans for the Project. The Project framework comprises:
 - EBRD's E&S Policy (2019) and associated Performance Requirements.
 - EIB's E&S Policy (2022) operationalised via Environmental and Social Standards.
 - ADB's policies including the Safeguard Policy Statement (2009) and the integrated Safeguard Requirements.
- Applicable **Good International Practice (GIP) guidelines** - EBRD, EIB, ADB and other lenders' on resettlement; biodiversity; forced labour; gender issues, non-discrimination and equal opportunities; building and construction activities; occupational health and safety; grievance management; worker accommodation; and others.

Relevant **European Union (EU) Directives**, including *inter alia* Directive 2019/1936 amending Directive 2008/96/EC on Road Infrastructure Safety Management, Directive 2004/54/EC Minimum Safety Requirements for Tunnels in the Trans European Network, EU Directive 2011/92/EU, as amended by Directive 2014/52/EU on the assessment of effects of certain public and private projects on the environment, Directive 92/43/EEC on 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 conservation of wild birds, EU Directive 2008/50/EC on ambient air quality and cleaner air for Europe, and others.

5 ROLES AND RESPONSIBILITIES

The ESIA defines the following project roles and responsibilities:

- **The Road Department** is the executing agency and has lead responsibility for road construction. The RD oversees the overall implementation of the full Project life cycle, including commitments in the ESIA report.
- **Lenders**: EBRD, EIB and ADB are the Project Lenders and will monitor Project implementation to ensure compliance with their respective E&S policies.
- **Construction Contractor**: selected through the RD bidding process and responsible for Project construction. The Contractor must implement the mitigation measures identified in the ESIA, including the **Environmental and Social Management Plan (ESMP)**, and must develop site specific E&S Management Plans to address all aspects of their activities including those not currently known, such as the construction camp and SDA locations. The Contractor must have a team of environmental, social, health and safety, biodiversity, and cultural heritage specialists.
- **Supervision Engineer** will be appointed by the RD to monitor Project implementation and ensure compliance with the Project's ESMP and other commitments and will have

⁵ Such as the Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters (1998) (the Aarhus Convention).

a team of international and national environmental, social, biodiversity, and health and safety specialists, as well as a cultural heritage monitor. The Supervision Engineer will report the E&S performance to the RD including non-compliances observed and the respective corrective actions with specified timelines roles and responsibilities, provide regular capacity building activities for the Contractor E&S team as needed.

6 ENVIRONMENTAL AND SOCIAL BASELINE

6.1 Physical Environment

6.1.1 Climate

The Project is situated in Syunik Region within the administrative boundaries of Sisian and Kajaran Communities. The regional climate is continental, being influenced by eastern air masses from the Caspian Sea and the dry Iranian plateau. Mean annual temperatures in the Sisian and Kajaran regions are 8.5°C and 6.9°C, with a mean annual rainfall of 532 mm and 686 mm, respectively⁶. Precipitation is highly variable but occurs predominantly between March and June. Average annual relative humidity is 60% for Sisian and 70% for Kajaran, with less than 30% at low altitudes (up to 1,000 m) and 60- 80% at higher altitudes – 2,600 m⁷. Snow cover starts at altitudes of 1,200 MASL. The depth of snow cover is 15-20 cm at altitudes of 1300-1500 m and 120-180 cm at 3,000 m and higher. The snow remains for 1-1.5 months a year at altitudes of up to 1,500 m, and 6.5-7 months at 3,000 m and higher.

6.1.2 Climate Change in Armenia

The effects of global warming are already evident in Armenia, with mean annual air temperature having increased by 1.23°C between 1929 and 2016⁸. Temperature increases have been more pronounced in recent times, whereby nearly a third of the recorded increase (+0.38°C) has occurred in the last decade alone (Republic of Armenia, 2020). Between 1990 and 2019, mean annual temperature increases averaged 0.9°C, compared to the baseline period (1961-1991) BUR3 (2021). The current average annual precipitation rate of 526 mm per year is 5.1% less than the average annual precipitation rate between 1961-1990 (592 mm per year).

The projected⁹ increase in mean annual temperature is between 1.6°C and 2.2°C by 2050. A changed climate will see different day-to-day weather patterns, resulting in reduced crop yields, damage to crops and livestock, increased soil erosion through extreme weather events, and reduced water quality. Extreme weather events in Armenia increased by 23.5% between 1975 and 2016 compared to the period 1961-1990. These extreme weather events cause mudflows, floods, landslides, and other natural hazards with negative impacts on the different economic sectors of Armenia. Such risks are further exacerbated in mountainous areas.

6.1.3 Ambient Air Quality

Current ambient air quality in the Project area is relatively good, as it is located largely away from major industrial enterprises. Vehicle emissions are low in the road's southern section (Kajaran) but higher in the northern section, due to greater population, traffic volumes and economic activities. Measured concentrations of SO₂, NO₂, CO, PM_{2.5} and PM₁₀ in the Project

⁶ Source: North-South Road Corridor Investment Program, Tranche 4: Section Sisian-Kajaran, Detail Design, Final Environmental Impact Assessment Report and Environmental Management Plan, November 2019.

⁷ RA Construction Norms II-7.01-2011 "Construction Climatology" (HShN).

⁸ Armenia's 4th National Communication on Climate Change, 2020.

⁹ Projected climate change is based on various assumed scenarios that combine so-called shared socio-economic pathways (SSPs) and representative concentration pathways (RCPs).

area are within the Armenian Admissible Concentration Limits. The concentrations of these air quality parameters also comply with the 2005 World Health Organisation (WHO) guidelines but not with the slightly more stringent 2021 WHO guidelines.

6.1.4 Topography

The terrain along the proposed road alignment is highly complex and has a diverse topography. It combines fold, coulisse-shaped and linearly stretched mountain ranges, volcanic massifs, upland plateaus, intermountain concavities, and river valleys. Mountain slopes are intensively weathered (eroded) with steep slopes (35° and more) and fragmented by the Vorotan, Voghji and Geghi River Valleys. The Bargushat ridge (which will be traversed by the road section) is located on the hillside of the Zangezur Mountain Range and extends for 42 km amid the Vorotan and Voghji River Basins. Peaks reach over 3,000 m, particularly Aramazd – 3,392 m, Geghaqar - 3343 m and Tarkatar - 3277 m. Greater Ishkhanasar, located 9 km northeast of the village of Noravan, is the highest point of the Project region (3,549 m).

6.1.5 Geology

The starting (northern) section of the planned road alignment is characterized by volcanic rocks of the Greater Ishkhanasar volcanic massif: Upper Pliocene - Eo-pleistocene period represented by basalt, andesite, dacite, rhyolite, obsidian, perlite, tuff-breccia, travertine (3.3-0.85 the absolute age in million years). There are numerous volcanic centres. The above-mentioned rocks are mainly covered with quaternary loose deposits: deluvial, proluvial, alluvial, eluvial colluvial. The bed and washout of the Vorotan River, as well as the terraces are lacustrine, fluvial proluvial and slope deposits of Upper pliocene - pleistocene age (3.3-0.01 the absolute age in million years). Near the entrance to Kajaran southern section, gabbros, granodiorites, quartz diorites, monzonites, nephelinic syenites, leucogranites of Upper Eocene age (42-38 million years) also appear.

6.1.6 Geological Hazards and Processes

Soil erosion in the Project area is mainly due to anthropogenic causes, i.e., mining operations around Kajaran and Ajabaj village in the Geghi River basin, as well as the Loradzor River basin. The slopes surrounding Shenatagh village are subject to soil erosion due to the density of earth roads. Soils are highly erodible in the proposed road's southern section and perhaps to a slightly lesser degree on the northern side due to the fact that the slopes are less severe there. Erosion caused by livestock husbandry, uncontrolled establishment of earth roads, and use of fallow agricultural lands is observed on the slopes close to almost all settlements within the Project region. Avalanches are observed upstream the Voghji and Geghi Rivers, at altitudes of 1,400-3,400 m.

6.1.7 Seismicity

Armenia is divided into the three seismic zones with Zone 3 being the most seismically hazardous. The road alignment will run through the 1st (Sisian-Shenatagh section and Bargushat tunnel) and 2nd (Qirs-Kajaran section) seismic zones.

6.1.8 Landscape and Visual Amenity

The planned road passes through six vertical landscape zones: low and middle mountain below forest level, low and middle mountain forest, middle mountain steppe, middle mountain meadow steppe, high mountain subalpine, high mountain alpine

6.1.9 Soil Quality

The Project region has (a) Mountain-fulvous soils of dry steppes, (b) Brown mountainous-forest soils of dry forests and bushes, (c) Subalpine mountain-meadow brown soils, (d) Mountainous-forest steppe soils, and (e) Alpine mountain-meadow turf-peat soils. The content of Cr, Co, Ni, Cu, Zn and As in soil sampled from 10 locations along the planned road alignment are above the Admissible Concentration Limits set by the national sanitary rules

and norms. The Project region and specially the Qirs-Kajaran area is rich in metallic deposits, so the high concentrations of heavy metals in soil samples can be explained by natural geological processes and are not considered to have been caused anthropogenically.

6.1.10 Noise and Vibration

The Project area is predominantly rural with local noise sources including old, poorly maintained agricultural vehicles, machinery and other traffic, exacerbated at night. Baseline noise and vibration measurements taken at sensitive receptors (residential houses, schools, shops, churches, museums or other buildings) that could be affected by the proposed Project, indicates exceedances¹⁰ of the Armenian standards¹¹. Baseline vibration measurements were also conducted close to the nearest industrial units, mostly small hydropower plants as the only sources of vibration from industrial activities. These measurements demonstrated that baseline vibration levels within the Sisian-Shenatagh section of the road, with some exceptions, are mostly below the national limit values.

6.1.11 Surface Water

The proposed road alignment passes through the Vorotan, Loradzor (Shenatagh), Karut, Geghi and Voghji River valleys and crosses the Rivers Vorotan, Loradzor, Karut, and Geghi and a number of their tributaries including the Noravan, Vaghatin and Aghbashget. These rivers are typically mountainous, steep and fast flowing, with narrow riverbeds in places. There are two reservoirs located close to the proposed road: Shamb and Geghi reservoirs. The Shamb reservoir is fed by the Vorotan River and has a total capacity is 13.6 mln.m³, while Geghi reservoir with a capacity 15 mln.m³ is located on the Geghi River. The surface water quality in the Rivers mostly meets the criteria for the 1st (excellent) and 2nd (good) classes as per Armenian classification system. The concentrations of Li, V, Mn, Mo and Sb in some samples from the Vorotan and Geghi Rivers is relatively high (representative of bad and poor classes) but is assumed to be due to abundant ore deposits in the area.

6.1.12 Ground Water

Groundwater occurs in the weathering crust of various rocks and deep cracks, as well as in the pores of alluvial-proluvial formations along riverbeds. A groundwater reserve of 429 mln.m³/year exists for the Vorotan River and 185.1 mln.m³/year for the Voghji River Basin, according to the multi-year average values. The major springs are spread in the Vorotan River valley and slopes of the Syunik volcanic plateau, in the upper and middle reaches of the Voghji and Geghi Rivers. Of the 16 registered springs in Syunik Region (so-called "water springs of national significance") two are located within the administrative boundaries of Project-affected settlements: "Vorotan" and "Sevjur" springs at the distance of 1,000 m and 800 m from the planned road alignment, respectively. Almost all the villages in the northern (Sisian-Shenatagh) section of the proposed road alignment have at least 1 or 2 springs of local significance. Most of these springs occur along the existing roads, are marked by cross-stones and are considered by local people as spiritual sites.

6.2 Biodiversity and Nature Conservation

The biodiversity baseline analysis was based on an extensive literature review, consultations with national and local stakeholders, site surveys undertaken over four seasons in 2021 and 2022 and fieldwork data gathering, including camera-trapping in key locations. Surveys were conducted over a year, for 16-17 days per season, to cover the variety of ecological cycles of different target species.

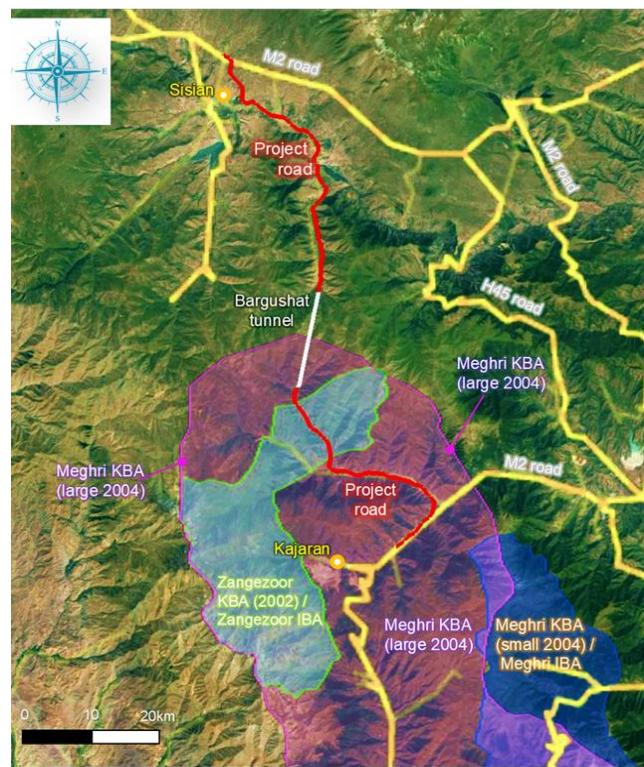
¹⁰ This should be re-confirmed prior to the Project implementation.

¹¹ Armenian standards are applied where they are more stringent than the EU or WHO standards.

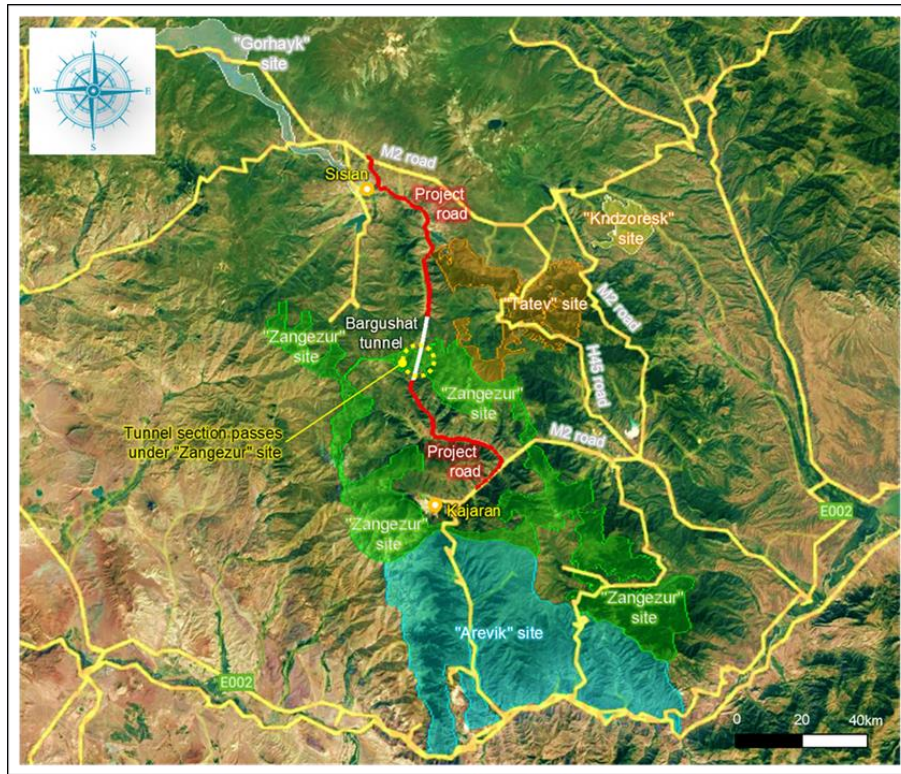
The proposed Project lies within the East Lesser Caucasus, a natural area critical for several threatened and/or endemic species. The Project region is also rich in specially protected areas (SPAs). These SPAs are Arevik National Park, Shikahogh State Reserve, and Zangezur, Khustup, Plane Grove, Boghaqar, and Sev Lich sanctuaries. In 2013 these SPAs were merged into the Zangezur Biosphere Complex SNCO, with total area of approximately 79 thousand hectares. The tunnel through the Bargushat ridge runs underneath the Zangezur Sanctuary with the tunnel's entry and exit portals being located outside the Sanctuary (**Figure 4 a**). There are flora and fauna species listed in the IUCN Red List and Armenia Red Book recorded in the Project Area.



a)



b)



c)

Source: Prepared by the Consultant.

Figure 4. Important Areas for Biodiversity in the Vicinity of the Road Project (a. National SPAs, b. KBAs/IBAs, c. Emerald Network Sites)

Armenia has not officially adopted Emerald Network sites. However, 23 sites situated in the RA territory have been nominated as *candidate* Emerald Sites. Of these, six are in Syunik Region. The proposed tunnel passes under the Bargushat ridge which is partly included in the Zangezur Emerald Network Site (Site Code AM0000015). In addition, the planned road section near Darbas settlement runs close to the nominated Tatev Emerald Site (Site Code AM0000016).

There are also Important Bird Areas (IBAs) and Key Biodiversity Areas (KBAs) in the Project area. In particular, the Qirs-Geghi section of the proposed road runs through Zangezur IBA and KBA. The Zangezur IBA occupies 23,236 ha and is characterized by artificial/terrestrial, forest, grassland and rocky habitats. There are five bird species for which the area has been categorised as an IBA: *Tetraogallus caspius*, *Lyrurus mlokosiewiczzi*, *Gypaetus barbatus*, *Neophron percnopterus*, and *Aquila chrysaetos*. The boundary of the Zangezur KBA exactly matches the Zangezur IBA. The biodiversity elements triggering KBA criteria for Zangezur KBA are the same five bird species.

The Project is about 4.5 km north-west of Meghri IBA also identified as Meghri KBA. It covers an area of 33,378 ha and 17 bird species trigger IBA and KBA criteria. A larger Meghri KBA, assessed in 2014 (123,647 ha) encompasses Zangezur IBA/KBA almost fully, approximately half of Meghri IBA's area, and a large part of Syunik Region, including the Project area. The species triggering the *larger* Meghri KBA criteria are *Capra aegagrus*, *Lutra lutra*, *Ovis orientalis*, *Testudo graeca* and *Lyrurus mlokosiewiczzi*.

The larger Meghri KBA is described in the CEPF Ecosystem Profile of the Caucasus Biodiversity Hotspot (East lesser Caucasus Hotspot). There are no management plans for the SPAs, KBAs and KBIs available, however it is known that the development of a management plan for the Zangezur Biosphere Complex has been initiated by the Ministry of Environment.

6.3 Socio-economic Environment

6.3.1 Demography

The proposed road will pass through Sisian and Kajaran Communities (municipalities) of Syunik Region in the south of Armenia. The population density of the region is 29.9 inhabitants/km², one of the lowest among the RA regions. The share of female population of Syunik Region (51.7%) is lower than the national average (52.8%). The rate of the region's working age population (66.7%) is higher than the national average (64.8%).

Sisian Community includes 36 settlements (including two towns - Sisian and Dastakert) with the total population of around 31,620 residents. The urban population is about 52% of the total population. Between 2019 and 2022 population growth rate was -2.3% due to low birth rate combined with high migration (both domestic and international). The gender structure of the community is almost balanced: women and men make up 49.4% and 50.6% of the population, respectively. The working age population is 63.9% of the total, of which 47.8 % are women.

Kajaran Community includes 22 settlements with one town – Kajaran. The total population is 8,945 residents with 8,567 people (96%) living in Kajaran town and only 378 in rural settlements. Between 2019 and 2022, the community's population grew by around 7.6%, due to the operation of the Zangezur Copper-Molybdenum Integrated Plant (Combine), one of the largest employers in the country. Women and men make up 53.4% and 46.6% of the population, respectively. The working age population is 56.4% of the total, of which 49.2 % are women.

Only 414 ethnic minority residents are in Syunik Region (0.3% of the total region's population), of whom 259 declare themselves as Russians (2011 Census). The Project-affected settlements of both Sisian and Kajaran Communities are almost exclusively inhabited by Armenians, and the communication language within the settlements is Armenian.

6.3.2 Economy and Employment

The key industries of Sisian Community are electricity generation (based on hydropower capacities), food production (dairy production, mineral water bottling) and non-metallic ore mining and construction materials production.

Agriculture is an important economic activity for Sisian Community: 80% of population are engaged in it. The main crops raised in the community are wheat, barley, potatoes, cabbage, and other vegetable crops. The livestock farms of the community have in total 35,500 heads of large and small cattle; bee breeding is also developed in the area (with around 15,000 bee colonies raised).

Kajaran Community's economy is dominated by industry with employs majority of local population. Kajaran town hosts the country's largest mining industry centre. There are also other industrial (production of explosives) and service (cargo transportation, maintenance of mining machinery) businesses associated with the mining facility. In addition, there are five small HPPs are located within Lernadzor administrative area of the community. Agriculture is not well developed in Kajaran Community. For example, the total livestock herd was only 3,127 heads and there were only 1,639 bee colonies in the community.

In Project-affected settlements of both communities, the majority of population is engaged in agriculture. The other employers are public utility / services operators, retail trade, and public institutions such as schools, kindergartens, and health institutions. In some villages of Sisian Community relatively large number of men are employed by the as armed forces.

6.3.3 Unemployment¹², Poverty, and Vulnerable Groups

For Sisian Community the unemployment rate is around 23%, which is much higher than the regional (13.1%) and national (18.2%) rates. The unemployment rate in the Kajaran Community is lower (around 13%) and corresponds to the regional rate. In both communities the majority of the registered unemployed are women due to limited employment opportunities for women in urban settlements.

The poverty level in Syunik Region is one of the country's lowest: in 2019, the region's poverty rate was 12.1%, while the national average rate was 26.4%. In Sisian Community 755 households (out of 3,020 in total) benefit from the state social support programme targeting people whose income is below the poverty level. In Kajaran Community there are only 58 households (out of 2,081 in total) of this type. 90 households receive the government's social assistance in the Project-affected rural settlements. The incomes of socially vulnerable households are mainly made up from retirement benefits, social assistance, and sales of agricultural products, and rarely of salaries and profit from agricultural activities.

Vulnerable groups in the Project-affected communities include disabled persons, elderly single-pensioner households, multi-children families, and households with income below poverty line.

6.3.4 Infrastructure

Water. The local potable water supply is available in all settlements. As reported by residents of Project-affected villages drinking water pipelines in almost all settlements were old and require rehabilitation. Residents of several villages complained about on drinking water quality from the centralised water supply systems especially during the periods of heavy rains. Some of the settlements have also local water discharge systems, which also require reconstruction.

Waste. There are two authorized municipal landfills in Syunik Region: the first one is located in the vicinities of Sisian Town, the second is within in Syunik rural settlement, Kapan Community.

Power. Syunik Region has hydropower capacities: three large hydropower plants (HPPs) comprising Vorotan cascade as well as around 50 small HPPs provide jointly around 9.3% of the country's energy generation and distribution output. Two HPPs are located at the reservoirs in the vicinity of the to the proposed road. All Project-affected settlements are connected to the power supply network. The accidental power cuts that periodically occur in the region, primarily in rural areas, are explained by poor condition of power distribution facilities (transmission lines and substations).

Natural gas is available in some settlements of the region mainly towns and large rural settlements; some villages of the region, including Project-affected villages are not connected to the gas distribution network.

Roads. The M2 interstate road, which is the key national transit corridor, is passing through Syunik Region and the affected municipalities, however it cannot currently serve its purpose. Due to mountainous landscape, the length of the regional road network is relatively low. The road network in Kajaran Community is less developed that in Sisian Community. Some Project-affected settlements have only one road connecting them with the outer world. The existing road network of the Project-affected settlements includes paved roads in good condition with some sections recently rehabilitated (M2 interstate road and T-8-10 "Aghitu-Noravan-H60" road). The road pavement of inter-community road H-60 "M2-Vaghatin-

¹² In Armenia, the unemployment rate estimates cover only urban population as rural population is considered as engaged in production or subsistence agriculture if not employed in public or private sector.

Shenatagh” is generally satisfactory; however, some sections do require rehabilitation. Intra-settlement roads are earth roads and require upgrade.

Healthcare. There are civil healthcare centres in Sisian and Kajaran and a Kapan Healthcare Centre in the regional capital, which provide outpatient as well as primary care and emergency medical services and include hospitals for 50, 20 and 85 beds respectively. Three rural settlements of Sisian Community host healthcare centres providing primary care and emergency medical services to the local population. In addition, midwifery (outpatient) stations operate in small villages of both communities. Some medical treatments (such as complicated surgeries) are unavailable in the region and are provided in Yerevan.

Education. There is one primary (tradesman school) and seven secondary vocational educational institutions in Syunik Region (with 300 attendees in total). Syunik Region hosts five higher education institutions. A branch of the Armenian National Agrarian University as well as a state college with economic/finance, nursery and agribusiness majors are located in Sisian Town. There is a technical school in Kajaran Town and no higher education institutions are in Kajaran community.

6.3.5 Land use and Land-based Livelihoods

In Project-affected settlements of Sisian Community agricultural lands occupies 84.9%¹³, forest lands 5.0%, and residential lands 1.6% of the total community’s land assets. There is a shortage of agricultural land in the area, especially within the administrative boundaries of Darbas, Shamb and Vorotnavan settlements and Sisian Town.

In Project-affected settlements of Kajaran Community agricultural lands constitute 64.5%, special protected areas - 14.4%, and forest lands 8.7% the total community’s land assets. Due to a low number of rural residents, no lack of agricultural lands is experienced in the area.

In both communities the croplands are both privately and community owned (rented to farmers). Perennial plantings are under private ownership, and the grazing lands are mainly community-owned and are used by the local villagers within their respective settlements.

In Sisian Community the croplands are mainly used for vegetable and melon farming, as well as for cultivating cereals. Residents of the Kajaran Community are mainly engaged in horticulture (fig, pears, apples, cherries, raspberries, blackberries are the key cultures) and cultivate vegetables.

The baseline analysis shows that most of the households in the Project-affected settlements performs farming activities (crop farming, animal husbandry, bee-keeping, vodka-making, gardening, etc.) and have at least one member employed in either private or public sector. The produced agricultural products are both sold and consumed internally, thus contributing to monetary and non-monetary incomes of the households.

6.3.6 Gender Issues and Women’s Concerns

The majority of the registered unemployed of the affected communities are women (67% of the unemployed of Sisian Community), and these are women living in urban settlements (see [Section 6.3.2](#) for details). The interviewed residents of rural Project-affected settlements stressed that there were less employment opportunities for women, who are mainly engaged in production or subsistence agriculture or employed by public services (schools, medical units, and kindergartens).

The largest concerns of the women from some of the Project-affected villages are the absence of natural gas supply and the absence or insufficient operation of sewage systems. In addition,

¹³ Not all lands designated as agricultural might be used for agricultural purposes due to local topography or other limitations.

all the interviewed rural women were concerned about the absence of a centralized heating in rural schools, and limited afterschool activities and infrastructure for children.

6.3.7 Cultural Heritage

Syunik Region hosts numerous important historical and cultural heritage sites as well as natural heritage sites and intangible heritage features.

The most famous **tangible cultural heritage** units of the region are ancient monasteries (Tatev Monastery, Voroṭnavank Monastery, Vahanavank Monastery), Zorats Qarer ('the Armenian Stonehenge'), the medieval cave-dwellings of Khndzoresk. The important **natural heritage sites** include Sev Lich lake nature preserve and Shikahogh forest reserve. None of them are in proximity to the proposed road.

In total, 46 sites hosting 67 units of cultural, historical, archaeological, natural, paleontological, and spiritual importance are within 500m on both sides of the proposed road alignment and tentatively proposed SDA sites. These include caves, tomb fields, cemeteries, shrines, churches and monasteries, fortresses, units of archaeological, historical-cultural, and spiritual significance; fossils, sections of diatomite origin lacustrine sediment, raw-material source (units of geological significance), and natural heritage units.

Five **intangible heritage features** included into the UNESCO's Representative List of the Intangible Cultural Heritage of Humanity can be met in Syunik Region, namely: a) Armenian letter art and its cultural expressions, b) duduk (a national instrument) and its music; c) performance of the Armenian Epic of "Daredevils of Sassoun or 'David of Sassoun"; d) Armenian Cross-Stones ('khachkar) Art; and e) the preparation, meaning and appearance of traditional bread lavash. 15 intangible heritage values of national importance are widespread in Syunik Region, including elements of cuisine, local holidays/rituals, a musical instrument, and traditional carpet weaving.

6.3.8 Tourism and Recreation

The flow of tourists to Sisian Community is currently concentrated in Sisian town, which is close to several famous points of historical and cultural value (e.g., the Zorats Qarer, megalithic settlement of Uyts, the rock paintings of Ukhtasa) and few villages around the Voroṭnavank Monastery and Voroṭnaberd fortress. There are hotels and guest-houses providing accommodation services to visitors at these settlements.

Although there are some touristic spots near the affected settlements of Kajaran Community, tourism is not developed there. The tourist flow is very limited and no households practice hosting tourists as a business activity. Overall, Syunik Region, especially its southern part, is known by scenic landscapes with forested mountains intersected by large, deep gorges of rivers (see **Figure 5**, **Figure 6**), which might be attractive for eco-tourists.



Source: photo taken by the Consultant

Figure 5. Landscape of the valley of Vorotan River, view from Vorotnavank Monastery (km 11+900), the road alignment shall pass along the left slope



Source: photo taken by the Consultant

Figure 6. Landscape in the southern part of the road alignment after Karut village

7 SUMMARY OF THE POTENTIAL E&S IMPACTS / RISKS AND MITIGATION

7.1 Approach to Impact Assessment, Mitigation and Management

The methodology for assessing the significance of impacts is provided in Section 5.5 of ESIA Volume 1. *Impact significance* is determined as a function of a receptor's *sensitivity* to the Project's pressure and the *impact magnitude* (extent of change to the natural or social environment), which is determined by its spatial extent, duration, potential to occur, and reversibility of expected changes. Assigning impact significance relies on reasoned argument, thresholds (where available), professional judgement and consideration of views of stakeholders (where provided). The key significance categories used within the ESIA are

major, moderate, minor, and negligible; significance grades were determined for both positive impacts and negative impacts.

Wherever the Project is likely to result in unacceptable negative environmental and/or social impacts, mitigation measures are proposed to avoid or reduce these impacts. For positive impacts, additional measures are also suggested to enhance the benefits or make them more sustainable. Where mitigation measures have been predicted to be required, the significance of the impact is rated before and after the proposed mitigation to indicate the residual impact significance after implementation. The mitigation and enhancement measures are brought together into an ESMP for the Project, and the appointed Contractor will further develop specific and thematic construction Management Plans based on the ESMP to effectively manage construction's E&S risks and impacts. In addition, as some components of the Project such as spoil disposal areas, construction camps, lay-down sites, and power and water supply, have not yet been fully defined additional actions have been included in the Project's Environmental and Social Action Plan (ESAP), for the Project to achieve full compliance with Lenders' requirements.

7.2 Impact Assessment and Mitigation

A high-level summary of E&S risks and impacts, recommended mitigation (or enhancement), and residual (i.e., 'post-mitigation') significance ratings are provided in the below sections.

7.2.1 Impacts on Physical Environment

The identified impacts during the **construction phase** include:

- **Air quality impacts** are predicted to derive principally from dust emissions, and PM₁₀ in particular. Modelled ambient air quality concentrations in the Project area during the construction phase mostly comply with Armenian and European Union air quality standards, with some localized areas predicted to exceed the standards, resulting in **moderate** impact significance. Dust control measures including water spraying, speed restrictions and the possible use of a chemical binder during construction are expected to reduce the residual impact significance to **minor**.
- Insignificant amount of **greenhouse gases** is expected to be generated over the six years of construction, compared to the national greenhouse gases emissions. Preliminarily **minor** residual impacts are predicted; detailed calculations will be conducted after the traffic study (ongoing as of summer 2023) would be completed.
- **Noise impacts** from construction activities are predicted to exceed the Armenian daytime standards along virtually the entire length of the road alignment, up to 900m from the roadway. A similar pattern is seen for night-time activities (exclusively tunnel construction). The impact is thus assessed as of **major** significance. There are multiple interventions that can be applied to mitigate construction noise such as limiting construction times, maintaining machinery and equipment, and using temporary noise barricades, thereby ensuring that the residual noise impact significance is reduced to **moderate**.
- **Vibration impacts** are principally caused by blasting, which generates high energy vibration that can cause damage to physical structures in the vibration wave. Smaller vibration sources are construction machinery and construction activities (compaction, drilling). Modelling of potential vibration impacts has indicated that multiple heritage structures (as a worst-case scenario) could be damaged by blasting activities thus potentially causing impact significance of **major**. Conducting a test blast and thereafter performing a well-designed blasting program using the lessons learned from the test blast is expected to effectively mitigate the risk and reduce residual impact significance to **minor**.
- **Potential surface water impacts** for the Project include a) uncontrolled runoff changing the hydraulic properties of the surface water systems, and b) possible contamination of surface water due to intensification of soil erosion, onset of dust and

exhaust emissions, accidental spillages/spills of hazardous materials and tunnel wastewater. The impact significance is likely to be **moderate**. Surface water runoff would need to be planned and managed, and precaution measures will be taken when constructing bridges over rivers to keep the residual risk significance at **negligible**.

- **Groundwater impacts** could occur during **construction** through the same processes as defined above for surface water. The impact significance is accordingly considered **moderate**. Proper characterization of the groundwater likely to enter the tunnels would provide an understanding of risks of such contamination and the development of effective treatment if required, reducing the residual impact significance to **moderate to minor**.
- **Construction waste impacts** pose various risks including leaching and possible infiltration of hazardous materials into groundwater. This is especially true of excess spoil from the tunnel construction where the need to identify additional disposal capacity renders an impact significance of **moderate**. The impact from disposal of domestic waste would be **minor**. Effective waste characterization prior to it being generated, including a separation of hazardous and non-hazardous waste, further segregation into non-recyclable and recyclable and providing for safe disposal options, and the expansion of SDAs, would see the residual significance of impacts from disposal of excess spoil and domestic waste reduced to no more than **minor**.

The identified impacts during **road operations** include:

- **Air quality impacts** will derive from vehicle exhaust emissions during the **operation of the road** resulting in **reductions in ambient air quality** on both sides of the road. Modelled ambient concentrations of nitrogen dioxide (NO₂) and carbon monoxide (CO) comply with the European Union standards under all projected traffic flows. However due to high sensitivity of human receptors, an impact significance is seen as **moderate**. The Project's mitigation, such as maintenance of roadside vegetation, and efforts by the RA Government and the RD to phase out older vehicles will see emissions reductions resulting in a residual impact significance of **minor**.
- **Greenhouse gases** will be emitted as components of vehicle exhaust gases during the operation phase. The GHG estimate has been completed for 2029, the first year of road operations, based on 2016 traffic study; it will be revisited after the new traffic study (ongoing as of summer 2023) would be completed. **Moderate** residual impacts are preliminarily predicted.
- **Traffic noise impacts during operations** were modelled indicating exceedances of human health-based noise thresholds defined by the WHO and exceedances of the Armenian noise standard wherever the roadway is within 900m of settlements. That effect is exacerbated for the 2048 projected road fleet leading to an impact significance of **major**. There are several options for mitigating these impacts, including the use of noise barriers which were shown in the assessment to be capable of reducing the sound pressure levels to comply with the Armenian noise standards. The residual impact significance can accordingly be reduced to **moderate**.
- **Geohazard-related risks** exist due to the mountainous terrain and the harsh climate (heavy rains, snowfalls, etc.) through which the road alignment passes. **Geohazards**, such as mudflows, landslides or snow avalanches, if they extend to the road, could cause significant injuries and death to road users and damage rivers and soil with impact significance of **major**. As the extent of likely geohazard impacts is not fully understood, detailed 3D modelling will be used to enable a further analysis of geohazard risks along the road alignment. This will inform the identification of additional required mitigation measures, that may include revisions to the roadway design, e.g., the construction of slope drainage systems. It is assumed that the implementation of such mitigation measures would reduce the residual impact significance to **minor**.
- **Potential surface water impacts during operations** are also predicted to result from unmanaged surface runoff together with the risk of contamination of that runoff from

hydrocarbon-based materials deposited on the roadway or released during accidents. The impact significance is seen as **minor** assuming the appropriate design solutions to control the above impacts are in place, but mitigation is nonetheless required in the form of avoiding the use of hazardous materials (such as de-icing fluids), rapid clean-up of spilled materials in the event of accidental releases and regular maintenance of culverts and drains. The residual impact then will be **negligible**.

- **Operational groundwater quality impacts** could occur during **operations** through possible contamination risk as a result of hazardous materials being spilled during motor vehicle accidents and percolating through to groundwater. Because the groundwater properties are not well defined, an impact significance of at least **moderate** is postulated due to uncertainties in groundwater vulnerability. A good understanding of the groundwater regime highlighting key potential vulnerabilities together with rapid deployment of counter-measures in the event of an accidental spill on the roadway would reduce the residual impact significance to **minor**.
- **Waste impacts during road operations** on surface and groundwater resources will result from large volumes of typical municipal solid waste due to littering and vehicles accidents causing an impact risk of **minor** (provided that there is effective cleanup and waste removal and disposal in place). The key to reducing this risk is for the RD to develop and implement an operations **Waste Management Plan** detailing waste characterisation, accounting and management of segregated waste and in so doing reduce residual impact significance to **negligible**.
- **Operational landscape impacts** will result from major permanent changes to the **landscape** through which the road passes potentially impacting on the user experience at the cultural heritage structure and cultural landscapes in general. The proximity of the proposed road alignment to the Voroṭnavank monastery (the new road will be 100 m closer than the old road, with a major cutting in the hillside) will disrupt the view from the monastery down the valley rendering a **major** impact significance specifically for the Voroṭnavank viewshed. For the remaining affected landscape visual amenity changes are seen as **moderate**. Landscaping can be used to mitigate the visual impacts at the other parts of the road alignment to **minor**; in the case of Voroṭnavank a change in alignment is required to reduce the residual impact significance to **moderate**.

7.2.2 Impacts on Biodiversity

The identified impacts during the **construction phase** include:

- **Impacts on priority biodiversity features and species and habitats triggering critical habitat** will be direct, that is associated with habitat degradation and inevitable habitat loss, species disturbance, potential mortality, and loss of connectivity, as well as possible accidental pollution. Indirect impacts will arise from habitat fragmentation and the increasing presence of people and related activities in previously remote areas (edge effect increase). The negative impact can be **major**, however with the application of avoidance and reduction measures, the residual impacts on these habitats and species are expected to be **moderate**. Implementation of the prepared Biodiversity Action Plan, with further compensation and offset measures, is expected to further reduce such impacts and achieve a **no net loss /net gain**.
- **Impacts on National protected areas, Emerald Network Sites, and IBAs/KBAs** can be negative **major**. The Project includes several road tunnels, which can be considered as significant avoidance measure, as they reduce possible interferences with important areas for biodiversity by passing below them. In particular, Bargushat tunnel will run underneath the Zangezour Sanctuary and Emerald Network Site, with the tunnel's entry and exit portals being located outside the Sanctuary. Further habitat restoration and mitigation measures will reduce potential **minor residual** impacts on habitats and species triggering the designation of these protected areas and Internationally Recognized Areas of Biodiversity Value. The completed Appropriate



Assessment shows that with the implementation of proposed mitigation measures, **none of the impacts will affect the integrity of the protected areas or internationally recognized areas of biodiversity.**

The identified impacts during the **operation phase** include:

- **Impacts on priority biodiversity features and species and habitats triggering critical habitat** during the road operation could arise directly from road traffic accidents and indirectly from pollution and increased accessibility to habitats (which will be more open to impacts) and can be **major**. After implementation of mitigation measures such residual impacts will be reduced to an acceptable **minor** level and further offsets and additional conservation measures, including the operation-stage Biodiversity Action Plan, will support the achievement of **a no net loss /net gain**.
- **Impacts on ecosystem services** – The most affected ecosystem services by the road construction and operation are expected to be on land use and agricultural activities (provisioning service: agriculture and livestock), erosion control (regulation services) and tangible cultural heritage (cultural services). Such impacts are viewed as **minor to moderate**. Provided that the mitigation measures are implemented and delivered effectively, the residual impacts on these ecosystem services would be **minor** at the scale of the project.
- **Impacts on National protected areas, Emerald Network Sites, and IBAs/KBAs** – The construction and operation of the road will result in **moderate** impacts from potential pollution and increased access to natural and species' habitats but do not have the potential to undermine the conservation objectives or the integrity of the protected areas and Internationally Recognized Areas of Biodiversity Value. Given the proposed mitigation, of which particularly the avoidance of the Zangezour sanctuary and tentative Emerald site through the set-up of the road in a tunnel, residual impacts are expected to be **minor**.

7.2.3 Socio-economic and Cultural Impacts

The identified impacts during the **construction phase** include:

- **Positive impacts on economy** are expected as the Construction Contractor will procure a range of raw materials, various products, equipment, and services for the Project needs and increase the demand for them at various markets. The impact significance is assumed to be **negligible at the national level, minor at the regional level, and moderate at the municipal level**. A **Procurement Plan** will be developed to maximise the positive impacts and prioritise procurement within Sisian and Kajaran municipalities (as possible). Residual beneficial impacts on the product / service markets are expected to be **minor at the national level, moderate at the regional level, and major at the municipal level**.
- **Positive impacts of the Project will relate to taxes and other payments** made to the state budgets being **negligible at the national level and minor at the municipal level**. The **Procurement Plan** will help channel the taxes/other payments to the municipal levels and the residual impacts would be **moderate at the municipal level and negligible at the national level**.
- **Positive impact on employment and labour markets** is predicted as the Client and Construction Contractor are expected to hire managers, engineers, and skilled (e.g., technicians, surveyors), semi-skilled (e.g., bulldozer drivers, security guards) and unskilled workers (e.g., earthworks workers). The Project will also trigger new vacancies among Project's suppliers and contractors. The combined impact would be **negligible at the national, minor at the regional, and moderate at the municipal and local employment labour markets**. A Recruitment Policy and a Construction Phase Recruitment Plan would prioritise and provide for the employment of people living in Project-affected municipalities and villages, subject to their qualification. The

residual beneficial impact is seen as **major at the local and municipal levels, negligible at the national level, minor at the regional level.**

- **The Project will trigger land acquisition and affect local land use agricultural livelihoods.** In total, 570 land plots with the total area of about 2,9 sq.km need to be acquired including 276 land plots (12.2% of the acquired land area) owned/used by private persons, and the rest is owned by the state and Sisian and Kajaran municipalities (communities). 276 privately owned/used affected plots include 236 agricultural, 34 residential and 6 land plots of other land use categories. The resettlement affects 2 residential and 9 non-residential structures, 6,895 fruit trees on 135 plots, and 45,352.84m² of crops on 34 land plots. Only 1.67% of community land used as pastures will be affected. The impact is assumed to be **major**. The **Resettlement Framework** defined compensation and livelihood restoration entitlement principles, which will be detailed in the Resettlement Plan. The forthcoming Traffic Management Plan and site-specific E&S Management Plans would propose alternative access, where needed, based on consultations with land users and local authorities. The residual adverse impact on land use and agricultural livelihoods would be **minor to moderate**.
- **Negative impact of the Project on activities related to use of the natural resources** (gathering (non)forest products, fishing, hunting, recreational use of forests and rivers) is predicted to be **negligible** due to possible short-term restricted access to rivers and forests on very few sections of the proposed road. With alternative access provided, the residual impact will remain **negligible**.
- **Negative impacts of the Project on public utilities and services** are predicted due to additional pressure on healthcare facilities, regional waste disposal and power supply systems. The impact significance would vary from **minor** (for power supply and waste disposal facilities) to **moderate** (for healthcare facilities). Medical units operating round-the-clock at construction camps will reduce **residual impact** on the regional healthcare system to **minor**. A Waste Management Plan will be implemented reducing the residual impact on waste disposal facilities to **negligible**. No impact on local water and sanitation systems is expected; load of Project's household wastewater at the regional wastewater treatment facilities would be **negligible**.
- Additional pressure on the road infrastructure, resulting in **deterioration of road physical structures and operational parameters of the affected roads**, is linked to transportation of construction materials, machinery, and equipment by heavy vehicles; the expected impact significance is **moderate** during the most part of the construction phase and **major** during short periods of delivering construction machinery, materials and equipment to specific construction sites. The Construction Traffic Management Plan will be developed based on road safety audit and condition survey and implemented to reduce adverse impacts to **negligible**.
- The Project will interfere with **existing infrastructure** falling within its footprint, such as gas and irrigation water pipelines, transmission lines and underground cables implying **moderate** impact significance. A Utilities Protection and Relocation Plan will be developed and implemented to reduce the residual impacts on existing infrastructure to **negligible**.
- The Project construction transport may affect **social facilities located along the existing roads**) due to vibration from movements of heavy vehicles or impeded access to them if some road sections are to be upgraded to host heavy vehicles. It should be noted that schools, churches, a monastery, a hospital, and a stadium are located along the existing roads of the Project-affected settlements that can be potentially used for Project-related construction transport. At the same time, no social infrastructure facilities were identified within 100 m on either side of the proposed road and its service roads. It is currently not known which roads of Syunik Region would be used for Project transportation, and impact significance is tentatively predicted as **moderate**. Mapping of sensitive social infrastructure (in particular, schools,



kindergartens, and healthcare facilities) and cultural heritage sites (churches and cemeteries, monuments) located along the existing roads will inform the Construction Traffic Management Plan, which will *inter alia* ensure presence of adequate signage on speed limits or other specific warning signs at sensitive locations. The delivery of the plan will help reduce the residual impact to **minor to negligible**.

- **Project-related risks to public health, safety and security** may relate to risks of traffic accidents involving local population and Project transport, communicable diseases brought in by in-coming workers, and risks related to possible trespassing the construction sites (and response by the onsite security staff). The risks of traffic accidents and communicable diseases are **moderate**, and risks related to Project security provisions are of **minor** significance. Mitigation measures, including management of construction traffic and worker camps and implementation of a Community and Occupational Health and Safety Plan, will reduce the residual risks to public health and safety to **minor**. Additional security arrangements (e.g., fencing and access controls at the construction sites) and community safety briefings would make the residual public health risk due to trespassing **negligible**. Potential emergency situations at the construction sites would not affect the local communities.
- **Impacts on occupational health and safety (OHS)** are possible at construction sites due to physical hazards (e.g., operating machinery and moving vehicles, working at elevation on bridges and overpasses, and in tunnels), chemical hazards (including dust, emissions, asphalt fumes) and increased noise levels. The OHS risks related to physical hazards and communicable diseases are **moderate**, risks of exposure to high levels of air pollution – **major**, and risks of climate stress – **minor**. Appropriate mitigations are proposed to control hazards and the Community and Occupational Health and Safety Plan will be delivered to reduce the negative residual OHS risks to **minor**.
- **Project's gender-specific impacts** can be both positive and negative. Positive impacts relate to increased direct and indirect women employment opportunities, as well as with women entrepreneurship opportunities linked to influx of Project labour force, such as catering, canteens, cafés, barber-shops, accommodation (hotel, guesthouse, or apartment renting), agricultural products sales. The significance of pertinent gender-specific impact related to women employment opportunities would be **negligible (at the regional level) and minor (at the local and municipal levels)**. The significance of gender-specific impact related to women entrepreneurship opportunities would be **minor**. Measures are proposed to increase and prioritise employment of local women, especially in vulnerable situations, build entrepreneurship capacities via trainings, etc. This would increase the residual beneficial impact linked to additional women employment opportunities to **minor to moderate**. In turn, impact linked to women entrepreneurship opportunities would remain **minor** (and potentially change to **moderate** in the medium-term). Risks of Gender-Based Violence and Harassment (GBVH) may occur among workers, community members and service users being of **minor** significance. A range of preventive measures including e.g., a Worker Code of Conduct and trainings would reduce the residual GBVH risks to **minor to negligible**.
- **Impacts on tangible cultural heritage (CH)** (potential physical damage to identified and undiscovered CH items and restricted access to the known CH sites) is predicted due to construction activities, such as topsoil clearing, earth works, blasting at some locations and others. The expected impact significance varies from **minor to moderate and major** depending on specific sensitivity values for affected CHs and impact magnitude. Site-specific mitigation, such as micro-siting of the road elements, fencing, demarcation, and relocation of cultural heritage unit, is developed in the ESIA. This mitigation will be converted into a detailed **Cultural Heritage Management Plan**, the implementation of which by qualified experts will reduce residual impact to **minor**.

- **No adverse impacts on intangible cultural heritage features** that are registered in the national list of values and the UNESCO representative list are expected. One spring monument in Vaghatin administrative area that is regarded by some locals as important and used as a rest area will be affected; mitigation is envisioned and this impact is seen as **negligible**.

The identified impacts/risks during the **operation phase** include:

- **Positive impacts on the road Infrastructure** include expansion and improvement of the regional road network due to construction of the new modern roads and upgrade of some existing roads. The impact would be **major at the local level, moderate at the municipal level** and **minor at the regional level**.
- **The Project will improve conditions for regional economic development** via a) better connectivity of Syunik Region and accessibility from other parts of the country, b) improved conditions for development of tourism and recreation in Sisian and Kajaran Communities and the region, and c) development of roadside businesses. The impact would be **minor at the regional level and moderate at the municipal level**.
- **Positive impacts related to Project procurement of goods and services** would continue during the operation phase and be associated with routine, periodic, and accidental road maintenance works being **negligible at the national and regional levels and minor at the municipal level** both before and after proposed mitigations applied.
- **Positive impacts will derive from taxes and other payments to the budgets** due to road operation and maintenance activities being **negligible at the national level and minor at the municipal level** both before and after proposed mitigations applied.
- **Positive impact of the Project-related job creation on employment and labour markets** will be limited to direct operational and maintenance jobs and indirect or induced jobs (e.g., opening and/or expansion of the roadside businesses); impact significance (both before and after proposed mitigations applied) is viewed as **moderate at the municipal and local levels and negligible at the national and regional levels**.
- **No negative impacts on land, land-based livelihoods and use of natural resources** are expected during the road operation. No land take is needed. Impacts on agricultural livelihoods would be prevented by constructed underpasses for cattle and agricultural vehicles. Operational road would not affect local nature resource practices.
- **Negative negligible impacts on the public utilities and services** are expected as the Project operations will require power supply, waste disposal, and wastewater treatment, and health care for staff. As the Project road largely bypasses the villages, traffic intensity at the internal roads of the settlements would not increase, and may decrease, and operational traffic-related risks to **social infrastructure facilities** in the Project-affected settlements would be also **negligible**.
- **Positive moderate impact on road safety** is expected due to reduced intensity of traffic within the residential areas and, therefore, the reduced number of traffic accidents and related public safety risks. Special safety programmes for the local settlements, focused on school children and farmers are recommended implying the **moderate** residual impact.
- **Risks to public health, safety and security** are limited to a risk of traffic accidents and a risk of emergencies, which may be caused by a physical failure of the road infrastructure and vehicles or unsafe behavior of road users (all being of **moderate significance**). The road would be constructed to meet modern safety standards. Given the applied mitigation, residual operational risks would be **minor**.

- **Negative moderate impacts on the OHS** would be caused by workers' involvement to the road and infrastructure operation, maintenance, and repair works; if mitigations, similar to those developed for the construction-phase impacts, are effectively implemented, the residual OHS impacts would be **minor**.
- **Positive gender-specific impacts** are expected at this stage including the new women employment and entrepreneurship opportunities in food markets, cafés, restaurants, hotels, and potentially in agro-tourism and eco-tourism businesses. The impact on women employment would be **negligible** at the regional level, **minor** at the municipal and local levels (and potentially increase to **moderate** for local women from vulnerable households). The impact on women entrepreneurship opportunities would be **minor**. The knock-on effect of both impacts would be increased welfare of women and their households. If proposed enhancement measures, which are the same as for construction, are applied, the residual impact on women employment opportunities would gradually become **moderate** at the municipal and local levels; the residual impact on women entrepreneurship **would remain minor** but **become** more sustainable over time.
- A risk of accidental damage of **cultural heritage during the maintenance** works would vary from **minor to moderate** as a function of specific sensitivity of affected CH resources and magnitudes of impact. It can be avoided or mitigated to **negligible**.
- **Positive impacts related to a potential revival of intangible cultural heritage** features is predicted in the settlements owing to the road operations and improved accessibility to the region. Local residents note that such traditions and practices as baking Lavash and Gata in tondir, crafting Dudik /playing Duduk music, hearing stories about Armenian cross-stones (Khachkars), carpet weaving, or mulberry vodka-making can revive and promote tourism. The impact can be **minor** (in the first years of road operation) **to moderate** (in the future), especially if supported by the cultural heritage authorities.

8 CUMULATIVE IMPACTS¹⁴

The E&S impacts of the Project were assessed in combination with potential E&S impacts resulting from other known projects or activities that were completed or are being or will be carried out in the Project area of influence in the near future. Several developments are planned to be constructed during the Project's construction phase and a number of potential cumulative impacts were identified as a result, as follows:

- Cumulatively, the planned developments are expected to result in a moderate positive impact on the local and municipal employment markets due to the generation of construction and operations jobs.
- Short-term cumulative risks of negligible to moderate significance are expected to public health resulting from combined construction air emissions and noise nuisance in the areas / corridors of the planned developments and at the settlements located along the routes that will be used by construction vehicles, as well as to public safety on these roads.
- Moderate cumulative pressure from various planned developments is possible on health care facilities in the area, especially in case of pandemics.

¹⁴ Cumulative impacts are E&S impacts that are the result of activities for implementation of the respective project in combination with other similar past, present or future activities within the observed area.

- Negligible cumulative impacts on biodiversity, including on critical habitats and species, are expected in some locations along the southern section of the Project road.
- Minor cumulative risk is predicted to worker safety during the construction stage due to the planned and/or concurrent projects.
- Negligible to moderate cumulative impacts on land resources, land use and agricultural activities are predicted in the Geghi and Lernadzor areas, and potentially in the planned power line buffer zones.
- Negligible to moderate cumulative impacts on soil are predicted in the Geghi and Lernadzor areas, and potentially in the power line routes.
- Moderate negative cumulative impacts on landscapes are predicted for the power lines and the Project together, whereas the re-cultivation of the old tailing facilities would positively transform the landscape (minor).
- Minor negative cumulative impacts on tangible cultural heritage might occur in the Geghi area and in the wider context – along the planned power lines, Project corridor and Kajaran-Agarak section.
- All planned developments are expected to result in minor-to-moderate positive cumulative impacts on the economy at the regional and municipal (including local) levels due to the taxes to be paid to state budgets, procurement opportunities, and development of small and medium enterprises, including opportunities for women.

Finally and importantly, the assessment predicts significant positive cumulative impacts on road users in terms of regional connectivity and road safety as a result of the realisation of the planned concurrent NSRC road projects (Sisian-Kajaran and Kajaran-Agarak). This can further contribute to potential cumulative support to the revival of intangible cultural heritage features in the region resulting in positive minor to moderate impact, and development of tourism.

Overall, possible cumulative impacts only slightly change (add to or deduct from) the residual significance of the Project impacts. No moderate or significant adverse cumulative impacts are expected. Tailored measures to mitigative negative cumulative impacts and to enhance positive cumulative impacts were developed and included in the **Project's ESMP**. The RD, as the Project Implementation Agency, will have overall responsibility for their implementation.

9 MONITORING ACTIONS

In accordance with Lenders' requirements, the Project's E&S performance will be continuously monitored during the construction and operation phases of the Project; to ensure compliance with the Project ESMP and other site/topic specific E&S management plans that will be prepared by the Contractor, the E&S Monitoring Plan, and that ESAP requirements are fulfilled. Appropriate human and material resources for their implementation will be allocated.

The Contractor will be responsible for conducting both observational and instrumental monitoring during the construction phase to ensure and demonstrate compliance with the requirements of the Management Plans and relevant legislation. For example: i) instrumental monitoring of air quality, water quality, noise, and vibration levels during the construction will be routinely carried out by the Contractor (or independent specialists hired by the Contractor); and ii) observational monitoring by the Contractor's environmental, social, health and safety, and cultural heritage specialists will be conducted to continually monitor that the correct approach is being taken to works on site. In addition, the Contractor will engage a biodiversity specialist who will specifically ensure and monitor the correct application of all biodiversity management and mitigation measures.

To ensure that all mitigation measures are being effectively implemented; according to the requirements of the ESIA (which includes the ESMP and E&S Management Plans), the Supervision Engineer will monitor the Contractor's actions throughout the Project Construction phase.

During operations, the E&S Monitoring Plan will be implemented by the RD. This plan will be agreed with the Lenders before the Project facilities are commissioned.

The RD will be required to report on the Project's E&S performance and progress against implementation of the ESAP, Stakeholder Engagement Plan (SEP) and other Project E&S Management Plans, to the Lenders at all stages of Project delivery.

10 STAKEHOLDER ENGAGEMENT AND GRIEVANCE MECHANISM

Stakeholder engagement on the Project started as early as March 2016, during the Project feasibility study and occurred as part of project development phases, namely during:

- The ADB-financed Project Feasibility Study and EIA process in 2016-2018.
- The ESIA process ongoing since April 2021:
 - ESIA Inception Stage Stakeholder Engagement (April - December 2021);
 - ESIA Scoping Stage disclosure and consultations (April -May 2022, **Figure 7**);
 - ESIA Socio-Economic Study (May - September 2022 and March – April 2023).
- Resettlement Planning:
 - Resettlement Framework Preparation (December 2021) and
 - Resettlement Plan Preparation (inventory and socio-economic survey in August – December 2022 with ongoing follow up).

Stakeholder engagement has been undertaken throughout the development of the ESIA. It was guided by a **preliminary Stakeholder Engagement Plan (SEP)**, which was prepared and disclosed as part of the Scoping Report¹⁵ in April 2022 to establish a framework for building and maintaining positive relations, and open and transparent two-way communication between the RD and stakeholders. During the ESIA process, from April 2021 to May 2023, up to 200 engagement events were held. Most were organised with support of the RD and regional, municipal, and local authorities. The engagement follows the requirements of the EBRD, EIB, and ADB and good international practice.

The preliminary SEP was further updated to include the engagement activities during the Project's **construction and operations stages**. The **updated SEP** forms part of the ESIA disclosure package and is prepared in compliance with requirement of national law, EBRD, EIB and ADB.

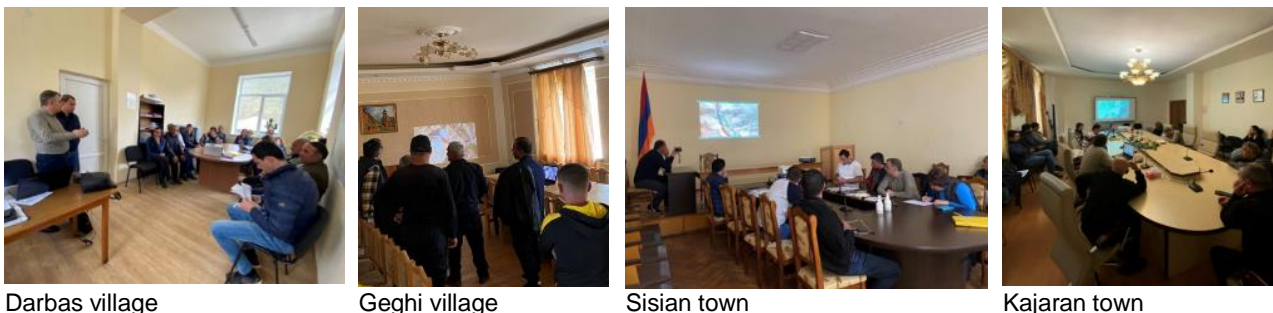


Figure 7. Photos of some ESIA scoping consultation meetings

¹⁵ https://armroad.am/en/news/inner/News_25.04.2022

Stakeholder engagement will continue in parallel with ESIA information disclosure, with the aim of continuing the facilitation of meaningful consultation and provision of information on the Project and its E&S implications (see the SEP for details). As per the SEP, the Project-related information and documents will be uploaded to the website of the RD at <https://armroad.am/en/safeguard/environmental-impact/el-reports> (English) and <https://armroad.am/am/safeguard/environmental-impact/el-reports> (Armenian).

The RD has set up a Project grievance mechanism for external stakeholders¹⁶ that complies with both, national and Lender requirements. Stakeholders can approach the RD via contact details provided below (Table 1) and available on the RD’s website (<https://armroad.am/en/contacts> or <https://armroad.am/am/contacts>). Details will also be posted on notice boards of Sisian and Kajaran Communities and affected Administrative Areas, and designated boards at construction sites, together with the contract details of the RD’s construction contractors. Once the Construction Contractor and Supervision Engineer are appointed, their contact details will be disclosed, so inquiries and grievances can be channelled to them as well. At a later stage additional contract persons on the Project would be Community Liaison Officers hired by the RD. All grievances and enquiries will be registered, reviewed, and responded per a procedure stipulated in the SEP.

Table 1. RD’s Contact Details for Raising Project-related Inquiries or Complaints

<p>Project-related inquiries and grievances can be sent to:</p>	<p>Mr Artur Sanoyan Project Manager for North-South Road Corridor Investment Project Tranches 2 and 4, "Road Department" Fund Government House 3, Republic Square, Yerevan 0010, Armenia artur.sanoyan@armroad.am office: +374 10 51-13-91 (269), mobile: +374 95 111 537</p>
<p>For general inquiries stakeholders can approach the RD using the contacts at its website (https://armroad.am/en/contacts)</p>	<p>"Road Department" Fund Government House 3, Republic Square, Yerevan 0010, Armenia +374 10 51-13-91 info@armroad.am</p>

The residents of the villages located along the proposed road can also submit their inquiries and complaints to the heads of their respective villages (namely, to representatives of Kajaran Community Head in Geghi and Lernadzor Administrative Areas, and to representatives of Sisian Community Head in Ishkhanasar, Aghitu, Noravan, Vaghatin, Vorotnavan, Darbas, Lor, Getatagh, and Shenatagh administrative areas). Any inquiries or concerns communicated to the local authorities (heads of villages or communities) will be immediately transmitted to the RD for review and redress.

The SEP also contains recommendations on the use of alternative methods of engagement with various stakeholders of the Project under unfavourable circumstances (e.g., pandemics).

¹⁶ A separate mechanism is developed to address worker grievances.