Updated Final – November 2019

Environmental Impact Assessment of Section F2 of the Khevi-Ubisa-Shorapani-Argveta Road (E60 Highway)
Republic of Georgia.

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Abbreviations and Acronyms

AADT	Annual Average Daily Traffic
AASHTO	American Association of State Highway and Transportation Officials
AM	Accountability Mechanism
ADB	Asian Development Bank
AST	Above Ground Storage Tank
AT	Argveta - Tbilisi
AQP	Air Quality Plan
BAP	Borrow Pit Action Plan
BAT	Best Available Technology
BGL	Below ground level
BoQ	Bill of Quantities
BOD	Biological Oxygen Demand
BRI	Bridge
CAREC	Central Asia Regional Economic Cooperation
CAP	Corrective action plan
ccTV	Closed Circuit TV
CFC	Chlorofluorocarbon
CIS	Commonwealth of Independent States
CO	Carbon monoxide
COD	Chemical Oxygen Demand
CO_2	Carbon Dioxide
Cr	Chromium
dBA	decibel
DD	Detailed Design
EA	Executing Agency
EAC	Environmental Assessment Code
EC	Electrical conductivity
EIA	Environmental Impact Assessment
EIB	European Investment Bank
EHS	Environmental Health and Safety
EMP	Environmental Management Plan
EM	Environment Manager
ERP	Emergency Response Plan
ES	Executive Summary
ESIA	Environmental and Social Impact Assessment
EU	European Union
EWH	East West Highway

EWHIPs	East West Highway Improvement Projects
FE	Iron
FS	Feasibility Study
GAA	Georgian American Alloys
GDP	Gross Domestic Product
GEOSTAT	National Statistics Office of Georgia
GEL	Georgian Lari
GHG	Greenhouse Gases
GoG	Government of Georgia
GOST	Technical Standard
GRM	Grievance Redress Mechanism
GRCE	Grievance Redress Committee
ha	Hectare
H&S	Health and Safety
HC	Hydrocarbon
HP	Horse Power
HZ	Hertz
IBA	Important Bird Area
IBC	Intermediate bulk storage containers
IFC	International Finance Corporation
IFI	International Finance Institutions
IEE	Initial Environmental Examination
IES	International Environmental Specialist
in/sec	Inch per second (25.4mm/sec)
IUCN	International Union for Conservation of Nature
km	Kilometer
km/h	Kilometers per Hour
Km^2	Square kilometer
LARP	Land Acquisition and Resettlement Plan
LC	Least Concern
LCF	Local Consulting Firm
L_{eaq}	Equivalent Continuous Level
MELT	Modified Eccentric Loader Terminal
mg/l	Milligram per liter
mg/m^3	Milligram per cubic meter
mg/kg	Milligram per kilogram
m^3/s	Cubic meters per second
m^3/h	Cubic meters per hour
m^3/d	Cubic meter per day
m	Meter
m^2	Square meter
m^3	Cubic Meter
m^3/s	Cubic meter per second
MAC	Maximum Allowable Concentrations
MCA	Multi-criteria analysis
MoEPA	Ministry of Environment Protection and Agriculture
MoESD	Ministry of Economy and Sustainable Development
MPE	Maximum Permissible Emission
MPC	Maximum permissible concentrations
MPD	Maximum Permissible Discharges
MSDS	Material Safety Data Sheet
$MtCO_2e$	Million tons of CO_2 equivalent
NES	National Environmental Specialist
NGO	Non-Governmental Organization
NH_4+	Ammonium

Nm^3	Normal cubic meter
NO_X	Nitrogen oxides
NO_2	Nitrogen Dioxide
NO_3	Nitrate
Ni	Nickel
NT	Near Threatened
OHS	Occupational Health and Safety
PA	Per Annum
PAP	Project Affected Person
PAH	Polycyclic aromatic hydrocarbons
PCR	Physical and cultural resources
PPV	Peak Particle Velocity
Pb	Lead
PM	Particulate matter
POPs	Persistent organic pollutants
PO_4	Phosphate
PMU	Project Managing Unit
PPE	Personal Protective Clothing
PPTA	Project Preparatory Technical Assistance
PPM	Parts per million
PSC	Pre-stressed concrete
SPM	Suspended Particulate Matter
RD	Road Department
RoW	Right of Way
SFF	State Forest Fund
SniP	Construction Standards
STD	Sexually transmitted diseases (such as HIV/AIDS)
SEMP	Specific Management Plan
SO_2	Sulfur Dioxide
SPS	Safeguard Policy Statement
TA	Tbilisi - Argveta
TBP	Tunnel Blasting Plan
TEM	Trans-European North-South Motorway
TMP	Traffic Management Plan
TOR	Terms of Reference
TSP	Total Suspended Particulates
TSS	Total suspended solids
TUN	Tunnel
UNEP	United Nations Environment Program
USAID	United States Agency for International Development
USD	United States Dollar
UST	Underground Ground Storage Tank
VU	Vulnerable
WB	World Bank
WHO	World Health Organization
WMP	Waste Management Plan
°C	Degrees Celsius
$\mu g/m^3$	Micrograms per cubic meter

Currency Exchange Rates as of 13 January2018
1 US$ = 2.56 (GEL)
($ refers in this report to US-Dollars)

Executive Summary

1. Introduction

1. This Environmental Impact Assessment (EIA) is part of the process of compliance with the ADB Safeguard Policy Statement (2009) in relation to the construction of Section F2 of the new Khevi-Ubisa-Shorapani-Argveta section of the E60 Highway, or more simply, the “Project”.

2. The EIA provides a road map to the environmental measures needed to prevent and/or mitigate negative environmental effects associated with the project. More specifically, the EIA:

- Describes the existing socio-environmental conditions within the Project area;
- Describes the project design, construction activities and operational parameters;
- Describes the extent, duration and severity of potential impacts;
- Analyzes all significant impacts; and
- Formulates the mitigation actions and presents it all in the form of an Environmental Management Plan (EMP).

3. Based on the existing ADB Environmental Safeguards Policy (2009), this Project falls under ADB’s project Category A as the project is considered to have significant diverse impacts over a wide area, such as noise impacts, significant quantities of spoil disposal, road safety impacts, and vibration.

2. Project Background

4. The Government of Georgia is endeavoring to make Georgia a regional and logistics hub and more attractive for businesses. The East West Highway (EWH), stretching 410 km from Sarpi on the Black Sea, at the border with Turkey, through the center of the country to the capital Tbilisi and on to the border with Azerbaijan, is the main inter-regional and international route between western and eastern Georgia, as well as its neighboring countries. Representing about 2% of Georgia's road network and one fourth of its international roads, the EWH serves 8,000 to 10,000 vehicles per day and carries over 60% of the country's international trade. The EWH will be an integral part of one of the six key CAREC corridors providing the shortest transit link to connect Central Asia with Europe and East Asia.

5. In light of the traffic growth on EWH, the high percentage of truck traffic, and the difficult terrain and resulting geometric profiles (which is resulting in high accident rates), capacity expansion of the current 2-lane mountainous section between Chumateleti and Argveta is crucial to realizing full potential of the EWH with improvements to the highway either completed or underway on each side of this section.

6. Therefore, the Government has requested the Asian Development Bank (ADB) and several other development partners to finance the remaining bottleneck sections (Chumateleti - Argveta) on the EWH. A feasibility study financed under a World Bank project for the Chumateleti Argveta section (comprising four sections F1 through F4) of the EWH was completed in 2015. The detailed design of Section F1 and F4 has been completed and selection of the construction Contractor is on-going. Detailed design of sections F2 and F3 is now on-going and this report forms the EIA for detailed design phase of section F2.

3. Project Description

7. The Project involves construction of a new road section of the E-60 highway located in Imereti Region of central Georgia (see

8. Figure 1). Section F2 forms the Khevi - Boriti portion of the Khevi-Ubisa-Shorapani-Argveta section of the E-60. The length of the Project road is as follows:

- Right lane **(TA** – meaning Tbilisi – Argveta direction**)** – 12.197 km;
- Left lane **(AT** – meaning Argveta – Tbilisi direction**)** – 12.193 km.

Figure 1: Road Location Map

9. The Projects geometric design standards have been selected based on traffic flow, road category and relief to ensure safe and unimpeded traffic flow. The road design is based on Georgian National Standard SST 72: 2009 "Standard on Geometrical and Structural Requirements for the Public Motor Roads of Georgia" and TEM (Trans-European North-South Motorway) Standards.

- The main technical parameters adopted in the detailed design are as follows:
- Design speed – 100 km/h (speed limit 80 km/h);
- Number of traffic lanes – 4;
- Width of traffic lane – 3.75 m;
- Width of each carriageway – 7.5 m;
- Width of paved shoulder (emergency lane) – 2.5 m;
- Width of verge – 1.0 m;
- Width of central reserve – 5.0 m;
- Width of paved shoulder at the central reserve – 1.0 m;

- Total width of each paved platform – 11.0 m
- Width of road bed – 27.0 m;
- Carriageway cross-fall on straight sections – 2.5%;
- Minimum radius of horizontal curve – 400 m;
- Maximum longitudinal gradient – 4%;
- Minimum convex curve – 15 000 m;
- Minimum concaved curve – 15 000 m.

10. Thirty five bridges will be constructed during the project works – 18 on the TA axis and 17 on the AT axis. The total length of the bridges is 8,297 meters, the longest of which is 1,362 meters. The bridges will be constructed from either composite steel-concrete or pre-cast steel-concrete

11. Twenty tunnels are proposed in Section F2:

- Two existing tunnels to be upgraded (TUN-2001-TA and TUN-2003-TA) of about 100-130 m;
- Two new tunnels parallel and adjacent to the existing (TUN-2001-AT and TUN-2003-AT) on the carriageway AT of about the same length;
- Two single tunnels on the carriageway AT (TUN-2002-AT and TUN-2004-AT) of about 200 and 400 m
- Seven tunnels with double tube with length from 300 m to about 1300 m. In this Section, the rock is generally good, even if there are some faults, generally the soil cover are not very thick.

12. To construct the roadbed in the project section concrete retaining walls and reinforced concrete support structures will be required on several sections due to the difficult relief conditions of the project section.

13. Two interchanges are planned in F2 Section, the first (interchange I1) at approximately KM5.3 has only ramps to and from Tbilisi; the second (interchange I2) at approximately KM9.3 is instead complete. Another interchange is exactly at the endpoint and it is split in two between F2 and F3. Most of this interchange will be included in F3. Only the ramps from and to Tbilisi will be included in F2 (interchange I3).

14. The following types of culverts will be constructed:

- Underpasses for rural roads, which are constructed of cast in situ reinforced concrete structures of closed contours cross sections 6.0x4.5 m - 6 units for passing rural roads is envisaged in the design.
- Cattle passes, which ensure cattle can cross the project road. Construction of cast in situ reinforced concrete structures of closed contours cross sections 4.0x2.5 m - 4 units are envisaged in the design.
- Culverts, for which cast in situ reinforced concrete culverts cross section 2.0x2.5 m - 17 units, 4.0x2.5 m - 2 units are envisaged in the design to provide water discharge from ravines and canals.

15. Two different pavement structures will be used:

- Concrete pavement structure for the motorway and interchanges; and
- Asphalt pavement structure for all Slip Roads and all Minor Roads and bridges.

4. Alternatives

16. The “No Action” Alternative in this instance is defined as a decision not to undertake the proposed construction of the Project Road. The “No Action” Alternative would result in the continued deterioration of the road, bridges and drainage structures along the RoW, thereby impeding the economic development of the Project Area and the Imereti region. All positive benefits would be foregone. The relatively minor, less than significant environmental impacts (such as noise and short-term air quality impacts due to maintenance activities) and inconveniences (such as traffic diversions) would be avoided in the short-run. In the long run, however, the steadily declining state of the roadway would severely hamper economic development in the area. In light of these considerations, the “No Action” Alternative is deemed to be neither prudent nor in the best interest of Georgia or those with an interest in, and attempting to assist restoration of, Georgia’s well-being.

17. Given the complex topography of the region and Georgia in general, there are no other feasible alternative corridors that would be able to compete with the existing corridor in terms of travel times. In addition the Project forms part of the overarching program to upgrade the E-60 motorway which includes many sections that have recently been upgraded, or are in the process of upgrading (or detailed design), including the sections of road joining the start and end points of the Project road.

18. As noted above, the Project forms part of a program upgrading the E-60. The Khevi – Argveta section of the E-60 (including section F2) is one of the last remaining sections of the road requiring upgrading. Accordingly, the Project is focusing on the upgrading of the E-60 and will not consider any other transport mode as an alternative.

19. During the Projects Feasibility Phase a number of alignments were considered that broadly follow the existing E-60 corridor. The result of the Feasibility Report was a draft final corridor which the detailed design would use as a basis for the final road alignment (horizontal and vertical). During the detailed design phase a number of factors were taken into account to determine the final alignment, they included the consideration of potential resettlement issues and social aspects such as access and noise.

20. Only one pavement type was considered for the main pavement; rigid concrete mainly due to the fact that concrete pavements are already constructed on preceding sections of the E60 Highway. Asphalt pavement structure will however be used for all Slip Roads, bridges and all Minor Roads and bridges.

21. Several locations were identified for the disposal of 1.9 million cubic meters of spoil material from cuts and tunnels. Four locations have been considered as potential location for of spoil material. The location originally proposed, Kutaisi bypass, has been eliminated due to a lack of space for all of the material and the costs of transporting the waste to the site as well as environmental considerations of a huge amount of truck journeys through Zestaphoni. Three other potential locations closer to section F3 were screened to determine the potential environmental impacts of these areas. Two of these areas have been eliminated based on the fact a large number of trees would need to be felled in these areas. The remaining site, close to Boriti, is considered a possible option for the disposal material given the large volumes of spoil to be generated by the Project. **Section C.6 – Alterative Spoil Disposal Locations** discusses this issue further.

5. Description of the Environment

22. The Project area is located to the west of the Likhi Range which connects the Greater and Lesser Caucus Mountains. The Project corridor is set within a landscape of mountains, and rolling hills. The existing road is located within the bottom of the river valley and elevations vary from around 480 above sea level at the start of the road to 305 meters above sea level at the end of the road section in Boriti.

23. Annual precipitation in Zestaphoni (the nearest weather station) is around 800 mm. Rainfall is highest in the Winter, Autumn and Spring, although rainfall can still be observed during the hotter summer months. The monthly temperature for Zestaphoni which ranges on average, from 0 °C in the winter months to around 28 °C in the summer. The dominant wind direction is from the east. However, strong winds from the west are also experienced quite frequently.

24. A climate risk and vulnerability assessment was prepared by ADB as part of the Project. The assessment concluded that the number of hot days (above 25ºC) is anticipated to increase and mean precipitation will decrease by 4.5% by 2050. The number of days with heavy rainfall will also increase while annual river run-off is anticipated to decrease by 13%. The assessment also indicated that the Project area is in a high-risk range for landslides.

25. According to the Seismic Hazard Map of Building Norms and Rules effective in Georgia the study area is located in the 8-point earthquake zone (MSK 64 scale).

26. Within the Project area the main sources of air emissions are from transport, including vehicles on the existing Project road. Air quality monitoring was carried out at six different locations during March 2018 to characterize the current air quality within the Study Area. The results of the ambient air quality monitoring show that in all instances the parameters monitored were below national, and where applicable, World Bank Group (WBG) standards.

27. The main rivers in the Project area include the Dzirula, Rikotula and the Dumala. The Project road flows parallel with the Rikotula from KM0.0 until it merges with the Dzirula adjacent to KM1.3 beneath bridge BRI 2.1.04 TA/AT. The Dzirula is the main river flowing through the valley in which the Project road is located. The Dumala is a major tributary of the Dzirula, but is located more than 300 m north of the new alignment in Boriti, almost at the end point of the Project road.

28. The project road crosses natural forest areas, agricultural land plots, hilly forest slopes, residential areas and riparian ecosystems. Due to anthropogenic impact in the Project area natural vegetation has been lost to agricultural and other urban development and these areas can be described as modified habitat. In these areas arable lands and pastures have developed. Over the time the fauna of the region has changed significantly, however, large portions of the Project area can still be classified as natural habitat.

29. According to available information there are three species considered as vulnerable in Georgia (Georgian Red List) that may be found within the Project area, the Otter (Lutra lutra) and the Caucasian squirrel (Sciurus anomalus) and the Mediterranean turtle (*Testudo graeca* Linnaeus). Site surveys did not reveal the presence of squirrels or turtles in the Project area. In addition, the review of the habitat along the alignment indicates that it is not optimum for existence of the Caucasian squirrel. Site surveys undertaken by local ecologists did not reveal evidence of otters in the Project area, such as otter holts or spraints, however, the ecologists did identify a number of locations within the Project area that are suitable habitat for otters. Anecdotal and photographic evidence provided by the ADB did however show that otters are present within the Project area, notably at the confluence of the Rikotula and Dzirula rivers.

30. The nearest protected area is the Borjomi Nature Reserve which is located more than 15 kilometers south of the Project road. The nearest Important Bird Area (IBA) to the Project road is the Adjara-Imereti Ridge more than twenty kilometers south of the Project road.

31. The Project road is located within the Region of Imereti. Imereti occupies a territory of approximately 6,552km^2 (9.4% of Georgia's area). Imereti consists of twelve administrative districts: Kutaisi (the Capital of the region), Tkibuli, Tskaltubo, Chiatura, Baghdati, Vani, Zestaphoni, Terjola, Samtredia, Sachkhere, Kharagauli, Khoni. There are 542 settlements in the region of which: 10 cities (Kutaisi, Tkibuli, Tskaltubo, Chiatura, Baghdati, Vani, Zestaponi, Terjola, Samtredia, Sachkhere, and Khoni); 3 towns (Shorapani, Kulashi and Kharagauli); and 529 villages. The Project road is located within Kharagauli Municipality. According to the most recent census data (2014), Imereti has a population of 533,906 which is a significant decrease

from the 2002 census when the population was recorded as 699,666. The population of Kharagauli was 19,473 the majority of which is classified as rural and only 1,965 as 'urban'

32. Of the total area of Kharagauli municipality 1.5% is used for agricultural purposes. 70.9% of this territory is occupied by pastures and 29.1% is used for ploughing and sowing, annual crops grow over 22.5% of the area, permanent plantings grow over 11,5% and perennial plants grow over 6,6% of the area. Out of agricultural branches, cattle-breeding and bee-keeping are most developed. During the Soviet times, industry was well-developed in Kharagauli municipality, with food enterprises, mining industry and timber plants, wine, milk and furniture complexes of enterprises. However, industrial activity has declined in the area since then and few large scale industrial activities remain. Folk trade is highly developed in the municipality.

33. The road network in the Project area is dominated by the existing E-60 which links Tbilisi with Batumi. Numerous local roads feed directly onto the existing E-60 in the Project area, and these roads vary in condition from good to very poor. There are no rail networks or airports within the Project area.

34. During the period 2012 – 2016 there were 2,713 collisions, 471 persons killed and 4,913 persons injured within the E-60 corridor, from km 18 to km 302 (284 km in total, from Tbilisi to Khobi) with some notable cluster locations. In other words, it means 1 collision every 16 hours, 1 person killed every 4 days and 1 person injured every 9 hours. Focusing the analysis on the Khevi – Argveta section, 351 collisions, 78 persons killed and 648 persons injured. Finally, along the F2 section 106 collisions occurred, with 25 persons killed and 204 persons injured.

35. Kharagauli Municipality previously used Boriti landfill located in Boriti Village. The landfill was put into operation in 2005 but is currently closed. As such there appears to be no landfill within the Project area for hazardous and non-hazardous waste.

36. Within the Project corridor the following key physical cultural resources have been identified; 1) Church – A small church is located within 20 meters of the existing alignment at KM10.0. The new alignment will be located approximately 25 meters further south of the existing alignment at KM10.0; and 2) Cemetery – The cemetery is located around 20 meters east of the existing alignment. The new alignment will pass approximately 125 meters north of the cemetery at KM8.6.

37. Dostakari-Beriti Emergency Medical Care Clinic in Boriti is located adjacent to the existing road. The new alignment will pass more than 300 meters south of the hospital with a tunnel (TUN 2011 AT/TA) at KM11.5. Three educational facilities are located within the Project area. Two are located within 50m of the new alignment (Public school of village Vashlevi and Khunevi School).

38. Noise levels within the Project area are predominantly a result of vehicle traffic on the existing road. Very little commercial or industrial activities can be observed in these areas that would give rise to significant noise levels. Noise and vibration monitoring has been undertake in both parts of the road for this EIA. Vibration values in the monitoring locations are currently too low to cause any structural or cosmetic damage and/or cause nuisance of the residents. According to the national standard the values are ranked as weak and non-perceptible. Noise monitoring undertaken at thirteen residential locations in the Project area showed that noise levels at the building facade varied according to their distance from the existing road. Properties located between 50 and 100 meters of the existing road had daytime noise levels ranging from the low 50's to the high 50's and nighttime noise levels of very similar values. Even further than 100 meters from the road, some of the monitored locations registered values above IFC nighttime limits of 45 dBA.

39. A noise model was also prepared for the existing road. Out of the 89 receptors modeled, only five had noise levels below the IFC daytime and night time standards indicating that the current road produces levels of noise that are not consistent with a health environment.

6. Impact Identification

40. The following provides a summary of the potential impacts associated with the roads:

Design / Preconstruction Phase

41. Air Quality – lack of foresight in the siting of construction camps, rock crushing plants, concrete batching plants in the pre-construction phase could lead to significant air quality impacts in the construction phase, especially to sensitive receptors.

42. Soils – Productive soils can also be impacted without due consideration of their value when locating access roads, camps, plant, etc. Soil erosion can also occur on embankments and around structures if adequate consideration of this issue is not taken into account in the design phase.

43. Natural Hazards - The Detailed Design Consultants have experience of designing roads in seismically active areas and have ensured that all designs are compliant with the relevant seismic standards of the GoG. The Consultants have also assessed all issues relating to landslides, which are considered relatively minor, and prepared designs to take these issues into account.

44. Land Use - As the road involves construction of an almost entirely new alignment land acquisition and resettlement could be anticipated to be extensive. However, the approach to design the road bypassing most residential areas and the construction of numerous tunnels reduces the level of resettlement and compensation that would otherwise be expected if the existing alignment was being upgraded.

45. Hydrology - During design, all drainage works have been designed based on the historical flood data and flood forecasting. A design discharge of 50 years return period is considered for culverts, and 100 years of bridges. Accordingly, failure of structures is not anticipated.

46. Health safety – Failure to incorporate a full range of safety measures into the road design may result in accidents and even deaths on the road, especially close to schools.

Construction Phase

47. Air Quality - During construction of the road, air quality may be degraded by a range of operational activities including; exhaust emissions from construction machinery; open burning of waste materials; and dust generated from haul roads, unpaved roads, exposed soils, material stock-piles, etc. This can lead to health impacts to locals and impacts to ecology and crops.

48. Soils - Potential soil contamination is a possibility in the construction phase resulting from poorly managed fuels, oils and other hazardous liquids used during the project works. It is also possible, that without adequate protection measures soil erosion could occur on road and bridge embankments.

49. Surface Water – Impacts to surface water and groundwater could occur through improper operation of construction camps, asphalt plants, etc. Poor construction management around bridges and close to surface watercourses could also lead to pollution incidents. Without due care temporary drainage structures may also fail, or get obstructed with construction debris, leading to flooding of property and access roads. Technical water may be sourced from the Dzirula and Rikotula rivers. The required amounts, potentially 200 m^3 per day (0.002 m^3/s) are insignificant given the flow rates of this river.

50. Groundwater – Impacts to groundwater include spills and leaks of hazardous liquids used at construction sites and camps and potential impacts to groundwater resources during tunnel construction (discussed in more detail below).

51. Bridge Construction - Bridge construction activities may increase silt load in the river during construction at bridge sites and may result in accidental spillage of concrete and liquid waste into the river. This may impact upon the ecology of rivers and aquatic wildlife.

52. State Forest Fund – A number of trees will need to be cut within the Project area, both on private land and within State Forest Fund areas. In addition, other trees (potentially including Georgian red-listed species) are located adjacent to the boundary of the site and may be damaged accidentally by construction works. A total of 4,896 trees have been identified in State Forest Fund areas. Of these, 18 are Georgian Red-listed species greater than 8cm in diameter. The trees cut in these areas will need to follow the procedures for de-listing, cutting and removal as described below. Trees that will be cut located on private land will require compensation to be paid to the landowners. The compensation will be made according to the Project LARP

53. Biodiversity – A range of Project related activities may have negative impacts upon fauna in the Project area, including site clearance, pollution and waste generation, light pollution and a lack of regulation. These activities may degrade habitat and impact significantly upon wildlife in the Project area. Site clearance carried out for the Project will result in loss of habitat that is presently being used by wildlife. Impacts to habitat were unavoidable given the constraints of the Project corridor and the need to design a safe road to a modern standard. It is estimated that approximately 33 hectares can be classified as natural habitat within the Project buffer – all of the land in this area will be cleared for construction works. Almost all of these areas comprise the afore mentioned State Forest Fund areas.

54. Protected Areas - The nearest protected area, Borjomi Nature Reserve, is located more than 15 kilometers south of the road and will not be impacted by Project works.

55. Infrastructure - The main impacts resulting from Project works will be road diversions and some temporary blocking of access routes. However, the road has been designed in a way so that it has relatively little impact upon the existing road, or other local roads due to the fact that it is a new alignment often passing through tunnels and over bridges. In some locations road closure will be needed and may occur for periods between one and two hours and as such is not a significant issue as long as the local population are given notice of the delays and suitable detours are provided. Use of local roads may also be damaged by large trucks transporting materials to and from the various work sites along the alignment.

56. Utilities - Medium and low voltage power lines, water supply and gas pipes are located within the Project corridor. It is possible that these utilities will need to be temporarily removed during construction.

57. Waste - Road construction will inevitably generate solid and liquid waste products including inert waste (e.g. concrete, wood, plastics, etc.) and hazardous waste (e.g. waste oils, batteries, etc.). In addition, uncontrolled discharges of sewage and 'grey water' (e.g. from washrooms and canteens) from construction sites and worker's camps may also cause odors and pollute local water resources.

58. Tunnel & Embankment Spoil Material - A large volume of spoil material will be generated from the tunneling works. Estimates provided by the Detailed Design Consultant indicate that as around 935,000 m^3 of spoil material will be generated from the tunnels, 161,000 m^3 from tunnel portals, 135,000 m^3 from local roads / interchanges and 1,010,000 m^3 from cut in side slopes. Where practical the spoil will be re-used as embankment material at the Project site. Estimates indicate that approximately 327,950 m^3 can be re-used as embankment material, which would leave approximately 1,913,050 m^3 as static balance.

59. The average journey distance to transport the spoil material from tunnels to the embankment areas may be around 5 kilometers. To transport material to the embankment areas approximately 27,000 return truck journeys will be required (based on $12m^3$ of material in each truck), or an average of 29 a day over the 30 month construction period.

60. Construction Camps - Construction camps constitute a temporary land use change and raise issues related to activities such as impacts to air quality; poor sanitation arrangement and

improper methods used for disposal of solid wastes and effluent; and transmission of communicable diseases to the local people by the construction workers due to inappropriate health monitoring facilities.

61. Tunnel Construction - The main typical environmental problems linked to the construction of underground works are; a) Triggering of surface settlements, structures collapses and slope instabilities, b) Drying up of springs and groundwater alterations, c) Storage and use of excavated materials, d) Noise, e) Vibrations, f) Pollution of groundwater, mainly after the realization of stabilization works by injections.

62. Community Health and Safety – Construction activities may result in an increase in road traffic accidents between vehicles, pedestrians and vehicles and livestock and vehicles. There will also be short term impacts to noise and air quality, which may impact upon health. Migrant workers may also increase community health and safety risks, for example, through the spread of sexually transmitted diseases.

63. Landscape - The Project Area largely consists of valleys with large trees and bushes of heights greater than 2 m. The hilly landscape greatly restricts visibility to a less than one km at receptor locations. The construction phase visual impact will be local and temporary. The activities during construction that will affect the aesthetics of the area include excavation, and storing of material in stockpiles and dumping at the waste disposal areas. The elevated interchanges and retaining walls in some sections may also have an aesthetic impact.

64. Occupational Health and Safety - Workers' rights including occupational health and safety need to be considered to avoid accidents and injuries, loss of man-hours, labor abuses and to ensure fair treatment, remuneration and working and living conditions.

65. Physical and Cultural Resources - No physical cultural resources have been identified within the Project corridor that are likely to be significantly impacted by Project works except for a small church at KM10.0 and a Cemetery at KM8.6. It is possible, given the rich cultural heritage of Georgia, that chance finds could occur during excavation works.

66. Noise - The potential noise related issue during construction of the project is disturbance to sensitive receptors in the Project area. The main sources of noise and vibration during construction of the project included; a) Construction machinery, b) Drilling activities, c) Haulage and general vehicle movements, d) Concrete mixing and aggregate production systems; and e) Construction Camps / Ancillary Facilities.

67. Vibration – A vibration model prepared for the Project shows that, for tunnels TUN-2001 to TUN-2006 and TUN-2008, there will be no receptors affected by structural damage (due to their absence or expropriation). In these locations blasting is acceptable. In the remaining tunnels, blasting has the potential to cause structural damage to as many as 42 properties, this is reduced to 16 when using mechanical excavation. The conclusions for cosmetic damage are very similar, with no impacts to TUN-2002 - TUN-2006 and TUN-2008 and only one receptor impacted next to TUN-2001. The number of receptors potentially subject to cosmetic damage is 64 with the use of blasting, reducing to 20 with the use of mechanical excavation technique. For bridge construction the model, both blasting and piling were modeled. However, only piling is considered relevant to the Project. Only 5 potential receptors have been identified that may suffer structural damage from piling, but all five receptors are very close to the bridge and are being considered for expropriation. A total of eleven receptors may suffer potential cosmetic damage, but this will reduce to six if the properties mentioned above are expropriated.

68. Cumulative Impacts – Cumulative impacts during the construction phase include:

- Construction Traffic – Most construction vehicles will be operating within their specific section (and even the Contractors individual 'Lot'), however, there will also be numerous daily vehicle movements across all three sections for the delivery of materials and the movement of spoil material to Kutaisi bypass. These combined vehicle movements will have impacts to noise and air quality along the road, in addition to the potential safety aspects that come with the movement of as many as 1,000 construction vehicles per day along the combined F2, F3 and F4 section.

- Construction Camps – There are, potentially six construction 'Lots' for the all three sections. This means that there could be six different contractors as well as at least three supervision engineers. Each one will need their own construction camps and offices. As noted above, the valley is rather constrained in terms of land availability and six construction camps could place a strain on the local population and the ecology of the area.

Operational Phase

69. Air Quality – The main source of air pollution during the operational phase will be vehicles moving on the highway. The main pollutants are: CO; NO_X; hydrocarbons (HC); SO_2; carbon dioxide (CO_2); and particulate matter (PM). An air dispersion model was prepared for this EIA to assess the potential operational impacts of the road on air quality in the future. The analysis of the impact on operational phase air quality determined by the traffic on the new road suggests that there are no negative impacts on the environment.

70. Climate Change – The climate risk and vulnerability assessment classified portions of the Project according to the risk of them being affected by climate change. Bridges, tunnels, cut sections and drainage structures were deemed to be at high and moderate risk from climate change. Road surface, road embankments, road base and interchanges were deemed to be at low risk from climate change. All of the items identified have been assessed by the Detailed Design Consultant and none of the issues identified are considered to represent a significant risk given the design measures already included as part of the Project.

71. Hydrology – In rare circumstances there could be a major spill of oil / fuel from tanker trucks. Such spills could impact significantly on the Dzirula and Rikotula rivers given the proximity of the road to these surface water courses in many locations along the alignment. Drainage of run-off from bridge decks could flow directly to the rivers if correct drainage is not installed on the bridges. This could be a problem if the bridges have accumulated oils and grease during dry periods and they are suddenly washed out during heavy rainfall.

72. Noise – A noise model was developed for the EIA to determine the noise levels on the Project road in year 1, 10 and 15 of the operational phase of the Project and how they impact upon 87 receptors identified in the Project area. Firstly, 23 receptors who are slated for expropriation were removed from the analysis, leaving 64 potential receptors. A comparison of the result of the 'ambient' existing noise levels (made using current traffic levels and baseline noise monitoring results) was made against the predicted levels to determine if the forecast noise was more than 3 dBA above the ambient. The results show that by year 15 seven receptors are still below IFC guidelines for daytime and nighttime noise (45 and 55 DBA) and a further 22 of the 64 identified receptors are within 3 dBA of the modeled ambient meaning that a total of 29 receptors would be within IFC guideline limits in the predicted year 15 scenario and 35 would be above the limits. Noise barriers, in certain locations and of certain heights, were then introduced to the model which led to a reduction in the amount of affected receptors above IFC guideline limits in the operational phase to 13.

73. Vibration - Highway traffic is not likely to have any measurable impact on the structures or on comfort.

74. Health and safety – Rehabilitation of the road will result in numerous beneficial health and safety impacts, including; reduced dust levels, faster emergency response times; improved pedestrian crossing facilities and improved road geometry.

75. Employment and Business - Although the existing road will remain open for almost its entire extent and interchanges will be constructed to access the existing road from the new alignment, it is likely that a number of roadside market traders will be impacted by the reduced traffic levels on the existing road.

76. After the Project construction phase many local workers may be without employment. However, the Project will have provided them, in many instances, with additional skills and experience to work on similar projects in other locations.

77. Visual Impact - Cut slopes, embankments, concrete bridges and tunnels will have an impact on the landscape within the valley throughout the Project lifecycle. The mitigation measures outlined above may go some way to enhancing the aesthetic value of the Project especially as vegetation grows back around construction zones, and in all likelihood any negative opinion of the new road in terms of visual impact will decrease over time as people get used to the altered landscape.

78. Induced Impacts – It is possible that construction of the new road could induce development along the corridor to some extent, but in general the purpose of the Project is to improve the existing E-60 corridor to provide safer and quicker journey times which will help facilitate the movement of people and goods locally and regionally. It is considered unlikely that significant new commercial, industrial or residential developments would arise along this portion of the corridor as a result of the Project that in turn may lead to; a) conversion of agricultural land, b) Increased population living within the corridor which may lead to stress on social services, such as schools, hospitals, etc, b) Required upgrading or expansion of utilities, such as electricity supply, and c) Stresses on water availability, specifically groundwater. It is also noted that the Project does not increase accessibility to forests.

7. Mitigation and Management Actions

79. The summary mitigation and management measures for the potential impacts identified above for the Roads include:

Design / Preconstruction Phase

80. Specific Environmental Management Plan (SEMP) - The SEMP will describe the precise location of the required mitigation / monitoring, the persons responsible for the mitigation / monitoring, the schedule and reporting methodology. The SEMP will also include the following plans:

- **Topic Specific Plans:**
- Waste Management Plan.
- Spoil Disposal Plan for Arrangement of Spoil Disposal Area.
- Re-cultivation Plan.
- Traffic Management Plan.
- Occupational Health and Safety Plan.
- Emergency Response Plan.
- Air Quality Plan.
- Spill Response Plan.
- Vibration Monitoring Plan.
- Clearance, Re-vegetation and Restoration Management Plan.
- Groundwater Management Plan.
- Tunnel Blasting Plan.
- Noise Management Plan.
- Biodiversity Action Plan.

- **Site Specific Plans:**
- Construction Camp Plan.
- Asphalt Plant Plan.
- Rock Crushing Plant Plan.
- Concrete Batching Plant Plan.
- Bridge Construction Plan (for each bridge construction site)

81. The SEMP will be submitted to the Engineer and RD for approval at least 10 days before taking possession of any work site. No access to the site will be allowed until the SEMPs are approved by the Engineer and RD. New topic specific or site specific EMPs may also need to be developed by the Contractor during the construction phase. These new plans will also need to be approved by the Engineer and the RD.

82. Permits – The Contractor shall be responsible for obtaining all of the required environmental permits prior to the start of construction. All permits will be reviewed by the Engineer before construction work commences.

83. Siting of Facilities – Locations for rock crushing facilities, concrete batching yards and asphalt plants will require approval from the Engineer, MoEPA and the RD during the Pre-construction phase. Efforts will be made to ensure that these facilities are as near to the Project road as practical to avoid unnecessary journeys and potential dust issues from vehicle movements during construction works on unpaved roads in urban areas. Haul routes will be prepared and submitted to the Engineer as part of his Traffic Management Plan (TMP). To prevent impacts arising from asphalt plants, construction camps, batching plants and rock crushing plants, they will be prohibited within 500 meters of any urban area or sensitive receptor (school, hospital, etc).

84. Air Quality - To adequately manage air quality impacts the Contractor will be responsible for the preparation of an Air Quality Plan.

85. Bridge Design - The bridge designs considered where possible, to avoid placing bridge piers in rivers. However, it is important to point out that the Project road is located in a complicated orography (a narrow valley with a central river) and that the geometric standards of the route have imposed strong constraints that oblige to pass over the river, to have no greater environmental impact on forests or populated areas. Bridge designs will ensure that drainage from bridge decks over 50 meters do not discharge directly to the watercourses beneath the bridges. Discharge waters will lead to an oil/grease interceptor tank or filter pond adjacent to the bridge in order to trap oil and grease run-off. In addition, the bridge design and layout must be aesthetically pleasing and in harmony with the existing environment.

86. Drainage Design - Consideration in the design phase has to be given to the issue of drainage and culverts to ensure that drainage patterns are improved from the existing conditions and that increased run-off does not occur or result in flooding of areas previously undisturbed or in those areas identified as flood prone by the Project FS. During design, all drainage works have been designed based on the historical flood data and flood forecasting. A design discharge of 50 years return period is considered for culverts, and 100 years of bridges. It is also strongly recommended that the RD considers including the use of oil separators within the road drainage system to capture any spills of oil / fuel and also to filter hydrocarbon run-off from the road in general.

87. Natural Hazards - No significant issues have been identified relating to landslides that cannot be managed by incorporation of the design measures

88. General Tree Protection - Prior to the commencement of works the Contractor shall stake the boundary of the entire work site, including intersections and areas under bridges (this excludes within rivers and tunnels, but not tunnel portals). The Contractor shall then identify

through a site survey if any Georgian Red-listed tree species are located within 5 meters of the site boundary. This survey will form part of the Contractors Clearance, Re-vegetation and Restoration Management Plan. If any of these trees are identified the contractor will be required to place wood fencing around the tree in order to protect the tree during construction works, including its root zones. The Engineer will inspect all of the tree protection measures on a regular basis.

89. Cutting of Trees – Cutting of trees can be addressed under two headings:

- Private Land – Compensation shall be paid to all affected tree owners as per the Project LARP.
- State Forest Fund – An inventory of the species to be de-listed is being prepared as part of this EIA and updates to this document will be made when the final information is received. The RD is responsible for supplying this information to the National Forest Agency in writing in order to complete the de-listing process. The RD shall also apply to the MoEPA in writing regarding the identified Red-List species in the project area so that they may also be de-listed from the SFF. Compensation payments for the tree cutting in SFF areas will paid to the Government by the RD according to GoG regulations prior to any tree cutting. No compensation in the form of re-planting is required under this resolution unless specified by the MoEPA in the Conclusion of Ecological Expertise.

90. Biodiversity – Prior to any land clearing activities, bridge works, or works in tunnels, site surveys shall be undertaken by national specialists to determine the presence of any species that may be impacted in these areas including bats, birds, otters, squirrels, herpetofauna and turtles. Management plans, for identified species noted in the area will be prepared by the Contractors specialists and implemented prior to the start of any land clearing/ construction works.

91. Infrastructure - A road condition survey will also be conducted by the Engineer prior to construction in order to gauge the damage to the road as a result of the intensive heavy traffic. Before completion of the Project the Engineer shall repeat the survey to determine which, if any roads need to be repaired by the Contractor. The Contractor will also submit a Traffic Management Plan to local traffic authorities prior to mobilization and include the plan as part of his SEMP.

92. Waste Management – The Contractor shall prepare and submit a waste management plan outlining measures to manage and disposal of all waste streams, including hazardous waste and methods for recycling waste. The plan will clearly identify how and where hazardous wastes will be disposed of.

93. Spoil Disposal – The responsibility for identifying the final disposal areas for tunnel and embankment spoil material lies with the Contractor. However, initial assessment of this issue has been undertaken for this EIA and environmental screening of three potential spoil disposal sites have been undertaken. One site, close to Boriti has the least environmental and social impacts and it is possible that the spoil material could be placed in this location. If the Contractor chooses to use this location, or another, he will be responsible firstly, for preparing a detailed assessment of this site to be approved by the ADB and the RD. Upon approval of this assessment, the Contractor shall then prepare a Spoil Disposal Plan for Arrangement of Spoil Disposal Area and a Re-cultivation Plan. This plan shall be prepared in accordance with regulation N 424 on Approval the Rules for Removal, Storage and Use of Topsoil and Re-cultivation. The Contractor will also complete an EIA for this location to satisfy the national EIA regulations. All relevant permits will be needed before any spoil can be placed in the identified area. The Plans will also be provided to the RD and the Engineer as part of his SSEMP. No spoil storage will be allowed until the RD and the Engineer have approved the plan.

94. Tunnels – The Contractor will develop a ground water management plan for each tunnel under which shall be submitted for approval by the Engineer at least four weeks prior to the start of tunnelling works. The plan shall include routine monitoring of the groundwater levels in wells

against baseline water levels (measured by the Contractor before the start of tunnel works) in the Project area which will be undertaken on a weekly basis by the Contractor within the vicinity of each tunnel he is excavating.

95. Emergency Response - The Contractor will be responsible for preparation of an Emergency Response Plan (ERP) which will include sections relating to; a) Containment of hazardous materials, b) Oil and fuel spills, c) Fire, gas leaks and explosions, d) Work-site accidents; and e) Earthquake and other natural hazards.

96. Loss of Land and Property - Under the terms of the Loan of the ADB, before the commencement of the construction works at any part of the site, the *Employer* must prepare the Land Acquisition and Resettlement Plan (the LARP), obtain the approval of ADB and then implement the plan and acquire the land.

97. Noise - Correct siting of construction camps and ancillary facilities will reduce the potential for elevated noise levels to affect sensitive receptors. Locating these facilities more than 500 meters downwind of sensitive receptors will limit potential noise impacts. In addition to the above, prior to the start of construction, and as part of his SEMP, the Contractor will develop a noise management plan.

98. Vibration - The Contractor will develop a detailed Tunnel Blasting Plan (TBP) as part of the overall construction schedule. The TBP shall specify, to a reasonable level of accuracy, the schedule for boring of each tunnel and will include the results of all of the pre-construction surveys undertaken.

Construction Phase

99. Air Quality - Proper control, siting and maintenance of equipment, including concrete batching plants, shall mitigate emissions impacts. Spraying of roads with water during dry periods and covering of friable materials will also help prevent dust impacts.

100. Soils – Standard measures are outlined within the EMP to reduce the impacts of potential spills and leaks. They include storing hazardous liquids in special storage areas within concrete bunds and the provision on spill kits in these areas. Erosion control measures and measures to preserve topsoil are also recommended within the EMP.

101. Surface water – Proper design, siting and management of facilities (including construction camps and concrete batching plants) will help reduce impacts to water quality. Accidental spills could occur and provisions are recommended in the EMP to manage such accidents. Temporary drainage in villages will be kept clear of construction debris to prevent flooding at work sites.

102. Drainage and Flooding - During the construction phase the Contractor will be required to construct, maintain, remove and reinstate as necessary temporary drainage works and take all other precautions necessary for the avoidance of damage to properties and land by flooding and silt washed down from the works. Should any operation being performed by the Contractor interrupt existing irrigation systems, the Contractors will restore the irrigation appurtenances to their original working conditions within 24 hours of being notified of the interruption. The Contractor will also be responsible for ensuring that no construction materials or construction waste block existing drainage channels within the Project corridor. The Engineer will be responsible for routine monitoring of drainage channels to ensure they remain free of waste and debris.

103. Biodiversity – Specific mitigation measures have been prepared for International Union for Conservation of Nature (IUCN) and Georgian Re-list species identified as part of this report. In addition, a range of general mitigation measures have been prepared to limit impacts to fauna, including for example, prohibiting hunting and poaching.

104. The Project will clear approximately 33 hectares of natural habitat. The EIA has identified the different habitats affected and the size of each habitat to be cleared. To mitigate this impact

the Project shall undertake a three phase approach. Firstly, the Contractor, as part of his Clearance, Re-vegetation and Restoration Management Plan, shall prepare a Biodiversity Action Plan (BAP) for the restoration of habitat within the Project corridor. This is of particular importance in the riparian environments where bridge construction occurs. The plan should be prepared by qualified national biodiversity specialists. Secondly, the Contractor shall prepare, as part of his BAP measure to restore habitat at his spoil disposal sites, including, if practical the spoil site identified close to Boriti. Third and finally, the Contractor will consult with MoEPA to determine if there are any areas within the vicinity of the Project area where habitat restoration programs would be beneficial to the local environment or community. Plant maintenance as part of such programs will be carried out for at least two years in the plantation areas. The Contractor will be responsible for the maintenance of these areas. If the maintenance period extends after the completion of the Contractors contract period the RD will be responsible for contracting an operator to maintain the trees for the remaining period. During the Construction phase the Engineer will undertake monthly monitoring of the re-planted areas and report on the success rate of the re-planted trees, which should be above 80%. If the success rate falls below 80% the Contractor will re-plant on a 1:1 basis to compensate for losses. The Contractor will be responsible for paying for any compensational re-planting.

105. Protected Areas - No construction activities, including camps, haul routes, etc. will be allowed within, or through protected areas, or reserves.

106. Landscape – The following mitigation measures are proposed to reduce the visual impact of the Project; a) minimize disturbance to, or movement of, soil and vegetation; b) undertake landscaping after the completion of the activities to match in with surrounding landscape; and c) Reinstate vegetation.

107. Infrastructure - The Contractor will continually provide information to the public about the scope and schedule of construction activities and expected disruptions and access restrictions and allow for adequate traffic flow around construction areas via diversions or temporary access roads.

108. Utilities - During construction all utilities in the Project area shall be kept operational, particularly during the winter months.

109. Waste Management - The Contractor will be responsible for the safe collection and removal of all waste materials from his site. Accordingly, he shall prepare contracts with a suitably licensed waste management contractor for the removal of inert and hazardous wastes from his sites. The Contractor as proof of the shipment of these wastes shall also keep waste manifests.

110. Asphalt Plants, Concrete Batching Plants and Construction Camps – The Project EMP provides a range of detailed mitigation and management measures for these facilities. All of these measures are based on international best practice.

111. Bridge Construction – In the first instance all feasible efforts will be made to minimize the construction footprint in the river as much as possible. In addition, A range of measures are provided in the EIA to prevent impacts occurring at bridge construction site including for example; ensuring no waste materials are dumped in the river, including re-enforced concrete debris, ensuring that no hazardous liquids are placed within ten meters of the river, providing portable toilets at bridge construction sites to prevent defecation by workers into the river and provision of areas where concrete mixers can wash out leftover concrete in the form of a lined settling pond at each bridge site. In addition, the Contractor, through his Environmental Manager, will be responsible for consulting with MoEPA to confirm the fish spawning period in relation to the bridge construction works to ensure that all works are undertaken in periods least likely to affect the fish spawning period.

112. Tunnels - Routine monitoring of the groundwater levels in wells in the Project area will be undertaken on a weekly basis by the Contractor within the vicinity of each tunnel under excavation. If drawdown levels in wells are significant the Contractor will provide a temporary

source of potable water to the affected persons until the groundwater levels are recharged. The Contractor will pass all drainage water from the tunnel through a settlement tank. Weekly monitoring of the water quality from the tank will be undertaken by the Contractor to assess for any pollution. If the drainage water meets drinking water standards it can be considered for re-use in any potentially depleted wells during the construction phase. The Contractor shall continue to monitor the water levels in the affected wells for a period of two months after construction is completed. If the wells begin to recharge to their pre-construction levels no further actions will be necessary. However, if the water fails to re-charge to pre-construction levels new boreholes, or alternative sources of water supply will be provided for the affected persons.

113. Blasting - The Project will conduct construction blasting consistent with Georgian and international safety standards. Blasting will be conducted using standard mining industry practices and procedures to ensure safety of personnel and equipment. This includes establishing a safety zone around the blast area, say to a distance of 500 m (actual distance will be established by the Contractor and approved by the Engineer based on the safety standards) and evacuating it. In addition, no blasting will be carried out within 100 m of the portal of the tunnel, blasting will be scheduled during the day only and local communities will be informed of blasting timetable in advance.

114. Community Health and Safety – The Contractor will be responsible for holding monthly community meetings within the Project area throughout the construction period. The monthly meetings will be held in the villages along the alignment and will provide a forum for locals to discuss specific issues, such as noise and dust, with the Contractor before making complaints formal through the Grievance Redress Mechanism.

115. Occupational Health and Safety - Health and safety plans, training and HIV/AIDS and vector borne disease awareness programs will be provided by the Contractor. The Contractor shall also be responsible for providing adequate Personal Protective Equipment for all workers, including sub-contractors and site visitors. If groundwater is to be used as potable water it will be tested weekly to ensure that the water quality meets the GoG drinking water standards.

116. Physical and Cultural Resources - The cemetery identified close to the Project road is unlikely to be significantly impacted by construction works, however, it is required that during the construction phase the boundary of the cemetery be fenced off to ensure that there is no encroachment into this area by construction workers or equipment. During the construction phase works shall be schedule that no works occur within 250 meters of the Church at KM8.6 on Sundays, or during religious holidays. In the event of any chance finds during the construction works procedures shall apply that are governed by GoG legislation and guidelines.

117. Noise – The Contractor will be responsible for implementing the range of good practice measures outlined in this EIA and its EMP to limit construction noise impacts, including time and activity constraints.

118. Vibration - The Detailed Design team has been made aware of the areas potentially subject to structural damage from tunnel blasting and the recommendation that all tunneling activities in these areas has to be done by Roadheader excavation (which is the less invasive mean of excavation) has been included in the Design Report. The use of Roadheader will also limit the potential for cosmetic damage in these locations. In addition, during the construction phase a number of activities will be followed relating to vibration, including building surveys, real time monitoring, etc.

Operational Phase

119. Noise – A range of potential mitigation measures have been assessed for the remaining 13 receptors potentially affected by elevated noise levels during the operational phase. They included speed limits, noise proof windows and low noise asphalt. However, none of these options are viable for the Project. The preferred mitigation for the Project involves monitoring and expropriation. Monitoring will be carried out at the potentially affected receptor during

operation up to year 15. Should measured noise be shown to exceed IFC limits at the property during this period, the owner of the house will be given the option to relocate after selling their house to the RD. Their property will then be included in the LARP or other similar instrument (post project).

120. The RD will be responsible for monitoring and then consulting with the remaining 13 receptors to determine what option is preferable to the individual receptors and as to whether any property level mitigation is possible (i.e. improvement of property boundary walls). This activity shall be completed during operation and will be particularly relevant for L21, R14 and R15 receptors which are predicted to go out of compliance in year 1 of operation. Should a property require resettlement, a corrective action plan will be prepared for the Project LARP or similar instrument to take into account any properties that may choose expropriation.

121. Climate Change – Although no significant risks have been identified, the Detailed Design Consultant shall ensure the recommendations made in this EIA are included in the "Recommendations for the management of the highway" document.

122. Hydrology - During the operational phase of the Project, the RD will be responsible for monitoring drainage along the road to ensure that it does result in increased run-off and flooding. The RD will be responsible for rectifying this issue if it occurs.

123. Groundwater - The Contractor shall continue to monitor the water levels in any affected ground water wells for a period of 12 months after construction is completed at the tunnel sites. If the wells begin to recharge to their pre-construction levels no further actions will be necessary. However, if the water fails to re-charge to pre-construction levels alternative water supply will be provided to the affected parties, this may include for example, increasing the depth of their wells, or piped water from another location, which, as noted above, appears to be a fairly effective option.

8. Monitoring Actions

124. To ensure that all of the above mitigation actions are completed according to the requirements of this EIA, monitoring shall be undertaken of Project works by the Engineer and by independent monitoring specialists. Specifically, both observational monitoring and instrumental monitoring shall be undertaken as follows:

125. Instrumental Monitoring – This shall be completed by independent specialists and will include; a) Routine air quality, water quality soil sampling and noise monitoring during the construction phase; and b) Annual noise monitoring throughout the Project operational lifecycle at the receptors identified as part of the noise model.

126. Schedules, parameters, locations are indicated by the EMP. The Engineer shall be responsible for contracting independent monitoring specialists during the construction phase. In addition, the Contractor will be responsible for real time monitoring of vibration during the Construction phase of the Project. The RD will be responsible for operational monitoring, e.g. hiring independent monitoring specialists.

127. Observational Monitoring – The Contractors actions shall be continually monitored by the Engineer throughout the Projects Construction phase. This will be achieved through weekly inspections of the Contractors environmental performance and his SEMP by national and international environmental specialists engaged by the Engineer throughout the construction period. The Engineer shall have the right to suspend works or payments if the Contractor is in violation of any of his obligations under the EMP and this EIA.

9. Consultations

128. Two rounds of stakeholder consultations were undertaken, firstly in Boriti in 2017 and secondly in Kharagauli in 2018. The first round of consultations helped define the scope of the EIA. The second round of consultations were then undertaken on the draft EIA. During the

consultations a number of issues were raised, such as disposal of tunnel spoil material, tree cutting and replanting, access to properties during construction and identification of sites of cultural heritage.

129. All of the issues identified in the consultations have been included within the impact assessment portion of the EIA and where practical, measures have been proposed to reduce the significance of, or mitigate impacts. **Section I** of the Report provides details of the consultation procedures and the main comments received. Consultations are also still on-going as part of the LARP procedure. As information from these consultations will be added to this EIA as they are received.

10 Conclusions

130. This EIA has established that in general there are no significant environmental issues that cannot be either totally prevented or adequately mitigated to levels acceptable GoG and international standards for Project activities.

131. However, several residual impacts have been identified in both the construction and operational phases of the Project, including:

Construction Phase

(i) Fauna - Site clearance will impact upon fauna in the Project corridor, including, for instance Otters. Residual impacts will be **MINOR/MEDIUM.** Further surveys of fauna prior to the start of construction to identify potentially affected species and action plans to manage these issues will help reduce the residual impacts.

(ii) Aquatic Flora and Fauna – A number of bridge piers will be constructed within the Dzirula and Rikotula rivers. In addition, bridge abutments will also encroach into the river in some locations. Even though mitigation measures outlined above will help reduce the significance of the impact, residual impacts will be **MODERATE** as aquatic flora and fauna are disturbed by the Project works.

(iii) Habitat - The clearing of a large portion of natural habitat will have significant impacts to biodiversity in the area. The restoration and re-planting programs should go a long way to mitigating these impacts, but in some locations, such as river banks, residual impacts will remain, and impacts will be **MODERATE TO MAJOR**. In addition, short term fragmentation of habitat maybe caused by access roads and other temporary construction facilities. In addition, the Clearance, Re-vegetation and Restoration Management Plan and its Biodiversity Action Plan will help manage potential impacts to habitat.

(iv) Land Use - No residual impacts are anticipated if the LARP is implemented correctly. However, there will still be disruption to the local community during the LARP implementation process. A GRM has been prepared to manage complaints received during this process. Residual impacts will be **MINOR/MODERATE.**

(v) Waste Management - In general, if the mitigation measures suggested are implemented residual impacts will be minor. However, restoration of any spoil disposal area will take a number of years and as such the residual impacts for the spoil disposal areas are considered **MINOR/MODERATE**.

(vi) Noise and Vibration – Despite the fact that comprehensive mitigation measures have been set to manage construction noise and vibration there may still be instances where construction works may result in unanticipated elevated levels of noise and vibration.

However, these will only be temporary and localized. Good oversight from the Contractors HSE team and the Engineers environmental manager should limit the impact of these types of incidents. Residual impacts will be **MINOR**.

Operational Phase

(i) Surface Water Drainage - It is noted that the Project requires interceptor tanks for bridge run-off and this should also be considered for the road drainage network in general, if not **LOW/MEDIUM** residual impacts will occur during the operational phase as polluted road water run-off drains directly into surface water courses.

(ii) Greenhouse Gases - Residual impacts from the generation of GHGs will remain throughout the lifecycle of the Project. This is an unavoidable consequence of the Project, but as noted in other sections of this report, the growth of the electric car market and more fuel efficient cars may, in the future lead to a decrease in the emissions generated on the Project road. Residual impacts will be **LOW/MEDIUM.**

(iii) Employment - After the Project construction phase many local workers may be without employment. However, the Project will have provided them, in many instances, with additional skills and experience to work on similar projects in other locations. Local businesses supplying the Contractors and their staff may also see a fall in trade, this is an unavoidable consequence of the Project. Residual impacts will be **LOW/MEDIUM.**

(iv) Habitat - In the short term the residual impacts will be **MEDIUM/HIGH** as the habitat is cleared. It will take a number of years for the habitat to be restored and for re-planted areas to develop into something similar to the habitats they are replacing. However, in the longer term, the significance of the impacts will reduce as these areas mature.

(v) Aquatic Flora and Fauna – The actual area in the river to be lost from bridge piers or retaining walls will be minimal compared to the wider aquatic habitat available in the Dzirula River, well below 1% of the habitat available. While habitat loss will cause local impacts to aquatic flora /fauna as rivers are dynamic systems it is expected that the river will make a full recovery following construction. Residual impacts will be **LOW/MEDIUM.**

(vi) Visual Impacts - Cut slopes, embankments, concrete bridges and tunnels will have an impact on the landscape within the valley throughout the Project lifecycle. The mitigation measures outlined above may go someway to enhancing the aesthetic value of the Project especially as vegetation grows back around construction zones, and in all likelihood any negative opinion of the new road in terms of visual impact will decrease over time as people get used to the altered landscape. Residual impacts will be **LOW/MEDIUM.**

(vii) Noise – Residual impacts will be negligible for all of the identified receptors if the noise barriers are constructed. For the remaining 13 receptors monitoring will be conducted during operation and where IFC noise limits are exceeded, the property owners will be expropriated. However, some property owners may choose to remain in their homes. These properties may be subject to elevated noise levels above IFC limits in the future, and for these receptors residual impacts will remain throughout the lifecycle of the Project. It is noted that the number of potentially affected receptors is only a very small percentage of the overall population within the Project area. Residual impacts will be **MEDIUM**.

11. Implementation

132. The EMP, its mitigation and monitoring programs, contained herewith will be included within the Project Bidding documents for project works. This ensures that all potential bidders are aware of the environmental requirements of the Project and its associated environmental costs.

133. The Bid documents state that the Contractor will be responsible for the implementation of the requirements of the EMP through his own Specific Environmental Management Plan (SEMP) which will adopt all of the conditions of the EMP and add site specific elements that are not currently known, such as the Contractors construction camp locations.

134. The EMP and all its requirements will also be added to the Contractors Contract, thereby making implementation of the EMP a legal requirement according to the Contract. He will then prepare his SEMP which will be approved and monitored by the Engineer. Should the Engineer, through routine monitoring by his national and international environmental specialists, note any non-conformance with the SEMP the Contractor can be held liable for breach of the contractual obligations of the EMP. To ensure compliance with the SEMP the Contractor will employ a national environmental specialist to monitor and report Project activities throughout the Project Construction phase.

135. A grievance redress mechanism (GRM) has also been prepared as part of the Project. The GRM provides a structure for stakeholders to make complaints and a mechanism for the complaints to be resolved both locally and centrally.

A. Introduction

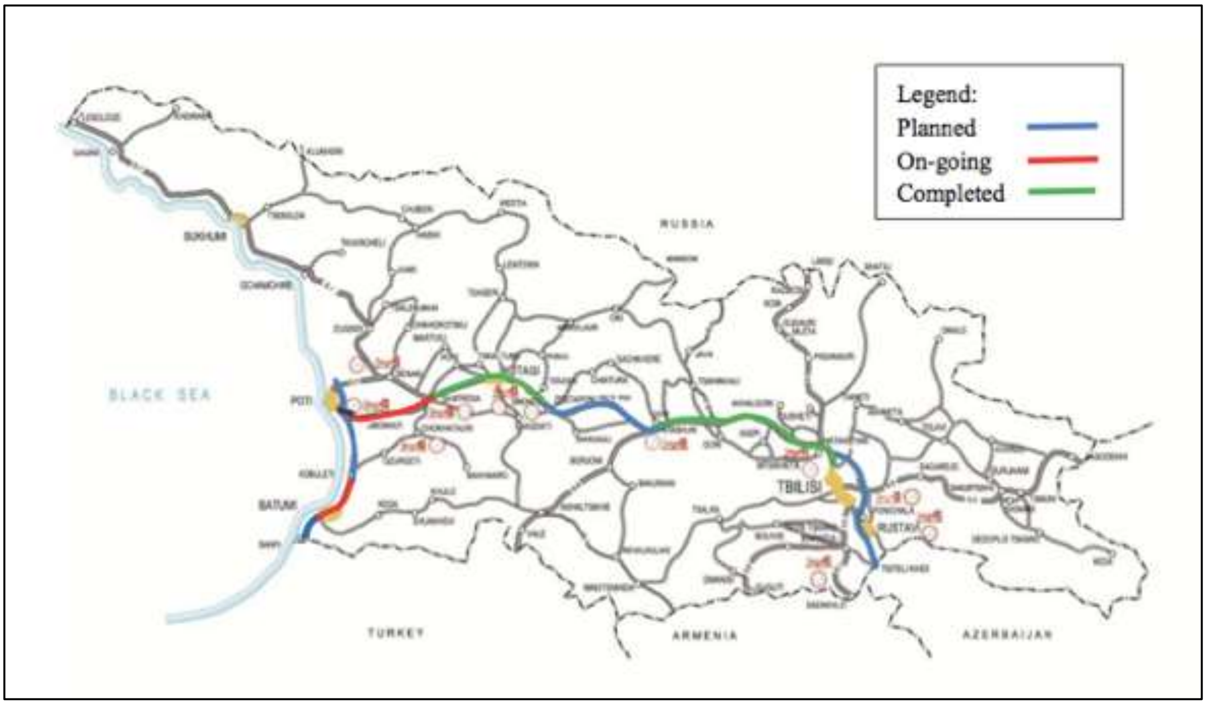
A.1 General

136. This section of the report; a) outlines the purpose of the EIA; b) provides a summary of the project, and c) identifies the project proponent.

A.2 Overview

137. The Government of Georgia is endeavoring to make Georgia a regional and logistics hub and more attractive for businesses. The East West Highway (EWH), stretching 410 km from Sarpi on the Black Sea, at the border with Turkey, through the center of the country to the capital Tbilisi and on to the border with Azerbaijan, is the main inter-regional and international route between western and eastern Georgia, as well as its neighboring countries. Representing about 2% of Georgia's road network and one fourth of its international roads, the EWH serves 8,000 to 10,000 vehicles per day and carries over 60% of the country's international trade. Georgia became part of the Central Asia Regional Economic Cooperation (CAREC) program in 2016, and the EWH will be an integral part of one of the six key CAREC corridors providing the shortest transit link to connect Central Asia with Europe and East Asia. Figure 2 illustrates the current status of road construction and rehabilitation projects in Georgia.

Figure 2: Status of Road Construction / Rehabilitation Projects in Georgia



138. In light of the traffic growth on EWH, the high percentage of truck traffic, and the difficult terrain and resulting geometric profiles (which is resulting in high accident rates), capacity expansion of the current 2-lane mountainous section between Chumateleti and Argveta is crucial to realizing full potential of the EWH with improvements to the highway either completed or underway on each side of this section.

139. Therefore, the Government has requested the Asian Development Bank (ADB) and several other development partners, including Japan International Cooperation Agency (JICA) and European Investment Bank (EIB) to finance the remaining bottleneck sections (Chumateleti - Argveta) on the EWH. A feasibility study financed under a World Bank (WB) project for the Chumateleti Argveta section (comprising four sections F1 through F4) of the EWH was completed in 2015.

Table 1: Chumateleti – Argveta Road Sections

Road Section	Location	Length (km)	Funding Agency
F1	Chumateleti-Khevi	11.10	WB
F2	Khevi-Ubisa	15.40	ADB
F3	Ubisa - Shoropani	10.50	EIB
F4	Shoropani - Argveta	15.80	JICA

140. The detailed design of Section F1 and F4 has been completed and selection of the construction Contractor is on-going. Detailed design of sections F2 and F3 is currently on-going. This EIA focuses on Section F2.

A.3 Purpose of the EIA Report

141. This Environmental Impact Assessment (EIA) is part of the process of compliance with the ADB Safeguard Policy Statement (2009) in relation to the construction of Section F2 of the new Khevi-Ubisa-Shorapani-Argveta section of the E60 Highway, or more simply, the “Project”.

142. The EIA provides a road map to the environmental measures needed to prevent and/or mitigate negative environmental effects associated with the Project. The EIA provides a detailed description of the direct and indirect environmental effects associated with the proposed Project during key periods of work.

143. More specifically, the EIA:

(i) Describes the existing socio-environmental conditions within the Project area;
(ii) Describes the project design, construction activities and operational parameters;
(iii) Describes the extent, duration and severity of potential impacts;
(iv) Analyzes all significant impacts; and
(v) Formulates the mitigation actions and presents it all in the form of an Environmental Management Plan (EMP).

A.4 Category of Project

144. Based on the existing ADB Environmental Safeguards Policy (2009), this Project falls under ADB’s project Category A as the project is considered to have significant diverse impacts over a wide area, such as noise impacts, significant quantities of spoil disposal, road safety impacts, and vibration.[1]

A.5 Scope of the EIA

[1] According to ADB “*A proposed project is classified as category A if it is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works. An environmental impact assessment is required.”*

145. Scoping is the process of determining which are the most critical issues to study in the EIA and involve community participation. The scope of the EIA in hand is based upon four factors; 1) the EIA requirements of the ADB and specifically the IRD/SPEA Terms of Reference (ToR) for the Project; 2) the findings of scoping consultations; 3) the defined Project Area; and 4) other best practice guidelines, e.g. IFC EHS Guidelines / EU environmental law. The following section provides further details of each of these aspects.

A.5.1 Scoping Consultations

146. Scoping consultations were held in June, 2017 in Boriti. Participants in the consultations were given an overview of the proposed project and then asked what they thought may be the significant issues that would require detailed study as part of an EIA. The following summarizes the key comments received:

- How will you dispose of spoil material from tunnels?
- Roadside businesses should be protected from construction impacts, e.g. dust, restricted access.
- Cattle underpasses should be considered.
- Will all three construction lots be undertaken at the same time, or will they be phased? This could cause a lot of traffic disruption.
- Will access to properties be disrupted during construction?
- There are periods of very high flow in the river, this should be carefully considered during the detailed design to ensure that flooding does not occur.

147. **Section I** provides the full details of the scoping consultations. **Section G** discusses these potential impacts in more detail and provides mitigation measures where warranted.

A.5.2 ADB Requirements

148. According to the ADB Terms of Reference (ToR) for the Detailed Design (DD) Consultants (IRD/SPEA), the following actions are required:

i. Based on the findings of the feasibility study, the Consultant shall identify the nature and scale of the potential environmental and social impacts of the road construction and operation and confirm that the proposed works fall under Environmental Category A as defined. The output of the Consultant’s work will be an EIA report, including Environmental Management Plan (EMP). The Consultant shall review relevant sources of information to identify presence of any known archaeological sites within the road corridor.

   The Consultant’s assignment will comprise of the following tasks for preparation of EIA report:

   - Identify sensitive environmental, social, and cultural heritage receptors within the corridor of East-West highway Khevi-Ubisa – Shorapani - Argveta, point out risks to the natural and social environment and to the cultural assets associated with the anticipated construction works in this section, and describe their nature and scope;
   - Cooperate with the engineers in the process of defining exact alignment of the highway with the purpose of integrating environmental, social, and cultural heritage perspectives into the selection of the optimal route;
   - Provide a set of detailed mitigation measures aimed at avoiding or decreasing expected negative impacts of construction on the natural, social, and cultural environment, and develop an environmental management plan including mitigation and monitoring plans;
   - Produce an EIA report, including an environmental management plan, satisfactory to the RD and the ADB; and

- Assist the RD, as requested, during public consultations on the draft EIA report and through the process of obtaining an environmental permit from MoEPA.

ii. Key issues environmental and social issues may include:
- Describe Noise and Air emissions modeling using the traffic projections of the detailed design;
- Impacts of noise, vibration and air pollution near inhabited areas during construction and operation;
- Risks of uncovering archaeological material during excavation works;
- Risks related to temporary storage and final disposal of construction waste and excess material;
- Risks of soil degradation and erosion from cutting slopes and borrowing construction materials;
- Identify the territories for spoiled soil disposal temporary and constantly storage, according to the Georgian Legislation;
- Risks of Landslide;
- Risks of ground water flows; and
- Risk of water pollution from construction near rivers and streams.

A.5.3 Best Practice

149. The World Bank Group (WBG) have prepared Environmental, Health and Safety Guidelines for a range of topics including noise, water quality, air quality, occupational health and safety, community health and safety, etc. Where relevant, the Project will include the recommendations of the WBG guidelines to ensure that the Project meets international best practice.

A.5.4 Structure of the Report

150. Given the findings of the scoping consultations, the recommendations of the ToR, best practices guidelines and the defined Project area the following structure will be followed:

Section A: Introduction – The section in hand provides the introductory information.

Section B: Description of the Project – Section B describes the Project need and its environmental setting. A scope of works is also provided indicating the type of engineering works required.

Section C: Analysis of Alternatives – This portion of the report provides an analysis of alternatives, including the ‘no project’ option.

Section D: Legal, Policy and Administrative Framework - This section presents an overview of the policy/legislative framework as well as the environmental assessment guidelines of Georgia that apply to the proposed project. The overview is based on recent EIA reports prepared for the previous East West Highway Improvement Projects (EWHIPs).

Section E: Methodology – This portion of the report provides the methodology for completion of the EIA, including the procedures followed for monitoring, surveys, modeling, etc.

Section F: Description of the Environment – This section of the report discusses the regional and local environmental baseline conditions. This section is divided into subsections relating to:

(i) Physical: geology; topography; soils; climate; air quality; noise; surface water; groundwater; seismicity and natural hazards.

(ii) Biological: flora and fauna; rare and/or endangered species (Red List species); critical habitats and ecosystems; protected areas. Particular attention shall be given to the presence of land plots registered as the State Forest Fund.

(iii) Human: population; communities; demographics; employment and socio-economics; land use; infrastructure (including local access roads); transport; public health; cultural heritage; archaeology; waste management; tourism.

Surveys have been conducted to address important gaps in the existing data and to collect up-to-date information on topics and areas where significant negative impacts are expected, specifically, flora, fauna, noise, air quality and water quality.

Section G: Environmental Impacts and Mitigation Measures – Section G outlines the potential environmental impacts and proposes mitigation measures to manage the impacts. This has included numerical modeling of noise, vibration and air quality to assist in predicting impacts and planning mitigation in these fields.

Section H: Environmental Management Plan – This section comprises an Environmental Mitigation Plan and an Environmental Monitoring Plan.

The Environmental Mitigation Plan:

(i) Clearly identifies what specific potential impacts various types of works may have on the sensitive receptors;

(ii) Provides concrete actions prescribed for managing these impacts, including location and timing of these actions;

(iii) Provides cost estimates for the main discrete mitigation measures (those that are unlikely to be part of a construction company' corporate policy and will not necessarily be included into general pricing of the contract); and

(iv) Specifies responsibility for the implementation of each mitigation activity.

The Environmental Monitoring Plan:

(i) Lists all prescribed mitigation measures by types of construction activities;

(ii) Provides selected criteria of monitoring implementation of mitigation measures;

(iii) Specifies methods for measuring outcomes of applied mitigation measures (visual, instrumental, survey, etc.);

(iv) Identifies location and timing/frequency of monitoring mitigation measures by the prescribed criteria;

(v) Gives cost estimates of monitoring mitigation measures by the prescribed criteria; and

(vi) Specifies responsibility for tracking each monitoring criterion.

Section I: Public Consultation, Information Disclosure & Grievance Mechanism – Section I provides a summary of all of the stakeholder consultation activities undertaken. The section also describes the grievance redress mechanism, setting out the mechanisms for resolving complaints about environmental performance.

Section J: Conclusions and Recommendations – The final section of the report provides the report conclusions and recommendations, including a description of any residual impacts.

B. Project Description

B.1 Section Layout

151. This section of the EIA provides the Project description. More specifically it provides; a) Summary of the type and location of the Project, including detailed site location maps, b) Road standards and profiles, c) Description of various Project components, including bridges, tunnels, interchanges, etc., d) Summary of the construction process and the sources of materials, e) An overview of construction facilities, and f) Summary of traffic safety measures.

B.2 Type and Location of project

152. The Project is a road construction project located in Imereti Region of central Georgia. The Project road comprises Section F2 (Khevi - Boriti) of the Khevi-Ubisa-Shorapani-Argveta Road (E-60). The length of Project road is:

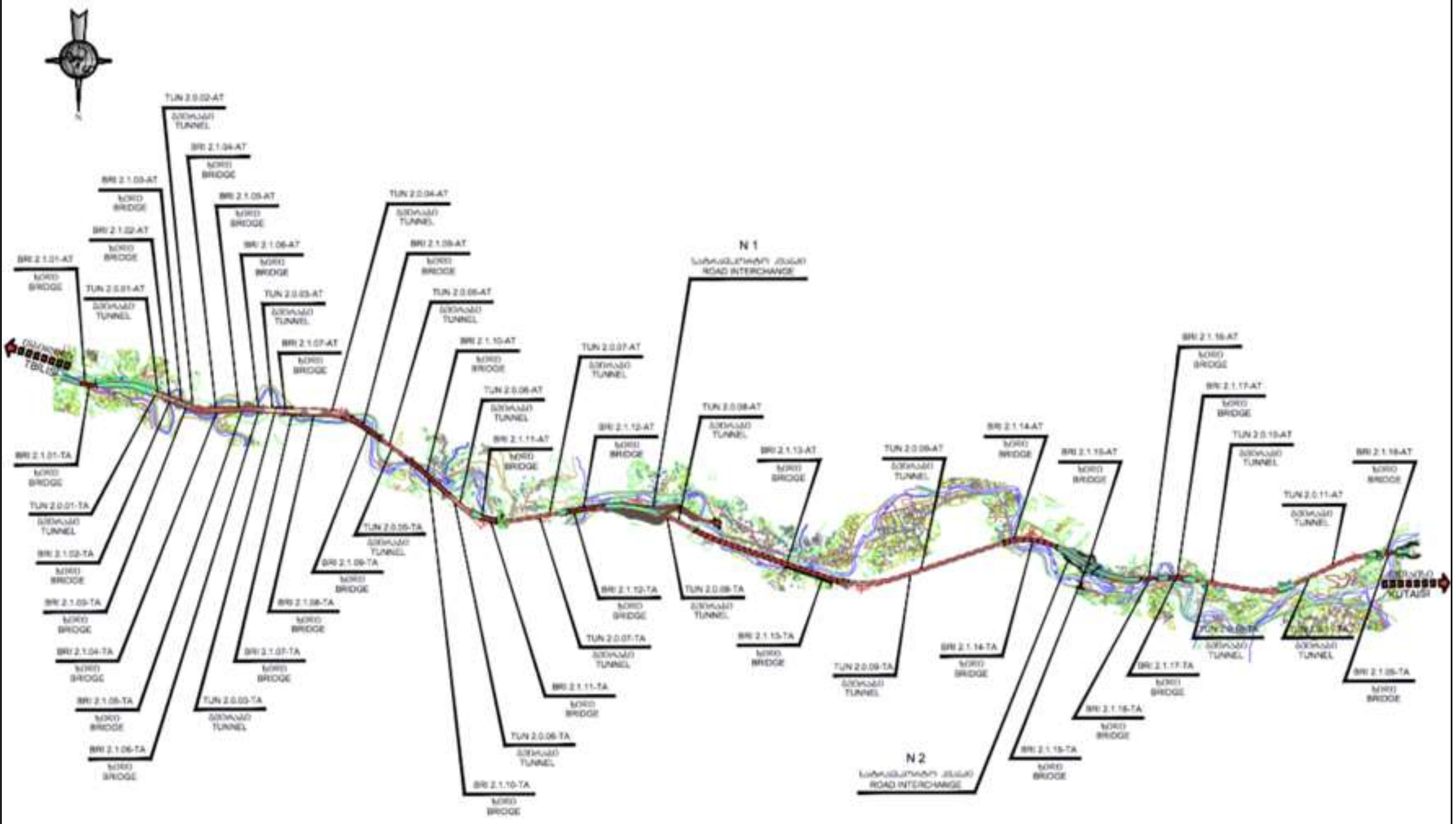
(i) Right lane (TA)[2] – 12,197 km;
(ii) Left lane (AT) – 12,193 km.

153. Figure 3 indicates the location of the Project within the context of Georgia. Figure 4 provides a map of the entire Project road and Figure 6 to Figure 25 provides a set of fifteen detailed maps of the site including locations of tunnels and bridges.

Figure 3: Road Location Map

[2] TA meaning Tbilisi – Argveta direction, AT meaning Argveta – Tbilisi direction.

Figure 4: Project Road Overview



NOTE:

1. Chainage (PK) is a section the length of which is 100 m.
2. One kilometer contains 10 PK i.e. 10PK=1KM.

Figure 5: Map Overview

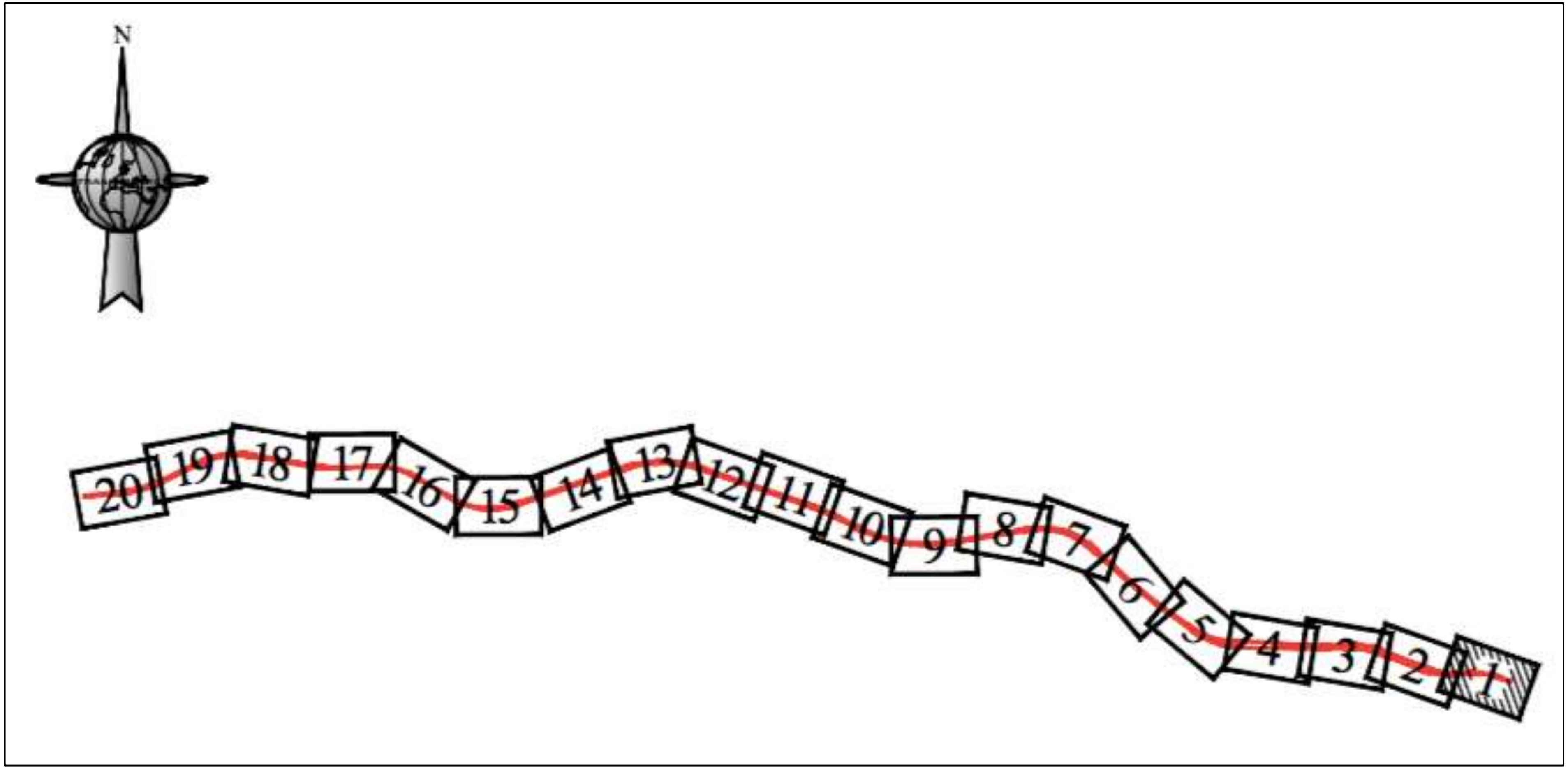


Figure 6: Map 1 - Project Road (KM0.0 – KM0.6)

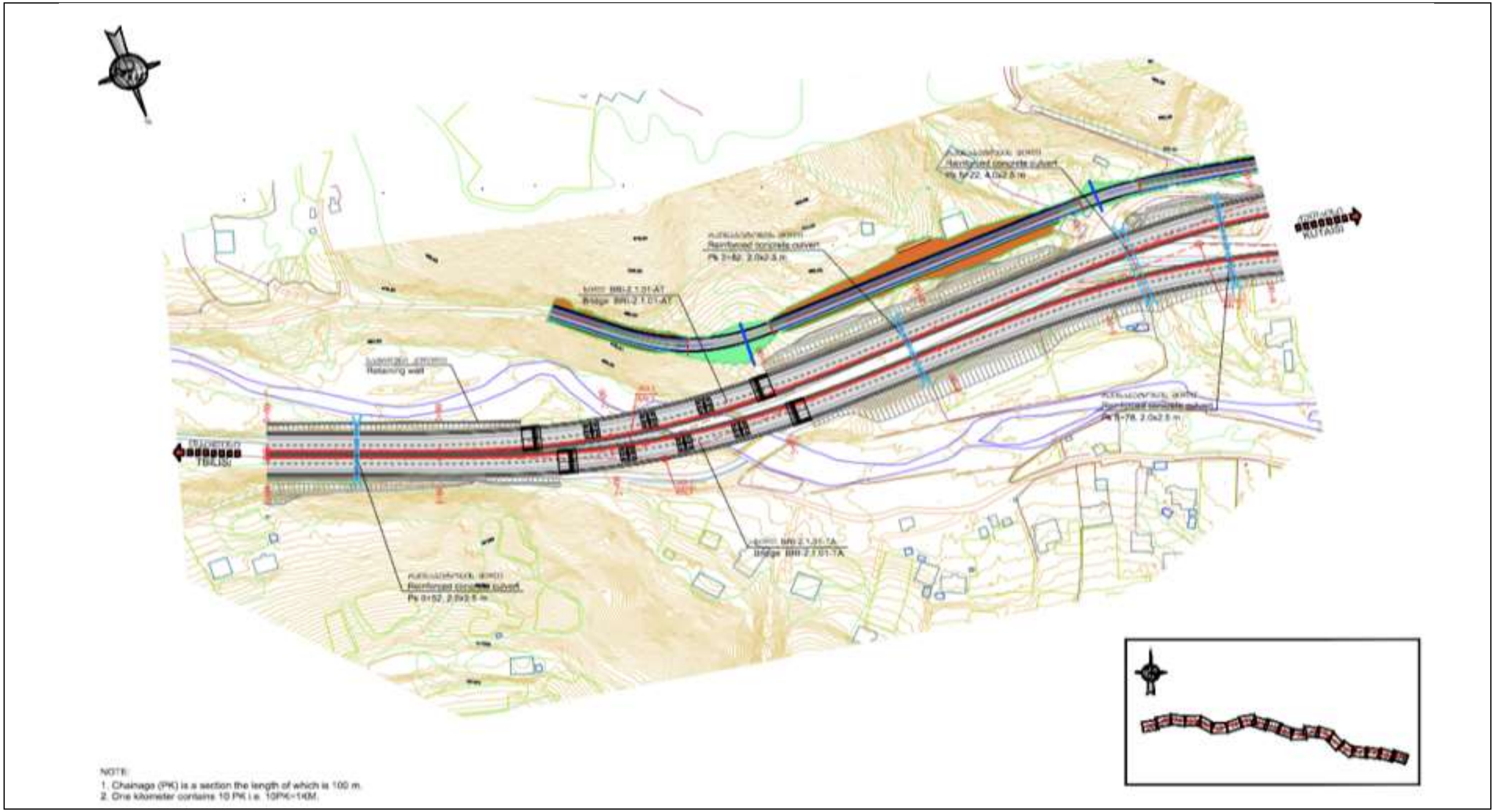


Figure 7: Map 2 - Project Road (KM0.6 – KM1.2)

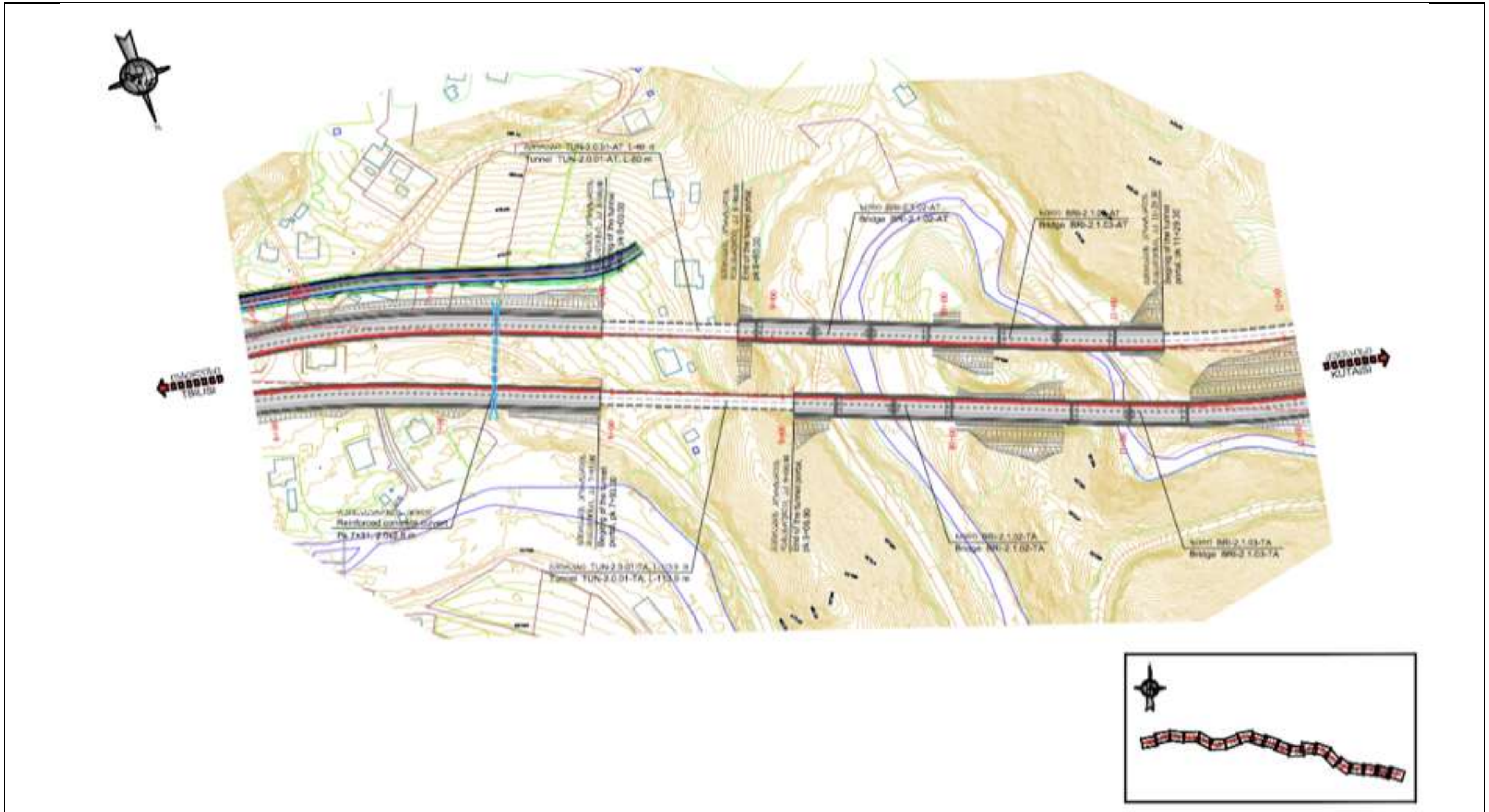


Figure 8: Map 3 - Project Road (KM1.2 – KM1.8)

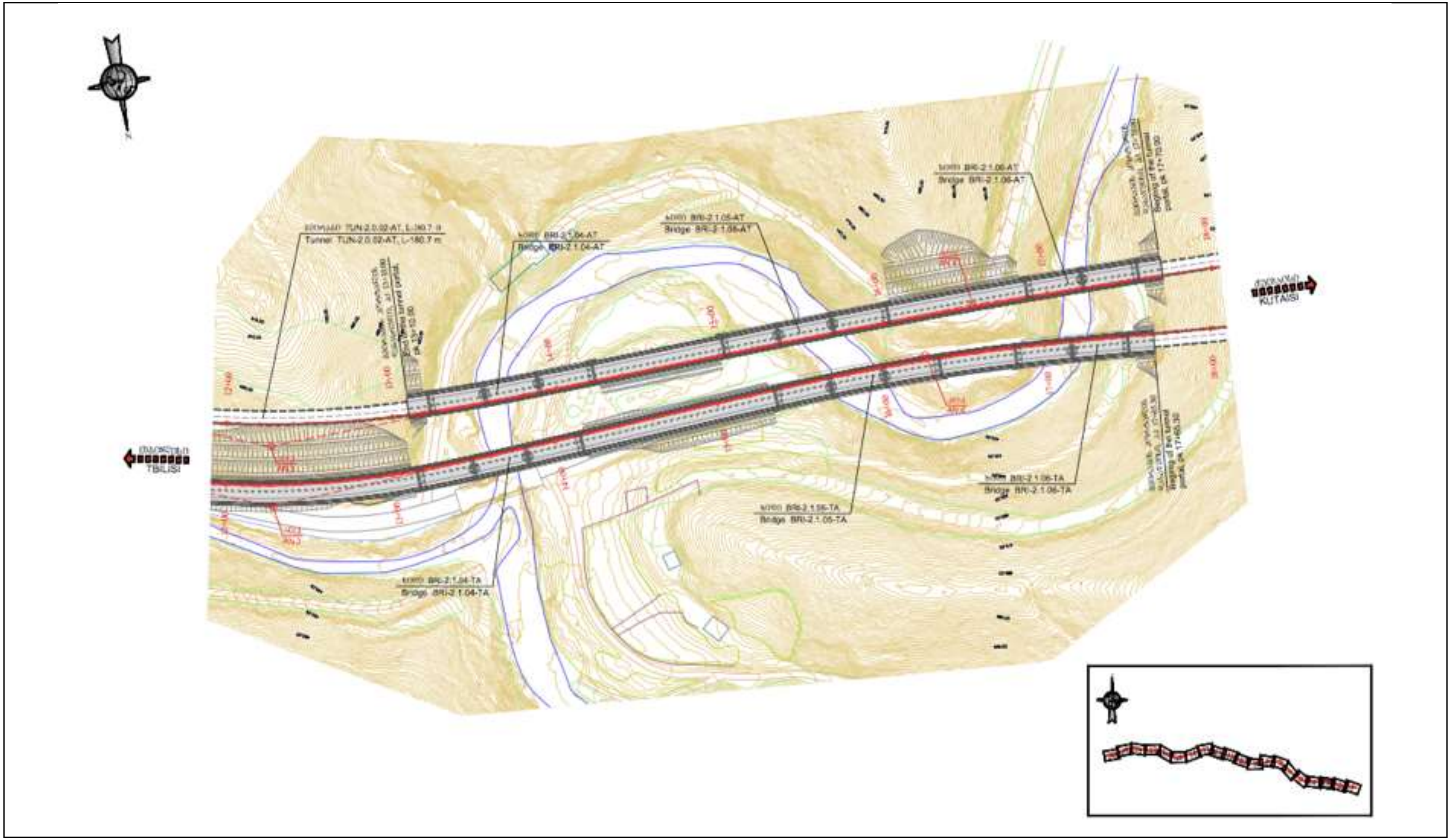


Figure 9: Map 4 - Project Road (KM1.8 – KM2.4)

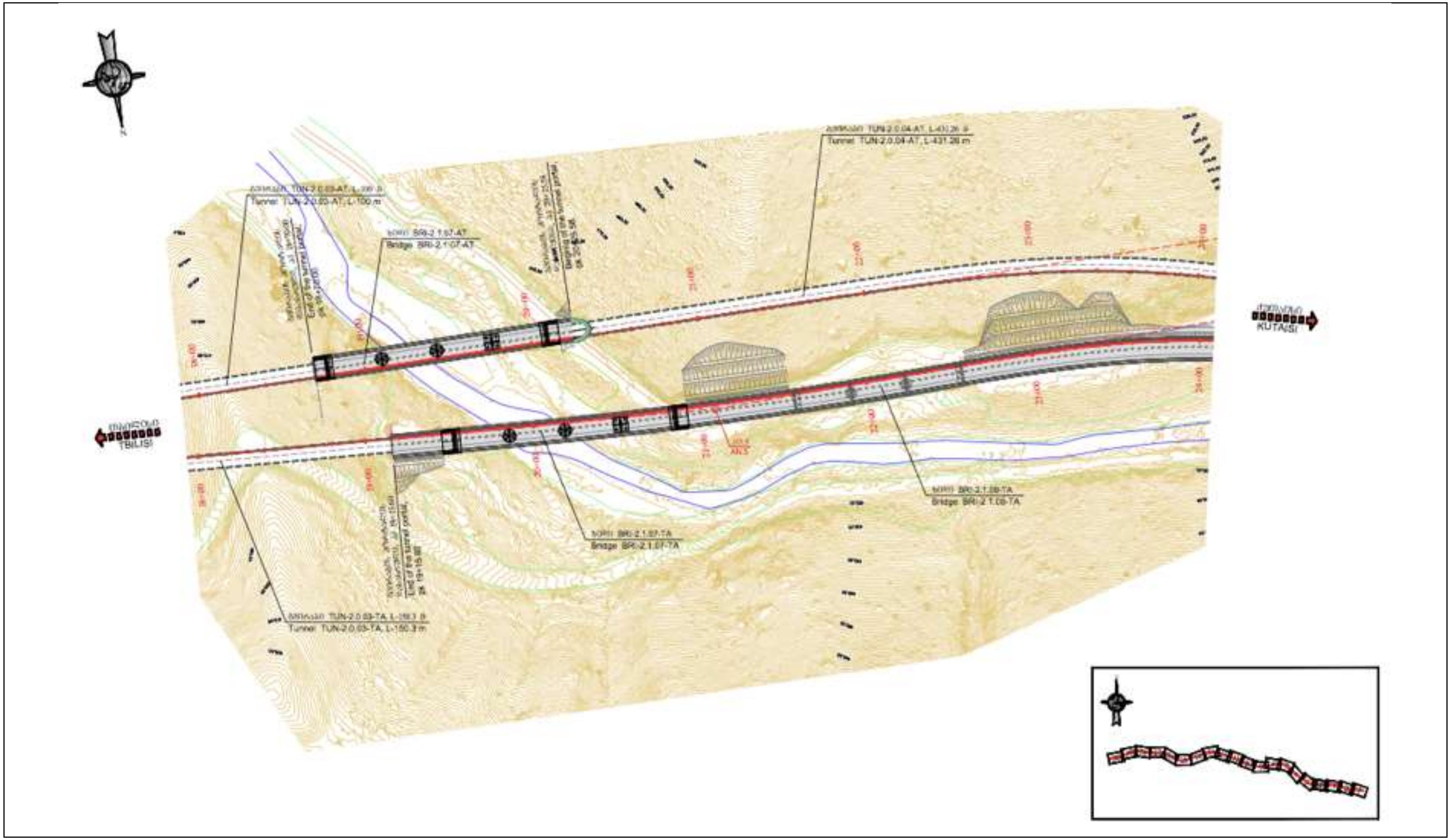


Figure 10: Map 5 - Project Road (KM2.4 – KM3.0)

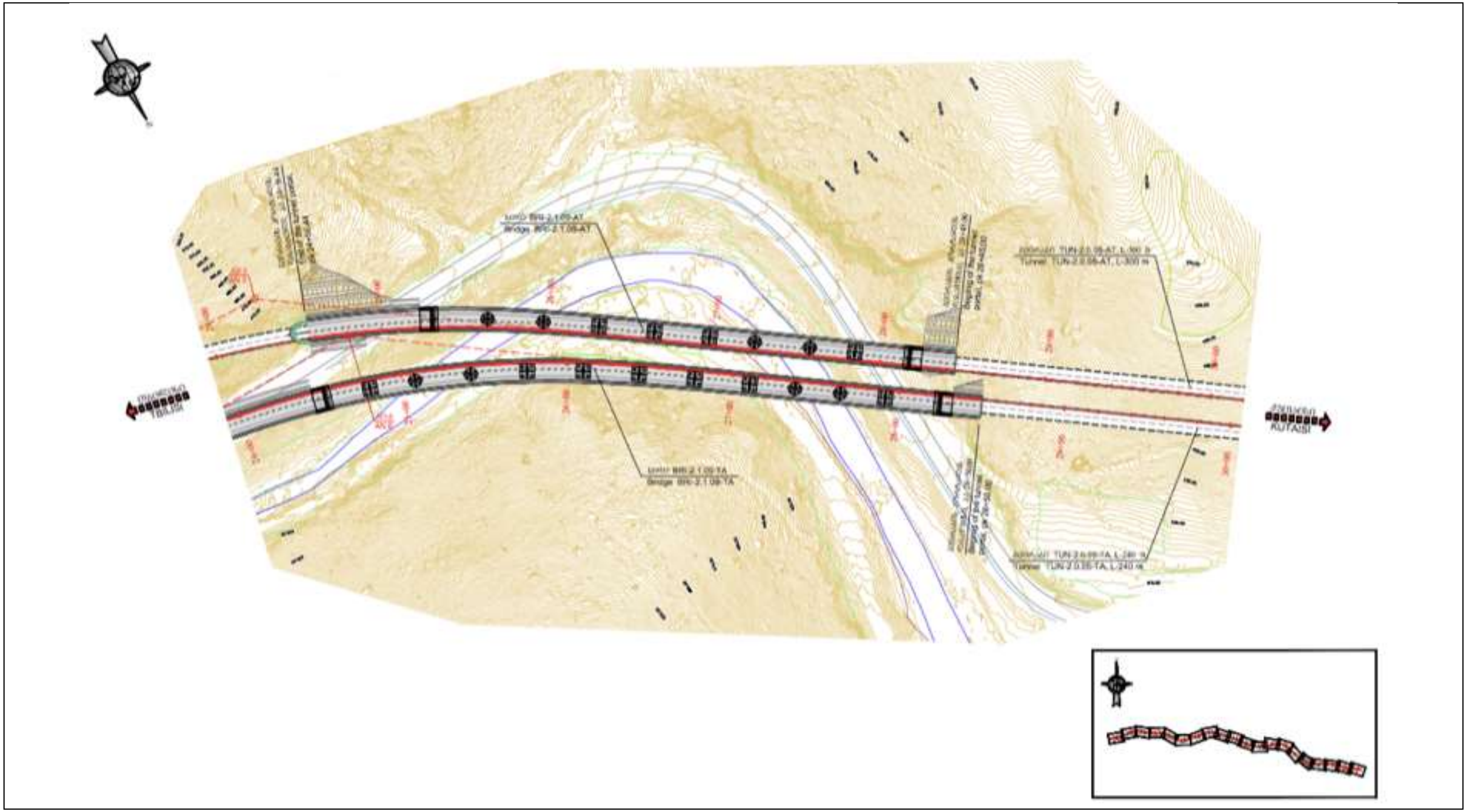


Figure 11: Map 6 - Project Road (KM3.0 – KM3.6)

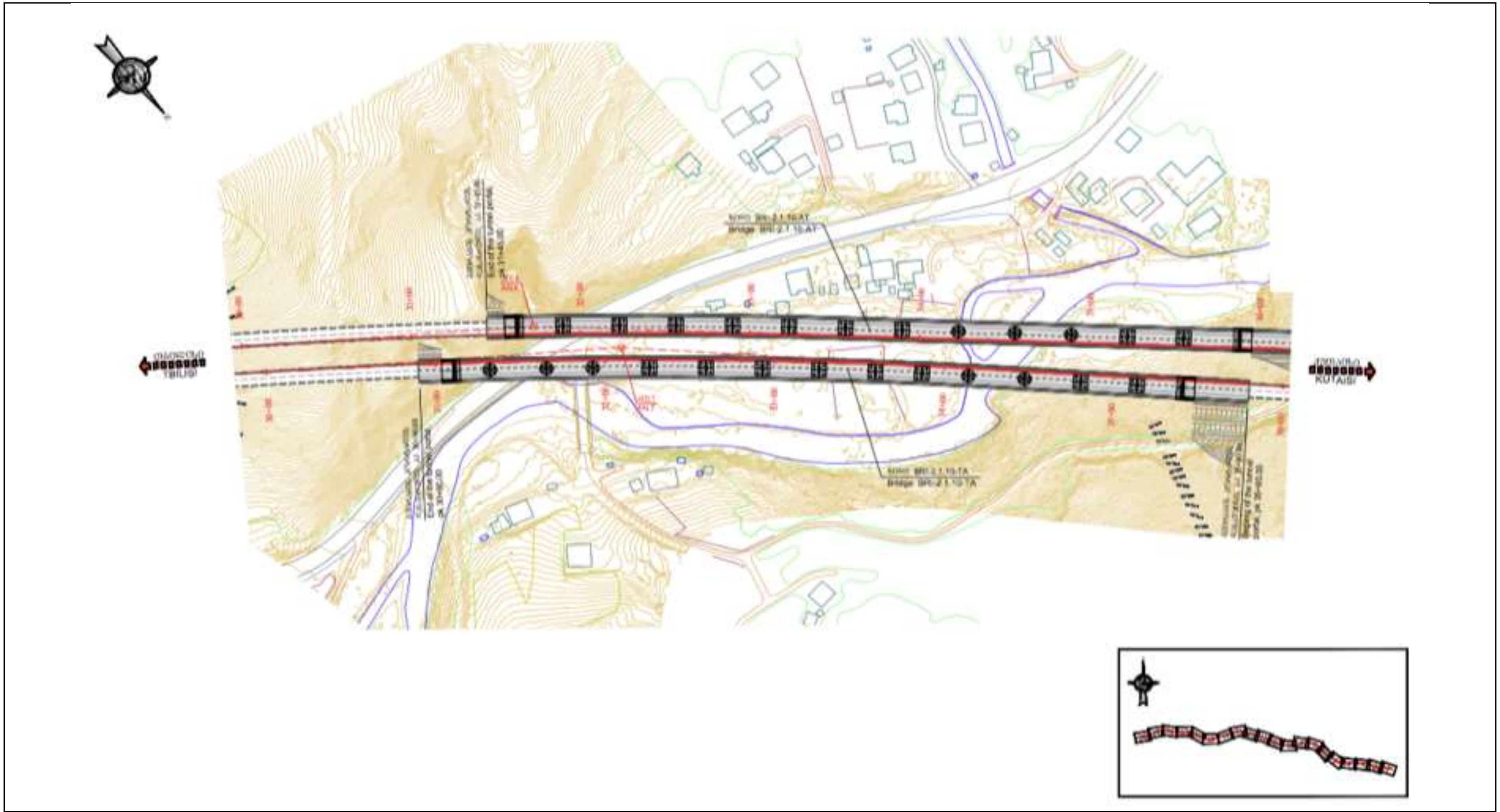


Figure 12: Map 7 - Project Road (KM3.6 – KM4.2)

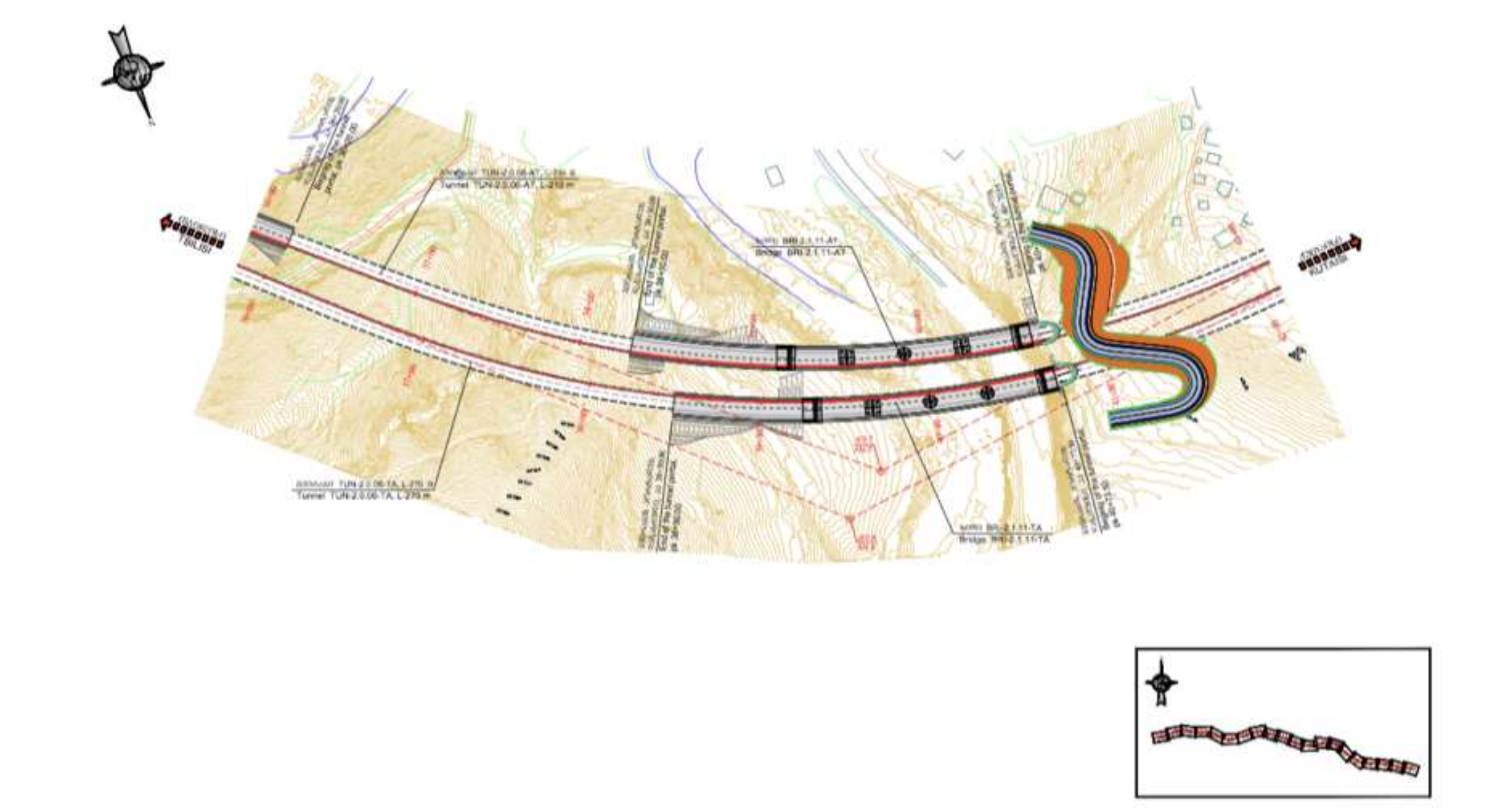


Figure 13: Map 8 - Project Road (KM4.2 – KM4.8)

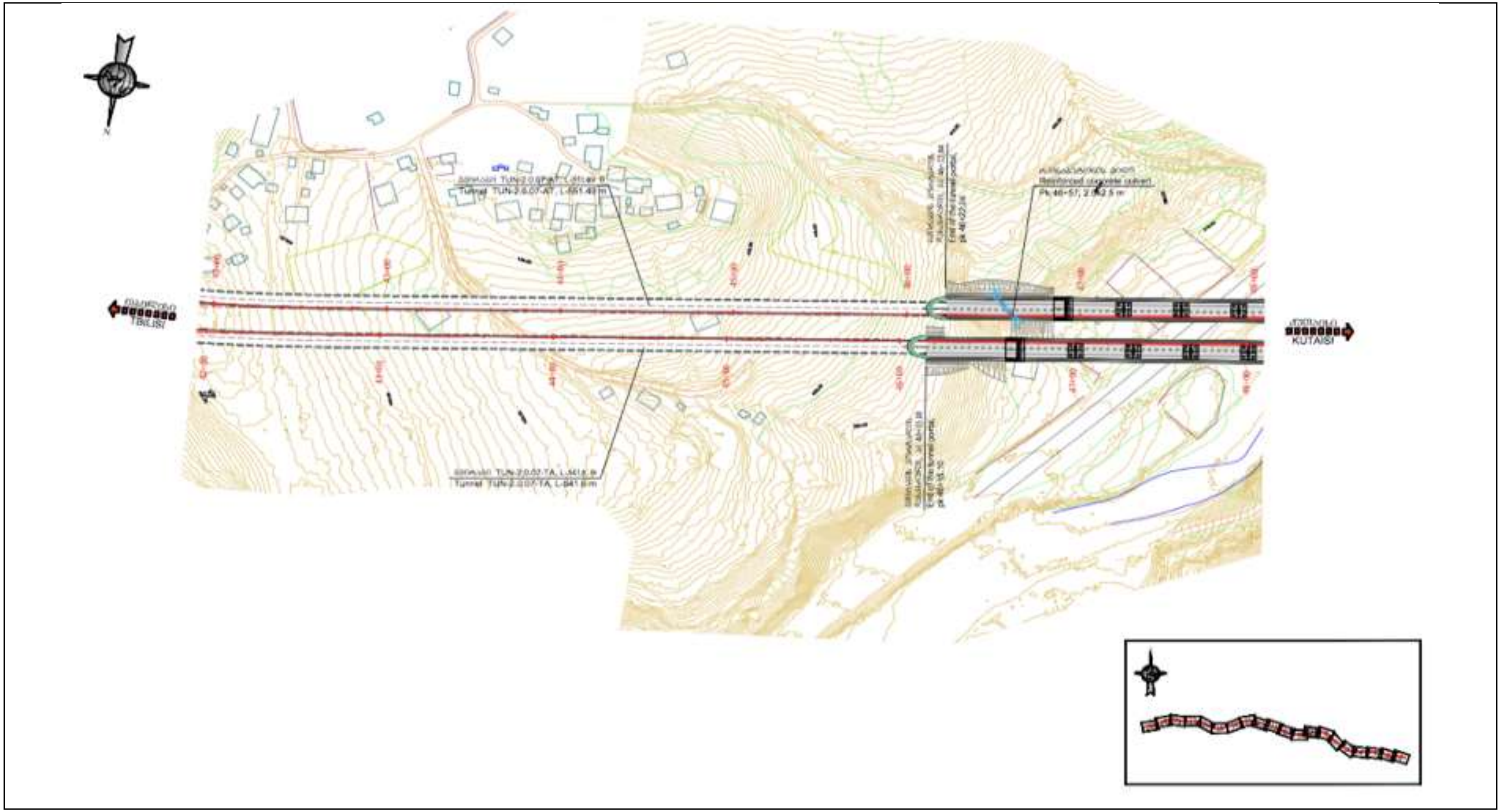


Figure 14: Map 9 - Project Road (KM4.8 – KM5.4)

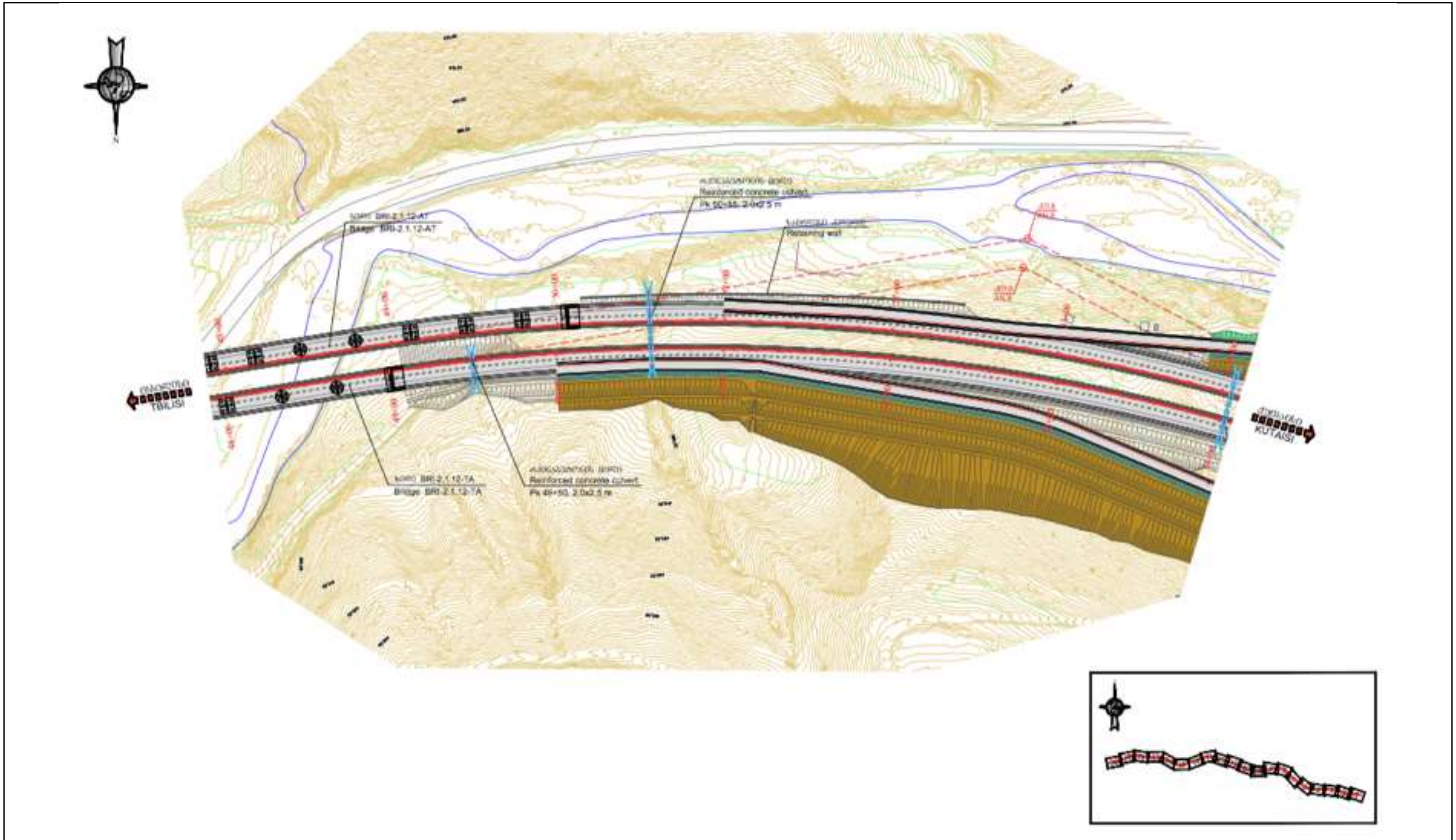


Figure 15: Map 10 - Project Road (KM5.4 – KM6.0)

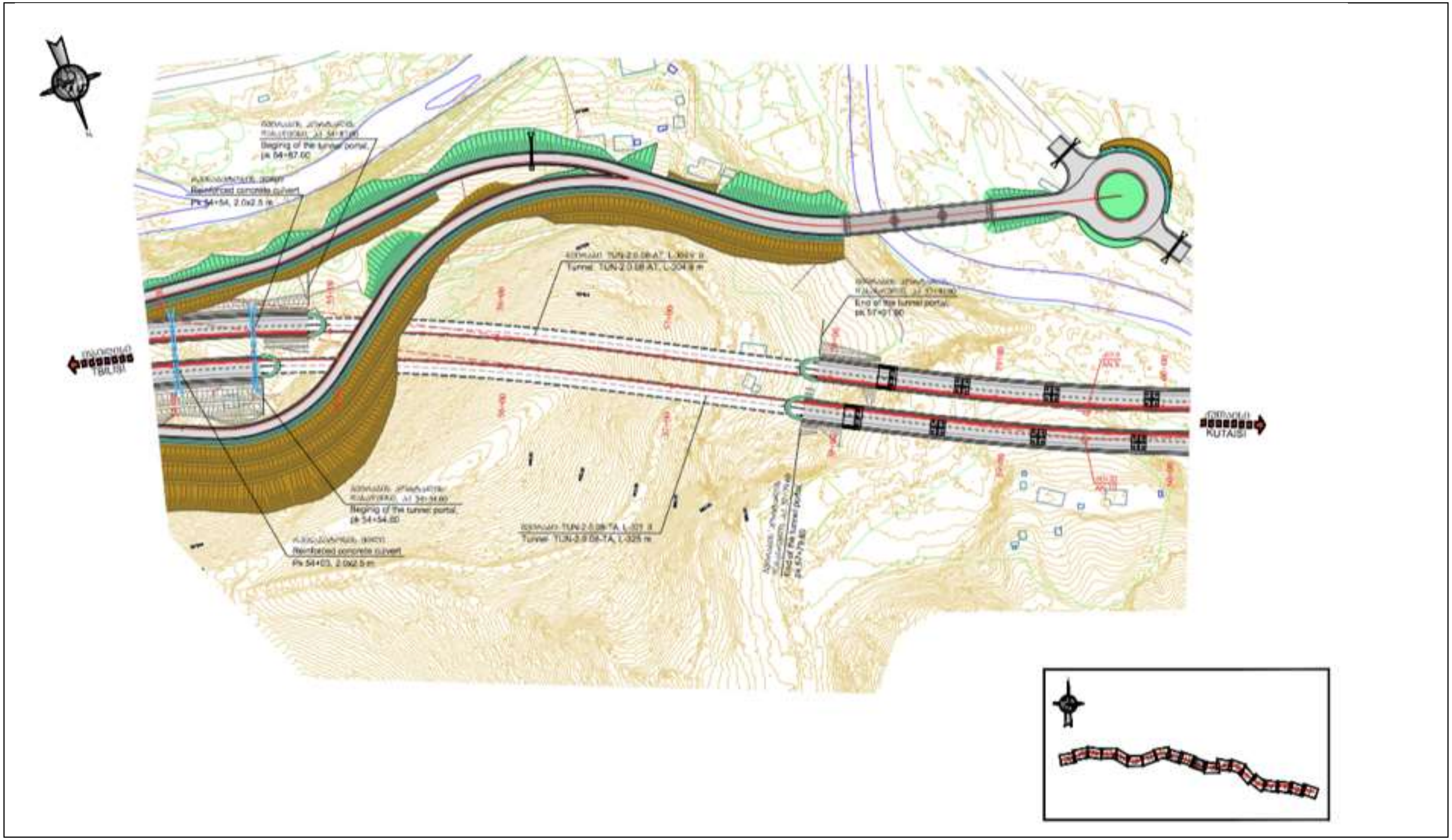


Figure 16: Map 11 - Project Road (KM6.0 – KM6.6)

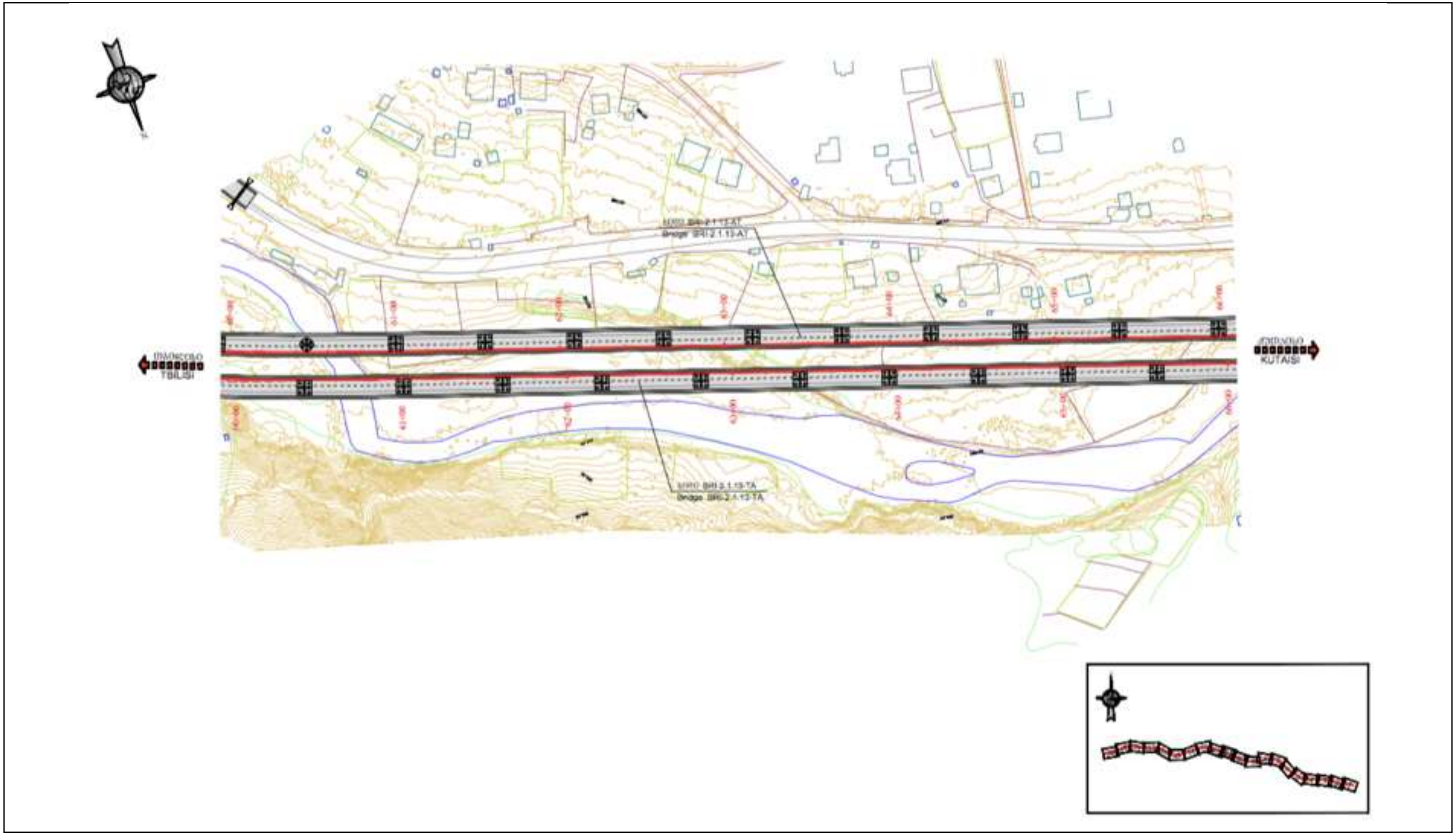


Figure 17: Map 12 - Project Road (KM6.6 – KM7.2)

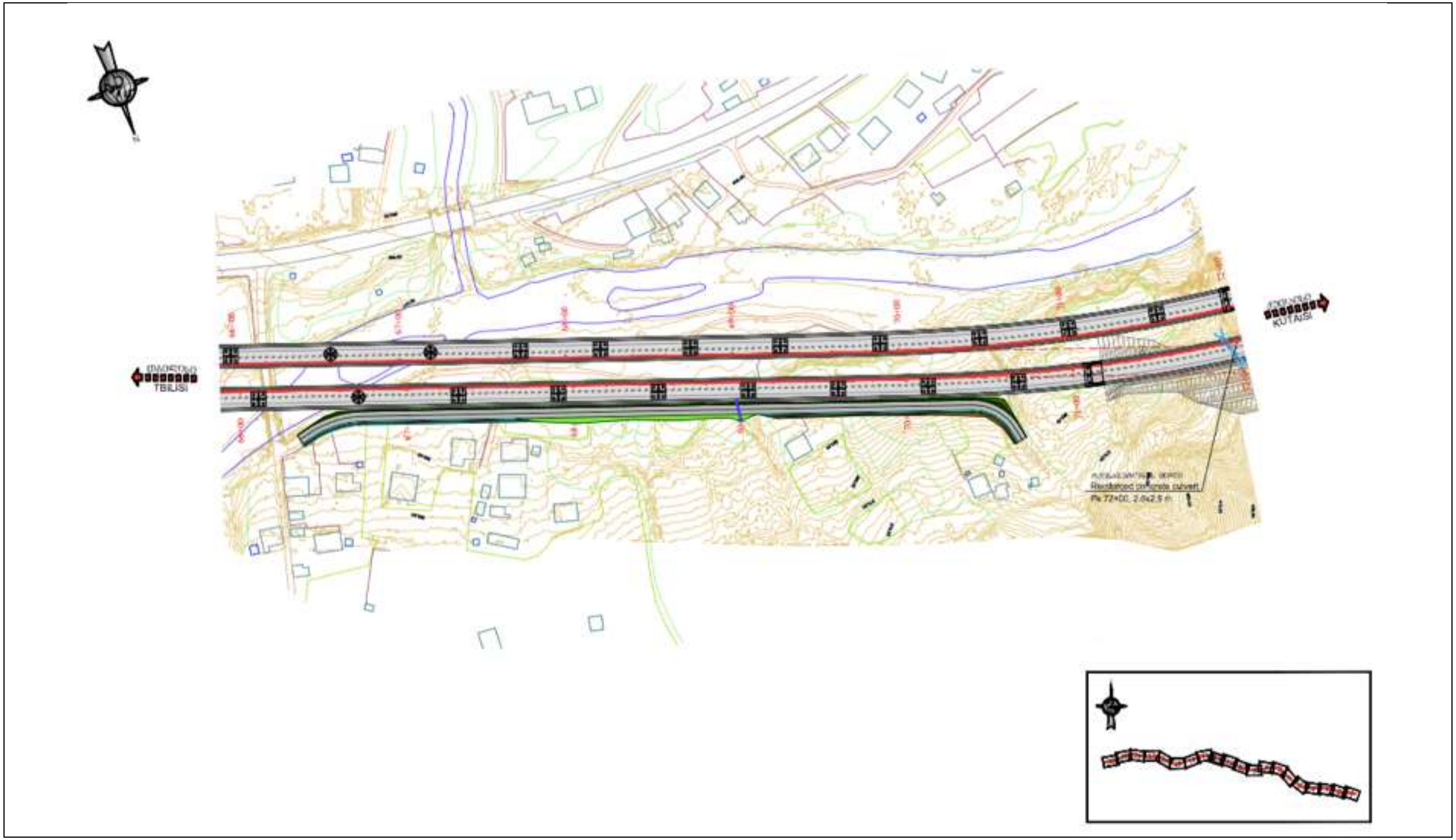


Figure 18: Map 13 - Project Road (KM7.2 – KM7.8)

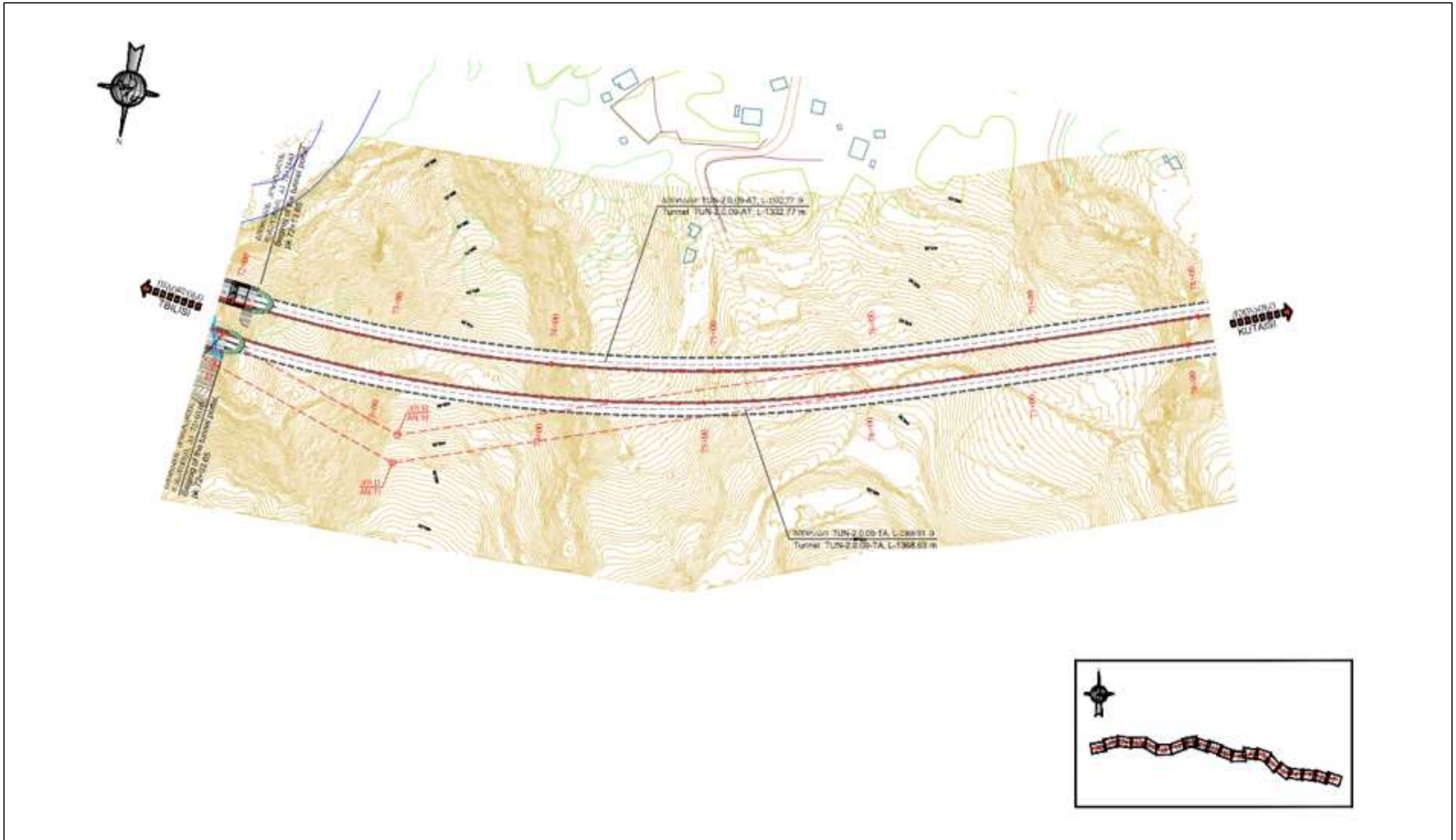


Figure 19: Map 14 - Project Road (KM7.8 – KM8.4)

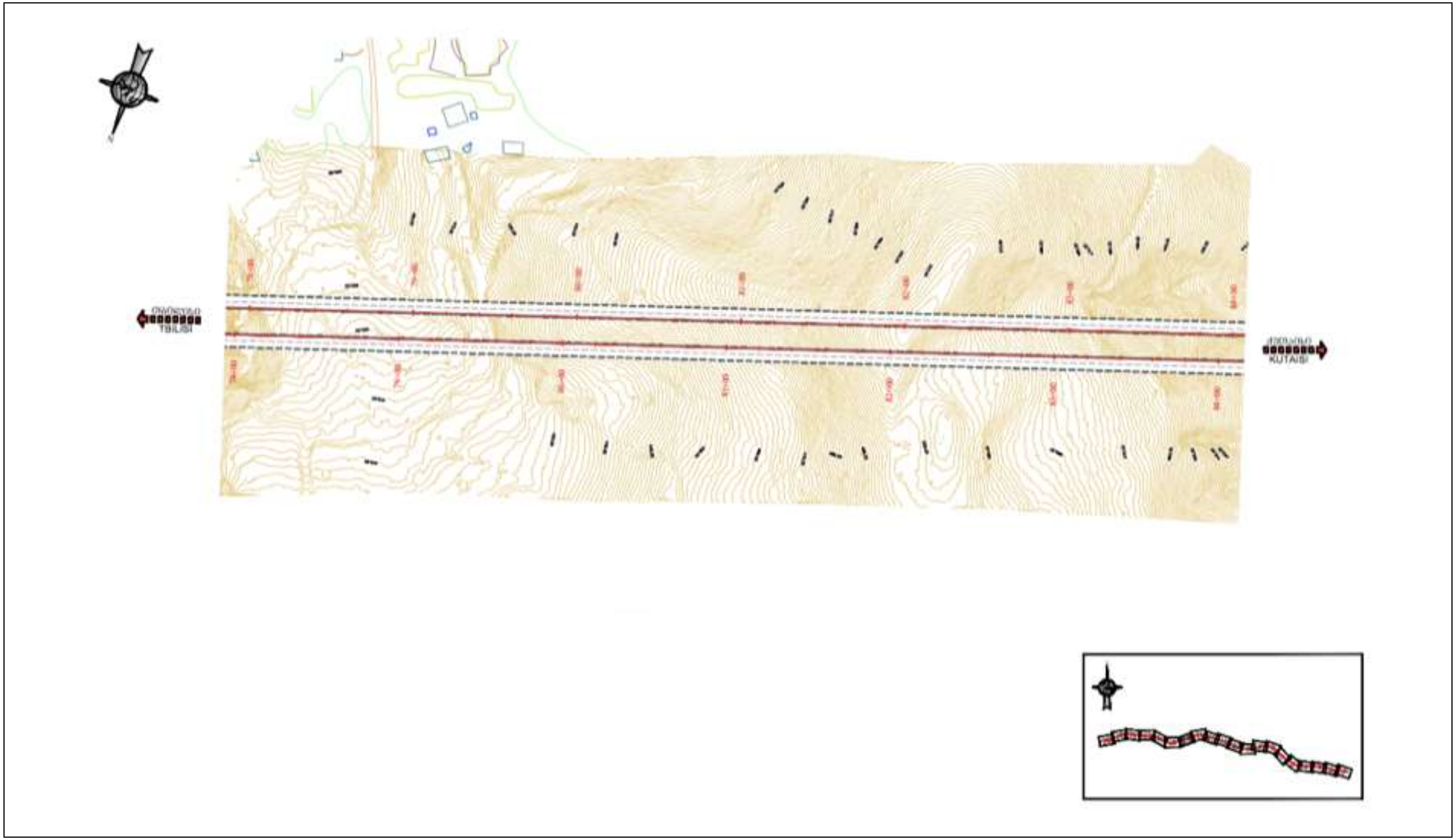


Figure 20: Map 15 - Project Road (KM8.4 – KM9.0)

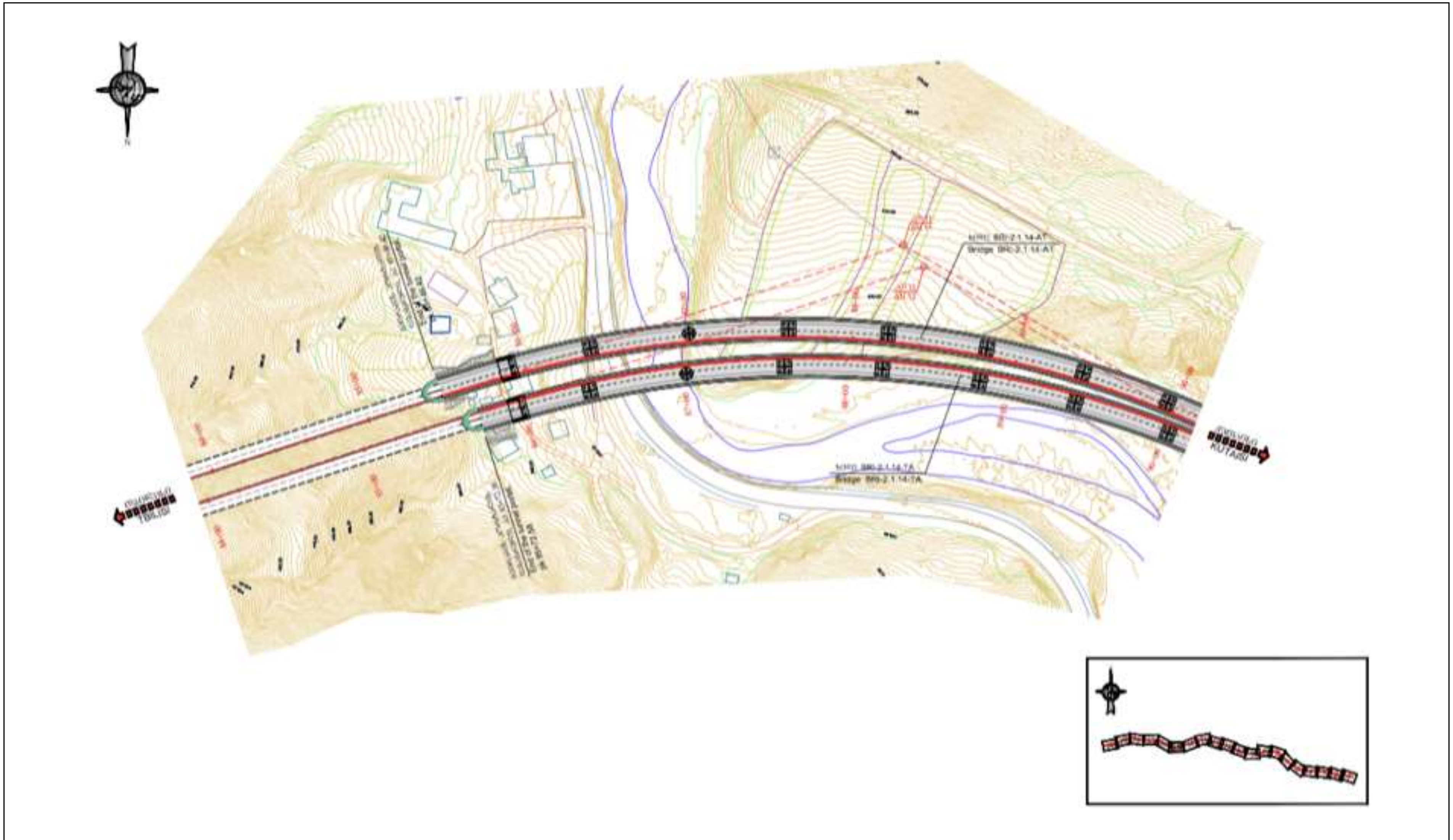


Figure 21: Map 16 - Project Road (KM9.0 – KM9.6)

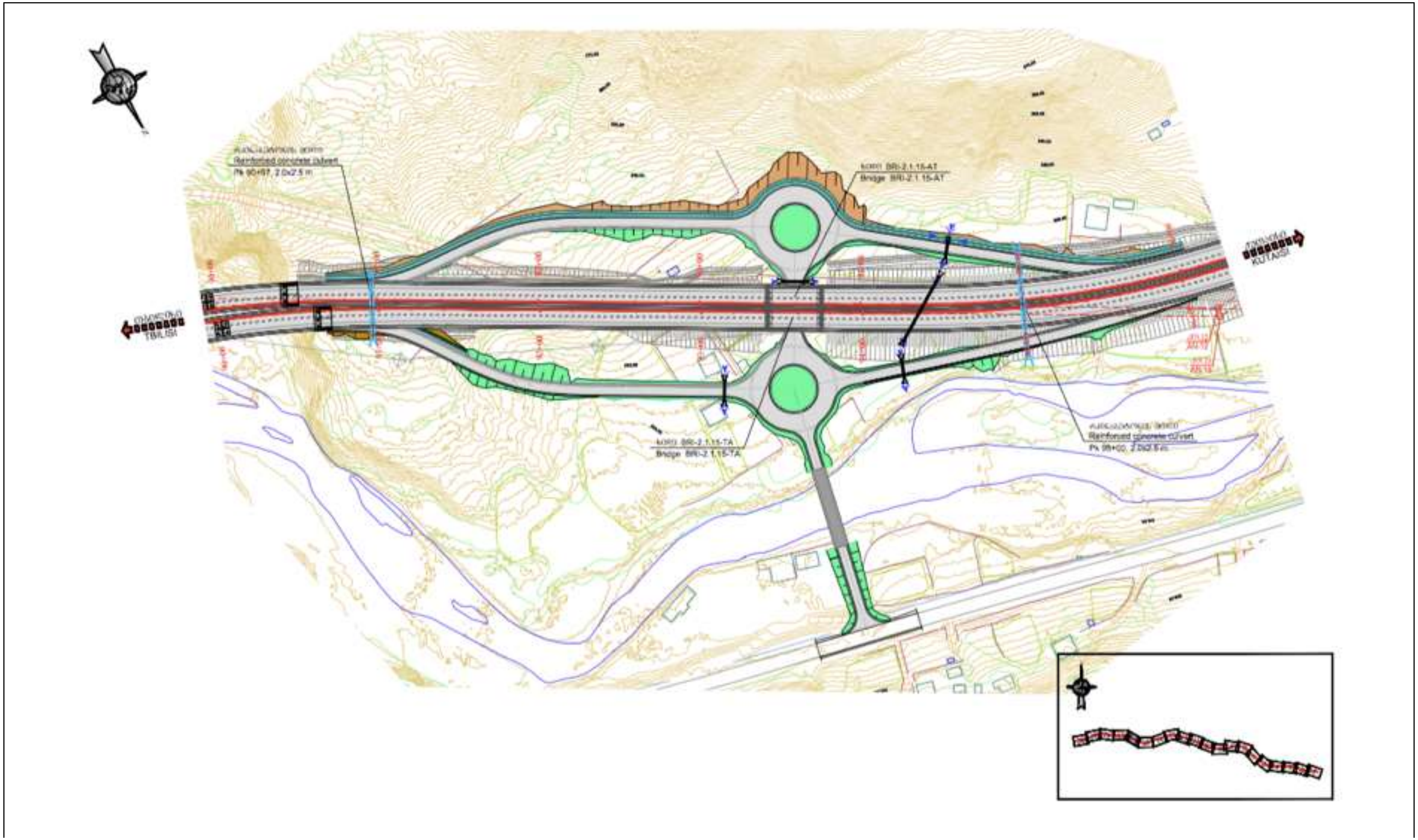


Figure 22: Map 17 - Project Road (KM9.6 – KM10.2)

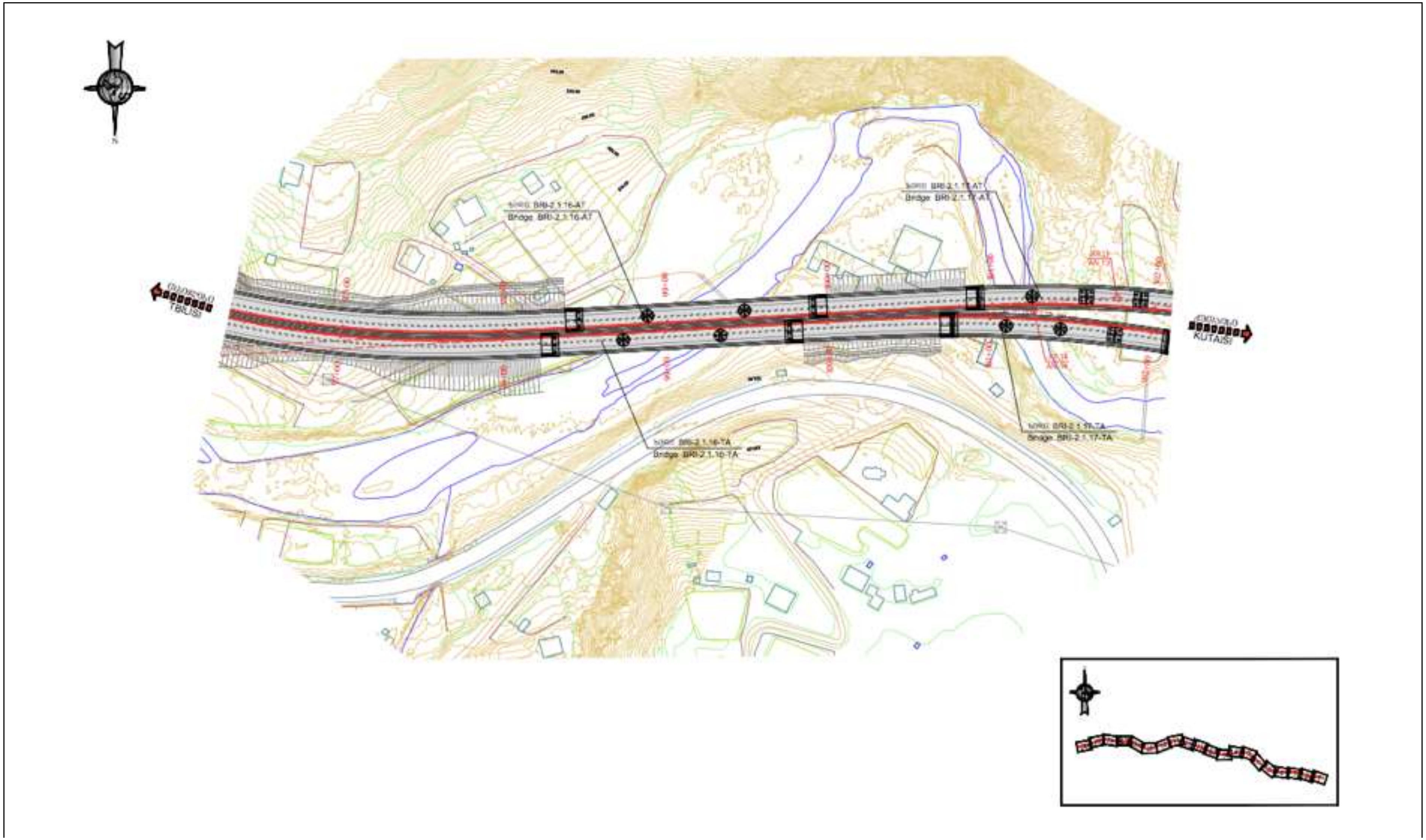


Figure 23: Map 18 - Project Road (KM10.2 – KM10.8)

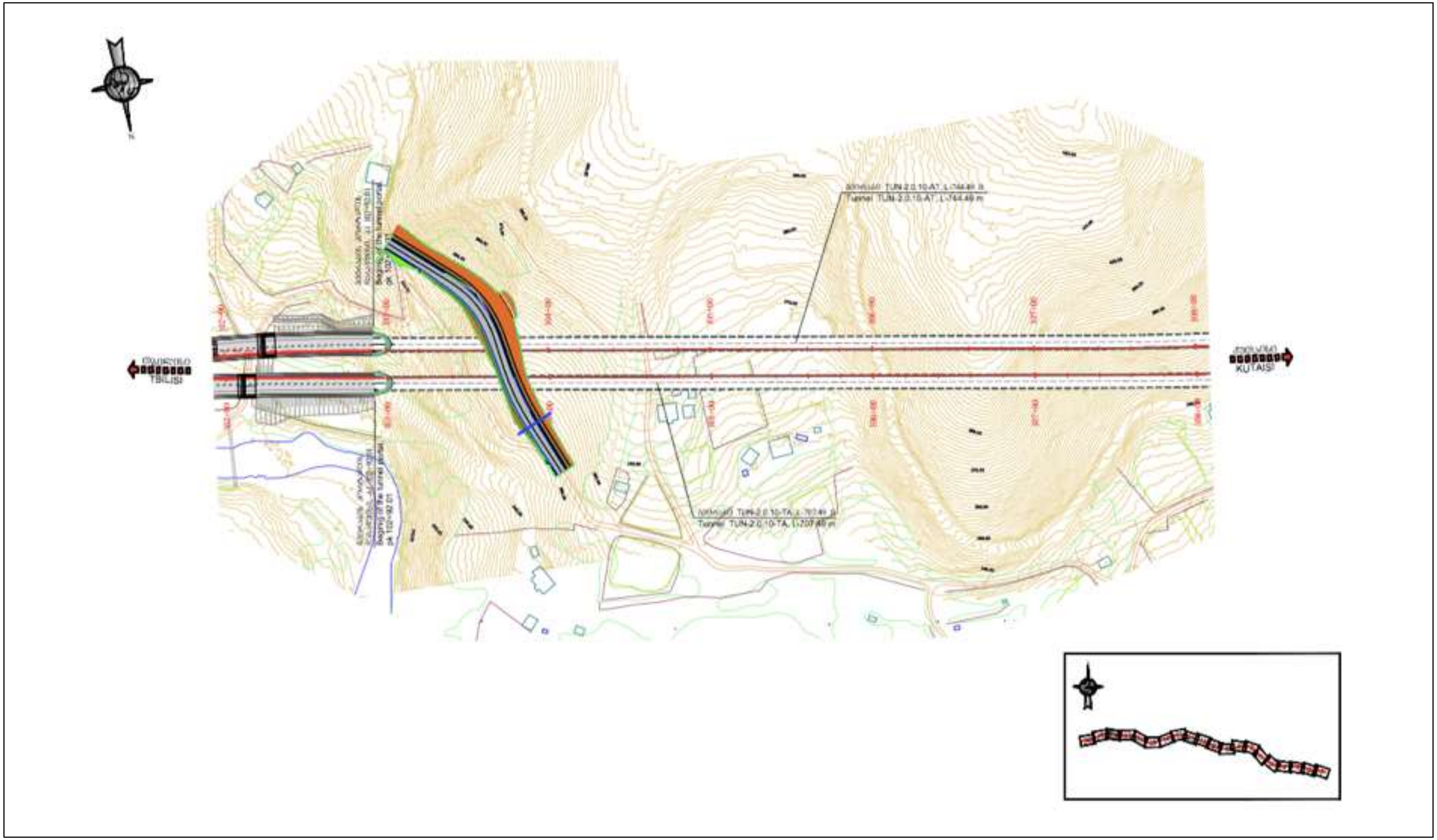


Figure 24: Map 19 - Project Road (KM10.8 – KM11.5)

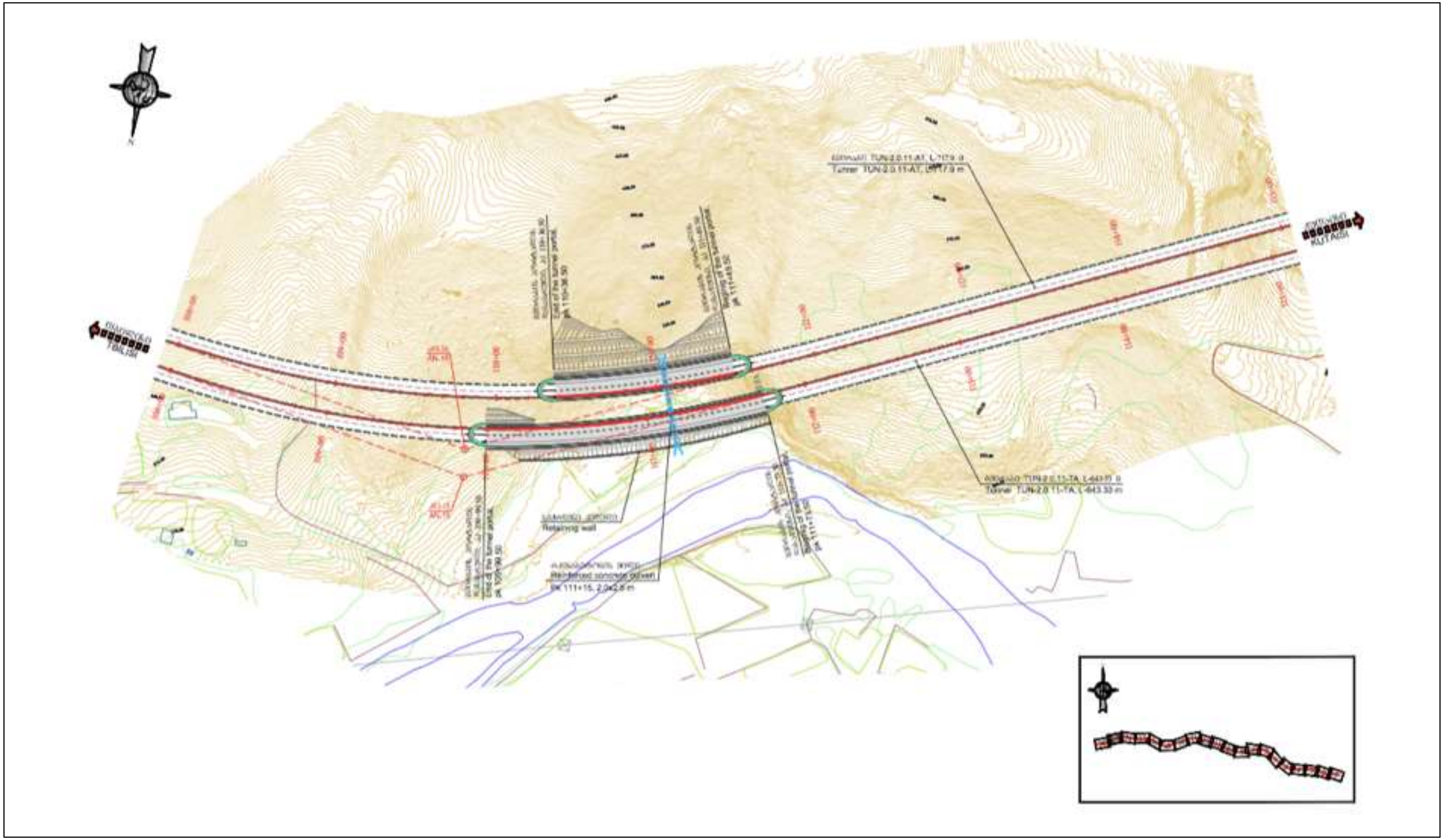
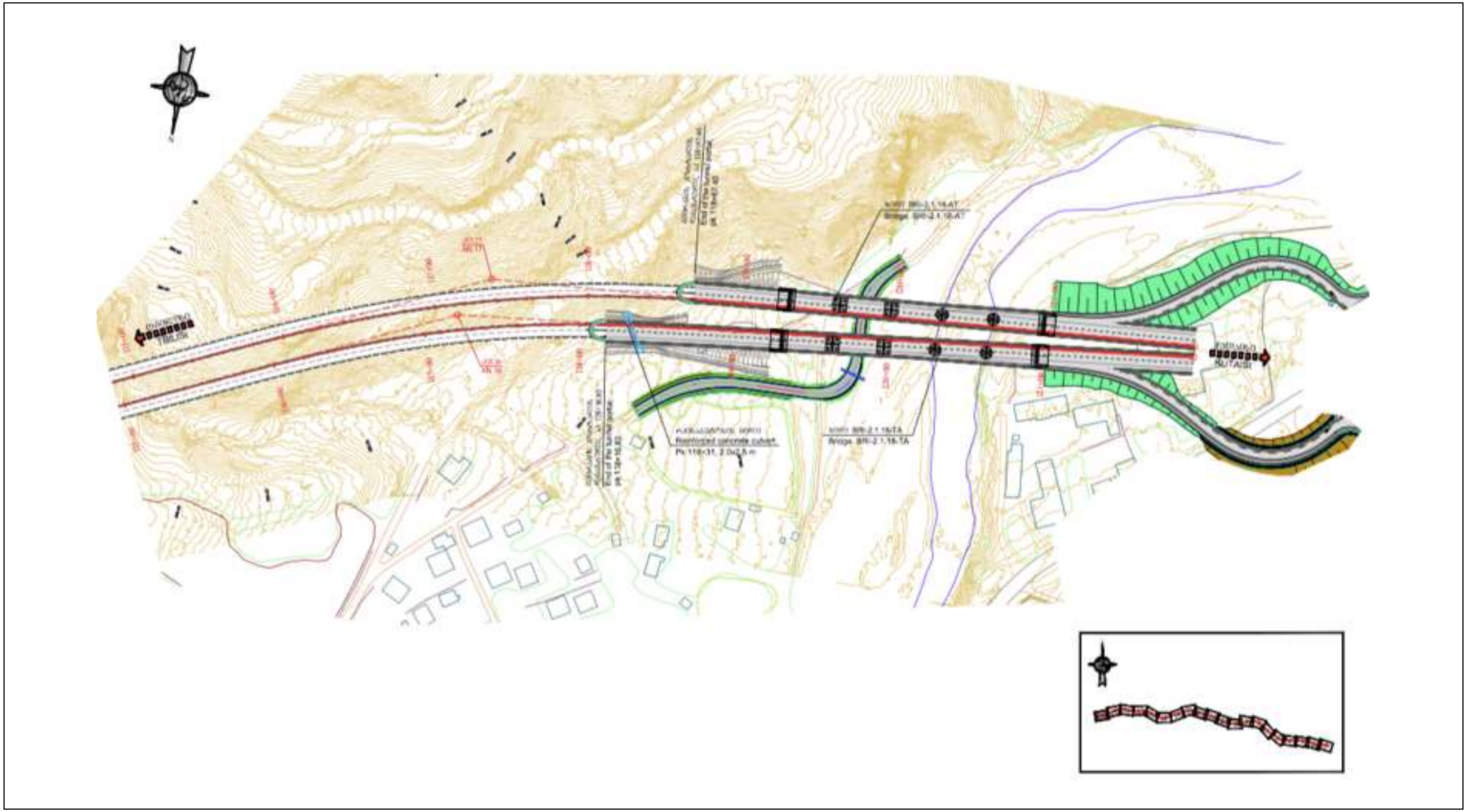


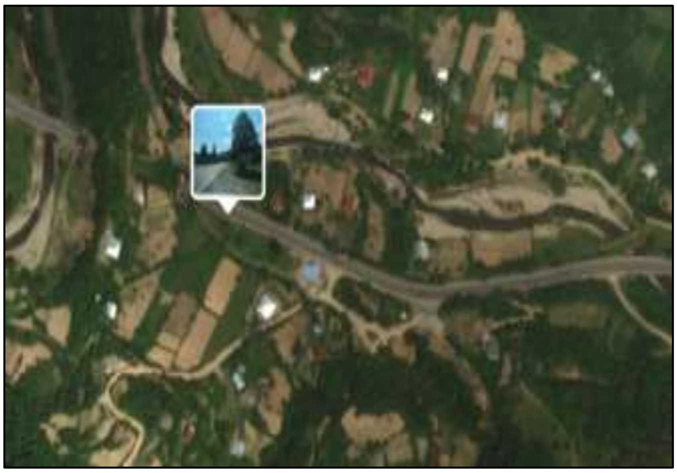
Figure 25: Map 20 - Project Road (KM10.8 – KM12.19)

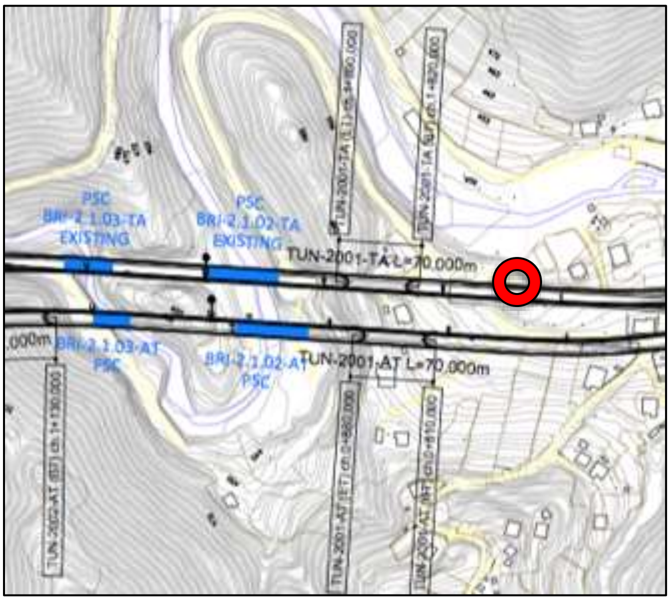


B.3 Environmental Setting

154. Figure 26 provides an overview of the F2 Section environmental setting.

Figure 26: F2 Environmental Setting



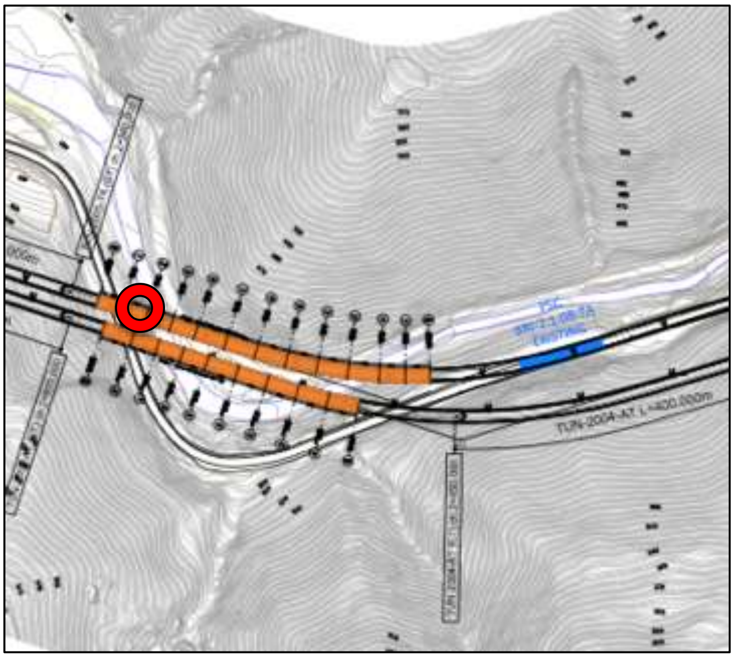


KM 0.7

The Project road starts on the alignment of the existing E-60 in Khevi heading west. Khevi is a small village situated in the valley of the Rikotula river. The photo opposite is taken looking east back towards the start of the Project road from KM0.7.

Land uses in this area are dominated by agricultural activities.

The TA section of the road will follow the existing alignment, the AT section will follow parallel to the existing alignment.



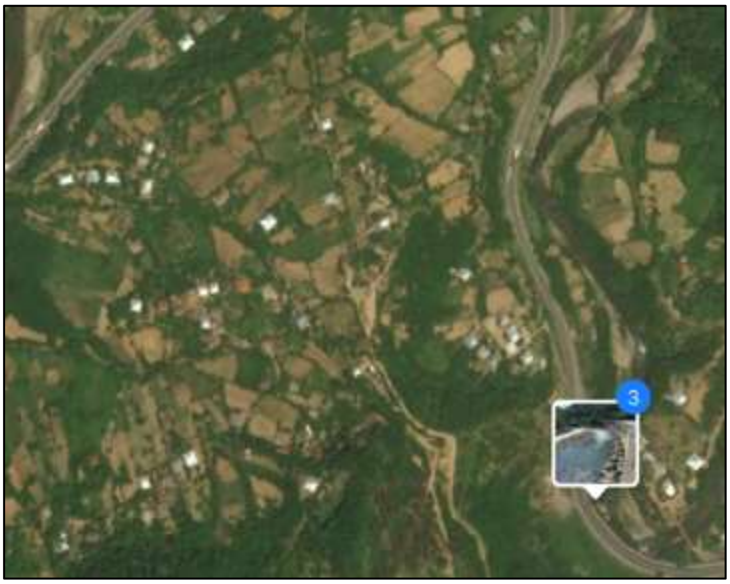
KM 2.8

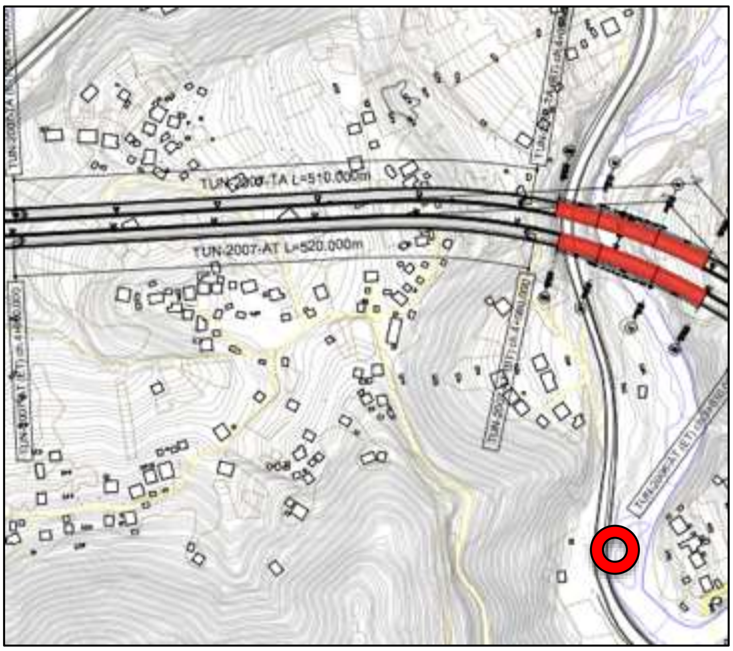
The existing road passes through a couple of tunnels and over several bridges which will be used by the TA alignment before the alignment starts to meander through the valley, following the Dzirula river.

The new alignment takes a more direct approach, cutting across the river, as shown opposite, and passing through tunnels.

The landscape in this area is a mix of small agricultural plots adjacent to the river and forests higher up the valley slopes. Population density is in this area is very low.

The photo opposite is taken looking south towards the area where the Bridge BRI-2.0.09 AT/TA will cross the Dzirula via a new bridge.



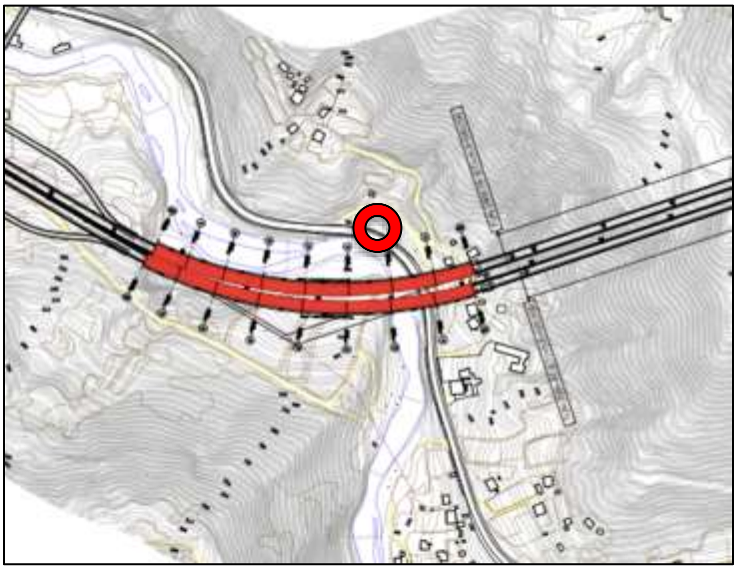


KM 4.0

The Project road continues east through a series of tunnels and bridges before reaching the small village of Khunevi where a small school is located close to the new alignment.

A bridge will be constructed straddling a portion of the village in the valley bottom which will require resettlement and compensation for a few properties in the village.

The photo opposite is taken looking north along the existing alignment which runs parallel with the Dzirula. The new alignment will pass above the river and the existing road via a bridge. The existing road will remain open throughout the construction and operational phases of the Project in this location.



KM 8.8

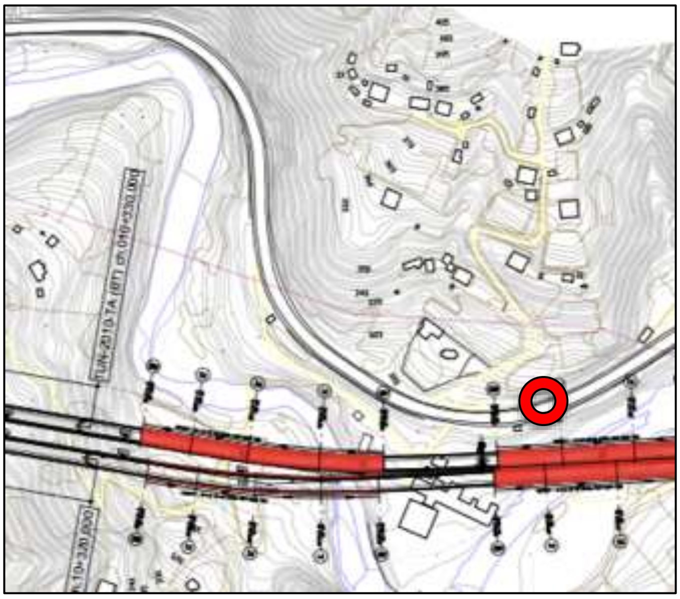
After leaving Khunevi the existing road follows the southern river bank while the new alignment is located in a tunnel on the north side of the river. Construction of tunnel portals in these areas will require a number of trees to be cut, and possibly some small access roads will need to be constructed to reach the tunnel portal areas.

At around KM5.0 the road reaches the village of Vertkvichala. The new alignment will run almost parallel to the existing road through the village, but it will be located on a bridge which will run straight east-west through the bottom of the valley for more than 1km.

This activity will result in a number of social and environmental issues, including, elevated noise levels, resettlement and compensation for loss of land.

Immediately after crossing the bridge the new alignment heads into a 1.3km long tunnel located north of the existing alignment. The tunnel exits at the point of the photo opposite crossing directly over the Dzirula. Just to the south of this point a school and cemetery can be found.

The roads only intersection follows directly after the bridge shown on the plan opposite.

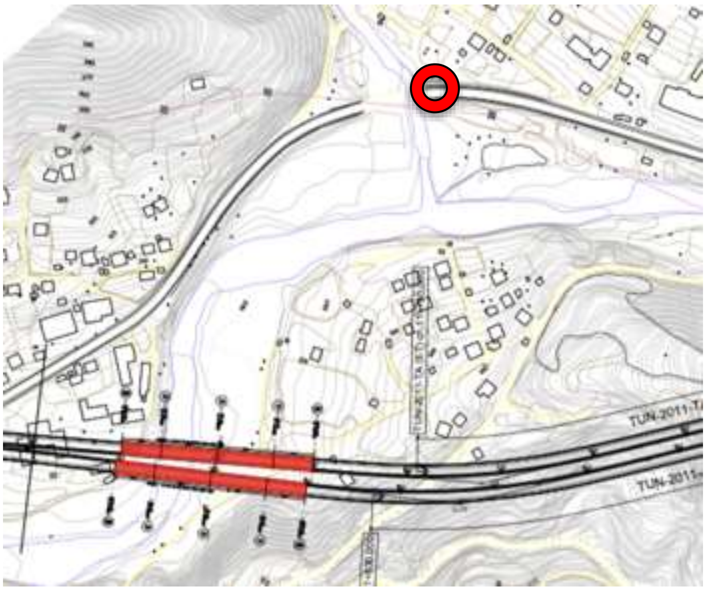


KM 10.1

After the intersection, which will provide access to the existing alignment (the existing alignment is generally unaffected by the new alignment from KM4.5 onwards), the new alignment runs generally to the south of the Dzirula with the existing alignment located on the north bank of the river.

This area is dominated by agricultural activity in the valley.

The photo opposite looks south towards the area where the road will be located on a bridge. A small church is located immediately to the north of the point where the photo opposite is taken.



KM 11.8

The Project road then disappears into two tunnels, both around 600 meters in length, before emerging to the south of the village of Boriti. It then crosses the Dzirula one last time before it reaches its end point at an intersection signaling the start of section F3.

Bypassing the village to the South has significant environmental benefits, such as reduced noise, improved air quality, and public safety.

The photo opposite is taken looking south from the conflux of the Dumala and Dzirula rivers. The new alignment crosses the river at the location of the arrow.

B.4 Road Standards and Profiles

155. Geometric design standards have been selected based on traffic flow, road category and relief to ensure safe and unimpeded traffic flow. The road design is based on the Georgian National Standard SST 72: 2009 “Standard on Geometrical and Structural Requirements for the Public Motor Roads of Georgia” and TEM (Trans-European North-South Motorway) Standards. The main technical parameters adopted in the detailed design are as follows:

(i) Design speed – 100 km/h (speed limit 80 km/h);
(ii) Number of traffic lanes – 4;
(iii) Width of traffic lane – 3.75 m;
(iv) Width of each carriageway – 7.5 m;
(v) Width of paved shoulder (emergency lane) – 2.5 m;
(vi) Width of verge – 1.0 m;
(vii) Width of central reserve – 5.0 m;
(viii) Width of paved shoulder at the central reserve – 1.0 m;
(ix) Total width of each paved platform – 11.0 m
(x) Width of road bed – 27.0 m;
(xi) Carriageway cross-fall on straight sections – 2.5%;
(xii) Minimum radius of horizontal curve – 400 m;
(xiii) Maximum longitudinal gradient – 4%;
(xiv) Minimum convex curve – 15 000 m;
(xv) Minimum concaved curve – 15 000 m.

156. A minimum radius of horizontal curve 400 m for the design speed 100 km/h is adopted based on Austrian standards (considered best practice for mountainous environments given the required speed levels and minimum radius) and Russian standards (SNiP 2.05.02-85) for mountainous relief. The road axis has been designed separately for two independent right and left lanes. The axis is located on the outer edge of the paved section (1.0 m) of the central reserve: Tbilisi-Argveta direction **TA,** Argveta-Tbilisi direction **AT**.

B.4.1 Cross Sections

157. In all the section of the motorway, the cross section is arranged in two carriageways with two traffic lanes each (2+2 lanes); the carriageways may be divided and independent according to the terrain characteristics. Traffic lanes in this proposal are always 3.75m, to guarantee enhanced and homogeneous safety level across the road.

158. **Cross Section on Embankment and Cuts** – The cross section includes:

(i) 2.50m wide paved external shoulder (hard shoulder) on the outmost of each carriageway this element may be widened on the internal carriageways, where sight analysis requires widening;
(ii) 1.00m verge on the outmost of the external shoulders, where external safety barrier may be located according to needs;
(iii) 5.00m wide central reserve (median), composed by:
- 3.00m space for the safety barrier (typically reinforced concrete, dual) and related workspace.
- 2x1.00m paved internal shoulders (or wider on the external carriageway only, where sight analysis requires widening).

159. The verge may also be 5-10cm above the pavement level, to protect embankment from erosion (should be interrupted every 25m to permit water flow, in dedicated channels with lining on embankments).

Figure 27: Typical Cross Section of Road Pavement

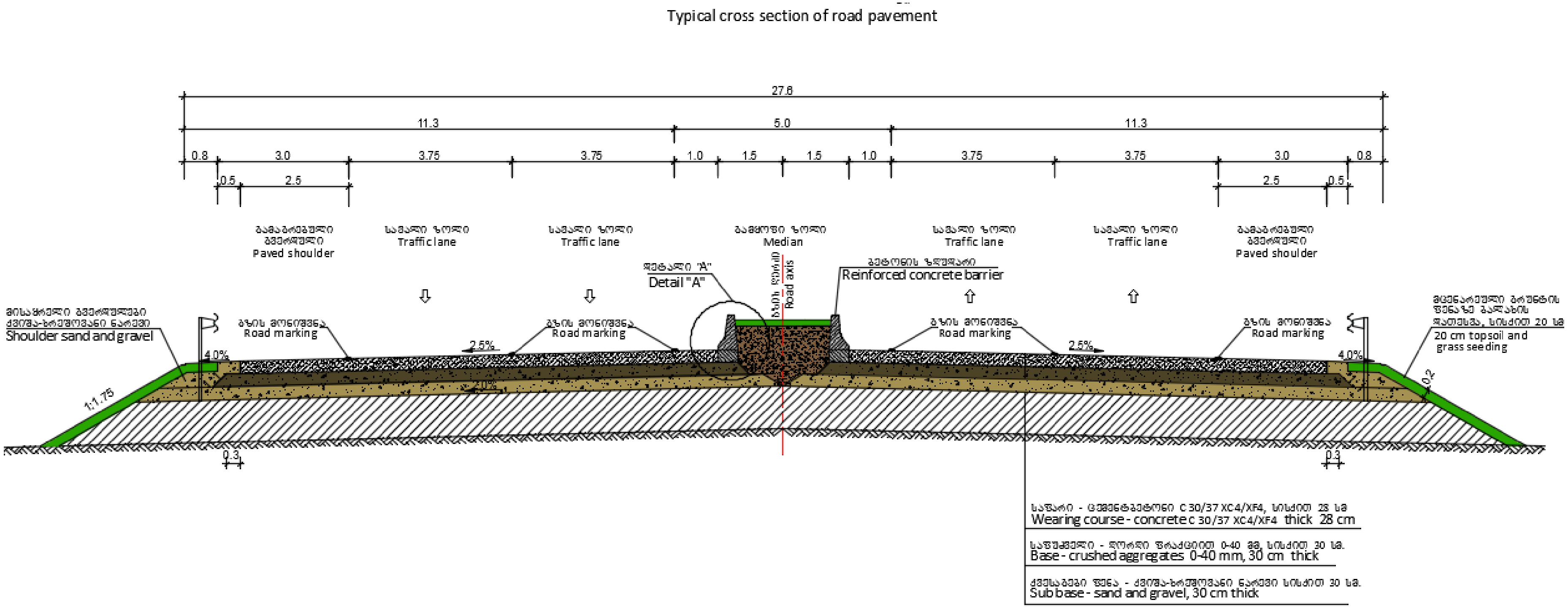


Figure 28: Other Types of Cross Section of Road Pavement

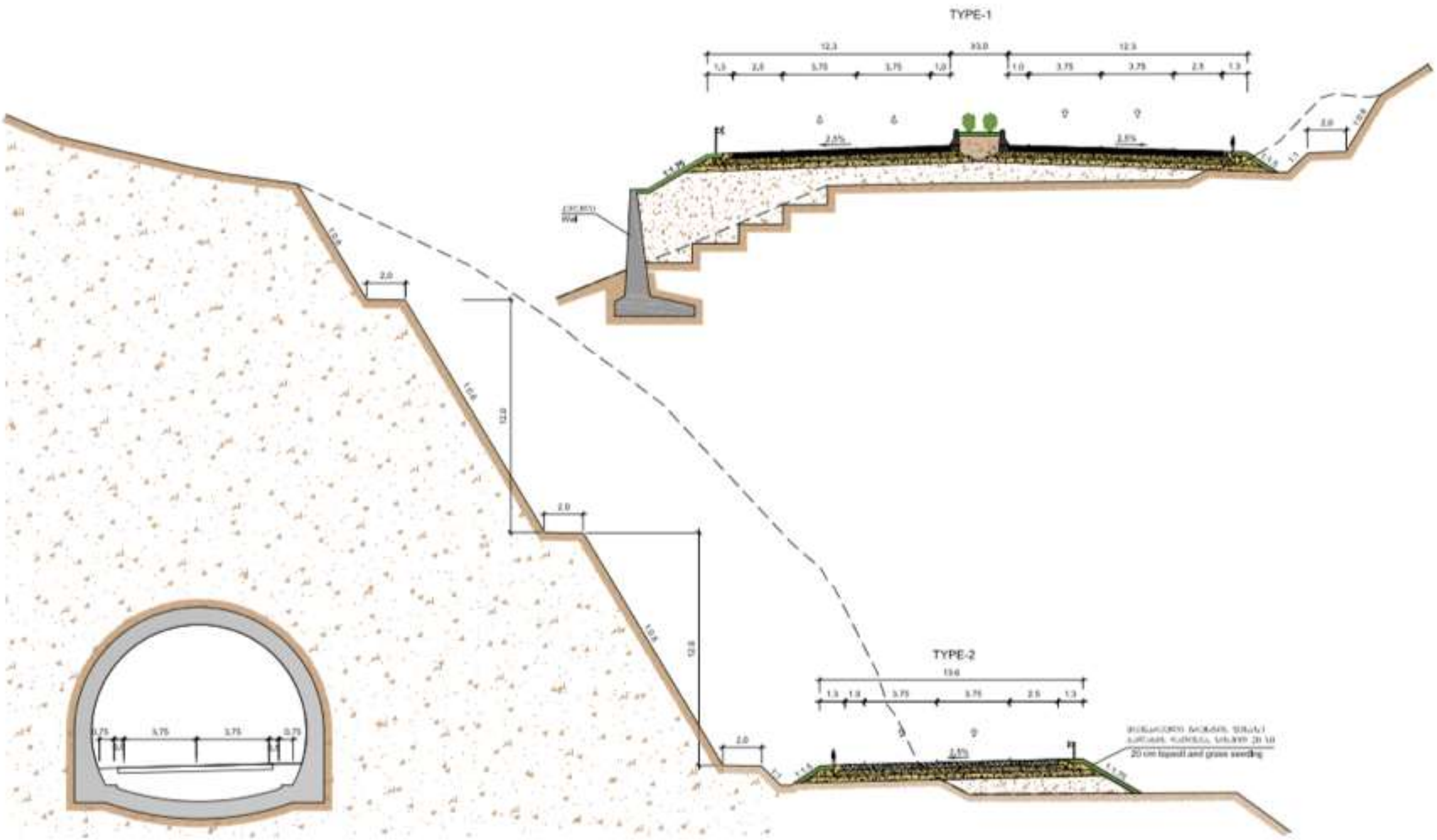


Figure 29: Other Types of Cross Section of Road Pavement

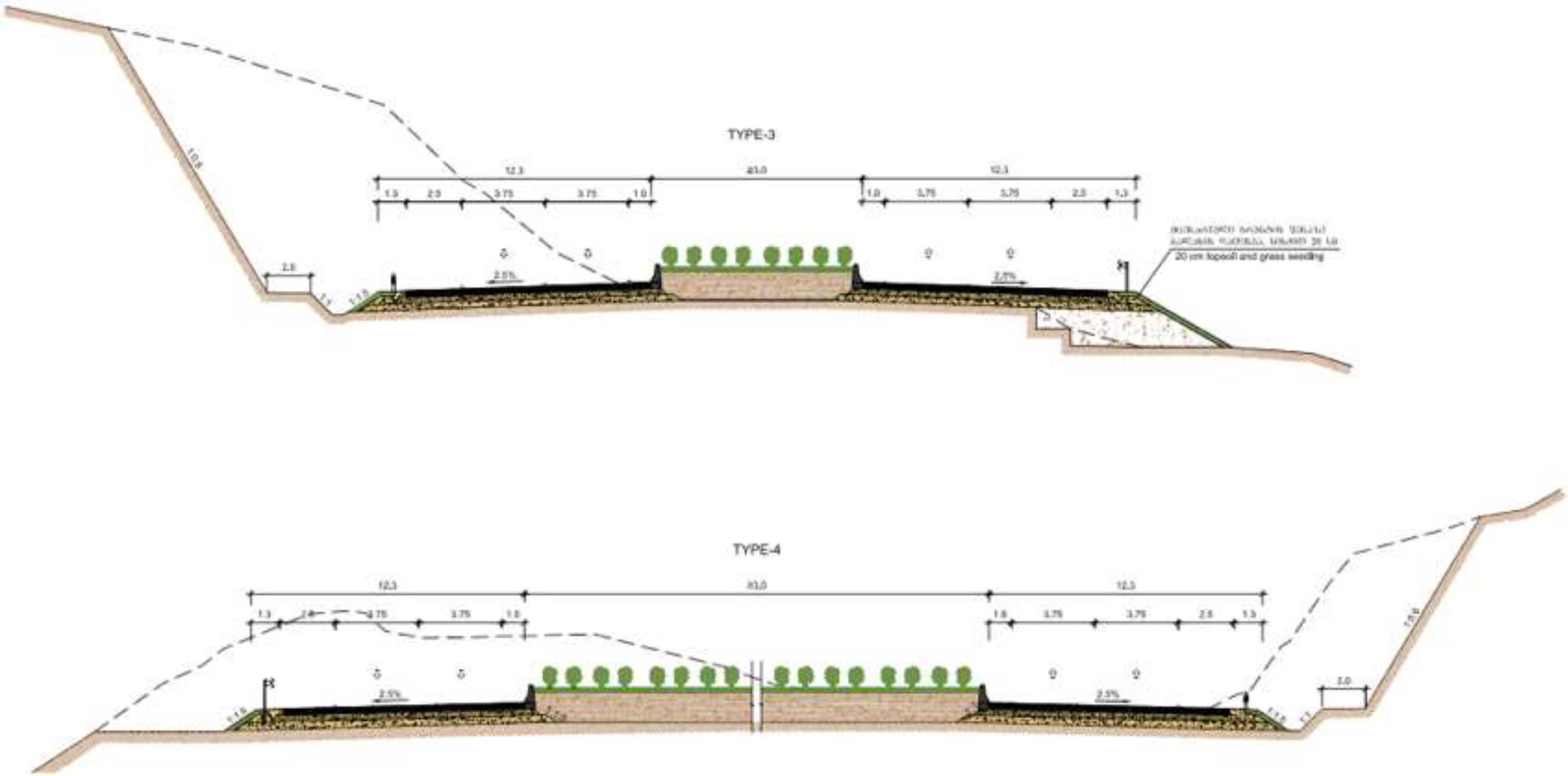


Figure 30: Cross Section on PSC Bridges

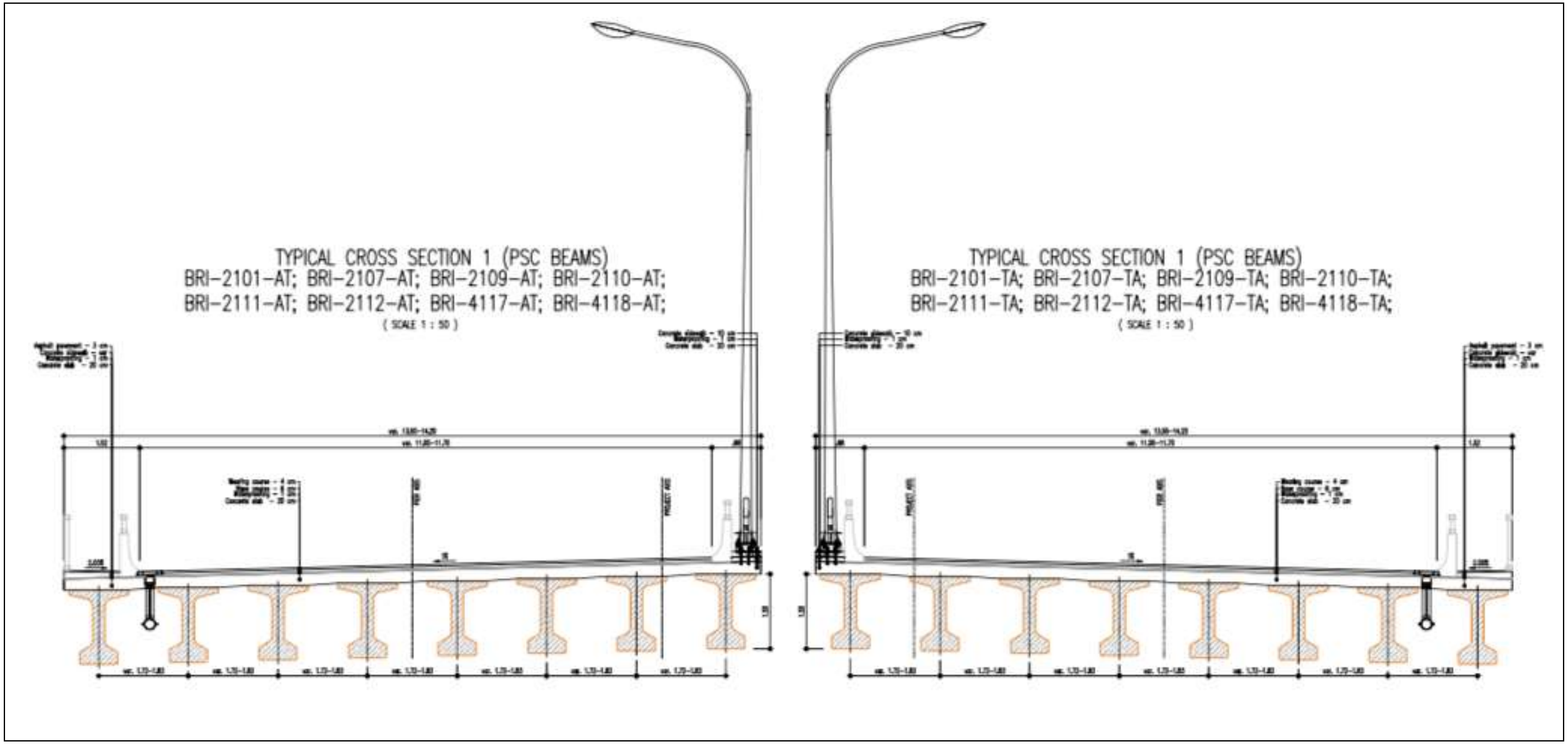


Figure 31: Cross Section on Steel-concrete Bridges

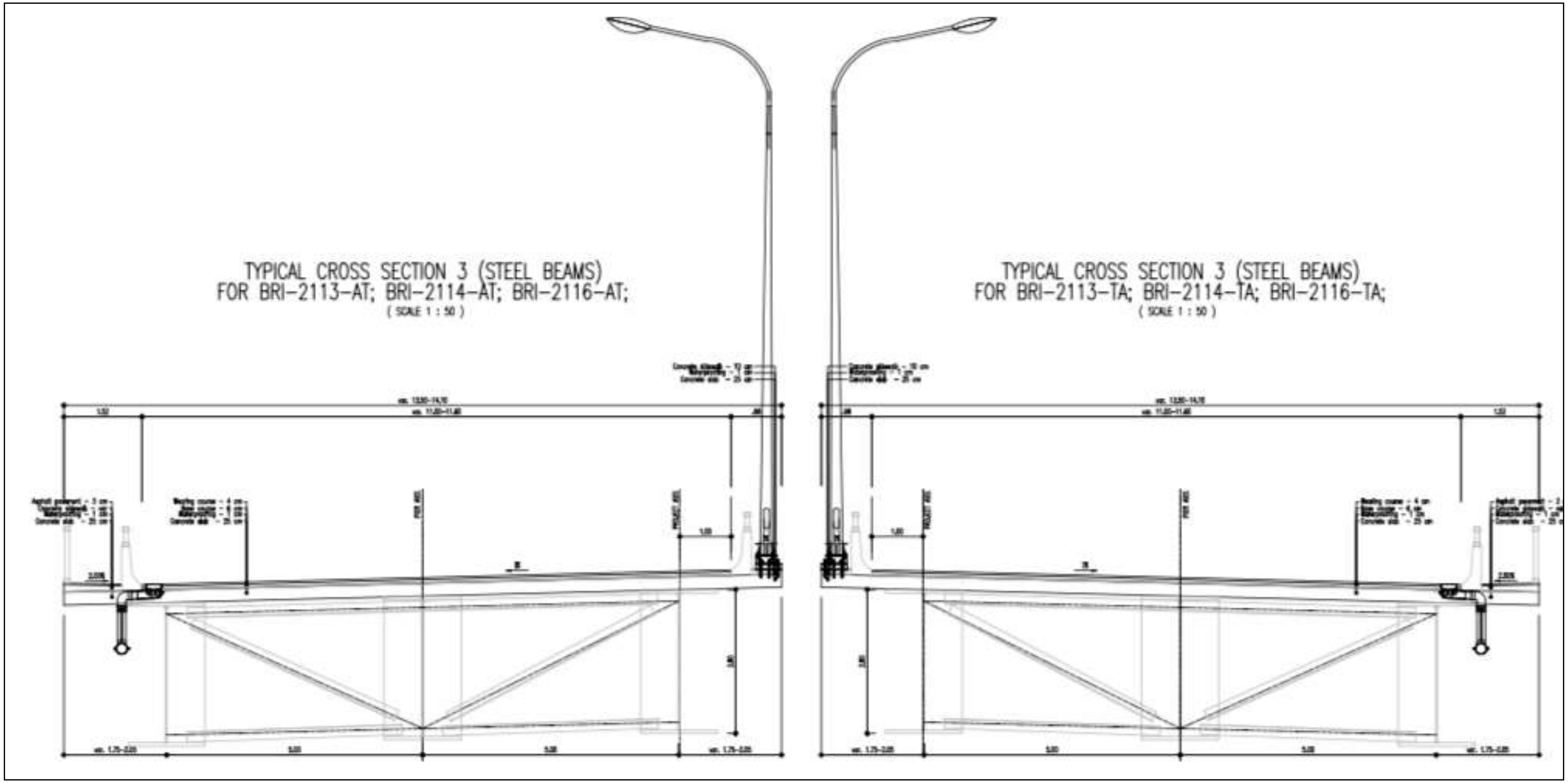
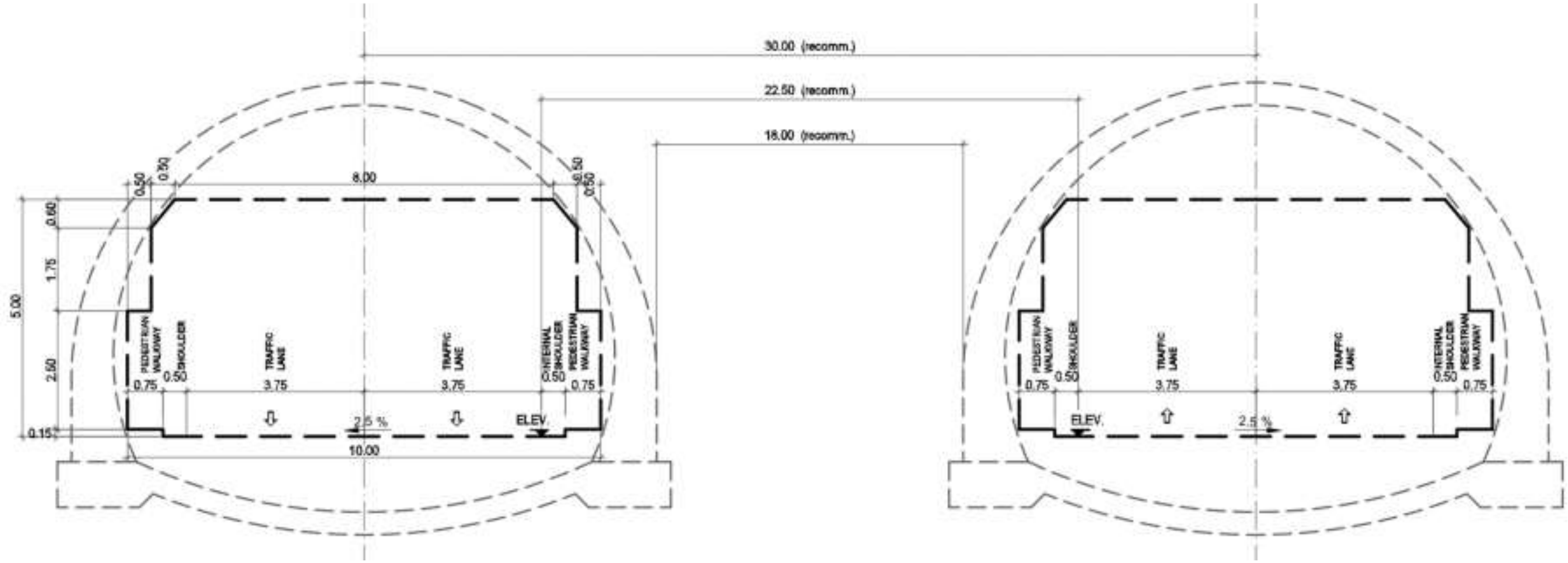


Figure 32: Cross Section in Tunnels



160. **Cross Section on Bridges** - The minimum width for the paved area is 11.00m (2x3.75+2.50+1.00). Safety barriers (internal and external) shall always be included, positioned outside of the shoulders (no element shall invade the shoulder space) and may be installed according to the manufacturer's specification. Side walkways shall be added, with a minimum clear width of 0.6m. Walkway may be also built with a cantilever metal structure, with external pedestrian parapet.

161. **Cross Section in Tunnels** - This is a functional cross section including the clear area (gabarit), so the structural part is not shown but shall be organized out of the dashed boundary line; the minimum vertical clearance is 5.00m, which is 1m more than the height of the standard trucks. All the structural parts and additional system (lighting, fans, cable ducts, etc.) shall be positioned outside the dashed boundary line. Minimum width for the paved area is 8.50m (2x3.75+2x0.50), pedestrian walkways are 0.75m wide, on both sides. There is no need of widening in the curves, since when the radius is minimum (400 m) the maximum speed allowed is 80 km/h.

B.5 Bridges

162. Thirty five bridges will be constructed during the project works, 18 on the TA axis and 17 on the TA axis. 17 of the bridges are located adjacent to each other and can be considered one bridge, but are not joined so constitute 'two' bridges. Table 2 and Table 3 below provides summary details of the bridges and their locations.

Table 2: F2 Bridges - TA Axis

#	Type	Length (m)	Number of Piers / in River	Start	End	Crossing
BRI-2.1.01	PSC	132.08	3/1	0+176.00	0+308.08	River
BRI-2.1.02	PSC	66.00	1/0	0+932.58	0+997.84	River
BRI-2.1.03	PSC	66.00	1/0	1+070.75	1+136.01	River
BRI-2.1.04	PSC	99.00	2/0	1+316.50	1+414.82	River
BRI-2.1.05	PSC	99.00	2/0	1+536.40	1+634.72	River
BRI-2.1.06	PSC	66.00	1/1	1+683.30	1+748.56	River
BRI-2.1.07	PSC	131.65	3/2	1+953.00	2+084.65	River
BRI-2.1.08	PSC	99.00	2/0	2+157.50	2+255.82	Dry Ravine
BRI-2.1.09	PSC	372.00	11/2	2+453.00	2+825.00	River
BRI-2.1.10	PSC	429.70	14/2	3+111.05	3+540.75	River
BRI-2.1.11	PSC	132.00	3/2	3+931.61	4+063.61	River
BRI-2.1.12	PSC	231.80	7/2	4+668.70	4+900.50	River
BRI-2.1.13	STEEL	1296.00	20/1	5+813.00	7+109.00	River
BRI-2.1.14	STEEL	462.00	8/1	8+600.00	9+062.00	River

BRI-2.1.15	PSC	33.00	0/0	9+341.30	9+374.30	Interchange
BRI-2.1.16	STEEL	144.00	2/2	9+832.00	9+976.00	River
BRI-2.1.17	PSC	133.70	3/2	10+077.00	10+210.70	River
BRI-2.1.18	PSC	165.00	4/2	11+931.50	12+096.50	River
	Total	**4157.93**				
	PSC	2255.93				
	STEEL	1902.00				

*PSC - Pre-cast Steel-concrete / STEEL - Composite steel-concrete

Table 3: F2 Bridges - AT Axis

#	Type	Length (m)	Number of Piers / in River	Start	End	Crossing
BRI-2.1.01	PSC	134.90	3/1	0+156.00	0+290.90	River
BRI-2.1.02	PSC	99.00	2/0	0+891.80	0+990.12	River
BRI-2.1.03	PSC	66.00	1/0	1+034.17	1+009.43	River
BRI-2.1.04	PSC	99.00	2/1	1+324.04	1+422.36	River
BRI-2.1.05	PSC	99.00	2/1	1+504.13	1+602.45	River
BRI-2.1.06	PSC	66.00	1/1	1+689.33	1+754.59	River
BRI-2.1.07	PSC	131.55	2/0	1+878.00	2+009.55	River
BRI-2.1.09	PSC	286.35	8/2	2+531.00	2+817.35	River
BRI-2.1.10	PSC	425.35	13/1	3+162.85	3+588.20	River
BRI-2.1.11	PSC	134.35	3/2	3+922.43	4+056.78	River
BRI-2.1.12	PSC	313.45	9/1	4+692.20	5+005.65	River
BRI-2.1.13	STEEL	1362.00	22/3	5+837.00	7+199.00	River
BRI-2.1.14	STEEL	450.00	8/0	8+593.00	9+043.00	River
BRI-2.1.15	PSC	33.00	0/0	9+342.54	9+375.54	Interchange
BRI-2.1.16	STEEL	144.00	2/2	9+846.00	9+990.00	River
BRI-2.1.17	PSC	132.00	3/1	10+092.00	10+224.00	River
BRI-2.1.18	PSC	165.00	4/2	11+929.80	12+094.80	River
	Total	**4140.95**				
	PSC	2184.95				
	Steel	1956.00				

163. The following presents a short description of the main bridges:

Pre-cast Steel-concrete (PSC) beams bridges (all spans in isostatic scheme):

(i) Bridge BRI-2001: both carriageways are composed by 4 spans of about 33 m.
(ii) Bridge BRI-2007: both carriageways are composed by 4 spans of about 33 m.
(iii) Bridge BRI-2009-TA: the bridge is composed by 12 spans, 7 of about 33 m and 5 of about 27 m.
(iv) Bridge BRI-2009-AT: the bridge is composed by 9 spans, 7 of about 33 m and 2 of about 27 m.
(v) Bridge BRI-2011: both carriageways are composed by 4 spans of about 33 m.
(vi) Bridge BRI-2012-TA: the bridge is composed by 7 spans of about 33 m.
(vii) Bridge BRI-2012-AT: the bridge is composed by 10 spans, 7 of about 33 m and 3 of about 27 m.
(viii) Bridge BRI-2017: both carriageways are composed by 4 spans of about 33 m.
(ix) Bridge BRI-2018: both carriageways are composed by 5 spans of about 33 m.

Composite steel-concrete deck bridges (all continuous deck):

(i) Bridge BRI-2014-TA: the bridge is composed by 23 spans with length 42 m, 48 m, 54 m and 60 m.
(ii) Bridge BRI-2014-AT: the bridge is composed by 25 spans with length 42 m, 48 m, 54 m and 60 m.
(iii) Bridge BRI-2015-TA: the bridge is composed by 8 spans with length 42 m and 60 m.
(iv) Bridge BRI-2015-AT: the bridge is composed by 8 span with length 42 m, 48 m and 60 m.
(v) Bridge BRI-2016: both carriageways are composed by 3 spans of 42+60+42 m.

164. Both bridge types have their advantages and disadvantages as follows:

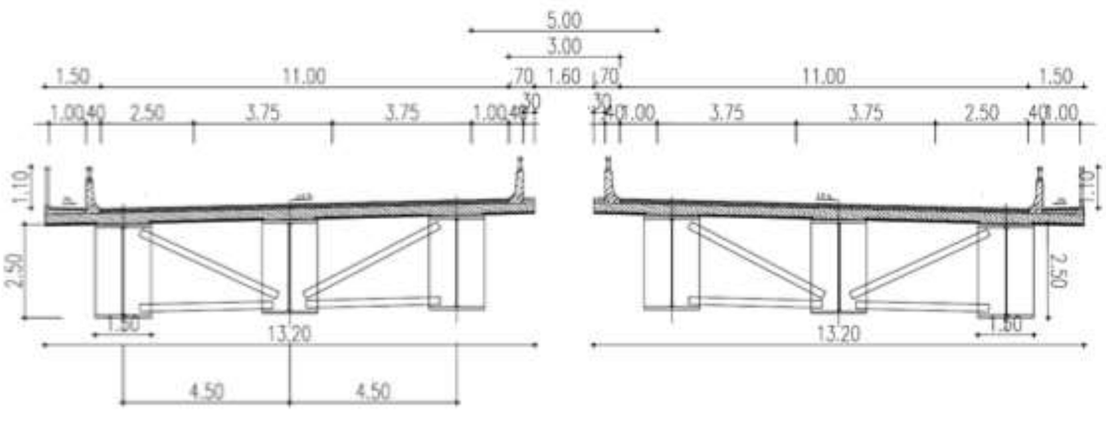
(i) Precast steel-concrete - In this method a crane moves the precast concrete girder up to the top of substructure. The weakness of this method is the requirement of installation of temporary plant for prefabrication of precast girder and difficulty of span arrangement over 40 m in a span length, but the strength is short construction period due to using crane method and economic efficiency.

(ii) Composite steel-concrete bridges - will be constructed using staging construction method using temporary steel bent to place the cast-in place concrete of superstructure. The weakness is relatively difficult in construction due to long period of construction to place cast-in-situ concrete of superstructure and requirement of temporary steel bent to support the formwork of concrete.

165. There are two types of pier geometry in elevation (see **Appendix I**).

166. The bridge decks will be composed by three main beams connected by diagonal and transversal bracings and with the slab cast on situ on a thin concrete plate thin slab (“predalle”), more or less as is shown in Figure 33 below.

Figure 33: Bridge Cross Section



167. For foundation of substructures, installation of piles will be done through boring using cast-in-place bored piles with reinforced concrete which was adopted due to local field condition, environment effect, and supply of materials. This construction method has less noise and vibration impacts compared to precast driving methods. The foundations on the riverbed will have a circular plinth, so to minimize the disturb to the flow of water.

B.6 Tunnels

168. Twenty tunnels are included in Section F2:

(i) Two existing tunnels to be qualify (TUN-2001-TA and TUN-2003-TA) of about 100-130 m;
(ii) Two new tunnels parallel and adjacent to the existing (TUN-2001-AT and TUN-2003-AT) on the carriageway AT of about the same length;
(iii) Two single tunnels on the carriageway AT (TUN-2002-AT and TUN-2004-AT) of about 200 and 400 m
(iv) Seven tunnels with double tube with length from 300 m to about 1300 m. In this Section, the rock is generally good, even if there are some faults, and generally the soils covers are not very thick.

Table 4: Tunnels in Section F2

				CHAINAGES			
Tunnel	**Carr.**	**Length**	**Length Underground**	**Start of Tunnel**	**Start Underground**	**End Underground**	**End of Tunnel**
TUN 2001	AT	100.4	52.6	800.00	829.00	88.,60	900.40
	TA	113.9	113.9	793.00	793.00	906.90	906.90
TUN 2002	AT	186.5	173.5	1.129.30	1.135.80	1,309.30	1,315.80
TUN 2003	AT	126.2	99.5	1.756.70	1.771.40	1,870.90	1,882.90
	TA	150.3	150.3	1.765.30	1.765.30	1,915.60	1,915.60
TUN 2004	AT	423.3	400	2,025.58	2.050.00	2,450.00	2,456.44
TUN 2005	AT	311.1	279.2	2,829.90	2,854.00	3,133.20	3,156.00
	TA	266	234.4	2,831.10	2,854.00	3,088.40	3,112.10
TUN 2006	AT	227.4	206.4	3,610.50	3,617.00	3,823.40	3,845.40
	TA	277.7	254,7	3,575.00	3,581.50	3,836.20	3,860.20
TUN 2007	AT	583.9	573	4,070.55	4,077.00	4,650.00	4,662.04
	TA	534.1	510	4,073.50	4,080.00	4,590.00	4,615.10
TUN 2008	AT	274.9	242.7	5,502.00	5,526.20	5,768.90	5,791.90
	TA	310	279	5,454.60	5,476.90	5,755.90	5,779.60
TUN 2009	AT	1325.3	1300	7,213.55	7,220.00	8,520.00	8,546.42
	TA	136.5	1335	7,203.55	7,210.00	8,545.00	8,572.58
TUN 2010	AT	736.9	710	10,292.01	10,320.00	11,030.00	11,036.45
	TA	694.4	663	10,297.53	10,330.00	10,993.00	10,999.50
TUN 2011	AT	710.4	679	11,149.50	11,156.00	11,835.00	11,867.40
	TA	635.8	610	11,173.50	11,180.00	11,790.00	11,816.83

*Existing tunnel

169. A study of the two existing tunnels is currently on-going. The proposed works, which has been preceded by some survey on the concrete lining (which showed more of 80 cm of thickness, no reinforcement and bad conditions due to water infiltrations) is the following:

(i) Remove 20-30 cm of existing concrete;
(ii) Install waterproofing membrane; and
(iii) Install new reinforcement bars.

Table 5: Typical Tunnel Dimensions

Parameter	Value
Width of pavement	7.50 m
Width of sidewalk	0.75 m
Width of Shoulder	0.50 m
Total width of tunnel	10.0

170. Ventilation - The primary ventilation for the tunnels having length >1000m will be of the longitudinal type. Ventilations is guaranteed by the use of axial Jet-Fans, having rotor's diameter 1.250mm, stainless steel box, with reversible flow, fire resistant for 2h at 400°C. Moreover, Jet-Fans cables and switching for fan's wiring have the same fire resistance characteristics.

171. Escape Routes - Escape routes are provided for tunnels which length is >1000m, which in case of fire will allow users to reach the other tube of the tunnel, and from there they will go to the nearest portal. Escape routes are accessible only through specific filter areas with fire doors REI 120 in order to avoid the propagation of the fire or smoke inside bypass and pressurized by ventilation systems.

172. Fire Protection - Tunnels having length >500m are equipped with the fire protection system. Pump stations and the related tanks are installed next to the substations ES3, ES4 and ES5. The electrical plant supply are realized according to standard EN 12845. Fire protection network will supply the 120l/min hydrants located inside the niches of the tunnel next to the SOS every 150m along the slow lane. Next to the portals will be posed 300l/min hydrants above the ground. SOS stations and inside the substations are equipped with fire extinguishers. Fire detection inside the tubes is realized with the heat sensitive cable or double conductor cable with insulation sensitive to temperature, protected by a special outer sheath. This system is added to the smoke detection inlet system, to the opacimeters and to the ccTV plant (obscuration function).

173. SOS Emergency Phone System - Tunnels longer than 300m SOS emergency phone at portals, inside the tunnels (every 150 m) and into pedestrian bypass allow service users to calls for roadside and emergency medical assistance.

174. In the absence of electric current, safety systems of the tunnel shall be supplied by a diesel generator which has to ensure the backup power and the continue functioning of the above services. Considering that the starter of the generator (even if it's automatic) needs several seconds (0,5 ÷ 15 sec.) and certain services like: safety lighting system, monitoring system, etc., can never be interrupted, it will be installed an UPS to intervene before the starter of the generator, in order to ensure the continuity without interruption of the safety and emergency services can never be interrupted.

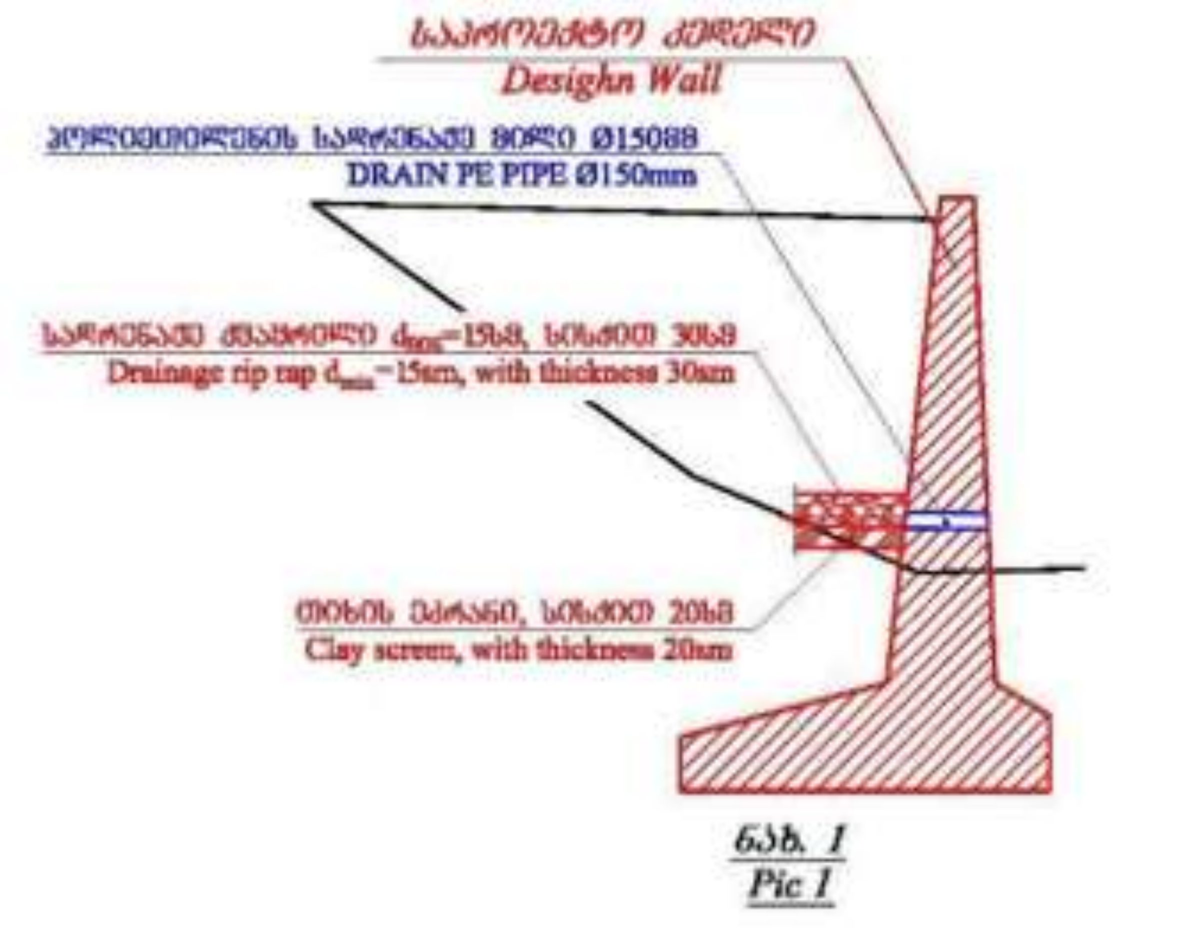
B.7 Retaining Walls

175. To construct the roadbed in the project section concrete retaining walls and reinforced concrete support structures will be required on several sections due to the difficult relief conditions of the project section. Reinforced concrete retaining walls all along the alignment and in particular in correspondence of the abutments of the bridges. The following three retaining walls have been included in the design:

(i) KM0.00 – KM0.15
(ii) KM5.00 – KM5.25
(iii) KM11.00 – KM11.20

176. The retaining walls are in reinforced concrete and may be founded directly on the rock, or by mean of concrete piles In the figure, the cross section of a wall. Figure 34 illustrates a typical retaining wall structure to be used.

Figure 34: Typical Retaining Wall



Note: Drain Pipe 150mm / Drainage Rip-rap thickness 30cm / Clay Screen thickness 20cm

B.8 Interchanges & Access Roads

177. Two interchanges are planned in the F2 Section:

(i) I1 - INTERCHANGE 1 - It has been envisaged to place the first interchange in the area of Sakasria village, at the left side of the river, around KM5.7. There will be designed a new bridge crossing Dzirula river to connect the existing traffic with the Interchange. This bridge is needed because of the position of the Interchange. The interchange is not complete, due to the lack of space. So the only ramps are the one coming from and going to Tbilisi.

(ii) I2 - INTERCHANGE 2 - The second Interchange will be around KM9.3. The type of this Interchange followed the previous sections and is designed like Diamond shape with small roundabouts.

178. Another interchange (interchange I3) is exactly at the endpoint and it is split in two between Section F2 and Section F3. Most of this last interchange will be included in the Section F3 and only the ramps from and to Tbilisi will be included in F2 section.

179. Figure 35 illustrates the location of the interchange I1 at KM5.7, Figure 36 illustrates the interchange at KM9.3 and Figure 37, the interchange at the end of the lot (I3).

Figure 35: Interchange I1 at KM5.7

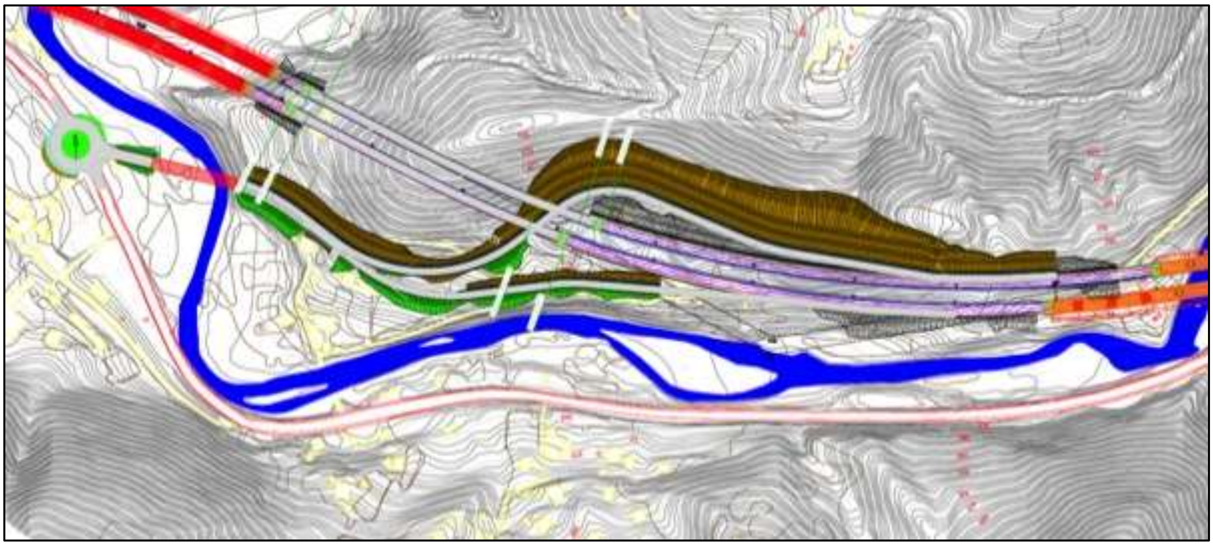


Figure 36: Interchange I2 at KM9.3

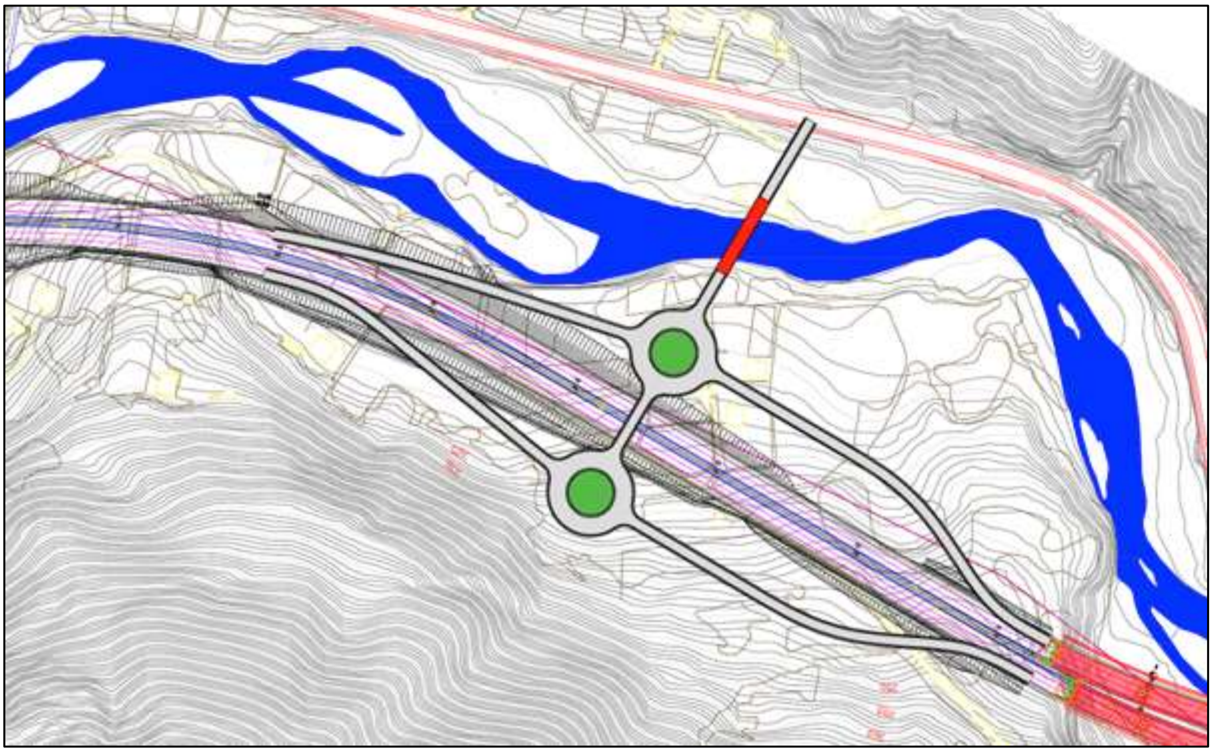
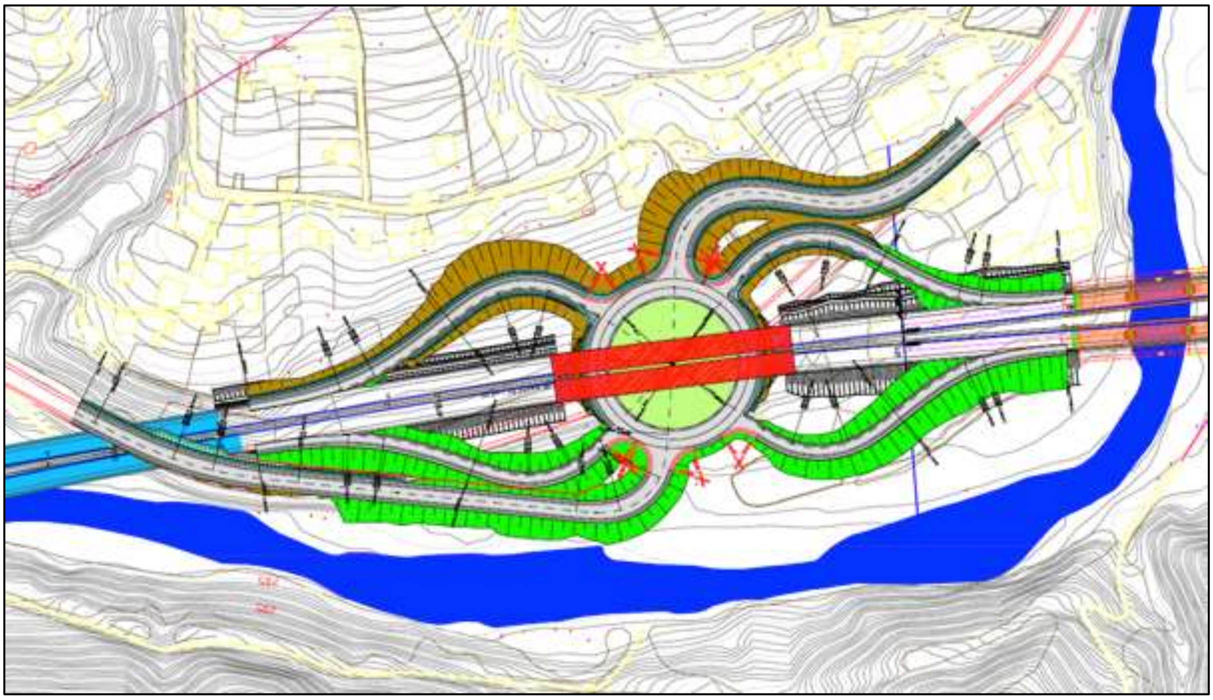


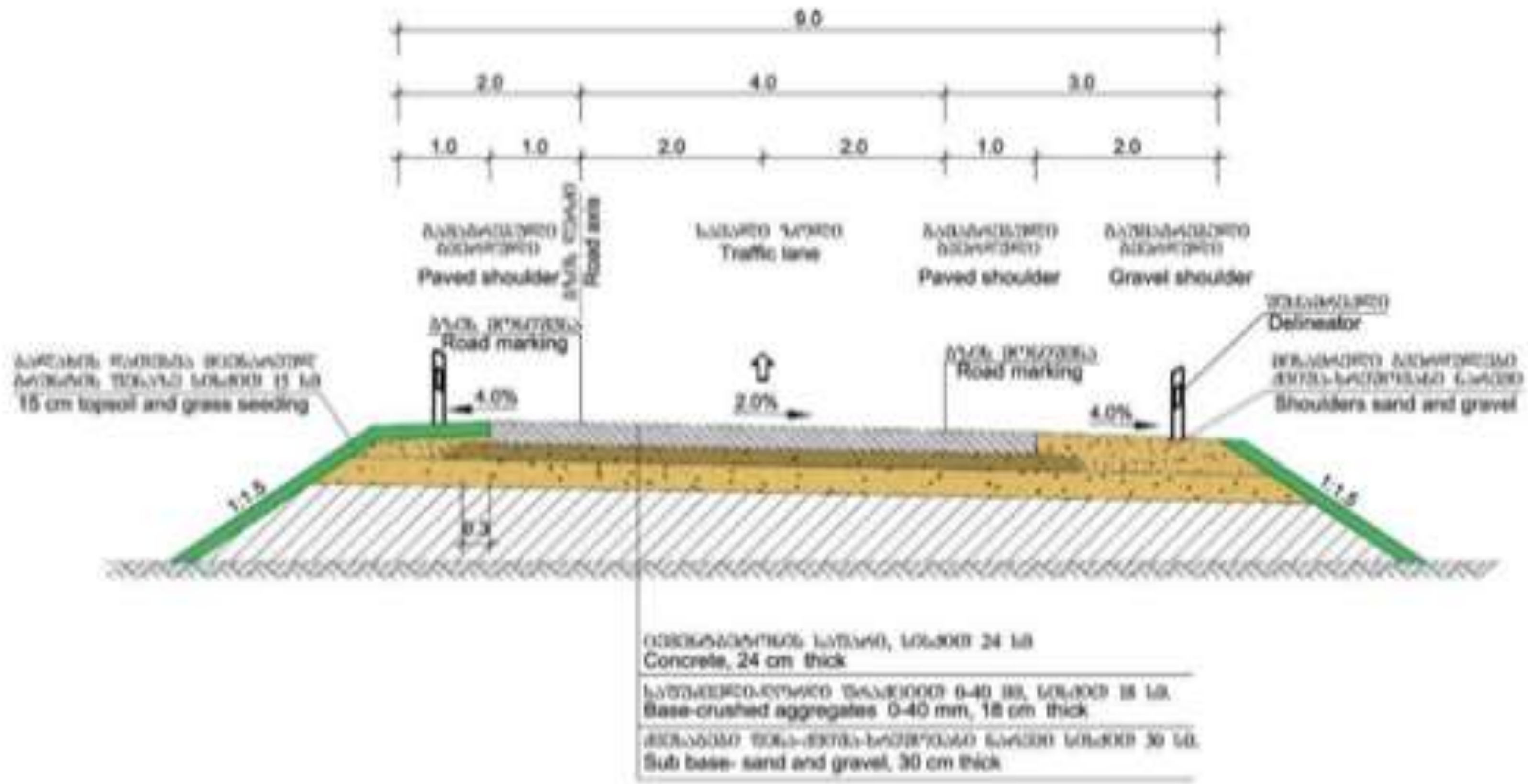
Figure 37: Interchange I3 at end of Lot



180. The pavement structure for interchanges includes:

(i) Pavement - cement-concrete, thickness 24 cm.
(ii) Base course - crushed aggregates 0-40 mm, thickness 20 cm.
(iii) Sub-base - sand and gravel mix, thickness 30 cm.

Figure 38: Road Pavement Structure for Interchanges



181. In addition five access roads will be constructed in areas where the new alignment cuts into existing local roads, either blocking access to properties or to the existing alignment. **Appendix F** illustrates the locations of these access roads. All access roads have been designed to ensure that local residents have access to the existing road which thereby links them to the new road via the interchanges mentioned above. This may, in some instances result in slight increases in journey times to the existing alignment.

B.9 Culverts and Underpasses

182. Culverts, cattle underpasses and rural road underpasses crossing the project motorway are designed in compliance with standard design practices for motorways using box type culverts. Culverts on the Project road ensure uninterrupted discharge of precipitations, water from ravines and water from drain channels. The cattle underpasses and rural road underpasses allow for the movement of cattle and wildlife, while pedestrians and vehicles can pass via the rural road underpasses.

183. The following types of culverts will be constructed.

(i) Underpasses for rural roads – cast in situ reinforced concrete structures – 6.0x4.5 m – 2 Units (KM5.13 / KM9.35).
(ii) Cattle underpasses – cast in situ reinforced concrete structures – 4.0x2.5 m – 1 Unit (KM5.22).
(iii) Cross drains – cast in situ reinforced concrete culverts – 2.0x2.5 m – 14 Units.
(iv) Cross drains – cast in situ reinforced concrete culverts – 1.0x1.5 m – I Unit.

B.10 Construction Process

184. During the construction phase the following activities will be undertaken:

(i) **Land Acquisition -** Under the terms of the Loan of the Asian Development Bank (ADB), before the commencement of the construction works at any part of the site, the *Employer* must prepare the Land Acquisition and Resettlement Plan (the LARP), obtain the approval of ADB and then implement the plan and acquire the land.
(ii) **Specific Environmental Management Plan (SEMP)** - Ensure that the SEMP is submitted to the Engineer for review at least 10 days before taking possession of any work site. No access to the site will be allowed until the SEMP is reviewed by the Engineer and approved by the RD / PIU.
(iii) **Site Clearing Works -** The Works include the following site clearing works within or adjacent to the RoW of the Project Road, in accordance with the Drawings or instructions of the Engineer:
  (a) Clearing and grubbing.
  (b) Removal and disposal of traffic signs, sign posts and their foundations.
  (c) Demolition, removal and disposal of existing bridges including foundations, abutments, piers, retaining walls, riverbank and waterway protection works.
  (d) Demolition, removal and disposal of existing culverts, inlet and outlet structures, headwalls, concrete drains, channel lining, and erosion protection works.
  (e) Removal of and any other natural or artificial objects within the RoW.
  (f) Removal and disposal of all vegetation and debris within the designated limits of the Right-of-Way.
(iv) **Relocation of Existing Services -** The Works include the relocation of all services affecting the construction of the Project Road within the Right-of-Way. The services include the following:

(a) water mains
(b) overhead electric supply lines
(c) gas pipelines
(d) underground telephone cables
(e) sewer mains

(v) **Construction Activities –** The main construction phase aspects are described in detail below.

B.10.1 Bridges

185. The construction of the new bridges includes but is not limited to the following parts of the structures and associated works:

(i) Foundations.
(ii) Substructure including bridge bearings.
(iii) Superstructure, including construction of expansion and deformation joints and footpaths.
(iv) Deck pavement including hydro isolation, drainage, hand railing, and conduits for services.
(v) Approach slabs.
(vi) Slope treatments in front and around the abutments.
(vii) Construction and maintenance of traffic detours.
(viii) Scour and erosion protection of the waterway areas and river bank protection upstream and downstream of the bridge crossing, and removal of old foundations and substructure from the waterways.
(ix) All necessary and incidental items required for a complete bridge.
(x) All new and widened bridges will be designed for the life expectancy of 100 years.
(xi) Oil and grease interceptor tanks.

B.10.2 Tunnels

186. The actual development of the tunnel design follows the principles of ADECO RS[3] method and is summarized in the following table.

Table 6: ADECO Tunnelling Method

Phase	ADECO RS
Survey phase	Analysis means first of all researching the medium to be tunneled from a geological and geomechanical point of view, especially by taking into consideration its resistance and deformability.
Diagnosis phase	And later forecasting by means of analytical and numeric instruments, what sort of stress-strain behavior will take place (Expected Deformation Response) when excavating (Categories A, B, C), in the hypothetical lack of stability operations.
Therapy Phase	The composition, in function of the foreseen behavior of the medium during excavation, of typical sections, defining the best type of stabilization operations for the expected operative context as well as phases, cadences, timing of implementation and any possible variability.

[3] ADECO is a method of calculation of the tunnels developed in Italy by prof. Lunardi and in the latest years widely spread in Italy and also in Europe. The main principles are described in the general report and the method consists in letting the tunnel develop deformations and thus decrease the stress on the structures (DE.CO.means Deformations Controlled). There is a prevision of utilization of sections of intervention and a system of monitoring of the deformations (topographic, generally) which give informations on the tunnel behaviour. Then there is a report called Guide Lines which for each behavior gives instructions of which section to apply.

Phase	ADECO RS
	Control of the Expected Deformation Response may come about by: • Defining the type of pre-confinement actions or confinement actions that are necessary to manage and control the Expected Deformation Response of the medium to excavation; • Choosing the type of stabilization operations from those available with today's technology, on the base of pre- confinement and confinement actions that each one is capable of guaranteeing; • Sizing and verification, by means of mathematical models, of the operations chosen to reach the medium's desired behavior under excavation with the necessary safety coefficient; and • Forecast, again using mathematical models, of the medium's stress-strain behavior under excavation when so stabilized.

B.10.3 Culverts

187. Project works include the construction of culverts and underpasses, including inlet and outlet structures and associated works in accordance with the Specification. The scope of the cross drainage works includes:

(i) Complete replacement of existing culverts which are old, structurally deficient or undersized;
(ii) Extension of existing culverts which are of adequate design and in good condition;
(iii) Construction of new culverts at locations where no cross drainage structure existed before;
(iv) Cleaning of existing culverts which are partially or completely silted;
(v) Miscellaneous repair of the existing culvert joints, headwalls, wing walls, and scour and erosion protection works; and
(vi) Construction of new scour protection and channel lining works.

B.10.4 Other Drainage Structures

188. Surface runoff from the carriageway and all other pavements, and any cut and embankment slopes must be discharged through longitudinal drains designed for adequate cross section, bed slopes, invert levels and the outfalls. The Works include construction of the drainage system components in urban and rural areas according to the types, dimensions, classes and material requirements for this work.

B.10.5 Earthworks

189. The Works include the following types of earthworks necessary for the construction of the Project Road and all associated works:

(i) Removal of topsoil.
(ii) Construction of embankments.
(iii) Construction of subgrade.
(iv) Excavation and removal of the existing pavement materials and the existing road embankment.
(v) Removal and replacement of unsuitable materials.
(vi) Structural excavation.
(vii) Excavation for the construction of side drainage and cross-drainage works.
(viii) Excavation for the removal and relocation of the existing utilities.
(ix) All backfilling necessary for the construction of bridges, retaining walls or other earth retaining structures, cross drainage structures and associated works, side drains and erosion protection work.

(x) Preparation of beddings and filters for all structural, cross drainage, side drains or pavement works.
(xi) Excavation, filling or backfilling necessary for the execution of any other incidental works.

190. Table 7 indicates the approximate earthworks and pavement quantities for the Project Road.

Table 7: Estimated Earthworks for Section F2

Description	Unit	Quantity
Stripping of topsoil	m^3	**26,000**
Road bed excavation and excavation in cut	m^3	**1,010,000**
Excavation in tunnel	m^3	**935,000**
Embankment Construction for roads and associated works up to bridge pay lines	m^3	**327,950**
Subgrade Preparation	m^3	**57,000**
Preparation of the underlying granular pavement layer	m^3	**127,000**
Dismantling of existing concrete structures	m^3	**4,000**
Removal and transportation of existing bituminous pavement	m^3	**4,400**
Asphalt pavement	m^3	**12,000**
Concrete pavement	m^3	**118.000**

B.10.6 Pavement

191. Two different pavement structures will be used:

(i) Concrete pavement structure for the motorway and interchanges; and
(ii) Asphalt pavement structure for all Slip Roads and all Minor Roads and bridges.

192. The following shall apply to the motorway, concrete pavement structure, construction category I:

(i) 28 cm Concrete;
(ii) 30 cm Crushed Aggregate Course;
(iii) 27 cm Granular Base Course;
(iv) 85 cm Total Pavement Construction.

193. The following shall apply to slip roads and minor roads, asphalt pavement structure, construction category III:

(i) 4cm Asphalt Wearing Course;
(ii) 4cm Asphalt Binding Course;
(iii) 14 cm Asphalt Bearing Course;
(iv) 58 cm Granular Base Course;
(v) 80 cm Total Pavement Construction.

194. For bridges, following the best practices all around the world and for durability reasons (total waterproofing and protection of the concrete slab), asphalt pavement is envisaged, precisely 11 cm of thickness.

195. Concrete pavements are already constructed on preceding sections of the highway. The pavement designs for the constructed sections were carried out in accordance to the German

pavement design standard RStO 01 which, given the extensive use of concrete pavement in Germany, is considered best practice.

196. The proposed pavement structure was designed according to "AASHTO, Guide for Design of Pavement Structures" and according to "RStO 01 the German Guideline for determination of Pavement Structures". Traffic load and other design parameters were evaluated for a 20 year design life cycle. At this stage of the project the pavement design and determination of the layer thicknesses aims at a constant pavement structure along the full length of the road which is suitable for the varying traffic loads.

B.10.7 Removal of Asphalt

197. There are some small section of the existing pavement which will need to be removed to make way for the new alignment. The Contractor shall remove the existing bituminous pavement layers in these areas and stockpile this material at locations that will be specified by the RD and instructed by the Engineer. The asphalt will be re-used, where practical, for access roads and temporary roads, and if not suitable will be re-used for shoulder material.

B.10.8 Construction Equipment

198. Table 8 provides indicative lists of the key equipment required in the construction phase (not including tunneling equipment).

Table 8: Key Equipment Section F2

No.	Equipment Type and Characteristics	Minimum Number required
1	Bulldozer (>245HP)	4
2	Excavator (>100HP)	12
3	Crushing and screening plant – mobile type at least 150 m3/h including rock material washing machinery	2
4	Concrete Paving Machinery width not less than 9.0 m for 2-layer concrete placing including film-forming machinery	2
5	Small Concrete Paving Machinery width not more than 5.0 m including film-forming machinery	1
6	Front Loader (>135HP)	15
7	Concrete batching plant (>150m3/hr)	2
8	Motor grader (>135HP)	10
9	Vibratory roller (> 13T)	8
10	Tipper truck (10T)	30
11	Tipper truck (16T)	30
12	Mobile concrete carriers (>25T)	25
13	Transit mixer (>6m3)	6
14	Crane (100 tons)	4
15	Crane (250 tons)	2

16	Rotary drilling Machine	8
17	Roadheader	2
18	Excavator Hammer	8
19	Jack Hammer	8
20	Pusher Leg	4
21	Truck mixer concrete pump	10

B.10.9 Personnel

199. The construction phase will last approximately 30 months and it is expected that approximately 600 direct employment opportunities will be available during the peak of construction. This may be divided between two construction ‘Lots’. The breakdown of skills required during the construction phase will be as follows:

(i) Skilled labour: 58%;
(ii) Semi-skilled labour: 20%; and
(iii) Unskilled labour: 22%.

B.11 Source of Materials

B.11.1 Borrow Material

200. An assessment of the volumes of cut and fill are provided in **Section F.7.3** which discusses the management of spoil material. No additional quarries or borrow pits will be needed under this Project.

B.11.2 Concrete Batching and Asphalt

201. Bitumen and bituminous products are not produced locally in Georgia and is mainly imported from Iran, Azerbaijan and Romania. Bituminous products, which are necessary for the project (production and construction) must be imported and comply with European standards.

202. Cement is produced locally by companies such as Saqcementi and Kartuli Cementi in Kaspi (approximately 70 km east of the Project area), other sources of cement may also be found closer to the site.

203. In case Contractor decides to run asphalt production facility the issues must be agreed with MoEPA. Asphalt production belongs to activities listed in Annex II to Environmental Assessment Code. MoEPA will make a decision in the need of EIA for this activity based on the screening procedure (ref. Environmental Assessment Code (document code: 360160000.05.001.018492).

204. The Contractor will be responsible for ensuring the concrete batching facilities and asphalt plant comply with the conditions outlined in **Section G.7.4** and that all necessary permits to operate are obtained from the MoEPA. The Contractor will source concrete and asphalt from existing batching plants or from his own dedicated plant. **Section G.7.4** provides explicit conditions for operating batching plants and asphalt plants and the conditions for sourcing concrete and asphalt from existing plants.

B.11.3 Technical and Potable water

205. Approximately 200 m^3 of technical water will be needed per day during the construction phase and around 15 m^3 of potable water per day. Most technical water will be sourced from the rivers adjacent to the construction sites. Potable water will be sourced from existing water

supply pipelines, or will be provided to camps in reusable bottles – no single use bottles will be permitted. The final locations of the extraction points (for both technical and potable water) will require the approval of the Engineer and the RD prior to the start of extraction to ensure that over extraction of water resources does not happen. Potable water will also need to be tested regularly throughout the construction period to ensure it meets the drinking water standards of GoG.

B.12 Camps and Storage Areas

B.12.1 Construction Camps

206. Camp sites will be selected keeping in view the availability of an adequate area for establishing campsites, including parking areas for machinery, stores and workshops, access to communication and local markets, and an appropriate distance from sensitive areas in the vicinity. The RD and supervision engineer will have to coordinate between contractors for F1, F2 and F3 to ensure that locations for each contractors camps are located appropriately and cumulative impacts are not made more significant. In addition, where practical, camp sites and ancillary facilities, such as batching plants, rock crushing, etc, should be kept separate (distance of more than 500 meters) to avoid noise and air quality impacts to accommodation areas and offices within camps.

207. The area requirement for construction camps will depend upon the workforce deployed and the type and quantity of machinery mobilized. For example, the camps may include rock crushing plant and concrete batching facilities. In view of the area required, it will not be possible to locate campsites within the RoW and the contractors will have to acquire land on lease from private landowners. The construction camp will also have facilities for site offices, workshop and storage yard, and other related facilities including fuel storage.

208. The Contractor will provide the following basic facilities in the construction camps:

- (i) Safe and reliable water supply.
- (ii) Hygienic sanitary facilities and sewerage system.
- (iii) Facilities for sewerage of toilet and domestic wastes.
- (iv) Storm water drainage facilities.
- (v) Sickbay and first aid facilities.

209. Detailed criteria for siting of construction camps and establishment of facilities are given in **Section G.7.4**.

B.12.2 Storage Areas

210. Temporary storage areas will be required for certain activities, such as the storage of sand and gravels and construction equipment. These storage areas may range in size from anything between 50 m^2 to more than a hectare. The precise locations of these temporary facilities is not known at this stage, as such mitigation measures shall be prepared to ensure that these areas are sited in approved locations.

B.13 Temporary Roads

211. The project included temporary road forecasts for access to construction sites, in particular to the main intervention sites, i.e. to tunnel portals and areas where bridges are envisaged. These temporary roads allow to access the construction sites from the existing roads. In general, such roads must be removed at the end of their use, unless otherwise notified by the Employer.

212. These forecast roads have been represented in the project for the sole purpose of indicating possible access routes and to evaluate the cost of construction within the BoQ. These schemes of design are indicative and not mandatory, although suggested: the Contractors, according to their working methods, available machinery and experience, can change them and must in any case submit to the Employer, or his Engineer, a detailed plan for such access roads and will also have to provide for the temporary acquisition of the relevant areas.

213. Such plan must be complete with detailed drawings of the elements that make up the road, the areas and the properties affected by possible occupation outside the areas owned by the administration, calculation reports if necessary. In addition, in this plan the existing traffic affected by the passage of construction vehicles must be shown and the Contractor will be responsible for requesting authorization from the Authority managing the use of the same infrastructure.

214. The Contractor shall install tanks for washing the truck wheels at the access points to the work site in order to guarantee the cleanness of the existing roads used for transport. The Contractor must also provide for the restoration of the existing roads if the Employer ascertains that the passage of construction vehicles has deteriorated the level of service. This assessment will be done in contradiction, to the presence of the Contractor, the Engineer and the Employer. Once ascertained, the costs for the restoration of such roads are totally on charge of the Contractor.

B.14 Road Safety

215. Besides a signage and markings plan in line with the best international motorway standards, the design has particularly focused on road restraint systems.

216. Safety barriers will be installed at the edges of the carriageways to prevent out-of-control vehicles from leaving the motorway or encroaching the opposite carriageway. In particular, as well as along the median, the barriers will be installed on the bridges and sections in embankments, where the expected consequences following a run-off are greater than a possible crash with the barrier. Both rigid and semi-rigid barriers will be implemented.

217. **Rigid barriers** - A rigid concrete barrier in line with current Georgian standards will be installed along the median. The barrier is anchored to the road infrastructure and has a profile that is similar to a New-Jersey type, so that vehicles can be redirected in the event of an impact. Similar barriers will be used on bridges.

218. **Semi-rigid barriers** - Guardrails have to comply with the European Standard EN-1317 “Road Restraint Systems” or comparable standards. In particular the roadside barriers shall be tested to properly retain heavy vehicles (13 tons) impacting at 70 km/h, i.e. containment level **H2** according to EN-1317 standard. This containment class takes into account the high percentage of heavy vehicles expected on the highway (about 15%).

219. Moreover, in order to limit the width of the verge behind the barrier to 80 cm, the working width of the barrier shall be consistent with this distance, i.e. class W2 according to EN-1317 standard.

220. Finally, in order to assure an adequate anchoring of the posts to the ground and avoid a soil collapse in case of crash, the planting depth shall be at least of 115 cm, thus assuring a correct plastic bending of the steel post (“plastic hinge”). This measure has been assessed through soil modeling with FLAC3D software.

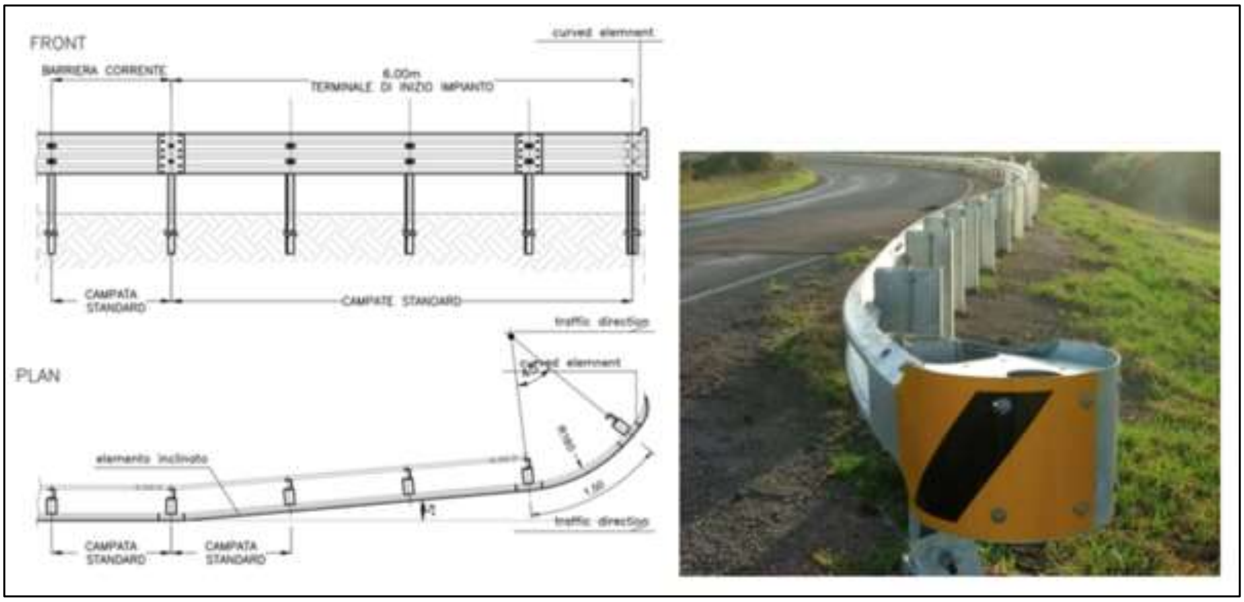
221. In order to assure a smooth transition between semi-rigid and rigid barriers (e.g. approaching to the bridges), the guardrail is gradually stiffened by doubling the number of posts in the ten spans preceding the rigid barrier.

222. Finally, special attention is given to the barrier terminals, which are curved outwards with respect to the mainline and terminated at full height. There is ample evidence, in fact, that this layout is safer than the ramped terminals that can cause vehicles to be launched and rolled. It is also recommended, if available on the local market, to install a Modified Eccentric Loader Terminal (MELT), which ensures even higher performance.

223. The main road safety benefits the project will deliver are the following:

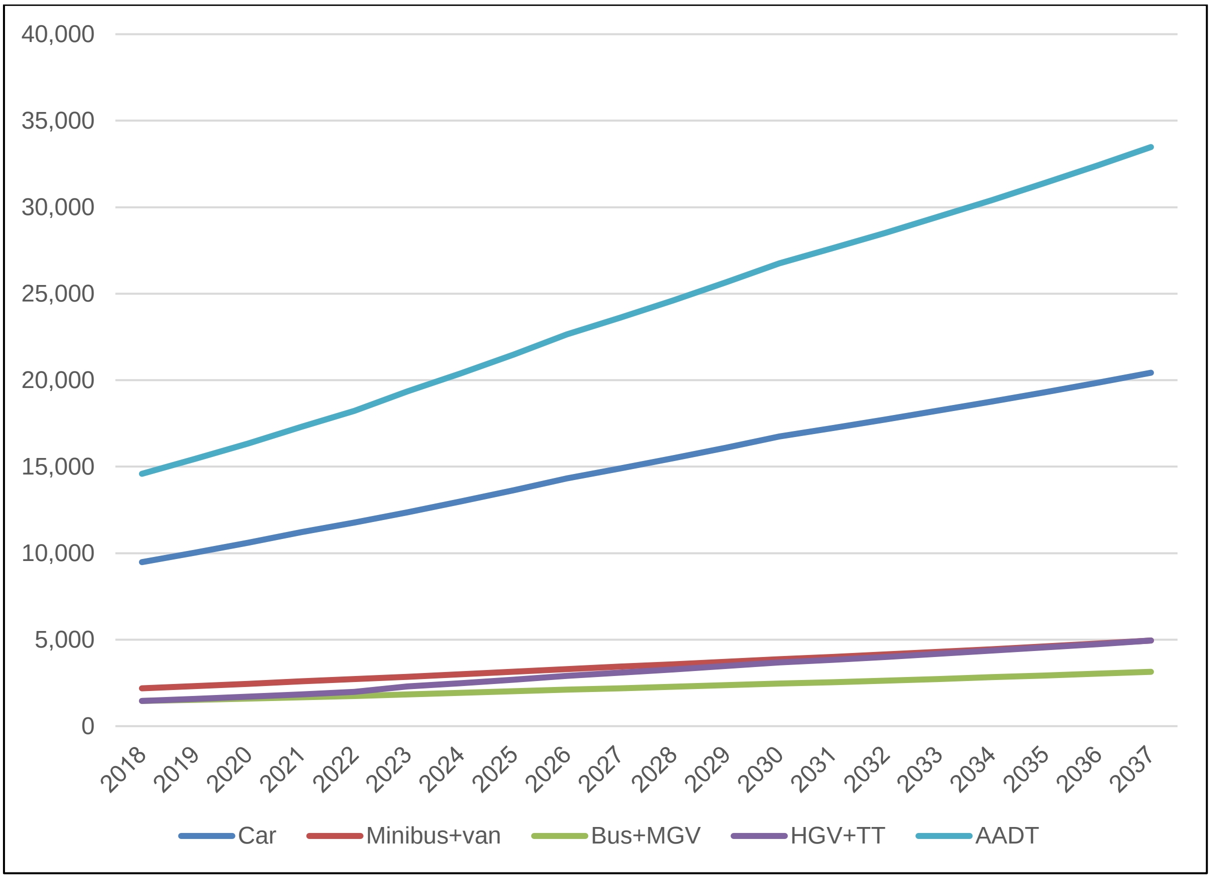
- (i) Reduced risk of vehicles leaving their lane to avoid potholes and surface deformations;
- (ii) Improved sight distances;
- (iii) Better separation between pedestrians and vehicles; and
- (iv) Better night driving conditions due to wider carriageway and improved pavement centerline markings.

Figure 39: Barrier terminal layout (left) and an example of MELT (right)



B.15 Traffic Projections

224. Traffic forecasts are presented below.


40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
2018
2019
2020
2021
2022
2023
2024
2025
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2027
2028
2029
2030
2031
2032
2033
2034
2035
2036
2037
Car
Minibus+van
Bus+MGV
HGV+TT
AADT

Source: ADB

C. Alternatives

C.1 General

225. One of the objectives of an EIA is to investigate alternatives to the Project. In relation to a proposed activity "alternatives" means different ways of meeting the general purposes and requirements of the proposed activity. The following section provides an assessment of alternative corridors, alignments, transport modes and technologies, as well as the 'no action' alternative.

C.2 The No Action Alternative

226. The "No Action" Alternative in this instance is defined as a decision not to undertake the proposed construction of the Project Road. The "No Action" Alternative would result in the continued deterioration of the road, bridges and drainage structures along the RoW, thereby impeding the economic development of the Project Area and the Imereti region. All positive benefits would be foregone. The relatively minor, less than significant environmental impacts (such as noise and short-term air quality impacts due to maintenance activities) and inconveniences (such as traffic diversions) would be avoided in the short-run. In the long run, however, the steadily declining state of the roadway would severely hamper economic development in the area. In light of these considerations, the "No Action" Alternative is deemed to be neither prudent nor in the best interest of Georgia or those with an interest in, and attempting to assist restoration of, Georgia's well-being.

C.3 Alternative Road Corridors

227. Given the complex topography of the region and Georgia in general, there are no other feasible alternative corridors that would be able to compete with the existing corridor in terms of travel times. In addition the Project forms part of the overarching program to upgrade the E-60 motorway which includes many sections that have recently been upgraded, or are in the process of upgrading (or detailed design), including the sections of road joining the start and end points of the Project road.

C.4 Alternative Alignments

228. Feasibility Study - As part of the Projects feasibility study [4] a range of alternative alignments were studied. The F2, F3 and F4 sections were grouped together under the heading of Section 2BC. Five alternative alignments were proposed for this 2BC section. The key features for each candidate alternative alignment with bidirectional 4 lane road are summarized below by Table 9 and shown in Figure 40 to **Figure 44**.

Table 9: Key Features of Alternative Alignments with Bidirectional 4 Lanes

Parameter	Alternative Alignment				
	Alt. 2BC-1 (Opt. Blue)	**Alt. 2BC-2 (Opt. Green)**	**Alt. 2BC-3 (Revised Yellow Line)**	**Alt. 2BC-4 (Red)**	**Alt. 2BC-5 (Navy)***
Total Road Length	50.6 km	49.9 km	48.7 km	48.3km	46.5m

[4] Feasibility Study for E-60 Highway Section from Zemo Osiarui to Argveta. Pyungwha Engineering Consultants. June 20th 2015.

Parameter		Alternative Alignment				
		Alt. 2BC-1 (Opt. Blue)	**Alt. 2BC-2 (Opt. Green)**	**Alt. 2BC-3 (Revised Yellow Line)**	**Alt. 2BC-4 (Red)**	**Alt. 2BC-5 (Navy)***
Minimum Horizontal Radius		250 m	250 m	450 m	800	1,200m
Maximum gradient		6 % / 7%	6 %	5 %	5 %	4 %
Structure Length	- Bridges - Tunnel	3,939 m 9,223 m	4,854 m 11,815 m	9,720 m 15,211 m	11,680m 17,500m	8,140 m 28,680 m
Earthwork	- Cut (m^3) - Fill (m^3)	4,878,844 1,978,999	7,999,914 2,251,942	3,556,837 3,017,640	3,128,890 2,152,170	-
Demolishing of buildings		88 buildings	167 buildings	133 buildings	153 buildings	-
Affected forest area (tree cutting)		26.3 ha	43.9 ha	39.3 ha	20.8 ha	-
Length of river interference		2,980 m	1,741 m	n/a	n/a	-
Use of existing road		26,070 m	1,216 m	960m	650 m	-
Length through or nearby villages		12.0 km	16.1 km	9.7 km	9.5 km	-

* Detailed information of Alt. 2BC-5 is not available since Navy Line is conceptual alignment of high speed line. The Consultant has estimated the cost using the plan drawing only.

229. The alternatives were assessed based on a multi-criteria analysis approach (MCA). Alignments Blue, Green and Yellow were assessed from the following criteria:

- Environmental quality and sustainability
    - Impact on landscape
    - Local air quality
    - Noise
    - Impact on biological diversity and ecological integrity

- Socio-economic and financial
    - Impact on agricultural land and opportunities
    - Economic benefits
    - Road construction cost
    - Road maintenance cost
    - Land acquisition and displacement impacts

230. From an environmental view the yellow alignment scored the best, but including all aspects (financial, social, engineering, etc) the blue alignment gained the highest score (see Table 10).

Table 10: MCA Performance Matrix

ANALYSIS	Optimized BLUE LINE			Optimized GREEN LINE			Revised YELLOW LINE		
	POINTS	WEIGHT	SCORE	POINTS	WEIGHT	SCORE	POINTS	WEIGHT	SCORE
Efficiency of Travel and Accessibility		5	-6		5	3		5	6
Road length	-2	1	-2	0	1	0	1	1	1
Maximum gradient and length of grade with maximum value	-1	1	-1	0	1	0	2	1	2
Vehicle Operating Costs	-1	2	-2	0	2	0	1	2	2
Traffic Efficiency under Construction	-1	1	-1	3	1	3	1	1	1
Environmental Quality + Sustainability		5	2		5	0		5	7
Impact on Landscape	0	1	0	2	1	2	2	1	2
Local Air-Quality	-1	1	-1	0	1	0	1	1	1
Noise	-1	1	-1	-2	1	-2	2	1	2
Impact on Biological Diversity and Ecological Integrity	2	2	4	0	2	0	1	2	2
Socio-Economical and Financial Aspects		50	115		50	55		50	50
Impacts on Agricultural Land and Opportunity	2	5	10	3	5	15	1	5	5
Economic Benefits	1	15	15	0	15	0	1	15	15

Road Construction Cost	4	10	40	3	10	30	2	10	20
Road Maintenance Cost	2	10	20	2	10	20	1	10	10
Land Acquisition and Displacement Impacts	3	10	30	-1	10	-10	0	10	0
Design and Engineering		40	45		40	-10		40	10
Geotechnical Risks, Impact on the Existing Landslide Areas	1	20	20	-1	20	-20	-1	20	-20
Creation of the New Landslide Risk and the Construction Failure	2	10	20	1	10	10	2	10	20
Use of the Existing Road Infrastructure	2	5	10	0	5	0	1	5	5
Safety	-1	5	-5	0	5	0	1	5	5
OVERALL SCORE	**156**			**48**			**73**		

231. Detailed Design - The alignment has been updated based on the insights gained during the FS and previous phases of drafting the detailed design. Essentials of the update were as follows:

(i) Adaptation to the design standards proposed by the Consultant and approved by the RD;
(ii) Review of the Feasibility Study issues;
(iii) Analysis and verification of the solutions provided in the previous design phase, mainly based on the observations during several site visits;
(iv) Explore the interactions between the road in project and the existing road network to find the most appropriate solutions;
(v) Study of the best solutions to ensure the maintenance of traffic during the construction of the new road; and
(vi) Reduction of impacts on environment and resettlement.

232. The analysis of the alignment shown in the Feasibility Study clearly indicates that the methodological approach was to try to update the existing road, maintaining as much as possible the old one.

233. This cost saving approach was the main drawback and compromised the geometry of the alignment: horizontal and vertical radii and slopes were often very close to the minimum and the overall geometry of the road needed smoothing in some sections.

Figure 40: Alternative Alignment 2BC-1

Figure 41: Alternative Alignment 2BC-2

Figure 42: Alternative Alignment 2BC-3

Figure 43: Alternative Alignment 2BC-4

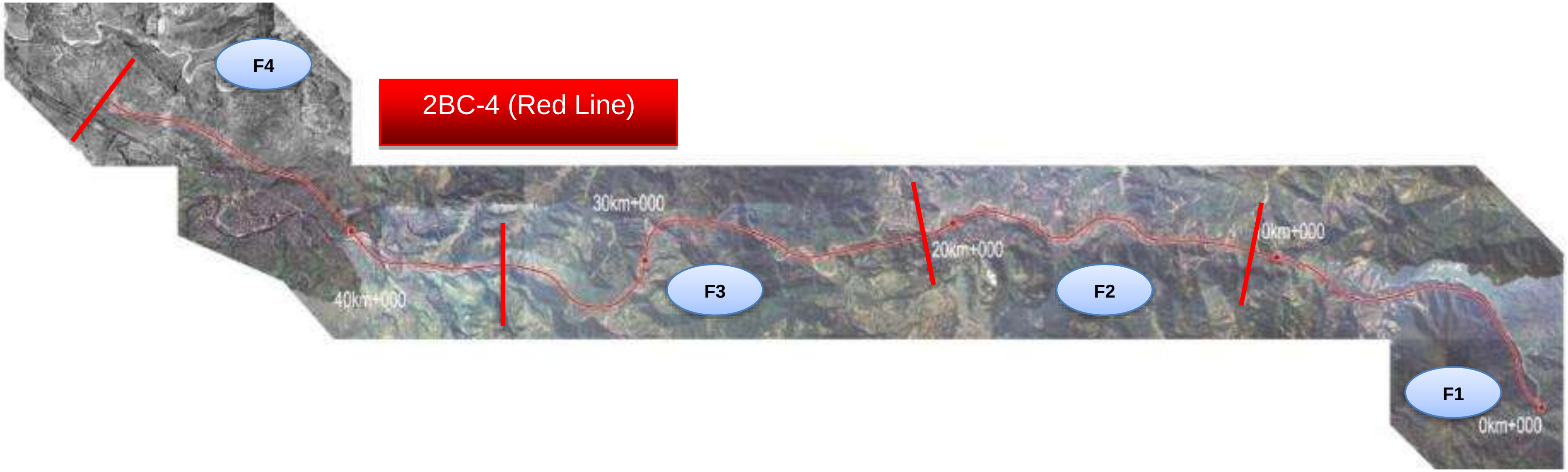
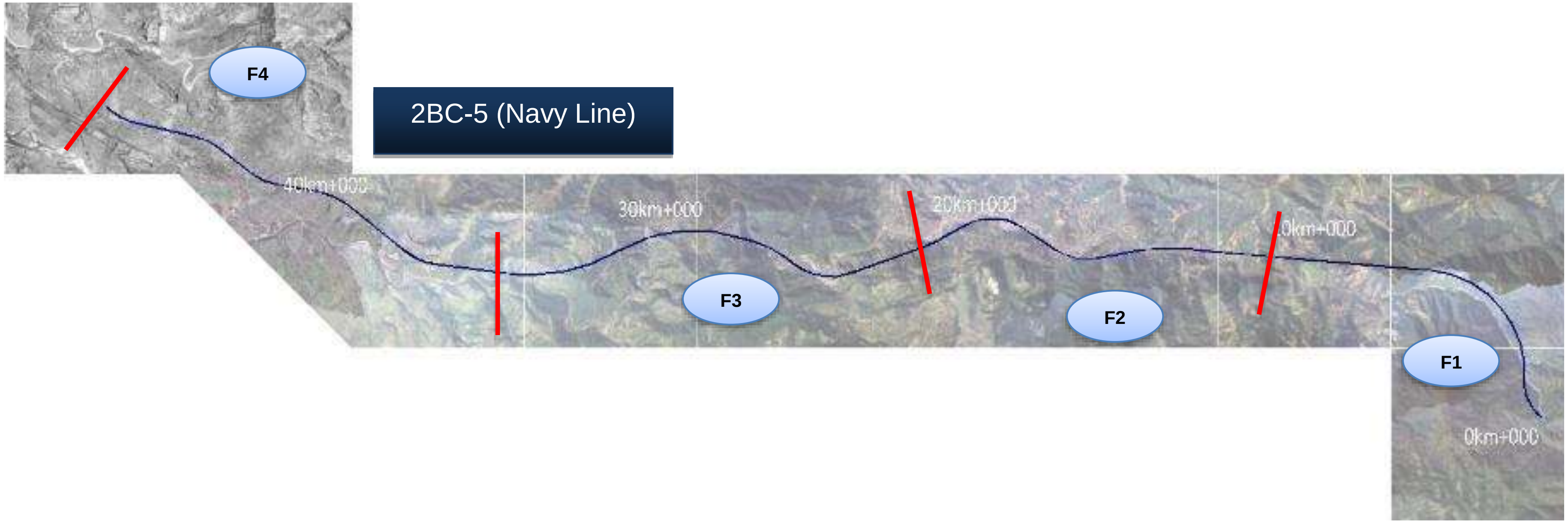


Figure 44: Alternative Alignment 2BC-5



234. In addition, the Feasibility Study showed some shortcomings in the definition (normal for that stage of Design) that may have led to a significant increase of costs in the Detailed Design. These are mainly found in:

(i) **Local roads/accessibility**: because of the difficult terrain and (in this Section) presence of numerous settlements, the connecting road network must be identified and reorganized, considering also that the highway belongs to a higher road category, therefore it is not possible to maintain direct access for private properties or roads with very low category. This necessity, in particular, carried to the acknowledgement that the existing road should be maintained in some section.

(ii) **Construction phases**: the construction of a highway in this area, with constraints caused from terrain and settlements, has the additional difficulty coming from the necessity to maintain traffic over the entire road section during the full construction. This carries to conflicting needs that shall be considered and addressed during the detailed design, that may require the modification of the "optimal" design: in some cases, the best option may not be feasible either for the possibility to organize the construction phases and maintaining the traffic, or because this requirement would carry to too expensive temporary arrangements.

235. These considerations have been translated into a series of updates of the alignment provided by the Feasibility Study.

236. The updating of standards has led to an increase in the minimum planimetric radius from 240 to 450m and the keeping of the road width of 3.75m even in the design speeds of 80km/h. Both choices improve road safety for increased visibility and perceived road continuity for the driver.

237. Considering the above a realignment of the whole section was made as part of the detailed design. The table below provides a summary of the main characteristic of F2 compared with the Feasibility Study.

Table 11: Main Characteristics of Section F2 Compared with the Ones of the FS

Item	Feasibility Study	Detailed Design
Maximum horizontal radius	244.5	550
Maximum gradient	4.50%	3.83%
Minimum vertical radius (crest)	4,000	15,000
Minimum vertical radius (sag)	4,000	15,000
Tunnel TA (number)	10	9
Tunnel TA (length)	6,155	4,340
Tunnel AT (number)	6	11
Tunnel AT (length)	3,790	5,020
Bridges TA (number)	8	18
Bridges TA (length)	1,170	4,160
Bridges AT (number)	8	17
Bridges AT (length)	1,175	4,140
Interchanges (number)	2	3

C.5 Alternative Transport Modes

238. As noted above, the Project forms part of a program upgrading the E-60. The Khevi – Argveta section of the E-60 (including section F3) if one of the last remaining sections of the road requiring upgrading. Accordingly, the Project is focusing on the upgrading of the E-60 and will not consider any other transport mode as an alternative.

C.6 Alternative Pavement Types

239. Only one pavement type was considered for the motorway and interchanges; rigid concrete.[5] The rigid pavement structure is recommended for the following reasons:

- (i) Concrete pavements are already constructed on preceding sections of the E60 Highway. The pavement designs for the already constructed sections were carried out in accordance to the German pavement design standard RStO.
- (ii) The high traffic load over the design life with heavy truck traffic requires a high strength to prevent rutting. The concrete pavement has a flexural strength and is less dependent on variations in subgrade strength. Deformation in the subgrade is not transferred to the subsequent layers.
- (iii) Along the alignment extreme varying surface temperatures of the pavement are expected from hot summer temperature to freezing in winter. Also contraction and expansion of the concrete slabs have to be considered by expansion joints, the integrity of the concrete is not reduced. Asphalt pavements may become soft in summer leading to rutting and hard and brittle in winter.
- (iv) The concrete surface is not damaged by the unavoidable oil and grease leaking from passing vehicles. The life span of a concrete pavement is general higher compared to a flexible pavement and maintenance cost might be also lower as the initial construction costs could be higher.
- (v) For the actual situation in Georgia with no local bitumen production which requires all bituminous products to be imported, the concrete production from local available sources (gravel and cement) seem to be in more than one respect advantageous.

240. The option of low noise asphalt should also be considered as a potential option on the bridges where elevated noise levels have been identified. The low noise asphalt could potentially reduce the noise levels by 3 dBA. The use of low noise asphalt will require higher maintenance costs over the years to ensure the surface performs to its required level.

C.7 Alternative Spoil Disposal Locations

241. Initially the static balance of spoil material generated by the Project was estimated to be a lower than the final calculated figures. spoil material from cut and tunnels was planned to be disposed of in the Kutaisi bypass. However, according to the RD this option would be too expensive given the huge volume of material to be moved there. Additionally, this option would have meant a large volume of daily truck movements (more than 200) travelling more than 50 kilometers along the E-60 through urban areas, including Zestaphoni.

242. Three additional alternative spoil location sites were then identified by the Detailed Design Consultant close to Boriti, see Figure 45. Initial desk-top screening of the sites indicated that the two locations north of the existing road would require a large amount of tree felling in an area which could potentially be described as natural habitat. In addition, these

[5] Asphalt pavement structure will however be used for all Slip Roads, bridges and all Minor Roads and bridges.

sites were considered quite complex in terms of their topography and hydrological conditions. Accordingly, these sites were screened out of the assessment.

243. That left one remaining potential location for the placement of the spoil material, the large area to the south of Boriti. In terms of location, it suits both sections F2 and F3, being at the start and end points of both road sections. This means that long distance vehicle movements will be eliminated. However, the original identified access road from the E-60 is located opposite the medical facility in Boriti, and as such, if this spoil disposal location is to be used, it is recommended a new alternative river crossing is constructed away from this sensitive site (dust could be a significant issue in the summer months).
244.

245. The site itself is located on a plateau area, meaning that hydrological issues would be minimized. It is also noted that this area comprises what appear to be open quarries, indicating that this site is already impacted quite heavily by human activity. Vegetation on this plateau is less dense than the other identified spoil areas meaning less tree cutting would be required. Also, the site is capable of containing all spoil material for both sections F2 and F3.

Figure 45: Locations of Potential Spoil Disposal Sites

246. A site visit to this area was made in May 2018. The site visit revealed the following issues:

(i) The access road to the site is located adjacent to the Dostakari-Beriti Emergency Medical Care Clinic in Boriti. The bridge crossing the Dzirula river is in poor condition. As such, a new access point and bridge crossing would most likely be needed to access the site.
(ii) A small cemetery is located at the start point of the access road. The access road is unpaved and currently only used by local residents as well as trucks accessing the quarry at the site.

(iii) The site itself comprises a rolling landscape with some relatively flat plateau areas.

(iv) Some small pockets of agricultural land can be found across the site, but there is no evidence of properties on the site except for the quarry located in the north eastern portion of the site.

(v) Most of the area identified for the spoil area comprises pastureland with few trees. No cattle were observed at the site.

(vi) No surface water features were noted at the site.

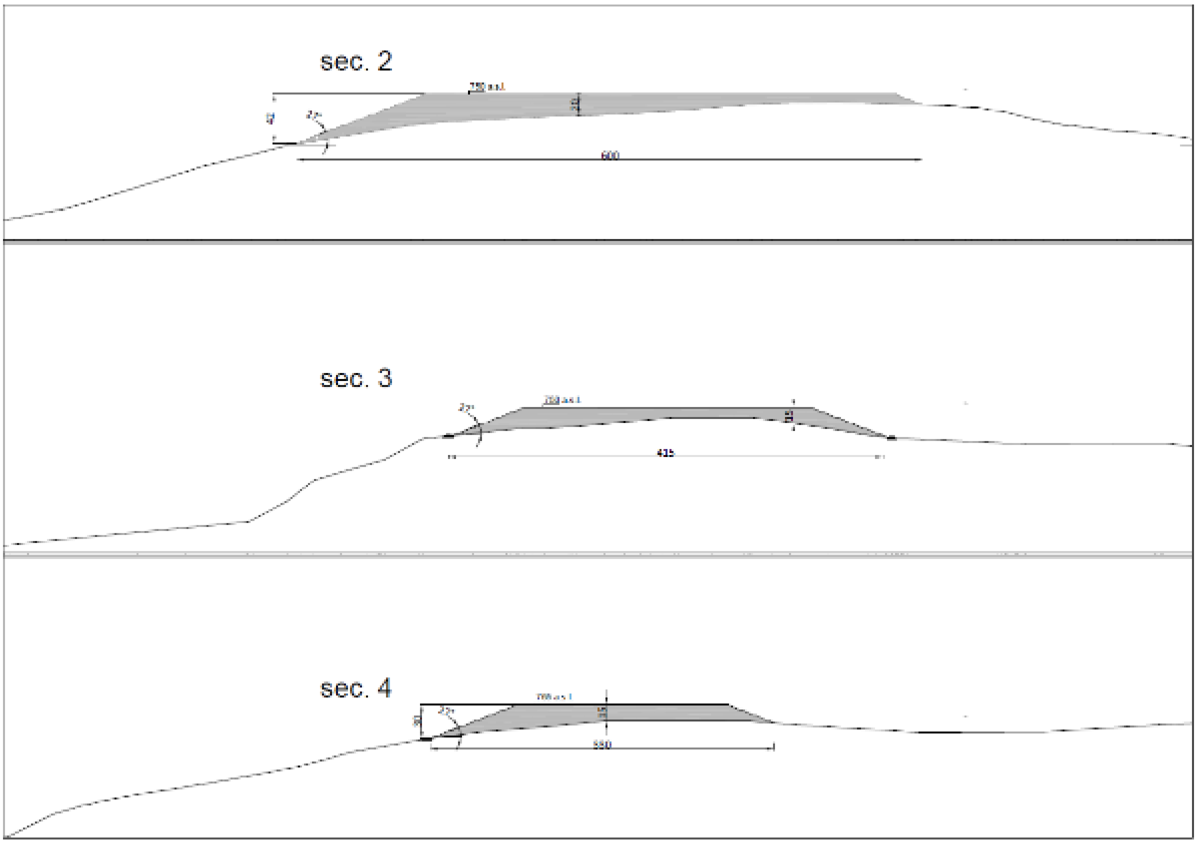
Figure 46: Spoil Disposal Site

247. If the issues relating to access can be resolved, and the relevant permits obtained from MoEPA, this site would provide a suitable option for the spoil disposal site. The Detailed Design team have prepared the following maps and cross sections for the site.

Figure 47: Spoil Disposal Site Access Road

Figure 48: Spoil Site Area

Figure 49: Spoil Site Cross Sections



248. Notwithstanding the above, the final selection of spoil locations rests with the Contractor, who may wish to choose alternative locations for cost reasons. There are a number of critical actions that the Contractor must complete before using this, or any other area as a spoil location, including the development of a EIA to meet national requirements. These measures are outlined in **Section G.7.3** below.

C.8 Alternative Construction Camps and Laydown Areas.

249. The locations of these facilities is not currently known. The Contractor will choose the sites which will need to follow the guidelines for siting and permitting as outlined in this EIA (**Section G.7.4 - Construction Camps, Asphalt Plants, Batching Plants & Temporary Storage Sites**)

D. Environmental Laws, Standards and Regulations

D.1 General

250. This section of the EIA provides a summary of:

(i) Environmental Legislation of Georgia;
(ii) The Administrative Framework;
(iii) Environmental Regulations and Standards of Georgia;
(iv) National Technical Regulations Relevant to the Project;
(v) Environmental Permitting Procedure;
(vi) Permit and Licenses Required for Off-site Works During Construction;
(vii) International Conventions Relevant to the Project Ratified by Georgia;
(viii) An overview of the ADB safeguard policies.

D.2 General

251. Georgian legislation comprises the Constitution, environmental laws, international agreements, subordinate legislation, normative acts, presidential orders and governmental decrees, ministerial orders, instructions and regulations. Along with the national regulations, Georgia is signatory to a number of international conventions, including those related to environmental protection.

252. The Ministry of Environmental Protection and Agriculture (MoEPA) of the Government of Georgia is responsible for regulating the activities that affect the natural environment.

D.3 Environmental Legislation of Georgia

253. A list of Georgia's environmental legislation as it pertains to the proposed project is given in Table 12.

Table 12: List of environmental laws and regulations relevant to the project

Year	Law / Regulation	Consolidated version -Last revision	Code
1994	Law on soil protection	07/12/2017	370.010.000.05.001.000.080
1995	Constitution of Georgia	13/10/2017	010.010.000.01.001.000.116
1996	Law on subsoil	07/12/2017	380.000.000.05.001.000.140
1996	Law on environmental protection	07/12/2017	360.000.000.05.001.000.184
1996	On the system of protected areas	07/12/2017	360.050.000.05.001.000.127
1997	Law on wildlife	07/12/2017	410.000.000.05.001.000.186
1997	Law on water	07/12/2017	400.000.000.05.001.000.253
1999	Law on protection of atmospheric air	07/12/2017	420.000.000.05.001.000.595
1999	Forestry code of Georgia	07/12/2017	390.000.000.05.001.000.599
1999	Law on compensation of damage from hazardous substances	07/12/2017	040.160.050.05.001.000.671
2000	Law on regulation and engineering protection of the sea and river banks	05/05/2011	400.010.010.05.001.000.830
2003	Law on Red List and Red Book of Georgia	07/12/2017	360.060.000.05.001.001.297
2005	Law on licences and permits	23/12/2017	300.310.000.05.001.001.914
2003	Law of Georgia on conservation of soil and restoration-amelioration of soil	07/12/2017	370.010.000.05.001.001.274

Year	Law / Regulation	Consolidated version -Last revision	Code
	fertility		
2014	Waste code	07/12/2017	360160000.05.001.017608
2017	Environmental Assessment Code	07/12/2017	360160000.05.001.018492

254. Brief summaries of the listed documents are given below:

255. **Constitution of Georgia** states the basic rights of people to live in a healthy environment and obligation to protect it. According to constitution everyone has the right to obtain complete, objective, and timely information about environmental conditions (Article 37 Part 3). It assures that the state shall protect environment and foster sustainable development (Article 37 Part 4). It establishes a legal framework that guarantees public access to information about the condition of the environment (Article 37 Part 5, Article 41 Part 1).

256. **Environmental Assessment Code (EAC).** The Code establishes a legal basis for regulating issues related to projects and strategic documents, which implementation may have significant impact on the environment, human life and health. It regulates the procedures related to environmental impact assessment, strategic environmental assessment, public participation in decision-making, trans boundary environmental impact assessment; defines rights and obligations of the developer, the planning authority, the public and the competent authorities in the course of decision-making envisaged by this Code; describes procedures of issuing Environmental Decision; exemption rules. The law includes two annexes. Annex I lists activities subject to EIA, Annex II - lists activities/projects that require screening procedure. Screening is responsibility of MoEPA. Under the EAC construction of international and interstate roads; construction and operation of tunnels and/or bridges on the international and interstate roads belongs to activities subject to EIA. According to the document, the main stages of environmental impact assessment include:

(i) Screening;
(ii) Scoping procedure;
(iii) Preparation of the EIA Report by the developer or the consultant;
(iv) Ensuring public participation;
(v) Examination of the information presented in the EIA Report and any supplementary information provided by the developer to the Ministry as well as assessment of the information received through the public participation and consultation processes;
(vi) Expertise procedure;
(vii) Implementation of transboundary environmental impact assessment procedure (weather appropriate);
(viii) Issuance of Environmental Decision or the decision on refusal to implement the project by the Minister.

257. **Law on Licenses and Permits** regulates legally organized activities posing certain threats to human life/health, and addresses specific state/public interests, including usage of resources, regulates activities requiring licenses/permits, determines types of licenses/permits required, and defines the procedures for issuing, revising and cancelling of licenses and permits. The law is generic and refers to the Environmental Assessment Code for details of environmental permitting (Environmental Decision) procedures.

258. **Law on Environmental Protection** regulates the legal relationship between the bodies of the state authority and the physical persons or legal entities (without distinction-legal form) in the field of environmental protection and in the use of nature on all Georgia's territory including its territorial waters, airspace, continental shelf and special economic zone. The law defines the

principles and norms of legal relations, rights and obligations and responsibilities, awareness raising, education and scientific research in the field of environment, key players and principles of environmental management; describes economical mechanisms and levers; ecological insurance; basics of environmental audit; environmental requirements during privatization; justifies needs of environmental standards and limits (air, water, soil, noise, vibration, fields, radiation) and ecological requirements for production, transportation and storage of goods and food products; ecological requirements applicable to waste; states necessity of environmental impact assessment and related issues (strategic environmental protection and transboundary environment assessment) referring to Environmental Assessment Code; defines general principles of environmental protection; considers different aspects on protection of ecosystems, protected areas, issues of global and regional management, protection of ozone layer, biodiversity, protection of Black Sea and international cooperation aspects. As stated in the law, in order to protect the climate against the global changes, the subject of the business activity is obliged to observe the limits to green-house gas emissions as well as to take measures for mitigating this emission. The emission of the green-house gases is regulated on the basis of integrated control of pollution of environment (Article 51). Besides, the subject of the business activity is obliged to reduce or stop production and use of such chemicals, which are likely to have effects on the ozone, layer of the earth and cause depletion of it (Article 52).

259. The status, of natural resources, study and usage of mineral resources is regulated by the **Law of Georgia on Subsoil**. The law describes rights and obligations of the users (Including re-cultivation after expiration of the license term), duration of the licenses (for energy resources – up to 45 years; for metal ores – up to 40 years; up to 30 years for construction materials and other non-ore mineral resources; ground water and gas (except for the natural gas) – up to 25 years); protection of natural resources and safety requirements; termination of license; state supervision and control over the use of mineral resources; general requirements during mining. With regards to the issues related to the licenses for use of the natural resources the law gives reference to the law on Licenses and Permits, Law on Oil and Gas and related regulations. The law states the need for protection of environment and OHS during operation (mining), including requirements for waste (including waste water) management. According to the law extraction and treatment of mineral resources from deposits both of natural and technogenic origin (soil disposal areas) are subject to state supervision and control.

260. The **Waste Management Code** (2015) provides the legal conditions for implementation of measures aiming at prevention of generation of waste and increased re-use, environmentally-sound treatment of waste (including recycling and extraction of secondary raw materials, energy recovery from waste, as well as safe disposal). The following summarizes the key points of the code.

(i) Article 7 - General waste management requirements

(a) Waste, depending on its type, properties and composition, shall be collected, transported and treated in a manner not impeding its further recovery.
(b) Waste shall be collected, transported and treated in a manner which excludes, to the maximum extent possible, pollution of the environment and risks for human health.
(c) In case of waste pollution caused by waste transport activities, the waste transporter shall be responsible for taking clean up measures.
(d) The producer and holder of waste is obliged to treat their waste
(e) on their own or hand it over for collection, transport and treatment to persons entitled to carry out such operations in accordance with this Law and legislation of Georgia.
(f) Where waste has been submitted for recovery or disposal, the original producer's and/or holder's responsibility shall remain until recovery or disposal is completed.

(g) Persons who collect and transport waste shall hand it over for treatment to appropriate facilities, holding the relevant permit or registration.
(h) The burning of waste outside permitted incinerators shall be prohibited.

(ii) Article 14 - Company waste management plan

(a) Legal and natural persons that produce more than 200 tonnes of non-hazardous waste or 1000 tonnes of inert waste or any amount of hazardous waste annually, shall prepare a company waste management plan.

(iii) Article 15 – Environmental Manager

(a) The persons under Article 14 of this Law shall nominate a suitable person as a company environmental manager.

(iv) Article 17 - General obligations for hazardous waste management

(a) The production, collection and transportation of hazardous waste, as well as its storage and treatment, shall be carried out in conditions providing protection for the environment and human health. It shall be prohibited to
- discard hazardous waste outside waste collection containers;
- discharge it into the sewerage systems or underground or surface waters, including the sea;
- burn it outside waste incinerators permitted for that purpose;
- treat it outside waste treatment facilities permitted to treat such type of waste

(v) Article 18 - Special obligations for hazardous waste management

(a) Waste producers that produce more than 2 tons of hazardous waste per year shall
- create and implement a suitable separation and collection system for such waste;
- designate an environmental manager, pursuant to Article 15 of this Law, responsible to make arrangements for the safe management of said waste;
- make arrangements for briefing and training for staff handling hazardous waste.

(b) Until the exact content of waste is unknown, the waste shall be regarded as hazardous.
(c) Hazardous waste for which no appropriate treatment techniques and/or technologies are available in accordance with the requirements of this Law within the territory of Georgia shall be exported for treatment. Until the export is carried out, the waste shall be safely stored at temporary storage facilities.
(d) The Ministry may exceptionally once allow for an extended storage period of up to one year if this is justified and does not harm human health or the environment.
(e) Hazardous waste may only be collected and transported by a natural or legal person after its registration pursuant to this Law.

(vi) Article 29 - Obligations for keeping records and reporting on waste

(a) Records on waste shall be kept and waste reports shall be submitted to the Ministry by natural and legal persons:
- dealing professionally with collection, transport and/or treatment of waste;
- which produced more than more than 2 tones non-hazardous

(excluding municipal waste) waste or any amount of hazardous waste per year.

261. **Law on Protection of Atmospheric Air.** The law regulates protection of atmospheric air from man-caused impact. Pollution of atmospheric air is emission of hazardous substances originating from activities which are able to have negative impact on human health and environment. Four types of pollution are considered (Part II, Chapter IV, Article II.2): Pollution of environment with hazardous matter, Radiation pollution of atmospheric air. Pollution with microorganisms and biologically active matter of microbial origin, Noise, vibration, electromagnetic fields and other physical impact. Maximum permitted limits for concentration of hazardous substances into the atmospheric air are defined for each contaminants and represent maximum concentration of hazardous pollutants, in averaged time span, recurring action of which has not have negative impact on human health and environment. Maximum permitted levels of emission of hazardous matters into the atmospheric air are defined with allowance of prospective of development of the enterprise, physical. geographical and climatic conditions, dispersion of emitted substances, background concentration of pollutants emitted from other neighboring enterprises, taking into account inter-location of existing or planned dwellings, sanatoria and recreation zones. In compliance with the law (Clause 28), in order to restrict pollution from the stationary sources6 of hazardous emissions the limits of emissions are to be set. The limit of pollution from the stationary source of emission is permitted quantity (mass) of emitted hazardous matters (Clause 29). Maximum annual emission level means the maximum permitted limit of discharge. This is annual permitted quantity of emission predetermined by technology in conditions of standard permitted capacity of discharge. Annual maximum capacity is defined for each hazardous substance and is calculated so that for each stationary source of emission cumulative emission from all registered sources of discharge does not exceed relevant maximum permitted value. Discharge of hazardous emissions from the stationary sources of emission without approved limits of discharge is forbidden. The standards of emissions (Clause 30) are to be worked out by the enterprise itself. According to the law (Clause 38) the enterprise is responsible for conducting self-monitoring which includes measurement of emission (evaluation), recording/registration and accounting. Emission which has not been recorded in self-monitoring record is considered illegal. As mentioned in the Clause 51 results of the monitoring and information on pollution of the air with hazardous substances is transparent and accessible for the public.

262. **Law on Water** regulates water use, defines rights and obligations of water users, sets out the types of licenses for the use of water, the rules and conditions of their issuance, considers conditions of suspension, withdrawal and deprivation of license, regulates water flows. The law states liability of all natural and legal persons to prevent pollution of catchment basins, water reservoirs, snow and ice covers, glaciers, permanent snow cover with industrial, household and other wastes and emissions which may cause deterioration of the underground water quality; prohibits piling of industrial and household wastes near the public water headwork's and in their sanitation zones, bans construction of facilities and implementation of any other activity which may cause water pollution; sets requirements for forest use within water protection zones. The state management of water protection and use is exercised through accounting, monitoring, licensing, control and supervision.

(i) State monitoring of water is implemented by the Legal Entity under Public Law - the National Environmental Agency under MoEPA. By virtue of the law when locating/designing/constructing/commissioning of a new or reconstructed enterprise, or other facility, as well as in introducing of new technological process capable to affect the state of water, the rational water use is to be secured. At

[6] Stationary source of pollution of the atmospheric air is stationary device or construction with a special emission unit. Any stationary device or construction which, proceeded from its technological peculiarities, is not fitted with sputtering device is also considered as a stationary source of emission.

the same time, attention is to be paid to the measures ensuring due accounting of water abstracted from and returned to water bodies; protection of water from contamination, pollution-and depletion; avoidance of the unfavorable water impact; restriction of land flooding up to minimum necessary level, protection of land from silting, swamping or drying up; as well as environmental protection and landscape preservation.

(ii) Under the law required is purification, up to the fixed standard, of the waste water discharged in a water body. In order to protect the quality of water resources, the law requests creation of sanitary protection zone that consists of three belts, each having a special regime. The procedure fixing the water quality standards, the maximum permissible rates of emission of harmful substances (including microorganisms) into ambience, the water abstraction quotas and the temporary rates (limits) of emission of harmful substances (including microorganisms) into water is defined by the Law of Georgia on the Environmental Protection.

(iii) Georgian legislation may provide liability for other violations of law in the water protection and use sphere. Water users shall compensate for damages caused by violation of the law on Water in the amount and under procedure established by legislation of Georgia. Under the Article 17 (Protection of natural resources of the Black Sea) anadromous fish species (fish species seasonally migrating upstream of a river against the current) within the rivers of Georgia shall be protected by creation of conditions necessary for their reproduction, through conservation of the habitat, determination of procedures for regulating the fishing industry, determination of a total permissible amount of catching these species within the territorial waters, and within and outside special economic zones of Georgia, also through implementation of other measures defined by the legislation of Georgia. Article 20 (River water protection zone) defines protection zone of a river shall be its adjacent territory, where a special regime is established to protect water resources from pollution, littering, fouling, and depletion. This zone may include its dry bed, adjacent terraces, natural elevated and steep riversides, as well as gullies directly adjacent to riversides. The width of a river water protection zone shall be measured in meters from the edge of a riverbed to both sides under the following procedure:
(a) 10 meters - in the case of a river up to 25 kilometers long,
(b) 20 meters - in the case of a river up to 50 kilometers long,
(c) 30 meters - in the case of a river up to 75 kilometers long,
(d) 50 meters - in the case of a river over 75 kilometers long.

(iv) Within this zone, prohibited activities are to: a) construct, expand or reconstruct functioning enterprises, except for cases directly determined by law; b) spray, by air atomisation, perennial plants, sown crops and forest lands with toxic chemicals; c) keep, collect or place toxic chemicals and mineral fertilizers, as well as any other wastes as defined in the legislation of Georgia. It is requested that hydraulic structures located within a water protection zone shall be normally equipped with appropriate technical facilities to completely exclude the possibility of river pollution and littering.

263. **Law on Wildlife.** The law regulates wildlife protection and use including hunting and fishing. The main goal of the law is to ensure protection and restoration of wildlife, its habitats, preservation and sustainability of species diversity and genetic resources, creation of conditions for sustainable development, taking into account the interests of present and future generation; legal ensuring of wildlife protection (including in-situ and ex-situ conservation, translocation and reproduction of wildlife) and state-based provision of use of wildlife objects. In addition to this law, Georgian legislation on the wildlife is based on the Constitution of Georgia, Georgia's

international agreements and treaties, laws on Environmental Protection and on the System of Protected Areas, law of Georgia on Wildlife and law of Georgia on the “Red List” and “Red Book”. It is one of the main goals of the Environmental Protection Law to support the preservation of biodiversity of the country, the preservation of rare, endemic and endangered species, the protection of the marine environment, and the maintenance of the ecological balance (Art. 3.1 (d)). The Law contains regulations on both wild animals and plants which are threatened by extinction and those which are not. Two main legal acts regulating the issues of species protection in Georgia.

264. **Law on Red List and Red Book** which gives the legal definitions of Red List and Red Book (relevant recommendations and methodological issues) of endangered species of Georgia. The Red List structure was also legally defined, as well as the relevant procedures for including species in the Red List, procedures for revising, and updating of it. The Law also regulates issues related to planning and financial matters connected with the protection, taking of, rehabilitation and conservation of endangered species. The Red List of Georgia was approved by Order of President of Georgia No. 303 (2006), later - by the Resolution of the Georgian Government No. 190, dated 20-Feb-14. The law defines special cases when removal of individuals of the Georgian Red List species from their habitats is allowed. Decisions are made by the Government of Georgia.

265. **Forestry Code** regulates relations and state policy in the area of forestry management, use and protection. The code specifies all activities, which may be carried out in Forestry Fund. It allows only those activities, which are related to forest resource protection or use such as timber logging, collection of non-timber resources, use of area for agriculture or recreation, establishment of hunting farms, etc. State forestry fund may be used for a special purpose in urgent cases. Decisions are made by the Government of Georgia.

266. **Law on Soil Protection.** The law provides the policy requirements and principles of the protection and preservation of fertility soil resources against negative impacts. Soil protection is the state problem since correct and rational use of all types of soil, including barren soil, saline soils, swamped soil, alkali soil and aqueous soil are the main reserve of dynamic development of agriculture and of the national economy as a whole. The purpose of the present Law is to establish the rights and the duties of landholders, landowners and the state in the field of soil protect. The law defines soil protection measures and methods and prohibits certain activities, e.g. use of fertile soil for non-agricultural purposes; implementation of non-agricultural activity without topsoil removal and conservation; any activity, which results in deterioration of soil properties, etc. In addition to this law soil protection issues are regulated by order #2-277 (25.11.2005) of the Minister of Agriculture on approving Recommendations for Complex Measures for Soil Protection from the Erosion.

267. **Law of on Conservation of Soil and Restoration-Amelioration of Soil Fertility** is to ensure conservation and improvement of soil in the territory of Georgia, define the legal principles, measures, limitations and prohibitions to that end; soil conservation and fertility restoration improvement measures. It prohibits unregulated grazing, removal of windbreaks, application of non-registered fertilizers or other substances, soil contamination and any activity, which results in deterioration of soil properties and facilitates desertification, swamping, salinization, etc. Businesses that use soil or conduct activities upon soil that have the potential to negatively impact soil conservation are required to follow the Law and related normative documents and regulations, including Order #113 (27.05.2005) of the Minister of Environment and Natural Resources’ Protection on affirming regulation on “Removal, Storage, Use and Re-cultivation of the Fertile Soil Layer” and 2) Resolution of the GoG #424 (31.12.2013) on affirming technical regulations on “Removal, Storage, Use and Re-cultivation of the Fertile Soil Layer”. These documents consider issues of land resources protection and rational use and issues related to removal, storage, use and re-cultivation of the fertile soil layer during different

activates. According to the regulation, restoration of degraded soil fertility must be implemented using re-cultivation (technical and biological) methods.

268. **Law on System of Protected Areas**. Forms a legal basis for planning, establishment and maintenance and assignment of categories of protected areas, described funding issues for each category. It specifies ownership forms of land and other natural resources in protected areas, allowed and prohibited activities.

269. **Law on Regulation and Engineering Protection of Seacoast and Riverbanks of Georgia** provides general principles and requirements for protection of coastal areas and riverbanks from negative environmental impacts.

270. **Law on Compensation for Damage Caused By Hazardous Substances** Includes principles and procedures for compensating the negative impacts caused by discharge of hazardous substances into environment.

271. Laws and regulations related to social aspects and land ownership applicable to the project are presented in Table 13**.**

Table 13: List of social and land ownership related laws relevant to the project

Year	Law / Regulation	Last revision	Code
1996	Law on agricultural land ownership	16/06/2017	370.030.000.05.001.000.132
1997	Civil code of Georgia	23/12/2017	040.000.000.05.001.000.223
1997	Law on compensation of land substitute costs and damages due to allocating agricultural land for non-agricultural purposes	25/12/2014	370.020.000.05.001.000.244
1999	Law on rules for expropriation of property for public needs	06/09/2013	020.060.040.05.001.000.670
2007	Law on cultural heritage	07/12/2017	450.030.000.05.001.002.815
2007	Law on public health	07/12/2017	470.000.000.05.001.002.920
2010	Law on state property	07/12/2017	040.110.030.05.01.004.174
2010	Labour Code	04/05/2017	270000000.04.001.016012

272. Brief summaries of the listed documents are given below.

273. **Civil Code** regulates contractual relations, describes the rights and responsibilities of natural and legal persons, defines the penalties in the case of violations of the requirements set out in the document. The Civil Code differentiates between movable and immovable property and provides rules for acquiring title over property, as well as any proprietary or obligatory rights thereto. This piece of legislation must be taken into account when entering into contracts in Georgia.

274. **Labour Code** regulates employment relations, unless such relations are otherwise regulated by international treaties that have been implemented in Georgia. Employers are obliged to comply with requirements and clauses of the document for the purpose of ensuring that the rights of employees are protected.

275. **Law on Public Health** regulates legal relations for ensuring a safe environment for human health. It indicates quality norms of for air, soil and water pollution and restrictions related to ionized radiation, noise and vibration. The limits must be complied with. Section 7 of the law is dedicated to safety of technological processes.

276. **Law on Compensation of Land Substitute Costs and Damages due to Allocating Agricultural Land for Non-agricultural Purposes** defines compensation amounts, required

at the time of allocation, use or disposal of agricultural land parcel for non-agricultural purpose; the payment procedure and the procedure for changing the agricultural land category, including payment of losses to landowners or land users, as a result of restricting their rights or reducing the quality of their land.

277. **Law on agricultural land ownership.** Objective of the law is to ensure improvement of the structure of agricultural land based on rational use of resources, avoidance of splitting and unsustainable use of the land plots. The law defined the rules for acquisition and selling the land, participation of the state in agricultural land related relations. The law deals with land ownership issues, restrictions of land alienation in case of co-ownership, sets priority of the state in buying out the agricultural land plots.

278. **Law on rules for expropriation of property for public needs** outlines respective procedures and conditions for expropriation of private property as well as procedures for compensation payment for expropriated property or the transfer of other property with the same market value.

279. **Law on State Property** regulates relationships on state property management and transfer for use by others, defines special requirements and procedures for transfers. The Ministry of Economy and Sustainable Development is the state authority in charge of the property.

280. **Law on cultural heritage** sets out procedures for protection of cultural heritage and permitting arrangements for archaeological investigations.

D.4 Administrative Framework

281. **Ministry of Environment Protection and Agriculture (MoEPA)** - In December 2017, MoEPA had its responsibilities split between the ministries of agriculture and economy, with the latter also taking over the Ministry of Energy.

282. MoEPA is responsible for all environmental protection issues and agriculture in Georgia. The responsibilities of the Ministry as the competent authority are: a) to intermit, limit, or stop any activity having or likely to have adverse impact on the environment, b) to carry our screening of planned development, c) to implement scoping, d) to issue environmental decision for project subject to EIA procedure (ref. Environmental Assessment Code), c) to control the execution of mitigation measures by the developer, d) to organize public meetings and discussion of an estimation of influence on environment and prepares the documentation (the project of the order of the minister) to let out the permission to influence to environment.

283. **Ministry of Economy and Sustainable Development (MoESD)** - MoESD is responsible for carrying out the review of technical documentation (including conclusion of independent experts) and issuing Permits on Construction for projects, as well as for supervision over constructing activities and for arranging Acceptance Commission after completion of construction. State supervision of construction and compliance monitoring is provided by the Main Architecture and Construction Inspection (MACI), which is operating under the Ministry of Economy and Sustainable Development of Georgia. Following to reorganization of MoEPA and the Ministry of Energy the MoESD took over the functions of the latter, as well as part of the main functions of MoEPA (viz. licencing activity).

284. **The Roads Department** - The Roads Department of the Ministry of Regional Development and Infrastructure (RD) is responsible for elaboration of policy and strategic plans related to developing motor roads, management of road and traffic related issues and construction, rehabilitation, reconstruction and maintenance of the roads of public use of international and national significance, utilizing funds from the state budget, lawns, grants and

other financial sources. Thus, the RD is responsible for the procurement of design and EIA studies, as well as works on construction and rehabilitation of roads and is responsible for ensuring compliance with the Georgian legislation and environmental and social requirements of the relevant donor organizations. Control of implementation of the Environmental Management Plan (EMP) is direct responsibility of the Roads Department. Within the RD there is Environmental Division dealing with the environmental issues. This division is supposed to review the EIAs and EMPs related to the Roads Department projects and perform monitoring of compliance of the contractor's performance with the approved EMPs, EIAs, environmental standards and other environmental commitments of the contractor.

285. **The Ministry of Culture, Monument Protection and Sports** - responsible on supervision of the construction activities in order to protect archaeological heritage. In case if construction is to be carried out in a historic sites or zones of cultural heritage, consent of the Ministry of Culture, Monument Protection and Sport is also required for issuing construction permit.

286. **The "National Service for the Foodstuffs Safety, Veterinary and Plant Protection" of the Ministry of Environmental Protection and Agriculture** - responsible for implementation of complex sanitary protection measures in case of identification burial sites during earthworks. Information about suspicious burial sites should be delivered to the "National Service for the Foodstuffs Safety, Veterinary and Plant Protection" of MoEPA by the Construction Contactor (field environmental officer) and RD field officer.

D.5 Environmental Regulations and Standards

287. Georgia has a large set of specific standards that refer to emission, effluent, and noise standards, as well as standard to handle and dispose specific wastes ranging from sewage to hazardous wastes. The following summarizes these laws and standards along with IFC and EU standards.

D.5.1 Ambient Air Quality Standards

288. Maximum permissible concentrations (MPC) for air born pollutants are set by the hygienic standards on Maximum Permissible Concentrations of Air Born Pollutants for Settlements (HN 2.1.6. 002-01), see Table 14. This project will also ensure compliance with IFC guideline values (not interim targets) as these values are, in some instances, more stringent than the national standards, the most stringent standards are highlighted in green.

Table 14: Ambient Air Quality Standards

Parameter	Averaging Period	Limit (μg/m³)		
		Maximum Permissible Concentration (MAC) for Air Quality	IFC Guideline Value	EU Ambient Air Quality Guidelines
Nitrogen Dioxide (NO_2)	30 minutes	200	-	-
	1 Hour	-	200	200
	24 Hours	40	-	-
	1 Year	-	40	40
Sulphur Dioxide (SO_2)	10 minutes	-	500	-
	30 minutes	500	-	-
	1 Hour	-	-	350
	24 Hours	50	20	125
Carbon Monoxide (CO)	30 minutes	5000	-	-
	24 Hours	3000	-	-
	24 Hours	150	-	-

Parameter	Averaging Period	Limit (µg/m³)		
		Maximum Permissible Concentration (MAC) for Air Quality	IFC Guideline Value	EU Ambient Air Quality Guidelines
Total Suspended Particulates (TSP) / Dust	30 minutes	500	-	-
PM10	1 year		20	40
	24 hour		50	50
PM2.5	1 year		10	25
	24 hour		25	-
Ozone	8-hour daily maximum		100	120

D.5.2. Surface Water Quality Standards

289. The values of Maximum Admissible Concentrations of the harmful substances in surface are provided in the Environmental Quality Norms approved by the Order #297N (16.08.2001) of the Ministry of Labour, Health and Social Protection (as amended by the Order No 38/n of the same Ministry of 24.02.2003). The admissible level of pollutants in surface water is given in Table 15. All effluents shall comply with the Georgian National Standards. However certain parameters are not specified in the national standards for these IFC Guidelines are being used as shown in the Table.

Table 15: Applicable Standards for Surface Water Quality

Parameter	Maximum Permissible concentration	Source
pH	6.5-8.5	National
Diluted Oxygen, mg/l	4-6	National
BOD5, mg/l	30	IFC
COD, mg/l	125	IFC
Total Nitrogen, N, mg/l	10	IFC
Total Phosphate, mg/l	2	IFC
Chlorides, mg/l	350	National
Oil Products, mg/l	0.3	National
Zinc (Zn^{2+})	1g/kg	National
Lead (Pb total)	23.0	National
Chrome (Cr^{6+})	32.0	National
Cadmium (Cd, total)	6.0	National
Total Suspended Solids, mg/l	50	IFC

290. Quality requirements depend on category of water body (ref. Technical regulations of protection of surface water from pollution, approved by decree #425 of the government of Georgia, 31/12/2013). The categories are: a) household water use, b) domestic water use and c) fisheries. The latter, in its turn, splits in highest, first and second categories.

Table 16: Water quality requirements by water use category

	Water use category			
	Household water use	Domestic water use	Fisheries	
			Highest and first	Second

	Increase not higher that listed below is allowed			
Suspended solids	0.25mg/l	0.75 mg/l	0.25mg/l	0.75 mg/l
	For rivers with natural content of suspended solids 30mg/l, around 5% increase is allowed			
	If waste water contains suspended particles with deposition rate above 0.2mm/sec discharge in water reservoirs is not allowed. Discharge of effluents containing suspended particles with deposition rate above 0.4mm/sec is prohibited.			
Floating matter	Patches and films of oil, petroleum products, fats must not be detectable			
Colour	Must not be visible in water column		Water must not have unusual colour	
	20cm	10cm	-	
Odour, taste	Water must not have odour and taste of higher than 1 unit intensity		Water must not result in unusual odour and taste in fish	
	After chlorination of other treatment	Without treatment	-	
Temperature	After discharge of waste water, temperature in water reservoir must not exceed by more than 5% compared to the natural value		For water bodies where cold water lowing fish is found (*Acipenseridae, Coregonidae*) maximum allowable temperatures in summer and winter are 20C and 5C respectively, for other water bodies 28C (in summer), 8C (in winter)	
pH	Must be in 6.5-8.5 interval			
Water mineralisation	<1000mg/l, Incl. chlorides – 350mg/l; sulphates - 500mg/l	To comply with requirement given in section related to taste (see above)	In accordance with taxation	
Dissolved oxygen	Must not be lower than			
	4mg/l	4mg/l	6mg/l	6mg/l
Biological oxygen demand	At 20C must not exceed			
	3mg/l	6mg/l	3mg/l	6mg/l
Chemical oxygen demand	Must not exceed			
	15 mg/l	30 mg/l	-	-
Chemical substances	Must not exceed maximum permissible limits			
Pathogens	Must be free for pathogens, including viable helmint eggs, tenia oncosperes and viable cysts of pathogen organisms			
Toxicity	-	-	At the point of discharge and control section of the river toxic impact must not be observed.	

D.5.3 Groundwater Quality Standards

291. Groundwater quality standards are not set under Georgian law. Drinking water quality standards are commonly used instead as assessment criteria for groundwater. Quality of drinking water is determined by the Technical Regulations for Drinking Water (approved by order №58 of the government of Georgia, (15.01.2014).

Table 17: Drinking water quality criteria

Parameter	Units	Value
Odour	Unit	2
Taste	Unit	2
Colour	Grad	15
Turbidity	Turbidity units (formazine) or mg/l (kaolin)	3.5 or 2
Metals and Miscellaneous		

Parameter	Units	Value
Boron, B	mg/kg	0.5
Arsenic, As	mg/kg	0.01
Cadmium, Cd	mg/kg	0.003
Copper, Cu	mg/kg	2
Mercury, Hg	mg/kg	0.006
Nickel, Ni	mg/kg	0.07
Lead, Pb	mg/kg	0.01
Selenium, Se	mg/kg	0.01
Zinc, Zn	mg/kg	3
Total Petroleum Hydrocarbons, TPH	mg/kg	0.1
Cyanide	mg/kg	0.07
Sulphate	mg/kg	250
Chloride	mg/kg	250
pH	pH value	6-9
Sodium, Na	mg/kg	200
Microbiological characteristics		
Thermotolerant coliforms	Bacteria in 100cm^3	not allowed
Tota; coliforms	Bacteria in 100cm^3	not allowed
Mesophylic aerobes and facultative anaerobes	Colony forming units in 1cm^3	< 50
Colifagues	Negative colonies in 100m^3	not allowed
Sulphitereducing clostridia	Spores in 20cm^3	not allowed
Lamblias and cysts	Cysts in 50dm	not allowed

D.5.4 Noise Standards

292. Admissible noise standards of the IFC and Georgian national standards for residential areas are similar. The national standards for noise are set according to the Technical regulation – Acoustic noise limits for rooms/premises in residential houses and public establishments (Document #300160070.10.003.020107, Date 15/08/2017) see Table 18.

293. For IFC noise impacts should not exceed the levels presented in Table 19 or result in a maximum increase in background levels of 3 dB at the nearest receptor location off site. This project will comply with both IFC Guidelines and Georgian Standards. Note that Georgian standards refer to the allowable limits indoors, not at the building façade.

Table 18: Georgian Standards for Noise Levels

Purpose/use of area and premises	Allowable limits (dBA)		
	L_{day}		23:00 – 08:00 L_{night}, Night
	08:00 - 19:00, Day	Evening 19:00-23:00	
Educational facilities and library halls	35	35	35
Medical facilities/chambers of medical institutions	40	40	40
Living quarters and dormitories	35	30	30
Hospital chambers	35	30	30
Hotel/motel rooms	40	35	35
Trading halls and reception facilities	55	55	55
Restaurant, bar, cafe halls	50	50	50
Theatre/concert halls and sacred premises	30	30	30
Sport halls and pools	55	55	55

Purpose/use of area and premises	**Allowable limits (dBA)**		
	L_{day}		**23:00 – 08:00 L_{night}, Night**
	08:00 - 19:00, Day	**Evening 19:00-23:00**	
Small offices (≤100m³) – working rooms and premises without office equipment	40	40	40
Small offices (≤100m³) – working rooms and premises without office equipment	40	40	40
Conference halls /meeting rooms	35	35	35
Areas bordering with houses residential, medical establishments, social service and children facilities (<6 storey buildings)	50	45	40
Areas bordering with houses residential, medical establishments, social service and children facilities (>6 storey buildings)	55	50	45
The areas bordering with hotels, trade, service, sport and public organizations	60	55	50

Note:
1. in case noise generated by indoor or outdoor sources is impulse or tonal, the limit must be 5dBA les than indicated in the table.
2. Acoustic noise limits given above are set for routine operation conditions of the 'space', i.e. windows and door are closed (exception – built-in ventilation canals), ventilation, air conditioning, lighting (in case available) are on; functional (baseline) noise (such as music, speech) not considered.

Table 19: IFC Noise Level Guidelines

Receptor	**One hour L_{aeq} (dBA)**	
	Daytime 07.00-22.00	**Night-time 22.00 – 07.00**
Residential; institutional; educational	55	45
Industrial; commercial	70	70

294. For workplace noise the following IFC standards are applicable.

Table 20: IFC Work Environment Noise limits

Type of Work, workplace	**IFC General EHS Guidelines**
Heavy Industry (no demand for oral communication)	85 Equivalent level Laeq,8h
Light industry (decreasing demand for oral communication)	50-65 Equivalent level Laeq,8h

D.5.5 Vibration Standards

295. The Georgian Standards for vibration are designed for human comfort. These are shown in Table 21. Note that no standards for building damage exist.

Table 21: Georgian General Admissible Vibration Values in Residential Houses, Hospitals and Rest Houses, Sanitary Norms 2001

Average Geometric Frequencies of Octave Zones (Hz)	**Allowable Values X0,Y0, Z0**			
	Vibro-acceleration		Vibro-speed	
	m/sec^2	dB	$m/sec\ 10^{-4}$	dB
2	4.0	72	3.2	76
4	4.5	73	1.8	71
8	5.6	75	1.1	67
16	11.0	81	1.1	67
31.5	22.0	87	1.1	67
63	45.0	93	1.1	67
Corrected and equivalent corrected values and their levels	4.0	72	1.1	67

Note: It is allowable to exceed vibration normative values during daytime by 5 dB during daytime In this table of inconstant vibrations, a correction for the allowable level values is 10dB, while the absolute values are multiplied by 0.32. The allowable levels of vibration for hospitals and rest houses have to be reduced by 3dB.

296. The American Association of State Highway and Transportation Officials (AASHTO) (1990) identifies maximum vibration levels for preventing damage to structures. Table 22 summarizes the maximum levels.

Table 22: AASHTO Maximum Vibration Levels for Preventing Damage

Type of Situation	**Limiting Velocity (in/sec)**
Historic sites or other critical locations	0.1
Residential buildings, plastered walls	0.2-0.3
Residential buildings in good repair with gypsum board walls	0.4-0.5
Engineered structures, without plaster	1.0-1.5

D.5.6 Soil Quality

297. Soil quality is currently assessed by Methodological Guides on Assessment of Level of Chemical Pollution of Soil (MG 2.1.7.004-02). However, these limits will soon be replaced as Georgia harmonizes its regulations with the EU and moves away from the outdated standards prepared while part of the Soviet Union. The national standards for soil quality are given in Table 23 along with the limits proposed by MoEPA and the Ministry of Labour, Health and Social Affairs.

Table 23: Soil screening values

Compound	**Units**	**Current Limit**	**Proposed Limit**
Metals and Miscellaneous			
Arsenic, As	mg/kg	2	30
Cadmium, Cd	mg/kg	2*	0.5** – 1.0***
Copper, Cu	mg/kg	3-132*	60**-100***
Mercury, Hg	mg/kg	2.1	
Nickel, Ni	mg/kg	4-80*	60**- 80***
Lead, Pb	mg/kg	32-130*	100** - 140***
Zinc, Zn	mg/kg	23-220*	130** - 200***
Total Petroleum Hydrocarbons	mg/kg	1000	-
Cyanide	mg/kg	0,2	-
Volatile Organic Compounds			

Compound	Units	Current Limit	Proposed Limit
Benzene	mg/kg	0.3	0.05
Toluene	mg/kg	0.3	-
Total xylenes	mg/kg	0.3	0.05
Semi Volatile Compounds			
Benzo(a)pyrene	mg/kg	0.02-0.2	0.1
Isopropylbenzene	mg/kg	0.5	-
Pesticides			
Atrazine	mg/kg	0.01-0.5	-
Lindane	mg/kg	0.1	-
DDT (and its metabolite)	mg/kg	0.1	0.075

* Note: Sodium and neutral (clay and clayey) pH >5.5 - No screening value available, ** Light Soils, ***Other Soils

D.6 National Technical Regulations Relevant to the Project

298. Technical (national) regulations applicable to the road project in Georgia include:
   (i) Law on Roads (310.090.000.05.001.000.089, last amended in 2013);
   (ii) Construction norms and regulations 2.05.03-84 - Design of bridges, viaducts, overpasses and pipes;
   (iii) Construction norms and regulations 2.05.02-85 - Motor roads (regulate traffic safety, environmental issues, set forth main technical and traffic operation norms, crossings and intersections, paving aspects, etc.)

299. According to these documents:
   (i) International and national importance roads should be built bypassing the settlements. Access roads to the settlements should be provided. To allow modernisation, the distance between the residential area (settlement) and the edge of the carriageway must be not less than 200m, distance to agricultural land - 50m. If because of technical or economical purposes the road is to cross the settlement, minimum distance to the residential area must be 50m, in case noise barriers are provided – 25m. For local roads minimum distance to residential area must be 50m, distance from agricultural land – 25m.
   (ii) To protect residential area from noise and emission impact, 10m wide green barrier must be arranged;
   (iii) Along with technical and economic aspects environmental impacts must be taken into account during design and construction;
   (iv) Prior to arrangement of temporary infrastructure and preparation of road embankment, topsoil must be removed and stockpiled until subsequent use for re-cultivation after completion of construction and removal of all temporary facilities;
   (v) Roads along the rivers, lakes and reservoirs must be built with consideration of protection zone boundaries for the surface water bodies.

D.7 Environmental Permitting Procedures

300. Since the draft of the EIA report for the planned development was disclosed before the entry into force of the new Environmental Assessment Code, permit application/issuance procedure follows the steps defined in the law on Environmental Impact Permit described below:

Table 24: Environmental impact permit issuance procedure (valid for the projects disclosed before January 1, 2018)

Step	Action	Comment	Timeframe
1	Publication of information on the project in central and regional newspapers.	The advertisement has to include the project title, location, place and the date, time and venue of public disclosure meeting(s). It will also identify locations where the EIA can be reviewed and where comments may be submitted.	Day 0
2	• Submission of the draft ESIA report to the Ministry of Environment Protection and Agriculture (MoEPA))	Hard copy and electronic version of the report delivered to MoEPA	within 3 days after announcement in the newspapers
	• Feedback	Receiving public comments on the disclosed EIA	45 days from announcement in the newspapers
	• Meetings with stakeholders including local community, NGOs, local authorities, etc.	All comments and questions must be documented and answers, minutes of the meeting(s) written up.	Between 50 and 60 days after publication of the advert
3	Development of final version of the ESIA and submission to MoEPA (together with Non-technical Summary, Technical Summary, reports on emissions and allowable limits) for the state ecological examination.	Comments received from the stakeholders considered in the report. Minutes of meeting(s) enclosed to the document as attachment. .	After arranging a public review of the EIA report and development of final version of the EIA, the developers is authorised to submit, within one year, an application to the permit issuing administrative body for a permit
4	Consideration of the documents by MoEPA and issuance of conclusion		20 days after registration of an application for a permit and submission of the EIA package to the MoEPA.

Note: According to the national regulations (Law on Licenses and Permits and in compliance with Resolution of the GoG on rules and conditions for issuance of construction permit (N57, 24 March 2009, with amendments) construction/ modernization of highways requires Construction Permit.

301. After January 1, 2018, the procedure including screening, scoping and EIA stages is has been introduced. According to the Code, ‘construction of international and interstate roads’ and ‘construction and operation of tunnels and/or bridges on the international and interstate roads’ belong to the Annex 1 projects that require EIA. This does not differ from the statement given in the law on Environmental Impact permit replaced by the new Code. The differences between the old and the new procedures are in scoping stage, which was not required before and increase role of the MoEPA is the public consultations process.

302. The procedure described below will be applicable to all international/interstate road and construction and operation of tunnels and/or bridges on the international and interstate roads disclosed after January 2018 (Note, this project was started prior to January 2018 so is not subject to the new rules).

Table 25: Environmental Decision (formerly environmental impact permit) issuance procedure (after January 1, 2018)

Step	Action	Comment	Timeframe
1	Written application to the Ministry submitted by developer.	The application submitted by the developer shall be accompanied with the following documents and/or data: a. EIA report; b. Projects on estimation of the limits for emission of harmful substances into the atmospheric air and for the injection of polluting substances into the surface waters together with the waste waters. c. Notification about a confidential part of a submitted application, if applicable; d. Copy of the document evidencing payment of the fee (500 GEL) in accordance with the existing legislation. e. Electronic copy of above mentioned documents.	Day 0
2	Ministry ensures publication of submitted application and attached documents on its official website as well as on the notice board of the relevant local authorities and/or representative bodies and upon request, provides paper copies of abovementioned documentation.	The Developer is entitled to request the Environmental Decision on several activities through a single application, if the activities are significantly interconnected.	within 3 days after submission of the application
3	Minister sets up the Expert Commission		within 5 days after registration of the application
4	Expert commission prepares and submits the expertise conclusion on the EIA report to the Ministry		within 40 days
5	Ministry takes decision on the finding of a deficiency in application		within 15 days after registration of the application
6	Feedback from stakeholders		within 40 days after the publication of the application
7	Publication of announcement on the public hearing	The announcement on public hearing shall include the information on: a. The content and brief description of the issue to be discussed, format of the discussion; b. The time, place and rules of the public hearing; c. The web address where the respective application, the EIA report and any other information relevant to decision-making	no less than 20 days prior to organizing the public hearing

Step	Action	Comment	Timeframe
		will be available as well as indication about the opportunity of accessing the paper copies of these documents during the public hearing.	
8	Public hearing	The Ministry is responsible for organizing and conducting the public hearing. It is chaired and protocoled by a representative of the Ministry. The public hearing is organized in the closest appropriate administrative building to the site of the planned project or within its vicinity. If the project is planned to be implemented within the administrative borders of a self-governing community, the public hearing is organized in the closest appropriate administrative building to the site of the project or within its vicinity and if the project is planned to be implemented within the administrative borders of a self-governing city, the public hearing is organized in the appropriate administrative building determined by the Ministry, or within its vicinity. The public hearing is open to the public and any person has a right to participate in it.	no earlier than 25th day and no later than 30th day after the publication of the application
9	Prior to issuance of the Environmental Decision or the decision on the refusal to implement the project, the Ministry ensures involvement of the Ministry of Culture and Monument Protection of Georgia, within its competence, in the administrative procedures as other public authority, under the rule envisaged by Article 84 of General Administrative Code of Georgia.		
10	The Minister issues individual administrative legal act on issuance of the Environmental Decision or the decision on the refusal to implement the project		no less than 51 and no more than 55 days after registration of the application
11	Ministry ensures publication of the EIA report, the Expertise Conclusion, the Environmental Decision or the legal act on the refusal to implement the project and the results of public participation on its official website as well as on the notice board of the relevant local authorities and/or representative bodies and upon request, provides paper copies of abovementioned documentation		within 5 days after issuing the Environmental Decision or the legal act on the refusal to implement the project

Note: The table does not include description of the scoping stage procedures.

D.8 Licenses, Permits, and Approvals

303. The Project will also be required to obtain a number of permits and consents, of which the main permits and the implementing national legislation are described in Table 26. The Law

on Licences and Permits governs the issue of all permits and consents. Subject to satisfaction of application requirements, all the permits are issued within 30 days from application submission.

Table 26: Permits Register

Permit Required Activity	Permit Title	Issuing Authority	Implementing Law	Responsible Party for Obtaining License
Pre-construction				
Construction activities	Construction Permit	Ministry of Economy and Sustainable Development	Law No.1775 on Licenses and Permits; Government Resolution N57 "On Terms and Conditions of issuance of Construction Permit"	RD
Construction activities	Environmental Decision	MoEPA	Law No.519 on Environmental Protection Law No 890-II Environmental Assessment Code	RD
Construction activities	Cultural Heritage Clearance	National Agency of Cultural Heritage	Law No 4708 "On Cultural Heritage" Law No.1775 on Licenses and Permits; Government Resolution N57 "On Terms and Conditions of issuance of Construction Permit"	RD
Construction activities	Visual geological-engineering conclusion	National Environmental Agency	Government Resolution N57 "On Terms and Conditions of issuance of Construction Permit"; Order N7 of the Minister of Environment Protection	RD
Construction Phase				
Tree felling in state forest lands for ROW and permanent facilities	Forest use agreement	MoEPA	Law No.2124 on Forestry Code of Georgia; Resolution No.242 of Government of Georgia on Approval of Rules for Forest Use Resolution No.132 of Government of Georgia on Approval of Regulations on Rules and Conditions of Issuance of Forest Usage License	Contractor
Tree felling in state forest lands for Temporary	Forest Use Agreement	MoEPA	Resolution No.242 of Government of Georgia on Approval of Rules for Forest Use;	Contractor

Facilities			Order N10/61 of the Chairman of State Department of Forestry	
Underground water abstraction	Mineral extraction licence	Ministry of Economy and Sustainable Development	Decree of the Government of Georgia N136 of August 11, 2005; Law N 946 "On Fees for Use of Natural Resources"	Contractor
Construction or upgrade of access roads	Approval of construction or upgrade activities	Ministry of Infrastructure and Regional Development; local municipalities	Government Resolution N57 "On Terms and Conditions of issuance of Construction Permit"	Contractor
Transportation of oversized and overweight cargo	Transportation permit	Ministry of Internal Affairs	Joint Order N956/1-1/746 of the Minister of Internal Affairs and Minister of Economic Development; Law N 700 "On Road Transport"; Law "On Road Traffic"	Contractor
Spoil disposal	Spoil disposal approval	MoEPA	Law "On Subsoils", May 8, 2012	Contractor
Import of explosives	Permit to import explosives	Ministry of Internal Affairs	Tax Code of Georgia; Decree of the Government of Georgia N420; Law N2911 "On Control of Technical Hazard"; Order N 1-1/2502 of the Minister of Economy and Sustainable Development	Contractor
Use of explosives	Permit to use explosives	Ministry of Economy and Sustainable Development	Tax Code of Georgia; Decree of the Government of Georgia N420; Law N2911 "On Control of Technical Hazard"; Order N 1-1/2502 of the Minister of Economy and Sustainable Development	Contractor

D.9 Construction Permits

304. The Law on Licences and Permits defines protocols for the issue, amendment and withdrawal of permits. For projects such as this, a construction permit is needed.

305. Construction permit – a different hierarchical permit which, proceeding from the economic interests of permit seekers, is divided into three mutually-dependent but in terms of administrative procedure independent stages: I stage – establishment of urban planning conditions; II stage - endorsement of architectural-construction design; III stage – issuance of

construction permit. The rules and principles defined by this law for permit issuance shall apply to these stages.

306. The responsible authority (the Road Department) must obtain the following approvals before it gets approval from the Ministry of Economy and Sustainable Development:

(i) Geological conclusions to be issued by National Environmental Agency;
(ii) Cultural heritage clearance to be issued by National Agency of Cultural Heritage;
(iii) Environmental Decision issued by MoEPA;
(iv) Project design approval to be issued by MoESD; and
(v) Project's registered rights to land.

D.10 State Forest Fund

307. According to The Resolution No.242 of Government of Georgia on Approval of Rules for Forest Use, Article 27_1 State forest land (or State Forest Fund (SFF)) may be used for the purposes of construction of motorways, as well as for other activities which are deemed as special use of forest lands. Article 27 states that if the activity that is deemed as special use of forest land and is subject to Ecological Expertise then the Client (in this case the RD) is obliged to apply to remove all trees identified in the affected SFF area from the SFF register or "de-list" them before they can be cut. The decision to de-list trees and plants from the State Forest Fund of Georgia is issued by the National Forest Agency excepting the vegetation species protected by the Red List of Georgia. A decision to de-list trees and plants from the Red List of Georgia is made by MoEPA. The client must apply to the MoEPA in writing regarding the presence of the Red-Listed species in the project area.

D.11 International Conventions and Agreements

308. Important international environmental treaties that have been signed by Georgia and may have relevance to the Project are listed in Table 27.

Table 27: International Agreements and Treaties

Date	Title	Status in Georgia	Date
Natural environment			
1961	International Convention for The Protection of New Varieties of Plants	Entry into force	2008
1971	Ramsar Convention on Wetlands of International Importance Especially as Wildfowl Habitat	Entry into force	1997
1973	Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	Entry into force	1996
1991	Agreement on The Conservation of Populations of European Bats	Entry into force	2002
1995	Agreement on The Conservation of African-Eurasian Migratory Waterbirds	Entry into force	2001
1997	International Plant Protection Convention (1997 Revised Text)	Entry into force	2007
1983	Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) (CMS)	Entry into force	2000
1992	Rio Convention on Biological Diversity	Entry into force	1994
2000	Cartagena Protocol on Biosafety to the Convention on Biological Diversity	Entry into force	2009
2000	European Landscape Convention	Entry into force	2011
2008	Convention on the Conservation of European Wildlife and Natural Habitats (Bern)	Entry into force	2010

Date	Title	Status in Georgia	Date
2010	European Landscape Convention	Entry into force	2011
Environmental pollution, waste			
1997	Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management	Entry into force	2009
1998	Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade	Entry into force	2007
1989	Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal	Entry into force	1995
2001	Stockholm Convention on Persistent Organic Pollutants	Entry into force	2007
Climate			
1994	UN Framework Convention on Climate Change (UNFCCC)	Entry into force	1994
1985	Vienna Convention for the Protection of the Ozone Layer	Entry into force	1996
1987	Montreal Protocol on Substances that Deplete the Ozone Layer, (and its London, Copenhagen, Montreal and Beijing Amendments 2000 and 2011)	Entry into force	1996
1997	Kyoto Protocol to UNFCCC	Entry into force	2005
1999	Geneva Convention on Long-Range Transboundary Air Pollution	Entry into force	1999
Cultural heritage			
1954	European Cultural Convention	Entry into force	1997
1972	Paris Convention Concerning the Protection of the World Cultural and Natural Heritage	Entry into force	1992
1982	European Convention on the Protection of the Archaeological Heritage	Entry into force	2000
1985	Convention for the Protection of the Architectural Heritage of Europe	Entry into force	2000
2005	Council of Europe Framework Convention on the Value of Cultural Heritage for Society (Faro convention)	Entry into force	2011
Public participation and information accessibility			
1998	Aarhus Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters	Ratified	2000
Labour issues			
1930	Forced Labour Convention	Entry into force	1993
1936	Holidays with Pay Convention	Entry into force	1993
1949	Freedom of Association and Protection of the Right to Organise Convention	Entry into force	1999
1948	Right to Organise and Collective Bargaining Convention	Entry into force	1993
1950	European Convention for the Protection of Human Rights and Fundamental Freedoms	Entry into force	1999
1951	Equal Remuneration Convention	Entry into force	1993
1957	Abolition of Forced Labour Convention	Entry into force	1996
1958	Discrimination (Employment and Occupation) Convention	Entry into force	1993
1962	ILO Social Policy (Basic Aims and Standards) Convention	Entry into	1997

Date	Title	Status in Georgia	Date
		force	
1964	Employment Policy Convention (Geneva)	Entry into force	1993
1973	Geneva Convention concerning Minimum Age for Admission to Employment	Entry into force	1996
1975	Human Resources Development Convention	Entry into force	1993
1978	Labour Relations (Public Service) Convention	Entry into force	2003
1997	Employment Service Convention	Entry into force	2002
1997	Private Employment Agencies Convention	Entry into force	2002
1999	Worst Forms of Child Labour Convention	Entry into force	2002

D.12 Asian Development Bank Safeguard Policies 2009

309. The ADB has three safeguard policies that seek to avoid, minimize or mitigate adverse environmental impacts and social costs to third parties, or vulnerable groups as a result of development projects[7].

310. **Safeguard Requirements 1: Environment** – The objectives are to ensure the environmental soundness and sustainability of projects, and to support the integration of environmental considerations into the project decision-making process. Environmental safeguards are triggered if a project is likely to have potential environmental risks and impacts. Eleven 'Policy Principles' have been adopted as part of the SPS, including:

(i) Use a screening process for each proposed project, as early as possible, to determine the appropriate extent and type of environmental assessment so that appropriate studies are undertaken commensurate with the significance of potential impacts and risks. (The Project is classified as a Category A project).
(ii) Conduct an environmental assessment for each proposed project to identify potential direct, indirect, cumulative, and induced impacts and risks to physical, biological, socioeconomic (including impacts on livelihood through environmental media, health and safety, vulnerable groups, and gender issues), and physical cultural resources in the context of the project's area of influence. Assess potential transboundary and global impacts, including climate change. Use strategic environmental assessment where appropriate. (The EIA herewith provides the environmental assessment for the Project, including an assessment of climate change. Transboundary impacts are not applicable).
(iii) Examine alternatives to the project's location, design, technology, and components and their potential environmental and social impacts and document the rationale for selecting the particular alternative proposed. Also consider the no project alternative. (Alternatives have been considered, including the 'no project' alternative in **Section C – Alternatives**).
(iv) Avoid, and where avoidance is not possible, minimize, mitigate, and/or offset adverse impacts and enhance positive impacts by means of environmental planning and management. Prepare an environmental management plan (EMP) that includes the proposed mitigation measures, environmental monitoring and

[7] ADB. 2009. Safeguard Policy Statement, Manila

reporting requirements, related institutional or organizational arrangements, capacity development and training measures, implementation schedule, cost estimates, and performance indicators. Key considerations for EMP preparation include mitigation of potential adverse impacts to the level of no significant harm to third parties, and the polluter pays principle. (An EMP has been prepared for the Project and is outlined in detail in **Section G – Environmental Management Plans and Institutional Requirements**).

(v) Carry out meaningful consultation with affected people and facilitate their informed participation. Ensure women's participation in consultation. Involve stakeholders, including affected people and concerned nongovernment organizations, early in the project preparation process and ensure that their views and concerns are made known to and understood by decision makers and taken into account. Continue consultations with stakeholders throughout project implementation as necessary to address issues related to environmental assessment. Establish a grievance redress mechanism to receive and facilitate resolution of the affected people's concerns and grievances regarding the project's environmental performance. (Consultations were held to discuss environmental issues, the findings of the consultations (and a description of the Project grievance redress mechanism) are presented in **Section H – Public Consultation, Information Disclosure & Grievance Mechanism**).

(vi) Disclose a draft environmental assessment (including the EMP) in a timely manner, before project appraisal, in an accessible place and in a form and language(s) understandable to affected people and other stakeholders. Disclose the final environmental assessment, and its updates if any, to affected people and other stakeholders. (This EIA and its EMP will be disclosed on the ADB and RD web-sites).

(vii) Implement the EMP and monitor its effectiveness. Document monitoring results, including the development and implementation of corrective actions, and disclose monitoring reports. (The EIA and its EMP outline a plan to monitor the implementation of the EMP and the institutional responsibilities for monitoring and reporting throughout the Project lifecycle: **Section G – EMP Institutional Responsibilities**).

(viii) Do not implement project activities in areas of critical habitats, unless (i) there are no measurable adverse impacts on the critical habitat that could impair its ability to function, (ii) there is no reduction in the population of any recognized endangered or critically endangered species, and (iii) any lesser impacts are mitigated. If a project is located within a legally protected area, implement additional programs to promote and enhance the conservation aims of the protected area. In an area of natural habitats, there must be no significant conversion or degradation, unless (i) alternatives are not available, (ii) the overall benefits from the project substantially outweigh the environmental costs, and (iii) any conversion or degradation is appropriately mitigated. Use a precautionary approach to the use, development, and management of renewable natural resources. (No critical habitats have been identified that would be significantly impacted by the Project).

(ix) Apply pollution prevention and control technologies and practices consistent with international good practices as reflected in internationally recognized standards such as the World Bank Group's Environmental, Health and Safety Guidelines. Adopt cleaner production processes and good energy efficiency practices. Avoid pollution, or, when avoidance is not possible, minimize or control the intensity or load of pollutant emissions and discharges, including direct and indirect greenhouse gases emissions, waste generation, and release of hazardous materials from their production, transportation, handling, and storage. Avoid the use of hazardous materials subject to international bans or phase-outs. Purchase, use, and manage pesticides based on integrated pest management approaches and reduce reliance on synthetic chemical pesticides. When host country regulations differ from these levels and measures, the borrower/client will achieve whichever is more stringent. (The EIA and its EMP outline specific mitigation and management measures to prevent and control pollution: **Section G – Environmental Management Plans and Institutional Requirements. Section D – Legal Framework,** identifies the most stringent regulations. No pesticides will be used during the lifecycle of the Project).

(x) Provide workers with safe and healthy working conditions and prevent accidents, injuries, and disease. Establish preventive and emergency preparedness and response measures to avoid, and where avoidance is not possible, to minimize, adverse impacts and risks to the health and safety of local communities. (The EIA and its EMP outline the requirement for specific health and safety plans and emergency response plans: **Section G – Environmental Management Plans and Institutional Requirements).**

(xi) Conserve physical cultural resources and avoid destroying or damaging them by using field-based surveys that employ qualified and experienced experts during environmental assessment. Provide for the use of “chance find” procedures that include a pre-approved management and conservation approach for materials that may be discovered during project implementation. (No physical and cultural resources have been identified that would be significantly impacted by the Project. Chance finds are discussed in **Section G – Physical and Cultural Resources**) and a sample chance finds procedure is provided in **Appendix E**.

Safeguard Requirements 2: Involuntary Resettlement.

311. The objectives are to avoid involuntary resettlement wherever possible; to minimize involuntary resettlement by exploring project and design alternatives; to enhance, or at least restore, the livelihoods of all displaced persons in real terms relative to pre-project levels; and to improve the standards of living of the displaced poor and other vulnerable groups. The safeguard requirements underscores the requirements for undertaking the social impact assessment and resettlement planning process, preparing social impact assessment reports and resettlement planning documents, exploring negotiated land acquisition, disclosing information and engaging in consultations, establishing a grievance mechanism, and resettlement monitoring and reporting.

312. The involuntary resettlement requirements apply to full or partial, permanent or temporary physical displacement (relocation, loss of residential land, or loss of shelter) and economic displacement (loss of land, assets, access to assets, income sources, or means of livelihoods) resulting from (i) involuntary acquisition of land, or (ii) involuntary restrictions on land use or on access to legally designated parks and protected areas. Resettlement is considered involuntary when displaced individuals or communities do not have the right to refuse land acquisition that results in displacement. A land acquisition and resettlement plan (LARP) has been prepared for the Project to ensure compliance with the safeguard on Involuntary Resettlement.

Safeguard Requirements 3: Indigenous Peoples.

313. The objective is to design and implement projects in a way that fosters full respect for Indigenous Peoples’ identity, dignity, human rights, livelihood systems, and cultural uniqueness as defined by the Indigenous Peoples themselves so that they (i) receive culturally appropriate social and economic benefits, (ii) do not suffer adverse impacts as a result of projects, and (iii) can participate actively in projects that affect them.

314. The Project does not involve impacts to Indigenous Peoples and therefore no further actions relating to this safeguard are required.

D.13 Comparison of ADB and National Requirements

315. The environmental assessment of the Project will need to satisfy the requirement of both the GoG and ADB. A harmonized safeguard framework is developed for conducting EIA study of the Project. The framework is given below.

Table 28: Comparison of ADB and GoG Legislation Requirements

Aspect	ADB	GoG	Harmonized Framework
Environmental Policy and Regulations	ADB's SPS (2009) sets out the policy objectives, scope and triggers, and principles for three key safeguard areas: • Environmental safeguards, • Involuntary resettlement safeguards, and • Indigenous peoples safeguards	Environmental assessment and permitting procedure in Georgia is set out in the Environmental Assessment Code.	The Project shall comply with both requirements.
Screening	ADB carry out project screening and categorization at the earliest stage of project preparation when sufficient information is available for this purpose using REA checklist Categorization into Category A, B, C, FI.	Project Proponent in consultation with MOENRP.	The Project is Categorized as Category A.
Alternatives	Examination of financially and technically feasible alternatives to the project location, design, technology and components, their potential environmental and social impacts. Consider no project alternative.	Alternative assessments are to be carried out for the project location and design.	Assessment of alternatives will include the location and design, and also no project alternative.
EIA Report	Guidelines and Table of Contents are provided for EIA report in SPS (2009). EMP will include proposed mitigation measures, monitoring and reporting requirements, institutional arrangements, schedules and cost estimates.	No Table of Contents are available for EIA reports. Only guidelines (Regulation) on EIA is available, which includes required content of the EIA.	The EIA and EMP reports will follow the table of contents proposed by ADB SPS (2009)
Public Consultations	Carry out meaningful consultation with affected people and facilitate their informed participation. Involving stakeholders, project- affected people and concerned NGOs early in the project preparation and ensure that their views and concerns are made known and understood by decision makers and taken into account. Continue consultations with stakeholders throughout project implementation as necessary to address environmental assessment- related issues.	Publication of information in national and regional mass-media. Arrange consultation not later than 60 days from the date of publication. All stakeholders are to be invited for the meetings.	Consultations will be carried out with the stakeholders, affected people, NGOs throughout the project cycle and consider their views in project design and safeguard plan. Questions and concerns raised during public consultations held will be considered and addressed in the EIA.
Public Disclosure	Draft EIA will be published in ADB website for 120 days before Project approval by the Board.	The draft EIA should be available for public review for 45 days before public consultations.	Draft EIA report (English and Georgian) will be published in ADB and Roads Department Websites. The copies of the draft EIA report will be made available with the municipal offices.

E. Baseline Data Collection Methodology

E.1 General

316. Background data and information was obtained from reputable published and unpublished sources, e.g., on: climate, topography, geology and soils, natural resources, flora and fauna, agriculture, and socio-economic data.

317. Several site inspections were conducted by the International Environmental Specialist during 2017 and 2018. The project area was reviewed and areas of potential environmental significance assessed carefully.

318. In addition, several surveys were undertaken to collect additional baseline data by a Local Consulting Firm (LCF) specializing in environmental and social studies. They include:

- (i) Instrumental Noise and Vibration Monitoring.
- (ii) Instrumental Air Quality Monitoring.
- (iii) Instrumental Water Quality Surveys.
- (iv) Flora and Fauna Surveys.
- (v) Physical and Cultural Resources Surveys.
- (vi) Socio-economic Surveys.

319. Formal discussions were held with a number of stakeholders (see **Section I**) in order to identify any specific areas of interest, or concern that needed to be surveyed or identified as part of the baseline collection phase.

E.2 Detailed Methodology

320. The following section outlines the detailed methodology followed for the collection of data.

E.2.1 Geology

321. Methodology for collection of baseline data – Geological maps were collected and geological information from the FS reviewed and incorporated into the report. Discussions with the Detailed Design Consultants Geotechnical specialist were also undertaken to discuss the geological conditions within the Project area based on information collected during the detailed design phase.

322. Sources of Data:

- (i) Detailed Design Consultant.

E.2.2 Topography

323. Methodology for collection of baseline data – The topography of the project area was assessed using Google Earth and Topographical maps.

324. Sources of Data:

- (i) Detailed Design Consultant – Site plans and profiles.
- (ii) Google Earth.

E.2.3 Soils

325. Methodology for collection of baseline data – Soils maps were collected and soils information from the FS reviewed. Other relevant EIAs were reviewed to determine the status of roadside contamination on the E-60.

326. Sources of Data:
- (i) Detailed Design Consultant.
- (ii) Feasibility Study for E-60 Highway Section from Zemo Osiarui to Argveta.
- (iii) Environmental and Social Impact Assessment of Works for the Improvement of Chumateleti-Khevi Section of E-60 Highway (Section F1).

E.2.4 Climate and Climate Change

327. Methodology for collection of baseline data – Meteorological data, including atmospheric pressure, air temperature, relative humidity, precipitation, wind speed and direction, were collected from secondary sources. Recently completed climate change reports were collected and reviewed.

328. Sources of Data:
- (i) Climate Risk and Vulnerability Assessment and Independent Proof Check. ADB April 2018.
- (ii) Second Regional Development Project, Imereti Regional Development Program, Imereti Tourism Development Strategy. Strategic Environmental, Cultural, Historical and Social Assessment. World Bank, 2014.
- (iii) Office of the Deputy Prime Minister (2005). Planning Minerals Policy Statement 2: Controlling and Mitigating the Environmental Effects of Minerals Extraction in England. Annex1: Dust.
- (iv) Meteoblue: https://www.meteoblue.com.

E.2.5 Air Quality

329. Methodology for collection of baseline data – Instrumental air quality monitoring was undertaken at six locations within the Project area during March 2018 to determine baseline conditions. NO_2, SO_2, CO, PM10, PM2.5 and Total Dust were monitored four times (30 minute averaging period) over a 24 hour period. The following equipment was used:

- (i) Carbon monoxide meter (China), range 0-100ppm
- (ii) Dust measuring unit CW-HAT 200, range 0-500 µg/m3
- (iii) Air analyser, TESTO-350 (Germany), range: CO (0-10 000 ppm); NO (0-4 000 ppm); NO2 (0-500 ppm); SO2 (0-5 000 ppm).

330. Site visits were also undertaken to assess if there were any other point sources of air pollution within the Project corridor.

331. Reference Documents:

- (i) IFC (2007). Environmental, Health and Safety Guidelines. General EHS Guidelines: Environmental. Air Emissions and Ambient Air. April 2007.

E.2.6 Hydrology

332. Methodology for collection of baseline data – Maps and locations of surface water courses were reviewed and discussions with the Detailed Design Consultant undertaken.

333. Instrumental monitoring of surface water quality was undertaken at thirteen locations in March 2018 to determine baseline conditions in the Project area, specifically in the areas close

to the bridge sites. Parameters monitored included pH, electrical conductivity (EC), turbidity, BOD, COD, dissolved oxygen (DO), Temperature, Total suspended solids (TSS), Total Coliform Bacteria, Oil and Grease, Total Phosphorus, Total Nitrogen, Total Ammonium, Petroleum Hydrocarbons, Total Residual Chlorine, Total Zinc, Magnesium, Dissolved Copper. Groundwater samples were also taken from two sites in March 2018.

334. The protocol for the surface water monitoring was as follows:

(i) Water sampling for chemical analysis was done in line with requirements of the technical regulation of the Sanitary rules on water sampling, approved by the Governmental decree #26 (dated January 3, 2014).
(ii) Sampling protocol was filled in on the sampling site. Samples marked.
(iii) The samples were stored in secure location to preclude conditions which could alter the properties of the sample or lead to its contamination/loss.
(iv) Samples were in custody sealed during storage and/or transportation and kept in the custody of the sampler until the samples were relinquished to another party.
(v) The samples were delivered to the lab within 24 hours from sampling. Prior to delivery to the lab the samples were kept in portable refrigerator.

335. Containers:

(i) Samples were collected in 1 litre PET bottles.
(ii) For TPH amber glass bottles were used.
(iii) BOD samples were collected in 300ml bottles.
(iv) 1 litre sterile bottle was used for the sample intended for microbiological examination.

336. In addition to the samples for offsite analysis, parameters such as temperature, dissolved oxygen, pH, important for fish wellbeing were measured on the spot.

337. <u>Sources of Baseline Data:</u>
(i) Second Regional Development Project, Imereti Regional Development Program, Imereti Tourism Development Strategy. Strategic Environmental, Cultural, Historical and Social Assessment. World Bank, 2014

E.2.7 Natural Hazards

338. <u>Methodology for collection of baseline data</u> – The FS was reviewed to determine areas where flood events occur. In addition, consultations with the Detailed Design Consultants geotechnical specialist was undertaken to determine areas where natural hazards exist, such as landslides.

E.2.8 Biodiversity

339. <u>Methodology for collection of baseline data</u> – Works included desk top data gathering and field works for verification of available information and additional data gathering. Field surveys were carried out on August 8-9, 2017; September 22-23, 2017 and 1-2 March 2018. In addition to that results of the field survey in the area of interest implemented for feasibility stage of the project (April 2015).

340. **Flora** - Following to desk top data gathering and analysis site 4 site visit have been carried out. Collection of the floristic data on the study area included covered two components: 1) collection of the data on the vegetation diversity in the study area and 2) field sampling of the vegetation of the study corridor(s) for obtaining precise empirical data. For identification of the plant species was used determinats and checklists of the flora of Georgia (Ketzkhoveli &

Gagnidze, 1971-2011; Czerepanov, 1995; Gagnidze, 2005). Information on the species distribution in the local habitats was obtained from the primary and secondary sources of information (Ketzkhoveli, 1960; Doluchanov, 2010, Akhalkatsi, Tarkhnishvili, 2012; Nakhutsrishvili, 2013, survey reports carried out by the team in the region under other assignments). Validity of the taxonomic statuses of the identified plant taxa was verified using the widely accessible plant taxonomic database “The Plant List” (The Plant List Vers. 1, 2010). Threat categories for the identified plant taxa were determined according the categories and criteria of International Union for Conservation of Nature (IUCN) guidelines (IUCN, 2003) and The Red List of Georgia (2006). Particular attention was paid to identification of any protected species in the project impact area. (Note: inventory of the trees diameter >8cm and <8cm is in process)

341. For the vegetation study 1x1m, 5x5m, 10x10m, 25x25m sampling plots were selected depending on the type of vegetation (forest, shrubs, wetland area, meadow) and the size of the area.

342. Plots were sampled in every type of existing habitat. Along with identification of diversity individual coverage scale in the total projecting coverage was determined. Braun-Blanquet cover-abundance scale was used for assessment.

343. **Biodiversity** - Following desk top data gathering and analysis four site visits have been carried out. The surveys were carried out in August 8-9, 2017; September 22-23, 2017; March 1-2, 2018 and April 22-23, 2018. The aim of the study was to identify of animal species within the study area; to reveal significant habitats for inhabitant species; to determine possible impact on animal biodiversity on construction and operation phases and to develop impact mitigation measures. Species, protected under Georgian legislation and international treaties (included in the Red List and species having other conservation status), species bearing special significance for local population have been paid particular attention to.

344. Walkover method has been used during the survey, along the species on transect, all observed species were visually recorded and identified. In addition with registration of the physical presence - traces, excrements, holes, burrows, feathers, fur, etc. were registered.

345. The surveyed corridor width was ranging from 50 to 2500m depending on location and potential species available. The surveys were carried out in different periods of the day. The peak activity periods (such as April for squirrels; end of March (peak of activity, reproduction period, from mid March until mid June) - for herps) were taken into account while survey planning.

346. The species composition of birds was determined by voice if it was not possible to observe them visually.

347. Reptiles and amphibians were studied in transects, shelters and water bodies – checked. The fact that activity of the reptiles depends on weather was taken into account. Keeping in mind that the species start to ‘appear’ end of March (Peak of activity is from mid March until mid June which is the reproduction period. In July and August they can be registered only in the morning and late evening when it is not too hot.)

348. Recording of adult phase of large invertebrates (butterflies, bugs, dragonflies, bees, grasshoppers, spiders, mollusks) was visually carried out on transects. Research methodology comprises the following activities: catching and identification of insects; turning over the stones and soil layer; checking of plants and plant residues; photographing; shaking off the insects on an awning and checking pond bottom - sieving.

349. **Aquatic fauna -** In addition to the desk top work the ichthyofauna study, undertaken in April 2018 included:

(i) Visual audits for identification of habitats suitable for fish species expected to be found in the stream (geomorphology of the substrate, general hydrological data, hypsometry, landform, landscape-visual features);
(ii) Field surveys:
  (a) Control catches with cast net, trammel net and kick net,
  (b) Determination of length, weight, gender, maturity stage, fattening coefficient, meristic and plastic characteristics, digestive tract content;
  (c) Collection of scales for identification of age, growth and growth rate;
  (d) Study of food base - hydroflora and hydrofauna; identification of macroinvertebrates and insects used for feeding, assessment of periphyton composition. Registration of perythytone and invertebrates within the wetted perimeter of the stream. Examination of stoned in the riverbed/wetted perimeter;
  (e) On-site measurements - determination of suspended solids; dissolved oxygen (using filed tester Oxi 330i); water and air temperature; pH;
(iii) Interview of the local population and amateur fishermen with at least 5-10 years of fishing experience); and
(iv) Laboratory processing of the obtained material (identification of age, growth and growth rate based on scales collected during the field survey (Note catch and release principle was complied with).

350. A survey of state forest fund areas was also undertaken and an inventory of species prepared along with a shape file of the state forest fund within the Project corridor.

351. Sources of Baseline Data:
(i) See **Appendix M**.

E.2.9 Protected Areas and IBAs

352. Methodology for collection of baseline data – Maps and data relating to Important Bird Areas (IBAs) and protected areas were collected and reviewed.

353. Sources of Data:
(i) Birdlife International - http://datazone.birdlife.org/site/mapsearch)
(ii) Protected Plant - https://www.protectedplanet.net/borjomi-strict-nature-reserve
(iii) Agency of Protected Areas of Georgia - http://apa.gov.ge/en/

E.2.10 Socio-economic conditions

354. Methodology for collection of baseline data – A review of existing data, including information provided by GEOSTAT as well as the information collected as part of the social surveys provided by the Detailed Design Consultants social specialists. Data on traffic accidents was also reviewed.

355. Sources of Data:
(i) http://www.geostat.ge/
(ii) Draft Land Acquisition and Resettlement Plan, Section F2 of Khevi-Ubisa-Shorapani-Argveta section (E60 Highway), April 2018
(iii) Feasibility Study for E-60 Highway Section from Zemo Osiarui to Argveta
(iv) Environmental and Social Impact Assessment of Works for the Improvement of Chumateleti-Khevi Section of E-60 Highway (Section F1).

E.2.11 Infrastructure

356. Methodology for collection of baseline data – The existing infrastructure in the Project area was identified during site visits and in consultation with the Detailed Design Consultant.

E.2.12 Land Use

357. Methodology for collection of baseline data – A review of the land uses was undertaken based on existing maps of the project area, satellite images, aerial photos and site visits.

E.2.13 Waste Management

358. Methodology for collection of baseline data – A review of the existing waste management situation in the region was undertaken and local waste management facilities were identified.

E.2.14 Health and Educational Facilities

359. Methodology for collection of baseline data – Site visits identified the health and educational facilities within the Project area. This was confirmed by a web-based search.

360. Sources of Data:
  (i) Ministry of Education and Sciences Georgia - http://www.mes.gov.ge/
  (ii) Ministry of Health Georgia - http://cloud.moh.gov.ge

E.2.15 Cultural Resources

361. Methodology for collection of baseline data – Existing data was reviewed and a site walkover was undertaken during March 2018 to determine what PCR was present within the Project area.

362. Sources of Data:
  (i) Second Regional Development Project, Imereti Regional Development Program, Imereti Tourism Development Strategy. Strategic Environmental, Cultural, Historical and Social Assessment. World Bank, 2014

E.2.16 Noise and Vibration

363. Methodology for collection of baseline data – Baseline noise monitoring has been undertaken at 13 residential properties within the Project corridor. The monitoring activities were undertaken over a period of two weeks during April and May 2018. Hourly logging of data over a 24 hour period was undertaken 3m from the façade of each residential property facing the existing road alignment. Monitors were placed 1.5m from the ground. Weather conditions were recorded, including wind speed.

364. Sources and Reference Documents:
  (i) IFC (2007). Environmental, Health and Safety Guidelines. General EHS Guidelines: Environmental. Noise. April 2007.

E.3 EIA Project Area

365. The potential impacts of the Project on its surrounding physical and biological environments include air and water quality impacts, noise generation, land transformation and changes to soil. These are expected to reduce with the increased distance from the Project facilities, affecting more the areas located closer, up to one kilometer, to the Project alignment. For this, a study area of one kilometer around the site was delineated, to assess the baseline

conditions in the areas likely to be affected by the Project due to its proximity to the Project site. This is referred to as the Study Area in this report. The Study Area selected for the EIA includes sensitive receptors [8] that are most likely to be impacted by the Project's development activities.

[8] Sensitive receptors include, but are not limited to, residential areas, schools, places of worship, wetlands, and habitats. These are areas which are more susceptible to the adverse effects of an anthropogenic activity such as noise, air emissions, traffic influx, and privacy issues

F. Description of the Environment

366. This section of the report discusses the existing environmental and social conditions within the Project area under the following headings:

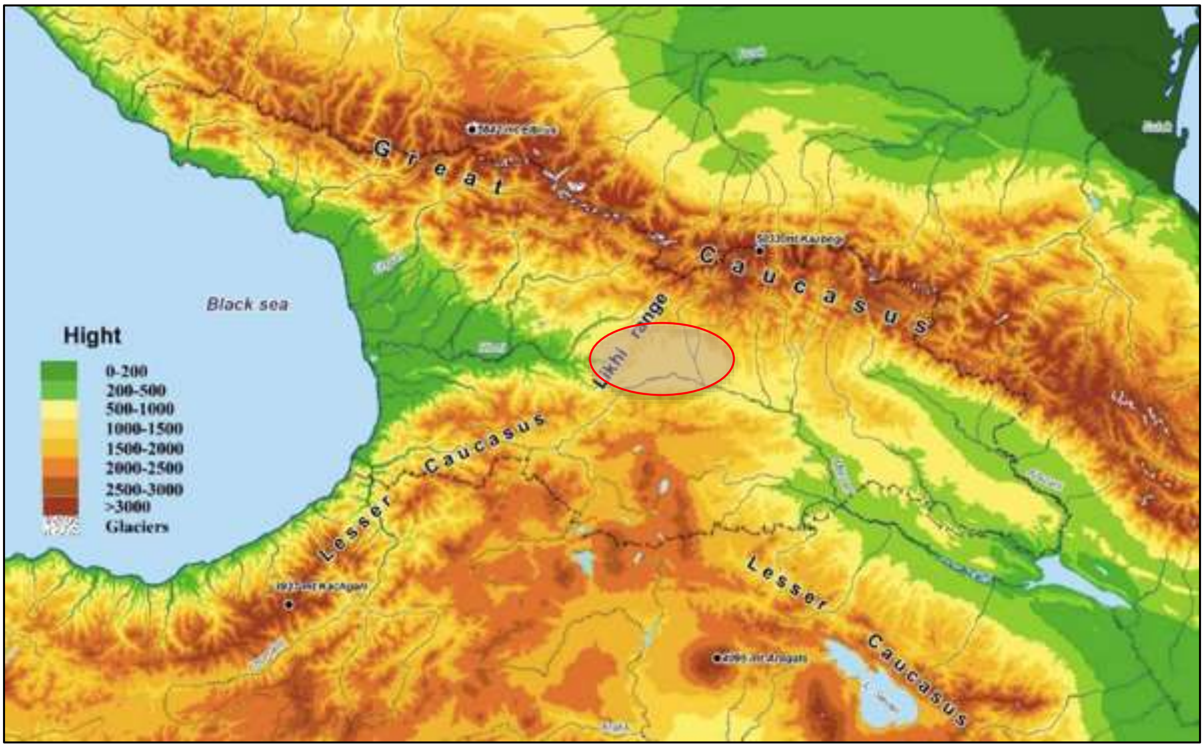
- (i) Physical Resources (air quality, hydrology, topography, etc.);
- (ii) Ecological Resources (flora, fauna, protected areas);
- (iii) Economic Resources (infrastructure, land use, etc.);
- (iv) Social and Cultural Resources (health, education, noise, cultural resources, etc.)

F.1 Physical Resources

F.1.1 Topography

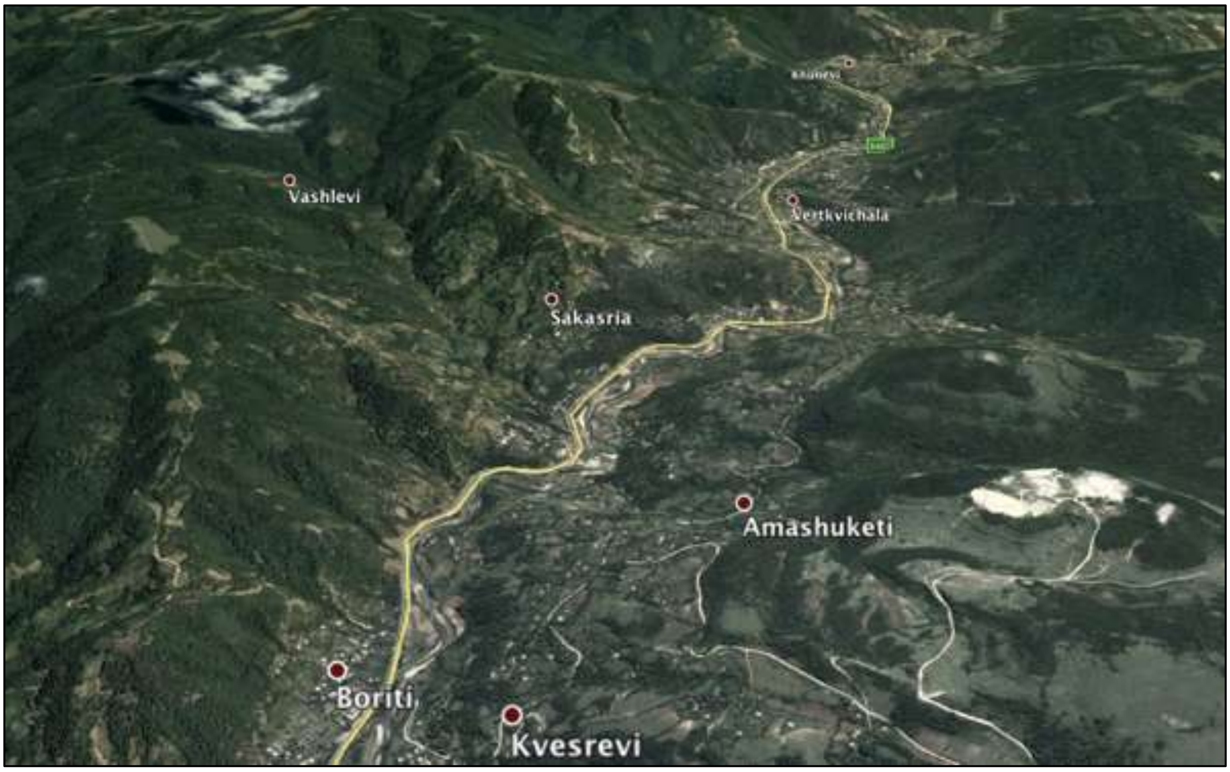
367. The Project area is located to the west of the Likhi Range which connects the Greater and Lesser Caucus Mountains (see Figure 50).

Figure 50: Regional Topography



368. The Project corridor is set within a landscape of mountains, and rolling hills. The existing road is located within the bottom of the river valley and elevations vary from around 480 above sea level at the start of the road to 305 meters above sea level at the end of the road section in Boriti. Figure 51 illustrates the mountainous / rolling landscape looking east from Boriti (end point of the Project road).

Figure 51: Topography of the Project Area



F.1.2 Geology & Soils

F.1.2.1 Geology

369. In the Project area, along the highway alignment, several major geological units can be identified:

(i) Quaternary soils, covering both the volcanic and the sedimentary rocky units, represented by:
   (a) mQ[9] - Railway, motor road and other soil embankments. Mainly coarse.
   (b) aaQ - Current alluvial deposits.
   (c) aQ - Recent alluvial and terraced deposits. Coarse.
   (d) cdQ - Colluvial deposits in the valley floors and debris at the slope bases. Coarse and/or fine.
   (e) eQ - Eluvial cover deposits on the upper plains. Coarse and/or fine.

(ii) Sedimentary rocks covering the crystalline basement, dated Middle Miocene. They are represented by the following formation:
   (a) K1 - Flyschoid alternation of argillites, arenaceus limestones and marls, from very hard to weak, thinly bedded.

(iii) Intrusive and metamorphic rocks constituting the Proterozoic crystalline basement. They are represented by the following geological formations:
   (a) PzGr - Pink and grey granites, meta-granites and grano-diorites, from mildly to heavily weathered, from massive to heavily fractured; locally, metamorphic facies and gabbros in rock mass are observed;
   (b) PzQgn - Grey quartz gneiss, from lightly to mildly weathered, from massive to heavily fractured;
   (c) PzGa – Dark gray gabbros, from massive to heavily fractured.

[9] mQ is anthropogenic in source

370. From a geo-lithological point of view, along the alignment, three main homogeneous sections can be identified, depending on similar lithological conditions:

(i) From km 0+000 to 3+250 – In the first tract, from km 0+000 to around km 0+700, under alluvial, colluvial and anthropic deposits (aaQ, cdQ and mQ formations), pink and grey granites (PzGr) lie. From km 0+700 to km 3+250, the outcropping rocks are represented by gabbros belonging to the PzGa formation. Above, quaternary deposits (aaQ, aQ, cdQ and mQ) of variable thickness are present. In this section, along the route, tunnels are expected to be excavated in PzGa formation; bridges are expected to have their abutments and piers on quaternary overlying PzGr and PzGa rocky formations.

(ii) From km 3+250 to 10+300 – Outcropping formations are represented by granites of the PzGr formation. Along the route, tunnels are expected to be excavated in this rocky formation and bridges are expected to have their abutments and piers on quaternary deposits (aaQ, aQ, cdQ and mQ with a variable thick) covering the crystalline basement.

(iii) From km 10+300 to 12+494 – In this section, the main outcropping rocks are granites belonging to the PzGr formation and, above them, the flyschoid unit K1 is present with a stratigraphic sub-horizontal contact. Quaternary soils cover the intrusive and sedimentary units, where the tunnels are expected to be excavated. Bridges are expected to have their abutments and piers on quaternary deposits covering the granites.

F.1.2.2 Soils

371. Within the eastern part of the Dzirula Gorge, three types of soils are observed: grey soils, yellow-grey soils, and humus-grey soils.

372. Pozdolic grey soils mainly appear on the intensively exhausted clay soils and clays. Their profiles are characterized with thin underlying formation followed by 3-5-cm humus horizon and 15-20-cm obviously fadedpodzolic horizon. The profiles end with alluvial-metamorphic hardened straw-colored and yellow or reddish-yellow horizon turning into the main rock. The humus content is low and the reaction is the acid one. Yellow soils are mainly spread on terrace formations and piedmont plains. The humus soil is represented by a granular soil layer (19-15 cm). Deeper there is anilluvial-metamorhic horizon that gradually turns into the main soil-forming rock. The content of the humus horizon in this type of soil makes 6-10%, and the level of acids prevails higher than the level of base materials.

373. Humus-calcareous soils are limestones, dolomites and their fission products. Their upper part has dark grey color that fades lower. In the upper part of the profile the reaction is neutral, in the lower part - alkaline. The lower part of the profile is enriched with carbonate. Concentration of humus in the upper part of the horizon is 6-10%. This soil type is met in the limestone rock zones characteristic for Cretaceous rocks along the Caucasus. Topsoil thicknesses along the road alignment are shown in Table 29.

Table 29: Topsoil Thickness in the Project Corridor

Chainage (km)	Topsoil Thickness (m)
0+000 - 0+279	0,3
0+279 - 0+517	0,2
0+517 - 0+777	0,4
0+777 - 0+830	0,3
0+830 - 0+909	0,1
0+909 - 0+990	0,1
0+990 - 1+095	0,1
1+095 - 1+312	0,15
1+312 - 1+384	0,2

Chainage (km)	Topsoil Thickness (m)
1+384 - 2+009	0,1
2+009 - 2+451	0,1
2+451 - 2+846	0,3
2+846 - 3+210	0,1
3+210 - 3+406	0,3
3+406 - 3+678	0,3
3+678 - 4+019	0,2
4+019 - 4+370	0,1
4+370 - 4+791	0,2
4+791 - 5+572	0,3
5+572 - 6+121	0,1
6+121 - 6+590	0,4
6+590 - 6+814	0,2
6+814 - 7+802	0,3
7+802 - 8+634	0,2
8+634 - 9+181	0,2
9+181 - 9+980	0,15
9+980 - 10+168	0,1
10+168 - 10+480	0,2
10+480 - 11+804	0,2
11+804 - 12+097	0,25
12+097 - 12+198	0,15

374. Soil sampling was undertaken in Section F1 along the roadside verges as part of the EIB funded EIA for the construction of this section of the E-60. Section F1 ends at the start point of F2 in Khevi village. Although the samples were above the current national limit for lead, they are below EU standards and also below the new proposed soil standards for Georgia (which are planned to enter into force sometime in 2018 and are based around EU standards). In addition, the Project is is a new alignment, with only minor areas following the existing road so there will be little excavation of roadside soils. No other sources of potential soil contamination were noted within the Project corridor and as such no soil samples were analyzed for potential contamination.

E.1.3 Geomorphology

375. The area is drained by the river Dzirula which, in the initial part of F2, presents sub-angular pattern, an index of considerable tectonic influence. The river Dzirula has higher relative heights. The erosion of the river bank is present in the correspondence of meanders. Along the river Drizula, in correspondence of the change of slope, where the alluvial plain appears wider, some alluvial fans have been detected. A secondary fluvial system, consisting mainly of temporary flows, is widespread throughout the study area. The small valley is narrow, mainly V-shaped when the water is on the rocks. Also the gravity-related soil forms are widespread, represented mainly by the edges of the natural slopes.

376. A detailed description of the alignment of the project road along Lot F2, in terms of geomorphology, is given below.

(i) km 0+000 – 1+400. On this segment of the alignment, the valley of the river Dzirula/Rikotula, is affected by banks of erosion and alluvial fans. There are changes of direction of the water flow in correspondence with the observed fault and in correspondence with the meanders the erosion of the river bank is deeply present. The river is linear till km 0+800, after this point there are some meanders; in correspondence with the meanders the erosion of the river bank is present. There is a tectonic contact between the meta-granites (PzGr formation) and Gabbros (PzGa formation) regulated by a fault oriented NNE-SSW. In this case the small V shaped valleys and the secondary fluvial system, consisting mainly of temporary flows, are set on the correspondence with the fault. The Meta-Granites (PzGr formation), the Gabbros (PzGa formation) and the colluvial deposits (cdQ formation) are the predominant lithology; edges of natural escarpment are present at the change of the lithology. In this segment of the alignment there are some superficial creeps on the northern slope on the meta-granites (PzGr formation) but they do not involve the alignment.

(ii) km 1+400 - 3+200. On this segment of the alignment, the valley of the river Dzirula, is affected by banks of erosion and alluvial fans. There are changes of direction of the water flow in correspondence with the observed faults and in correspondence of the meanders the erosion of the river bank is heavily present. Differently from the previous described segment there is a minor presence of the secondary fluvial system; also in this case the small V shaped valleys and the secondary fluvial system, consisting mainly of temporary flows, are set in correspondence of the faults.

(iii) km 3+200 – 4+800. On this segment of the alignment, the river Dzirula evidences some meanders, as in the previous ones with meanders of erosion of the river bank is present; in this segment of the stream there is a considerable tectonic influence. In this segment the secondary fluvial system composed by temporary rivers is highly developed on the meta-granites (PzGr formation). In the same context there are some alluvial fans, on the colluvial deposits (cdQ formation), increased by temporary rivers. The meta-granites (PzGr formation) and the colluvial deposits (cdQ formation) are the predominant lithology but it is evident a geological contact between the meta-granites (PzGr formation) and the Gabbros (PzGa formation).

(iv) km 4+800 - 6+500. On this segment of the alignment, the valley of the river Dzirula, is affected by banks of erosion and alluvial fans. There are changes of direction of the water flow in correspondence with the observed faults and in correspondence with the meanders the erosion of the river bank is present. In this segment there is a minor presence of the secondary fluvial system developed on the meta-granites (PzGr formation); also in this case the small V shaped valleys and the secondary fluvial system, consisting mainly of temporary flows, are set in correspondence of the faults. In the same context there are some alluvial fans, on the colluvial deposits (cdQ formation), increased by temporary rivers.

(v) km 6+500 – 9+200. Along this segment of the alignment, the river Dzirula its subjected to a considerable tectonic influence; there are changes of direction of the water flow in correspondence with the observed faults and in correspondence with the meanders the erosion of the river banks are presents. In this case the small V shaped valley and the secondary fluvial system, consisting mainly of temporary flows, are set on the correspondence of the fault.

(vi) km 9+200 – 11+100. On this segment of the alignment, the valley of the river Dzirula, is affected by banks of erosion and alluvial fans. There are changes of direction of the water flow in correspondence of the observed fault and in correspondence of the meanders the erosion of the river bank is present. In this segment the secondary fluvial system composed by temporary rivers is developed on the meta-granites (PzGr formation) and on the flyshoid alteration of argillites (K1 formation) on the southern slope. On the northern slope the secondary fluvial system develops on the quartz-gneiss (PzQGn formation) presenting the same erosion structures of the southern slide: small V shapes. This segment is affected by many faults on the quartz-gneiss (PzQGn formation) and on the meta-granites (PzGr formation), with a prevalent orientation towards NNE-SSW; in this case also the small V shaped valleys and the secondary fluvial system are set on the correspondence of the faults. In the same context there are some alluvial fans, on the colluvial deposits (cdQ formation), increased by the temporary rivers.

(vii) km 11+100 – 12+198. On this segment of the alignment, the river Dzirula its subjected to a considerable tectonic influence; there are changes of direction of the water flow in correspondence with the observed faults and in correspondence with the meanders the erosion of the river bank are present. In this segment the secondary fluvial system composed by temporary rivers is developed on the meta-granites (PzGr formation) and on the flyshoid alteration of argillites (K1 formation). In the same context there are some alluvial fans, on the colluvial deposits (cdQ formation), increased by the temporary rivers. There are two tectonic contacts; one of them is between the meta-granites (PzGr formation) and on the flyshoid alteration of argillites (K1 formation) regulated by faults oriented NNE-SSW in on the southern slope. The other tectonic contact is between the quartz-gneiss (PzQGn formation) and the meta-granites (PzGr formation) regulated by faults orientated NNE-SSW on the northern slope. In this case also the small V shaped valleys and temporary flows, are set on the correspondence of the faults.

F.1.4 Natural Hazards

377. Regional Context - Georgia is one of the more complex mountainous regions living through the development of natural disasters, in which multi-spectral natural hazards are distinguished by their high recurrence rates and negative consequences for the population and infrastructure, as well as high rates of land resource losses and economic damage. Among the different types of natural disasters that periodically cause significant damage to the country's economy and often cause human casualties, the most relevant to the Project are landslides.

378. Almost all morphological-climatic zones in Georgia, starting with the sea coastline up to the high altitude mountain alpine-nival zone, have experienced damage to different extents. Over 50,000 landslides of different sizes and over 3,000 mudflow-transforming watercourses (rivers, canyons) have been identified in the country, as well as hundreds of kilometers of eroded riverbanks and coastline. Up to 70% of the territory and around 63% of the population are permanently at risk of natural disasters of different intensities.

379. Local Context - Landslides – An assessment of landslide areas has been undertaken as part of the detailed design. The following areas were identified:

(i) Superficial creeps
- (a) Around KM2.0 involving the alignment, on bridge (BRI-2.1.07-TA) above the Gabbros (PzGa formation); - Detailed Design Consultants consider this insignificant.
- (b) Around KM5.0 involving the western abutments of bridge BR-2.1.12-AT; - Detailed Design Consultants consider this insignificant.
- (c) Around KM5.5 involving the eastern portals of tunnels TUN 2.0.08-TA and TUN-2.0.08-AT.; - The Detailed Design Consultants have indicated that this area will be stabilized with the construction of the tunnel portals.

(ii) Diffuse superficial instability
- (a) Between KM2.8 and KM2.9, involving colluvial deposits (cdQ formation) and Gabbros (PzGa formation), in correspondence of the eastern portals of tunnels TUN-2.0.05-TA and TUN-2.0.05-TA and western abutments of bridges BRI-2.1.09-TA and 2.1.09-AT. – The Detailed Design Consultants have indicated that this area will be stabilized with the construction of the portals and will not affect the bridge abutments.

(iii) Active landslide
- (a) Between KM10.3 and KM10.4 involving the flyshoid alteration of argillites and limestones (K1 formation). The thicknesses of these active landslide are only a few meters); - The Detailed Design Consultants have indicated that these landslide areas can be managed with the construction of the eastern portal of TUN-2.0.10-AT.
- (b) Between KM11.0 and KM11.2, on granite (PzGr formation), close to the contact with the flysch (K1 formation), involving the eastern portals of tunnels TUN-2.0.11-TA and TUN-2.0.11-AT. - The Detailed Design Consultants have indicated that this area will be stabilized with the construction of the portals.

380. Seismicity - According to the Seismic Hazard Map of Building Norms and Rules effective in Georgia "Earthquake-resisting construction (SSM III, 21.10.2009 N 128, article 1477) PN 01.01-09)", the study area is located in the 8-point earthquake zone (MSK 64 scale[10]) with the dimensionless coefficient of seismicity (A) equaling 0.14 (Boriti village) under the same document. Figure 52 illustrates the seismic conditions in Georgia.

Figure 52: Seismicity Map of Georgia (MSK Scale)

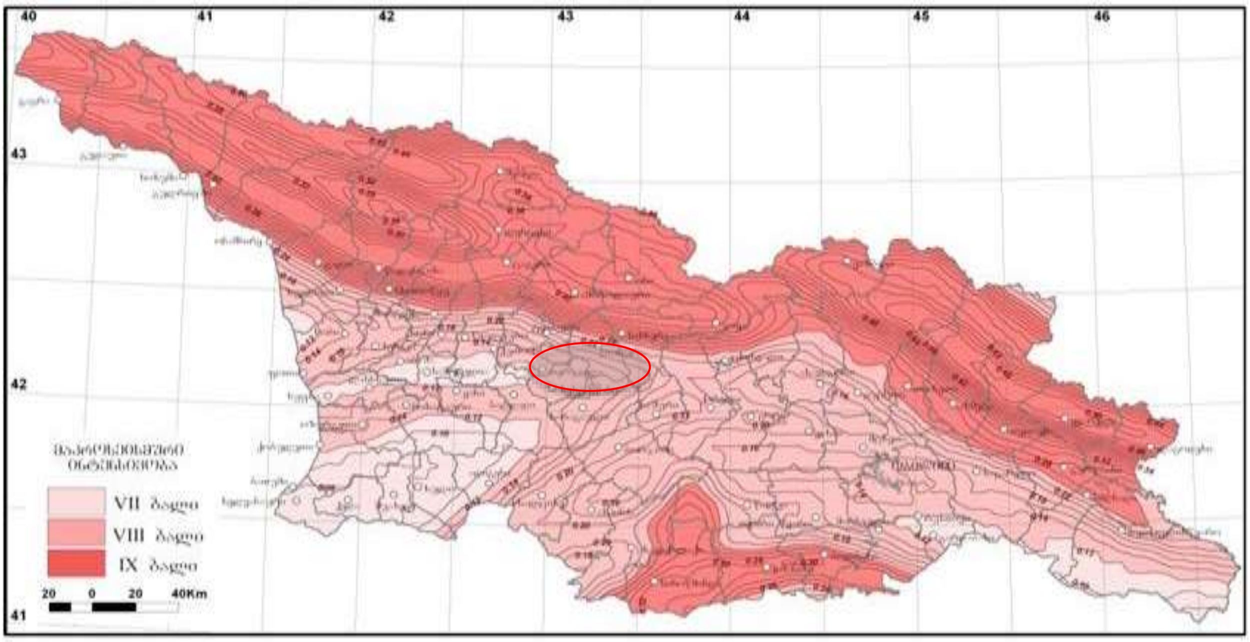


Table 30: Seismicity in the Region

Settlement	Region	Municipality	Seismicity coefficient	Magnitude (MSK64 scale)
Khunevi	Imereti	Kharagauli	0.15	8
Vertkvichala	Imereti	Kharagauli	0.14	8
Boriti	Imereti	Kharagauli	0.14	8
Makatubani	Imereti	Kharagauli	0.14	8

F.1.5 Air quality

F.1.5.1 Site Observations

381. The Project road is located within a rural setting with no point sources of industrial emissions noted within the Project area. Apart from rural household emissions from wood burning stoves and heating the only other source of air emissions are from road transport, including vehicles on the existing E-60.

F.1.5.2 Sensitive Receptors

382. The Project road passes close to a number of residential properties and sensitive receptors. Those within 200 meters have been mapped and are included as part of the air quality and noise assessment provided in **Section G** of this EIA.

[10] *MSK-64*, is a macroseismic intensity scale used to evaluate the severity of ground shaking on the basis of observed effects in an area of the earthquake occurrence. The MSK scale has 12 intensity degrees. Magnitude VIII can be compared to 6 – 7 on the richter scale.

F.1.5.3 Baseline Ambient Air Quality

383. Air quality monitoring was carried out at nine different locations during March, 2018 to characterize the current air quality within the Study Area. The pollutants selected for evaluation are based on the expected emissions from the Project activities and the level of risk to human health posed by these pollutants. They include:

(i) Total Suspended Particulates (TSP), or Dust;
(ii) Carbon Monoxide (CO);
(iii) Nitrogen Dioxide (NO_2);
(iv) Sulfur Dioxide (SO_2); and
(v) Particulate Matter (PM_{10} and $PM_{2.5}$)

384. A description of sampling locations and the rationale of selection is given in Table 31. The locations are also provided by
385.
386. Figure 53. The ambient air quality data was compared against applicable IFC, EU and Georgian Standards.

Table 31: Ambient Air Quality Monitoring Locations

Sample ID	Approximate Location	Coordinates	Rationale for Site Selection
F2-A1	KM0.6	42°05'50.77"N / 43°24'05.16"E	Khevi Village
F2-A2	KM3.3	42°06'14.04"N / 43°22'01.28"E	Close to Khunevi School
F2-A3	KM4.1	42°06'20.77"N / 43°21'43.70"E	Khunevi village
F2-A4	KM6.4	42°06'31.95"N / 43°20'06.21"E	Vertkvichala Village
F2-A5	KM8.6	42°06'18.78"N / 43°18'34.61"E	Close to School in Vertkvichala
F2-A6	KM12.1	42°06'30.41"N / 43°16'03.18"E	End of Project road in Boriti

Figure 53: Ambient Air Quality Monitoring Locations

Table 32: Ambient Air Quality Monitoring Result

#	Time*	Wind speed, m/s	Wind direction	CO, µg/m3	NO_2, µg/m3	SO_2, µg/m3	PM10, µg/m3	PM 2.5, µg/m3	Total dust, µg/m3
F2-A1									
1	8:00	0.8	W	2000	<200	<500	42	34	<100
2	13:00	1.2	W	1000	<200	<500	38	30	<100
3	18:10	<0,1		<1000	<200	<500	28	25	<100
4	23:10	<0,1		<1000	<200	<500	25	23	<100
F2-A2									
1	8:40	1	W	1000	<200	<500	23	21	<100
2	13:50	1.1	W	1000	<200	<500	35	28	<100
3	19:00	<0,1		<1000	<200	<500	25	23	<100
4	0:05	<0,1		<1000	<200	<500	20	18	<100
F2-A3									
1	9:25	0.9	W	<1000	<200	<500	44	34	<100
2	14:35	1.2	W	1000	<200	<500	45	37	<100
3	19:50	<0,1		<1000	<200	<500	30	21	<100
4	0:50	<0,1		<1000	<200	<500	20	18	<100
F2-A4									
1	10:10	1.1	W	1000	<200	<500	32	25	<100
2	15:20	1.1	W	1000	<200	<500	42	35	<100
3	20:30	<0,1		<1000	<200	<500	28	24	<100
4	1:40	<0,1		<1000	<200	<500	25	23	<100
F2-A5									
1	11:00	1.1	W	1000	<200	<500	17	15	<100
2	16:00	1.1	W	1000	<200	<500	23	21	<100
3	21:20	<0,1		<1000	<200	<500	9	7	<100
4	2:20	<0,1		<1000	<200	<500	5	3	<100
F2-A6									

#	Time*	Wind speed, m/s	Wind direction	CO, µg/m3	NO_2, µg/m3	SO_2, µg/m3	PM10, µg/m3	PM 2.5, µg/m3	Total dust, µg/m3
1	11:45	1.5	W	<1000	<200	<500	25	23	<100
2	16:50	1.2	W	<1000	<200	<500	30	27	<100
3	22:20	<0,1		<1000	<200	<500	15	11	<100
4	3:20	<0,1		<1000	<200	<500	5	4	<100
	MPC/guideline values/limits		**Aver. period**	**CO, µg/m3**	**NO_2, µg/m3**	**SO_2, µg/m3**	**PM10, µg/m3**	**PM 2.5, µg/m3**	**TSP, µg/m3**
1	National limit – max. permissible one time (volley) concentration (MPC), µg/m^3 *		24 h	3000	40	50	n/a	n/a	150
			30 min	5000	200	500	n/a	n/a	500
2	IFC/WHO (updated 2016) –guideline value, µg/m3		1 year	n/a	40	50	20	10	n/a
			8h	10000	n/a	n/a	n/a	n/a	n/a
			24 h	n/a	n/a	20	50	25	120
			1h	30000	200	n/a	n/a	n/a	n/a
			30 min	60000	n/a	n/a	n/a	n/a	n/a
			10 min	100000	n/a	500	n/a	n/a	n/a
3	EU limit, µg/m3		1 year	n/a	40	n/a	40	25	n/a
			8h	10000	n/a	n/a	n/a	n/a	n/a
			24 h	n/a	n/a	125	n/a	n/a	n/a
			1h	n/a	200	350	n/a	n/a	n/a

***Averaging Period** - 30 mins

Equipment
Carbon monoxide meter (China), diapason 0-100ppm
Dust measuring unit CW-HAT 200, diapason 0-500 µg/m^3
Air analyser, TESTO-350 (Germany),
Diapason: CO (0-10 000 ppm); NO (0-4 000 ppm); NO_2 (0-500 ppm); SO_2 (0-5 000 ppm)

387. The results of the ambient air quality monitoring are provided in Table 32. The results, which provide a ‘snapshot’ of the air quality in the Project area on this particular day of the year show that ambient air quality meets the national standards for CO, TSP, NO_2 and SO_2. It is noted that air quality can vary due to a range of parameters that are different on given days and periods of the year. Even following IFC averaging periods we would still only reveal a ‘snapshot’ of one day during the year which would not give a clear understanding of air quality in the Project area throughout the year. Accordingly, national standards were followed for baseline data collection.

388. As noted above, there are no major point sources of air emissions within the Project corridor and the only major emissions of air quality result from vehicle traffic on the E-60. **Section G** of this report provides an air quality model for the new alignment, and this model clearly shows that the Project will not have significant impacts on air quality.

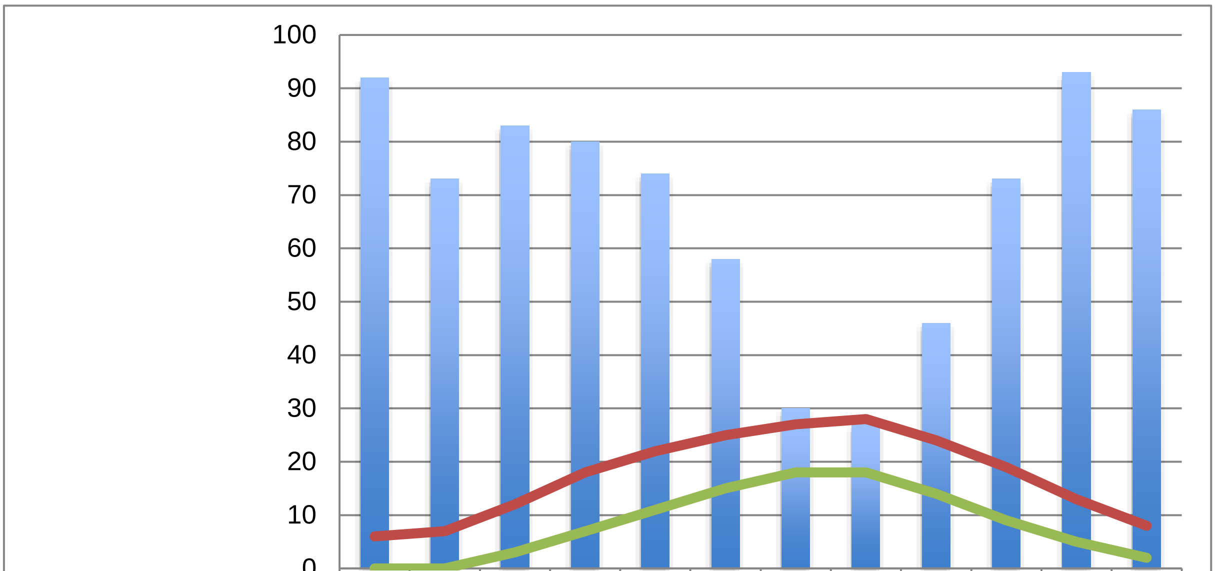
F.1.6 Climate

389. Due to the peculiar geographical position of Georgia between the Black and Caspian seas and the presence of powerful natural climatologic in the North of the Main Caucasus Range, and also owing to the large range of elevations above sea level, the climate of Georgia is varies quite widely for a small country. According to technical document GOST 16350-80 the Project road is located in district II9, which is characterized by a temperate warm climate with mild winters.

F.1.6.1 Precipitation & Temperature

390. Annual precipitation in Boriti (end point of the Project Road) is around 800 mm. Rainfall is highest in the Winter, Autumn and Spring, although rainfall can still be observed during the hotter summer months.

Figure 54: Precipitation (mm) and Temperature (°C), Boriti

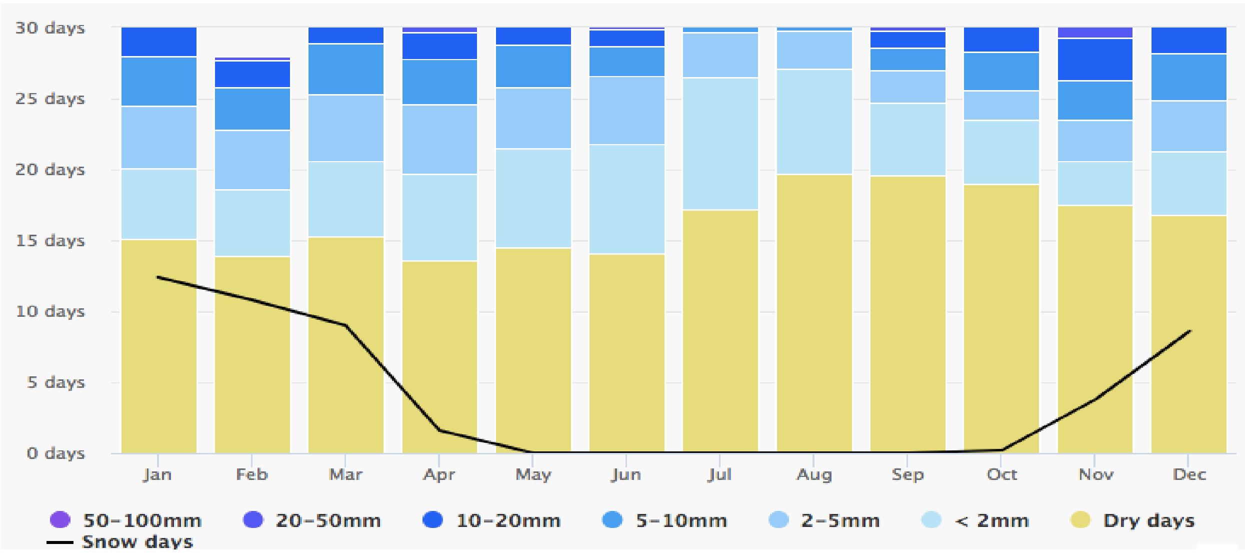


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Precipitation (mm)	92	73	83	80	74	58	30	27	46	73	93	86
Mean Daily Maximum (	6	7	12	18	22	25	27	28	24	19	13	8
Mean Daily Minumum	0	0	3	7	11	15	18	18	14	9	5	2

Source: Meteoblue

391. Less than 0.2 mm/day are considered sufficient to effectively suppress wind-blown dust emissions[11] [12]. Figure 55 details the number of days showing >0.2 mm/day rainfall. On average each year, around ten such days occur between November and June and rarely in the months of July to August.

Figure 55: Precipitation Levels (mm), Boriti



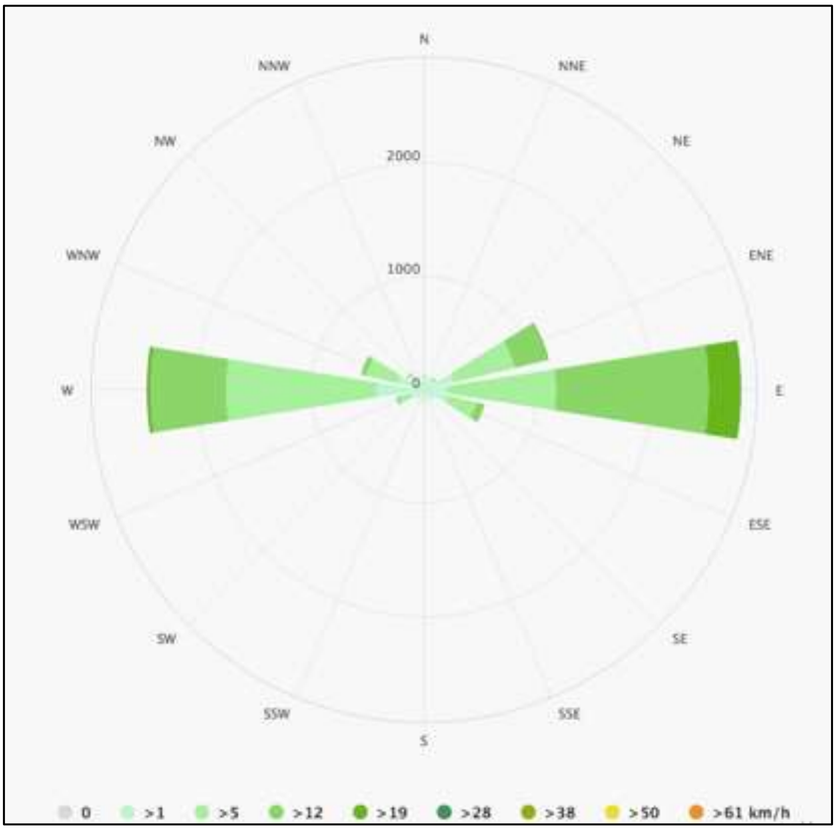
Source: Meteoblue

[11] IFC (2007). Environmental, Health and Safety Guidelines. General EHS Guidelines: Environmental. Air Emissions and Ambient Air. April 2007.
[12] Office of the Deputy Prime Minister (2005). *Planning Minerals Policy Statement 2: Controlling and Mitigating the Environmental Effects of Minerals Extraction in England. Annex1: Dust*.

F.1.6.2 Prevailing Winds

392. Wind strength, direction and frequency is shown in Figure 56**.** The wind rose illustrates that the dominant wind direction is from the east. However, strong winds from the west are also experienced quite frequently.

Figure 56: Wind Rose, Boriti



Source: Meteoblue

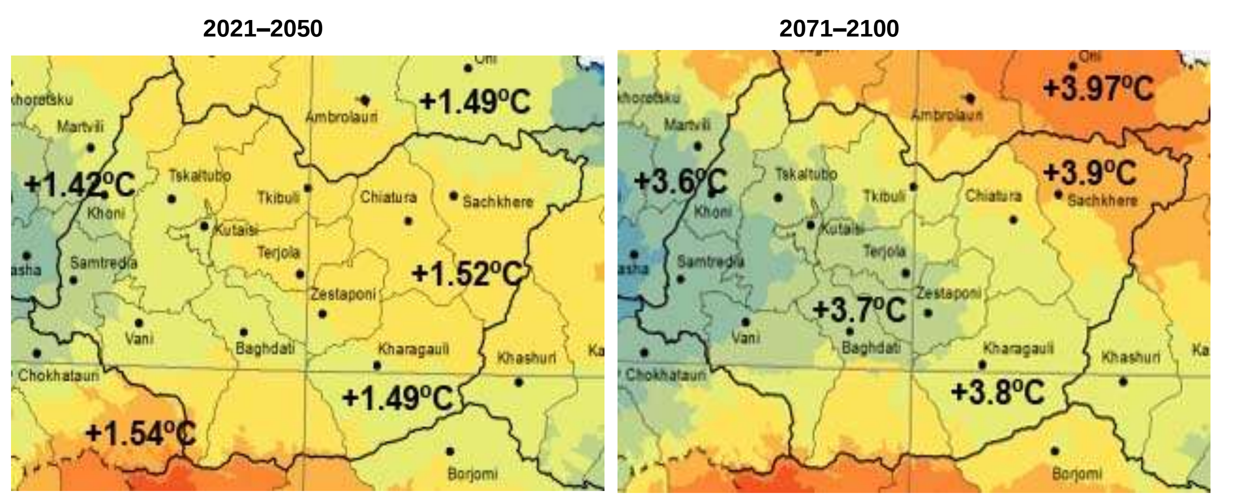
F.1.6.3 Climate Change

393. General – The following section is reproduced from the Climate Risk and Vulnerability Assessment & Independent Proof Check prepared for the Project by the ADB in April, 2018.

394. Projected Climate Changes in Georgia - Projected climate changes in Georgia are outlined below.

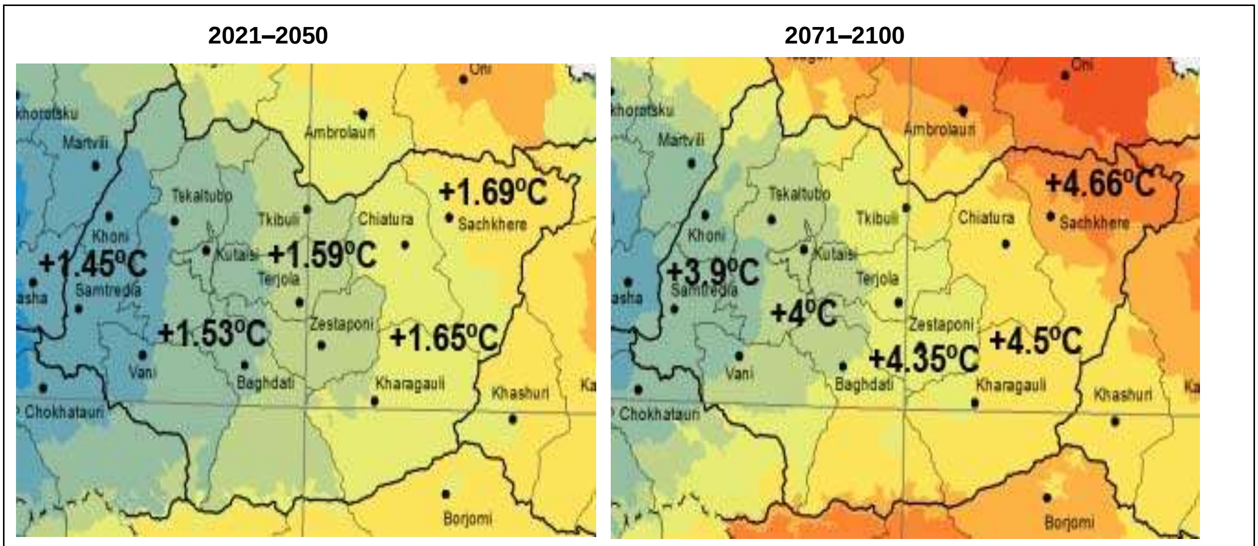
395. Average annual temperatures are expected to increase by 1.3°–1.6°C by 2050 and 3°–4°C toward 2100 (Figure 57).

Figure 57: Projected changes in annual mean temperature (in °C) in the Imereti Region



396. The increases are highest in September, when temperatures are already at their highest. The greatest overall increase is expected in northwest Georgia, especially in the Kakheti region (Sagarejo, Sighnaghi and Dedoplistskaro municipalities). The least warming is expected in the Black Sea coastal area and Kolkheti Lowland of Georgia. In the project area, by 2100, summer temperatures may be higher by 4.5°C (Figure 58).

Figure 58: Projected changes in summer temperature (in °C) in the Imereti Region



397. The increase in temperatures will be accompanied by an increase in the number of hot days (days where the average daily temperature is higher than 25ºC). In some mountain areas, the number of hot days may double. In the project area, by 2050, the number of hot days will increase to 38 days p.a., and by 2100 the number of hot days will increase to 66 days p.a.

398. In addition, more frequent heat waves will occur during June–August. The population in the project area is considered to be highly vulnerable to heat waves (80% vulnerability). Concurrent with the increase in temperatures, and the increase in droughty conditions, a decrease in overall humidity (with some exceptions, such as Mestia, Khaishi and Keda) is expected.

399. A decrease in the number of days and nights with frost (i.e., number of days when daily minimum temperature is less that 0ºC) is also expected. The current range of frost days in

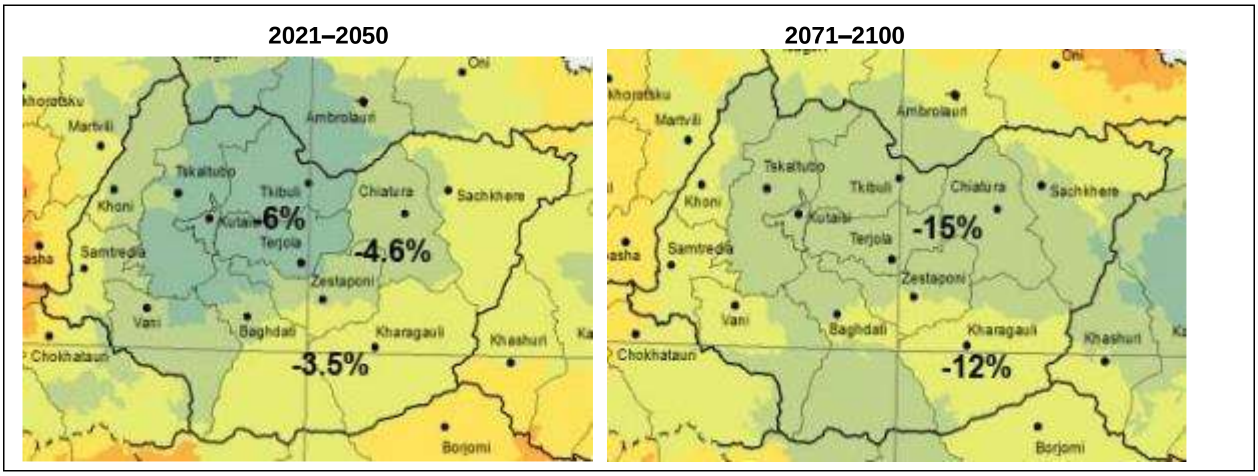
Georgia is 80–120 days. In the project area, by 2050, the number of frost days will decrease by 21 days p.a., and by 2100 the number of frost days will decrease by 55 days p.a.

400. Wind speeds are not expected to strengthen, and wind direction will remain variable across the four road segments.

401. By 2160, due to higher temperatures a complete loss of Georgia's 637 glaciers is expected, leading to a decrease in the annual glacial runoff. By 2100, glacial runoff is predicted to decrease by up to 40%, and as a result, annual river runoff will decrease by about 13%.

402. Precipitation projections include a general increase of 5% up to 2050, followed by a drastic decline of up to 24% by 2100. The exception is the central part of the Likhi Range (in Mta-Sabueti) where precipitation is predicted to increase by 93%. In the project area, however, precipitation decreases will occur much faster. By 2050, annual mean precipitation will decrease by 4.5%, and by 2100 it will decrease by close to 13% (Figure 59).

Figure 59: Projected changes in annual mean precipitation (in %) in the Imereti Region



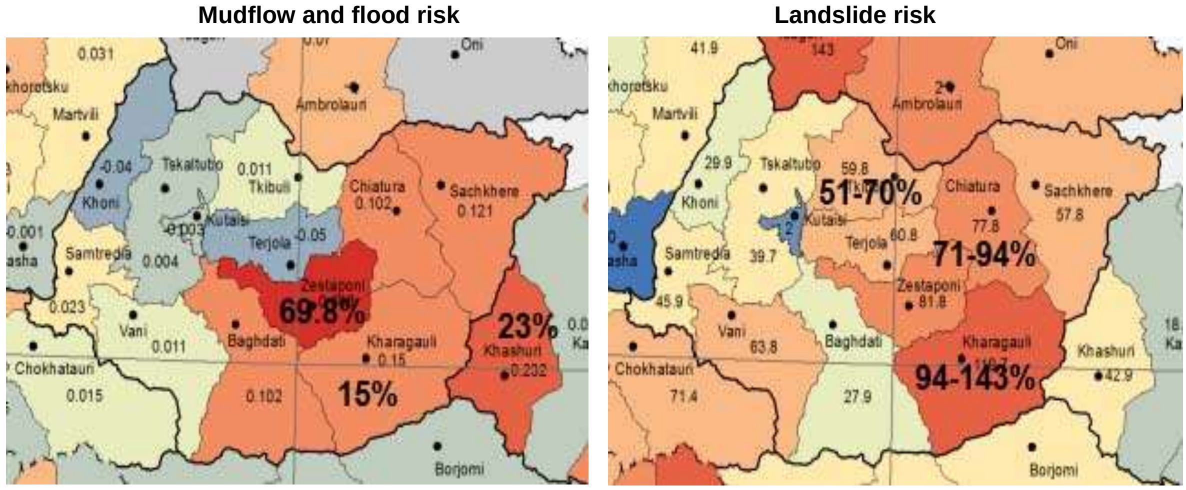
403. The seasonal variability of precipitation will increase in the project area. By 2050, precipitation decreases of -3.5%, -15%, -4%, and -3% are expected during the winter, spring, summer and autumn months, respectively. By 2100, the expected decrease in precipitation will be -4.5%, -23%, -32%, -10%, respectively, for the winter, spring, summer and autumn months.

404. Despite the long-term decrease in precipitation, an increase in the amount and intensity of daily and multi-day rainfall events is expected. In the project area, the number of days with heavy rain, when total daily precipitation exceeds 20 mm, will increase by 2050 to 44 days p.a.

405. These changes will lead to increased risk of flash floods, mudflows and landslides. In the project area, the risk of erosion processes, floods and landslides is expected to increase. For landslides, the project corridor has a high-risk range (94%–143%).

406. For mudflows and floods, the projected risk range for F2 is between 15% and 70% (Figure 60).

Figure 60: Projected mudflow, landslide and flood risk (in %) in the Imereti Region (2021–2050)



F.1.6.4 Greenhouse Gases (GHGs)

407. General - According to the World Resources Institute Climate Analysis Indicators Tool (WRI CAIT), Georgia's 2011 GHG profile was dominated by emissions from the energy sector, which accounted for 71% (7.5 $MtCO_2e$) of Georgia's total emissions. Land-use change and forestry (LUCF) was the second most significant sector. Of the 7.5 $MtCO_2e$ % of emissions from the energy sector approximately 2 of the 7.5 $MtCO_2e$ was attributable to the transport sector (resulting from purchases of large, inefficient, aging used cars, as well as economic growth and improved living conditions overall. From 2001-2009, the number of vehicles doubled, and the number of buses and minibuses tripled.[13] In 2013 emissions data compiled by the World Resources Institute (WRI) indicated that Georgia produced around 14 $MtCO_2e$ or 0.0003% of global GHG emissions. 2 $MtCO_2e$ represents 0.00004% of global GHG emissions.

F.1.7 Hydrology

F.1.7.1 Surface Water

408. Regional Context – In Georgia there are 26,060 rivers and stream with a total length of 60,000 km. They belong both to the Caspian and Black Sea basins. 25,075 (99.4%) of the rivers are small (less than 25km length), with total length of 54,768 km. More than 18,109 (70%) of the rivers belong to the Black Sea basin, and 7,951 (30%) belong to the Caspian Sea basin.

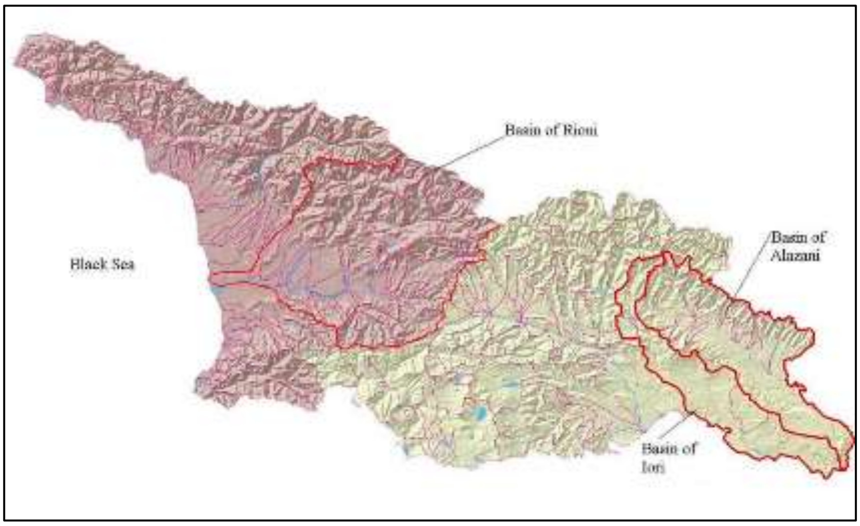


Figure 61: Rioni Sub-basin

[13] Greenhouse Gas Emissions in Georgia. USAID, July, 2016

Figure 52 illustrates the division on the Caspian and Black Sea basins.

409. The Project road is located within the Black Sea basin in the Rioni sub-basin. The Rioni sub-basin dominates western Georgia and has a total catchment area of 13,400 km^2, which is approximately 20% of the whole Georgian territory.

410. Local Context – The main rivers in the Project area include the Dzirula, Rikotula and the Dumala. The Project road flows parallel with the Rikotula from KM0.0 until it merges with the Dzirula adjacent to KM1.3 beneath bridge BRI 2.1.04 TA/AT. The Dzirula is the main river flowing through the valley in which the Project road is located. The Dumala is a major tributary of the Dzirula, but is located more than 300 m north of the new alignment in Boriti, almost at the end point of the Project road.

411. **Dzirula River -** The river heads at 1,252 m above sea level where several brooks merge on the western slopes of Likhi Range and flows into the river Kvirila from its left bank. The length of the river is 89 km, its total fall is 1,052 m and the area of its catchment basin is 1,270 km^2. The river comprises 1,386 tributaries with the total length of 1,677 km.

Figure 62: Dzirula River (Approximately KM8.0)

412. The river basin is located on Imereti Plateau and is bordered by Likhi Range from east and south-east and by the river Kvirila basin from north and north-west. The relief of the river basin within the limits of the Likhi Range is strongly dissected with deep gorges of the river tributaries. The geology of the river basin is represented by granites, gneisses, limestones and sandstones. The soil cover of the basin is represented by loamy soils, and the vegetation cover in almost all basin is presented as a dense hardwood forest.

413. The river gorge is winding and mostly V-shaped. The width of the gorge bed varies from 20-25 m to 300-350 m. The slopes of the river gorge merge with the slopes of the adjacent

ridges. The river has terraces only in its middle and lower reaches. The width of the terraces varies from 50 to 400 m; their height is from 2-3 m to 7-8 m. The river floodplain is weakly developed.

414. The river bed is moderately winding and mostly non-branched. The bed in the upper reaches is stony giving the current a mountainous character. The width of the current varies from 10 to 30 m, its depth is 0.5-1.8 m, and its speed is within the limits of 0.8 and 1.5 m/sec.

415. The river is mostly fed with snow and rain waters. Its water regime is characterized by spring flood often accelerated by freshets caused by rains, non-stable low-water periods in summer and freshets in autumn and winter caused by rains and rapid air warming. The yearly distribution of the river flow is extremely uneven. On average, 48% of the annual flow flows in spring, 9-12% flows in summer and autumn and 30% flows in winter. Short icy events mostly as icy edges are fixed only at the river mouths.

Table 33: Average monthly discharges of the Dzirula River (million m^3)

River	Station	Catchment (km^2)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Dzirula	Tseva	1190	21.6	33.5	54.0	58.2	29.8	19.4	13.5	9.59	8.93	16.0	20.1	25.9

Table 34: Peak Discharges of the Dzirula River (million m^3)

River	Station	Catchment (km^2)	Reoccurrence □ Year					
			1000	100	50	20	10	5
Dzirula	Tseva	1190	965	670	575	455	380	315

416. **Rikotula River** - The Rikotula heads on the north-eastern slope of the western fork of Surami Ridge, at the altitude of 1,100 m and merges with the river Dzirula from its left side, in 33 km from its estuary. The length of the river is 10,1 km, its total fall is 643 m, its mean slope is 64,3 ‰, and the area of the catch basin is 70.4 km^2. The total length of the first-range tributaries of the river is 45 km. The river basin is located on the western slopes of Surami Ridge. Its geology is mainly presented as crystal rocks of Dzirula massif, mostly granites. Mostly mountain and forest soils are common in the basin.

417. The vegetation cover of the basin is presented as dense hardwood forest occupying 65% of the basin. The entire river gorge is a V-shaped, with its slopes having high gradients and merging with the slopes of the adjacent slopes. The riverbed is moderately winding and mostly non-branched. The river is alimented with snow, rain and ground waters. The water regime of the river is characterized by spring floods caused by snow-melt, freshets caused by autumn and winter rains and non-stable summer low water periods. It should be noted that the levels of the freshets caused by rains exceed those caused by snow- melt. In the low water periods, the water in the river is clean, transparent and drinkable. The river is used to run the village mills.

418. **Dumala** - The river Dumala heads at the altitude of 960 m, from the spring outflowing on the northern slope of mountain Dzira, at Surami ridge and flows into the river Dzirula from its right side, at village Boriti. The length of the river is 34 km, its total fall is 676 m, its mean slope

is 19,9‰, the area of its catch basin is 124 km^2, the mean altitude of the river basin is 730 m. The river is flown by 157 tributaries of different ranges, with the total length of 189 km.

419. The river basin is located over the western slopes of Surami ridge, between the catch basins of the rivers Dzirula and Kvirila. In a geomorphological respect, the river basin is divided into two zones - the upper hilly zone and the lower mountainous zone. The upper hilly zone, which is located between the river mouth and village Mandaeti, is characterized by relatively smoother relief forms, while the relief in the lower mountainous zone has high slopes and clear contours. The geology of the basin is presented by granites, limestones and sandstones, which are covered with loamy soils. Hardwood forest grows all along the river.

420. The river gorge from its mouth to village Mandaeti is a box-like. Below, to the confluence, it is V- shaped. The width of the gorge bed varies from 10-15 m to 70-80 m. The gorge slopes are dissectioned with the gorges of tributaries and gullies. The river bed is winding and mostly non- branched. The width of the current is from 2 to 16 m, its depth is 0,2-0,7 m and its velocity changes from 0,4 m/sec to 1,0-1,5 m/sec. The river is fed with rain and ground waters. Its water regime is characterized by spring floods, autumn freshets and summer and winter unstable low-water periods. A relatively more stable low-water period is fixed in august and September. Icy events as an 0,2-0,3-metre-thick icy cover from the river mouth to village Karbouli is fixed from December through February. The river is used to run the village mills.

421. Surface Water Quality – Monitoring of surface water was undertaken in March 2018 to assess the status of surface water quality. Monitoring was undertaken at all of the locations where the new alignment crosses the river. Figure 63 illustrates the monitoring locations and Table 35 provides a table of the monitoring locations. The results of the water quality monitoring are presented in Table 36 below.

Figure 63: Surface Water Monitoring Locations

Table 35: Surface Water Monitoring Locations

	Point #	Coordinates	
		X	Y
1	F2-SW1	368146	4661766
2	F2-SW2	367382	4661970
3	F2-SW3	366938	4661965
4	F2-SW4	366988	4662191
5	F2-SW5	366387	4662036
6	F2-SW6	365630	4662379
7	F2-SW7	365035	4662638

	Point #	Coordinates	
		X	Y
8	F2-SW8	363771	4662783
9	F2-SW9	362662	4663152
10	F2-SW10	362151	4663368
11	F2-SW11	360165	4662943
12	F2-SW12	358256	4663908
13	F2-SW13	356936	4663265

422. The results of the monitoring show that all parameters are below the Georgian MACs.

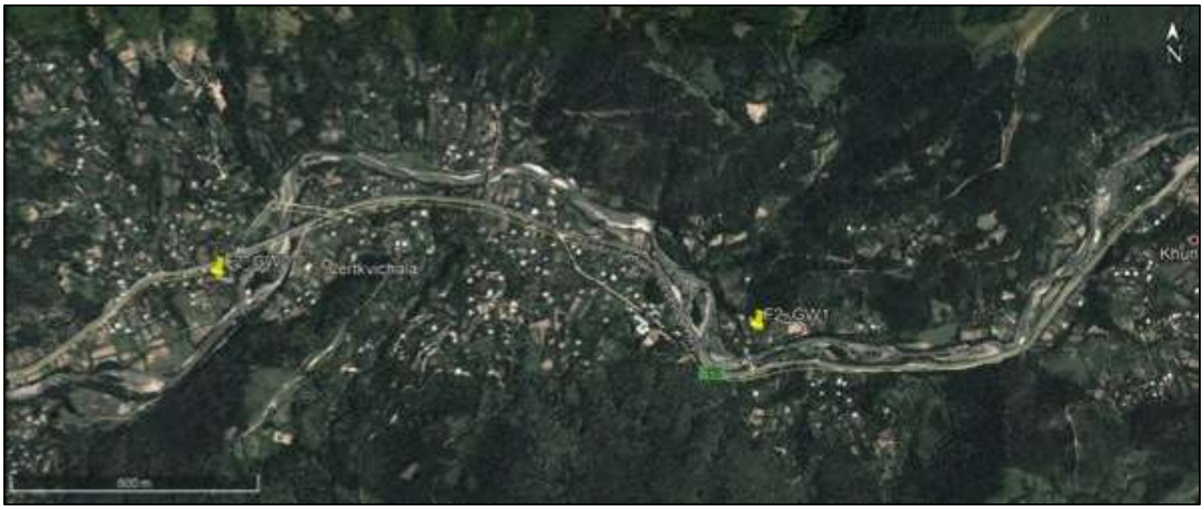
F.1.7.2 Groundwater Water

423. Local Context – The water bearing strata is of contemporary alluvial deposits characterized by a free groundwater table declining along the general flow of the rivers. The shallow ground water level is 1.5m – 1.8m below ground and anticipated amplitude of groundwater level fluctuation is below 1m. At some locations near the riverbeds, groundwater is very shallow depths (0.3m). Aquifers are mainly fed from rivers and precipitation.

424. As part of the Projects Geological study a number of boreholes were excavated within the Project area. Groundwater levels between generally ranged between 0.3 and 8.8 meters in depth. A number of groundwater wells and natural springs are present within the Project area and according to a recent World Bank study groundwater and springs are main sources of water supply for the Imereti population although the study did not indicate if these sources were owned by the water users or if the water was piped.[14]

425. Groundwater Quality - Two groundwater samples were collected from ground water wells within the Project area. Figure 64 illustrates the monitoring locations and Table 37 provides a table of the monitoring locations. In addition, a water sample was taken from a spring in Vertkvichala. The results of the monitoring are presented in Table 38 below.

Figure 64: Groundwater Monitoring Locations



[14] Second Regional Development Project, Imereti Regional Development Program, Imereti Tourism Development Strategy. Strategic Environmental, Cultural, Historical and Social Assessment. World Bank, 2014

Table 36: Surface Water Quality Monitoring Results

#	Parameter	Units	F2-SW1	F2-SW2	F2-SW3	F2-SW4	F2-SW5	F2-SW6	F2-SW7	F2-SW8	F2-SW9	F2-SW10	F2-SW11	F2-SW12	F2-SW13	National, maximum allowable concentration
1	pH	-	7.0	7.0	7.15	7.05	7.0	7.1	7.1	7.05	7.1	7.1	7.1	7.25	7.2	6.5-8.5
2	Electrical conductivity (EC)	S/m	0.0059	0.0062	0.0063	0.0064	0.0066	0.0069	0.0068	0.0066	0.0068	0.0066	0.0065	0.0070	0.0066	n/a
3	Turbidity	FTU	167.0	133.0	328.0	338.0	182.0	242.0	185.0	219.0	135.0	105.0	228.0	125.0	213.0	n/a
4	BOD_{5},	mg/l O_2	1.1	0.8	0.6	0.9	0.9	1.5	1.4	1.9	1.5	1.1	0.4	0.4	0.6	6
5	COD	mg/l O_2	18.0	<15.0	<15.0	<15.0	<15.0	<15.0	<15.0	18.0	<15.0	<15.0	<15.0	<15.0	18.0	30
6	Dissolved oxygen (DO)	mg/l	11.6	12.1	11.2	11.9	10.9	11.5	10.2	11.8	10.3	9.9	10.5	10.1	10.6	≥4
7	Total suspended solids(TSS)	mg/l	40.4	41.8	41.6	39.4	45.3	42.1	44.8	43.2	42.1	45.0	44.8	44.0	43.0	increase by ≤ 0.75
8	Oil and grease	mg/l	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	n/a
9	Total Phosphorus	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	2
10	Total Nitrogen	mg/l	0.44	0.63	0.54	0.54	0.58	0.51	0.49	0.60	0.53	0.57	0.51	0.48	0.56	n/a
11	Total Ammonium	mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.5 mg/l NH4
12	TPH	mg/l	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.3
13	Total residual chlorine	mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	n/a
14	Total Zinc	mg/l	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	1
15	Dissolved Copper	mg/l	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	1
16	Manganese	mg/l	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	1
17	Total Coliform Bacteria	1000ml	3200	2800	4600	1430	2700	3400	4700	9000	4800	5100	5300	5100	5360	≤10 000
18	Temperature	^{0}C	7.7	7.4	8.0	7.0	7.9	7.7	8.1	10.4	10.5	10.8	10.8	10.9	11.0	

Table 37: Groundwater Monitoring Locations

#	Point #	Coordinates		Description
		X	Y	
1	F2-GW1	362968	4662843	Location vil.Vertkvichala. Well depth approximately 11 m. Water level (from the top of the well to water table) 3.42m. Note: distance from ground level till the top of the well is 0.65cm. According to the owner (Makhaz Lomidze) water level changes seasonally (drops in dry season).
2	F2-GW2	361270	4663041	Location vil.Vertkvichala. Well depth approximately 6.4m. Water level (from the top of the well) 3.81m. Note: distance from ground level till the top of the well is 0.71cm. According to the owner (Ilo Lursmanashvili) water level does not change.
3	F2-Sp1	363026	4662763	Location vil.Vertkvichala.

Table 38: Groundwater Monitoring Results

#	Parameter	Units	F2_GW1	F2_GW2	F2_Sp1	Method/standard	National limit, maximum allowable concentration	WHO, guidance values, mg/l
1	pH	-	7.50	7.65	7.35	ISO 10523-08	6.5-8.5	n/a
2	Dissolved oxygen (DO)	mg/l	10.1	9.40	10.3	ISO 5815-03	n/a	n/a
3	Electrical conductivity (EC)	S/m	0.0159	0.0344	0.0074	ISO 7888-85	n/a	n/a
4	Alkalinity	mg-eq/l	1.32	3.36	0.6	Gost 23268.3-78	n/a	n/a
5	Hardness	mg-eq/l	1.49	3.80	0.8	Gost 23268.5-78	7-10	n/a
6	Total suspended solids (TSS)	mg/l	16.4	24.4	37.6	ISO 11923-97	n/a	n/a
7	Total dissolved solids	mg/l	136.7	334.0	75.6	Calculated	1000-1500	n/a
8	Arsenic, As	mg/l	<0.005	<0.005	<0.005	Gost 4152-89	<0.01	0.01
9	Chlorides	mg/l	7.10	15.6	7.1	Gost 23268,17-78	<250	n/a
10	Iron, Fe	mg/l	1.27	0.05	0.07	EPA 3005 A-92	<0.3	n/a
11	Nitrates	mg/l	6.64	8.84	6.2	Gost 18823-73	<50	50
12	Sodium, Na	mg/l	5.28	11.55	2.64	ISO 9964-3-93	<200	n/a
13	Potassium, K	mg/l	1.10	3.47	0.33	ISO 9964-3-93	n/a	n/a
14	Calcium, Ca	mg/l	16.0	56.0	12.0	Gost 23268,5-78	<140	n/a
15	Magnesium, Mg	mg/l	8.4	12.2	2.4	Gost 23268,5-78	<85	n/a
16	Lead, Pb	mg/l	<0.01	<0.01	<0.01	ISO 8288-A-86	<0.01	0.01
17	Sulphates	mg/l	10.4	20.0	4.0	Gost 23268,3-78	<250	n/a
18	Manganese, Mn	mg/l	<0.02	<0.02	<0.02	EPA 3005 A-92	<0.4	0.4*

426. The results of the groundwater monitoring show that all measured parameters are below national MACs and WHO guideline values.

F.2 Ecological Resources

427. The project road crosses forest areas, agricultural land plots, residential areas and riparian ecosystems. Due to human activity in the main part of the Project area natural vegetation has been lost. In these areas arable lands and pastures have developed. This change from natural habitats to agricultural production and urban landscape has therefore changed the assemblage of fauna within the area. Animals currently found in the area of interest are mainly presented by those species that live in forested areas and/or can tolerate presence of humans.

428. The natural forest massifs have significant value from biodiversity protection viewpoint, because of their importance as wildlife corridors for the local animal species.

429. To fully understand the biodiversity in the Project area a biodiversity study was carried out by the LCF. The study was based on two aspects, firstly existing data was collected and analyzed in the form of a 'desk-top' study'. This was then followed up with field surveys. The aim of the study was to identify of animal species within the study area; to reveal significant habitats for inhabitant species; to determine possible impact on animal biodiversity on construction and operation phases and to develop impact mitigation measures.

F.2.1 Habitat

430. Main Habitats in the Project Area - The study are has been divided in 5 sections according to the habitats types (see Figure 65).

Figure 65: Main Habitats in the Project Area

1	Code of Georgia 62GE04 Vegetation of agricultural-economic settlements and cultivable land
2	Code of Georgia 91EO Alluvial forest with Adler trees - Alnus glutinosa and ash tree - Fraxinus excelsior
3	Code of Georgia 323GE Clayey and rock riverine vegetation with duckweed/Alpine rivers and their ligneous vegetation
4	Code of Georgia 9160GE Oak or oak-hornbeam forests (Quercitum -Carpinion betuli)
5	Code of Georgia 918 0 GE Tilio-Acerion forests of slopes, screes and ravines

431. **Habitat 1. Code of Georgia 62GE04 vegetation of urban and rural areas -** General description Vegetation of village settlements and cultivable land is extremely interesting from the point of view of plants of economic importance. In this habitat there are various species of aborigine, invasive and adventive cosmopolitan plants related to wild relatives of cultural plants and those used in traditional (people's) and scientific medicine, including, Chicory - *Cichorium*

intybus, meliot - *Melilotus officinalis*, yarrow - *Achillea milllefolium*, agrimony – *Agrimonia eupatoria*, creeping couch-grass - *Agropyron repens*, shepherd's purse - *Capsella bursa-pastoris*, henbane - *Hyoscyamus niger*, mother of nettle - *Lamium album*, forest mallow - *Malva sylvestris*, great plantain - *Plantago major*, coltsfoot - *Tussilago farfara*, etc.

432. These plants are distributed on the territories of the city and village settlements, roadsides and transformed habitats. Most of them create primary successions on eroded slopes as a result of industrial activities and construction works. Within this habitat, in residential and homestead plots cereals and fruits are cultivated (see Figure 66).

Figure 66: View of the village area

433. **Habitat 2 - Code of Georgia 91EO - Alluvial forest with Adler trees and Ash[15] -** Riverside forests are developed both in the forest zone and places without the forest, where it grows as a narrow line along the river-bed. In the forest zone the riparian forest is less distinguished from the structure of the bordering forest. Besides wing-nut and alder trees there is an Ash (*Fraxinus oxycarpa*), Aspen (*Populus tremula*); from lianas - Smilax (*Smilax excelsa*) is met. In the forest zone, riparian forest does not differ from adjacent forest structure. In the riverside areas species like Common alder (*Alnus barbata*) are met, however less often that in wetland forests. Near the river Date-plum (*Diospyrus lotus*) and Black locust (*Robinia pseudoacacia*) are registered (see Figure 67).

434. **Habitat 3 - Code of Georgia 323 GE Clayey and rock riverine vegetation with duckweed** - On river banks covered with silt or mud thin scrub can be found - hawthorn (*Crataegus kyrtostyla*), oriental hornbeam (*Carpinus orientalis*) and Jerusalem thorn (*Paliurus*

[15] Corresponding categories:
1. United Kingdom classification: "W5 Alnus glutinosa-Carex paniculata woodland", "W6 Alnus glutinosa-Urtica dioica woodland)" and "W7 Alnus glutinosa-Fraxinus excelsiorLysimachia nemorum woodland".
2. German classification: "43040401 Weichholzauenwald mit weitgehend ungertörter Überflutungsdynamik", "43040402 Weichholzauenwald ohne Überflutung", "430403 Schwarzerlenwald (an Fließgewässern)", "430402 Eschenwald (an Fließgewässern)", "430401 Grauerlenauenwald (montan, Alpenvorland, Alpen).
3. Nordic classification: "2234 Fraxinus excelsior-typ" and "224 Alskog". 4) Associated habitat Forests of this type border with moist meadows and flood plane forests

spina-christi). Riverside vegetation is under the influence of floods during which it can completely disappear and then revive again. Mainly annual plants *Carex capillaris, Agrostis verticillata, Chamaenerion hirsutum, Verbascum gnaphalode*, cereals and perennial dicotyledons can be found (see Figure 68).

Figure 67: Secondary mixed forest of Dzirula River with dominance of Alder Black locust

Figure 68: View of Riverside Vegetation

435. Habitat 4 - Code of Georgia: 9160GE- Oak or oak-hornbeam forests (Quercitum - Carpinion betuli)16 - The study corridor and next to it two types of Oak are met: the Georgian

[16] Corresponding categories:
1. 91G0 * Pannonic woods with Quercus petraea and Carpinus betulus
2. PAL.CLASS.: 41.2B, 41.266, 41.267
3. German classification: "430703 Stieleichen-Hainbuchenwald feuchter bis frischer Standorte".
4. Nordic classification: "2223 Fagus sylvatica-Mercurialis perennis-Allium ursinum-typ".

oak (Quercus iberica) and the nationally red listed Imeretian oak (Quercus imeretina). The following species can be found together with the oak: Oriental hornbeam (Carpinus orientalis), Maple (Acer sp.), Black locust (Robinia fseudoacacia), European ash (Fraxinus excelsior). In such forest massives oak forms mono-dominant groups and mixes with abovementioned plant species. In sub-communities Oak-Hornbeam with Ruscus bushes is worth to mention (see Figure 69).

Figure 69: Oak-Hornbeam with Ruscus Bushes

436. **Habitat 5 - Code of Georgia: 9180 GE Tilio-Acerion forests of slopes, screes and ravines[17] -** Mixed forests (Tilio-Acerion) are created by secondary species Field maple (*Acer campestre*), European ash (*Fraxinus excelsior*), Elm (*Almus foliacea*), lime (*Tilia begonifolia*), and are located on steep rocky slopes, mainly on limestone, sometimes on siliceous ground material at various elevations. In some areas different type mixed forest with dominance of lime (*Tilia begonifolia*), with Common hornbeam (*Carpinus betulus*), Oriental hornbeam (*Carpinus orientalis*), Field elm (*Almus foliacea*), European alder (*Alnus barbata*), Common hazel (*Corilus avellana*). In early spring flowering herbaceous plants blooming early - *Scilla sibirica, Primula woronowii, Helleborus caucasicus, Viola alba, V. odorata* etc. are often met. In summer the following replace them - *Poa nemoralis, Piptatherum virescens, Polygonatum glaberrimum, Tamus communis, Laser trilobum*.

437. A description of the habitats by sections of the new alignment is given below and followed by more detailed maps of the habitat along the alignment.

[17] Corresponding categories:
1. United Kingdom classification: "W8 Fraxinus excelsior-Acer campestre-Mercurialis perennis woodland" and "W9 Fraxinus excelsior-Sorbus aucuparia-Mercurialis perennis woodland".
2. German classification: "430604 Sommerlinden-Begulmen-Blockschuttwald", "430603 Ahorn-Linden-Hangschuttwald (wärmere Standorte)", "430602 Eschen-Ahorn-Schluchtbzw. -Hangwald (fleucht-kühle Standorte)", "430601 Sommerlinden-HainbuchenSchuttwald".
3. Nordic classification: "2233 Ulmus glabra -typ", "2235 Tilia cordata -typ" and "2236 Quercus robur-Ulmus glabra-Tilia cordata-typ". In Boreal region corresponding species-poor communities often with Anemone nemorosa, Corydalis spp., Primula veris.
4) Associated habitat 1. Hornbeam forest

Unit 1
UTM T38: 0356876E Y 4663234N
Habitat 91EO - Alluvial forest with Adler trees and Ash
Projection vegetation coverage 50%

Alnus barbata	3
Carpinus orientalis	2
Fraxinus excelsior	2
Gleditsia triacanthos	2
Rosa canina	1
Ficus carica	1
Rubus sp.	1
Sambucus ebulus	1

Low sensitivity habitat

Location – near the crossroad and bridge Modified landscape – pastures and developed land.

Unit 2
UTM T38: 0358967E, 4663848N
Habitat: 62GE04 Vegetation of urban and rural areas
Projection vegetation coverage: 30 %
Species list/ Species cover%

Alnus barbata	1
Carpinus orientalis	1
Prunus divaricata	1
Ranunculus sp.	2
Geranium sp.	1
Rosa canina	1
Ficus carica	1
Rubus sp.	1
Sambucus ebulus	1
Anagallis arvensis	1

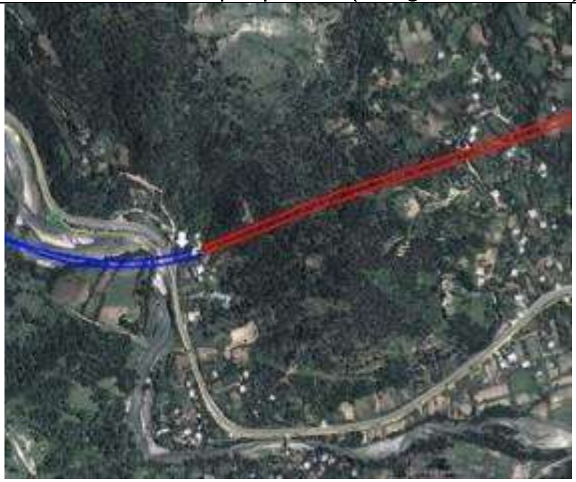
Low sensitivity area
area.


Blue-scarlet pimpernel *(Anagallis arvensis)*


Geranium sp.

After that point alignment runs through developed area (pastures, agricultural land plots). Vegetation is similar to that of unit 1, but in this section a number of trees reduces leaving space to shrubs and grasses (see some samples on the left).

Unit 3. Closer to the section where construction of a bridge and tunnel (indicative coordinates UTM T38 03659178E, 4663147N) is planned vegetation coverage is less. Plant species are not diverse. In the area the species listed under the unit 2 section are sometimes met.



In this section in oak-hornbeam forest area above the tunnel, protected oak species (*Quercus imeretina, vulnerable species)* is met – however, the species are not found in the project impact zone. They are present in the area above the tunnel. Another protected species –Walnut (*Juglans regia*) is found to be present in the residential zone, close to the houses.

Unit 4
UTM T38: 0360269E, 4663170N
Habitat: 9160GE-02 Oak or oak-hornbeam forests (Quercitum -Carpinion betuli)
Projection vegetation coverage: 60 %
Species list/ Species cover%

Carpinus caucasica	1
Carpinus orientalis	2
Prunus divaricata	1
Ranunculus sp.	1
Pinus sosnowskyi	1
Juglans regia	1
Rosa canina	1
Ficus carica	1
Rubus sp.	1
Quercus iberica	2
Quercus imeretina	1
Populus alba	1

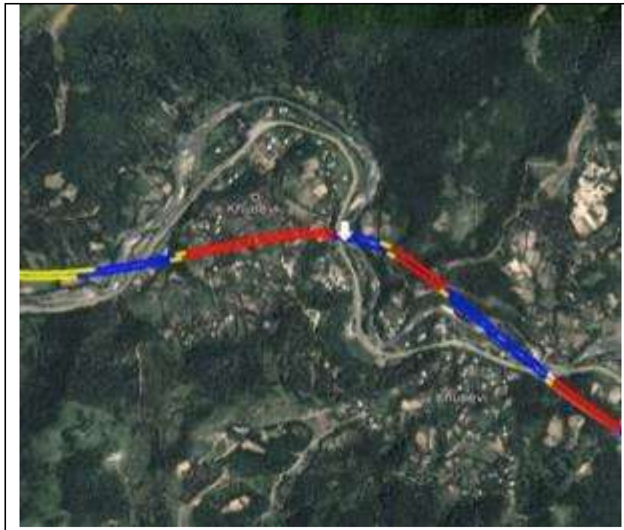
.

Unit 5. In the tunnel exit and the bridge construction area (indicative coordinates UTM T38 03616226E; 4663465N) the plants here are represented by alder and hornbeam with projection coverage 50%.

Species composition of the plants in this section of alignment are similar to this described under unit 1, viz:
European alder (*Alnus barbata*),
Oriental hornbeam (*Carpinus orientalis*),
Common ash (*Fraxinus excelsior*),
Honey locust (*Gleditsia triacanthos*),
Dogrose (*Rosa canina*),
Common fig (*Ficus carica*),
Blackberry (Rubus sp.),
Danewort (*Sambucus ebulus*).

Unit 6. The section where construction of the road is planned (area west to Khunevi) represents developed agricultural area with pastures and small forest massif. The landscape is agricultural. Forest – secondary. Indicative coordinates of the unit are UTM T38 0363342E, 4662891N.

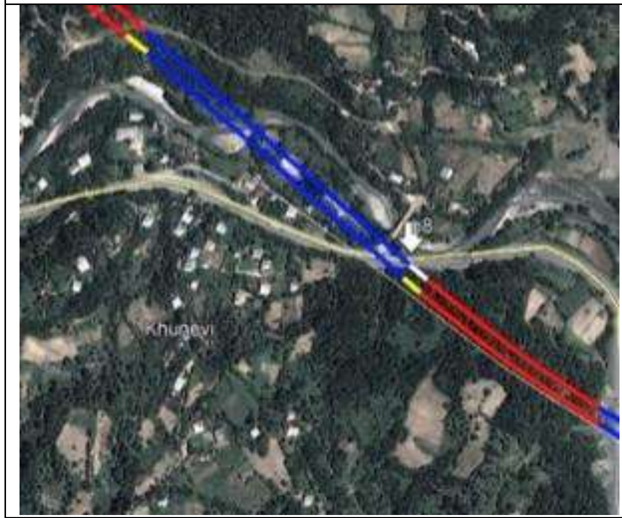
Species composition found in the area is similar to that of the Unit 2:
European alder (*Alnus barbata*),
Orinatal hornbeam (*Carpinus orientalis*),
Cherry plum (*Prunus divaricata*),
Dogrose (*Rosa canina*),
Blackberry (Rubus sp.),
Common fig (*Ficus carica*),
Buttercup (Ranunculus sp.),
Geranium (Geranium sp.),
Danewort (*Sambucus ebulus*),
Blue-scarlet pimpernel (*Anagallis arvensis*).



The following section – bridge, crossing existing road and the river. In this section riverine forest is crossed.

Unit 7
UTM T38: 0364629E, 4662944N
Habitat: 91E0* Alluvial forest with Adler trees - Alnus glutinosa and ash tree -Fraxinus excelsior
Projection vegetation coverage: 70 %
Species list/ Species cover%

Alnus barbata	1
Carpinus orientalis	2
Prunus divaricata	1
Ranunculus sp.	1
Salix alba	1
Robinia pseudoacacia	2
Fraxinus excelsior	1
Ficus carica	1
Rubus sp.	1
Quercus iberica	2
Populus alba	1

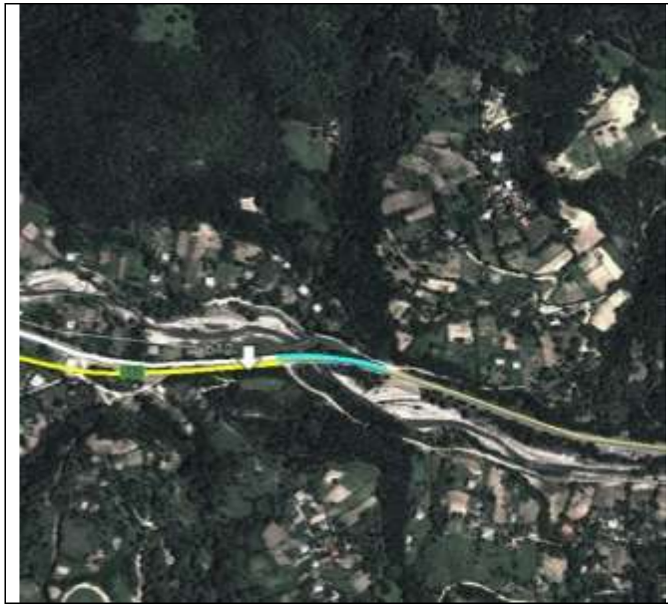


Within this section oak-hornbeam forest is registered. Neither protected species nor mature trees are registered in the impact area.

Unit 8
UTM T38: 0365336E; 4662486N
Habitat: 9160GE-02 Oak or oak-hornbeam forests (Quercitum -Carpinion betuli)
Projection vegetation coverage: 70 %
Species list/ Species cover%

Carpinus caucasica	2
Carpinus orientalis	3
Acer platanoides	1
Pinus sosnowskyi	2
Quercus iberica	2
Ficus carica	1
Rubus sp.	1
Gleditsia triacanthos	1

		**Unit 9**. UTM from T38 0365620E, 4662275N – till unit 10 (UTM coordinates T38 0366928E, 4662046N) - alignment crosses the road and the river, partly coinciding with existing road. Forested areas are bypassed via tunnels.
		**Unit 11**. Up to UTM T38 0367601E, 4661882N pine plantations, agricultural land and populated areas where such species as Cherry plum (*Prunus divaricate), Mulberry (Morus alba),* Common fig *(Ficus carica)* are present.

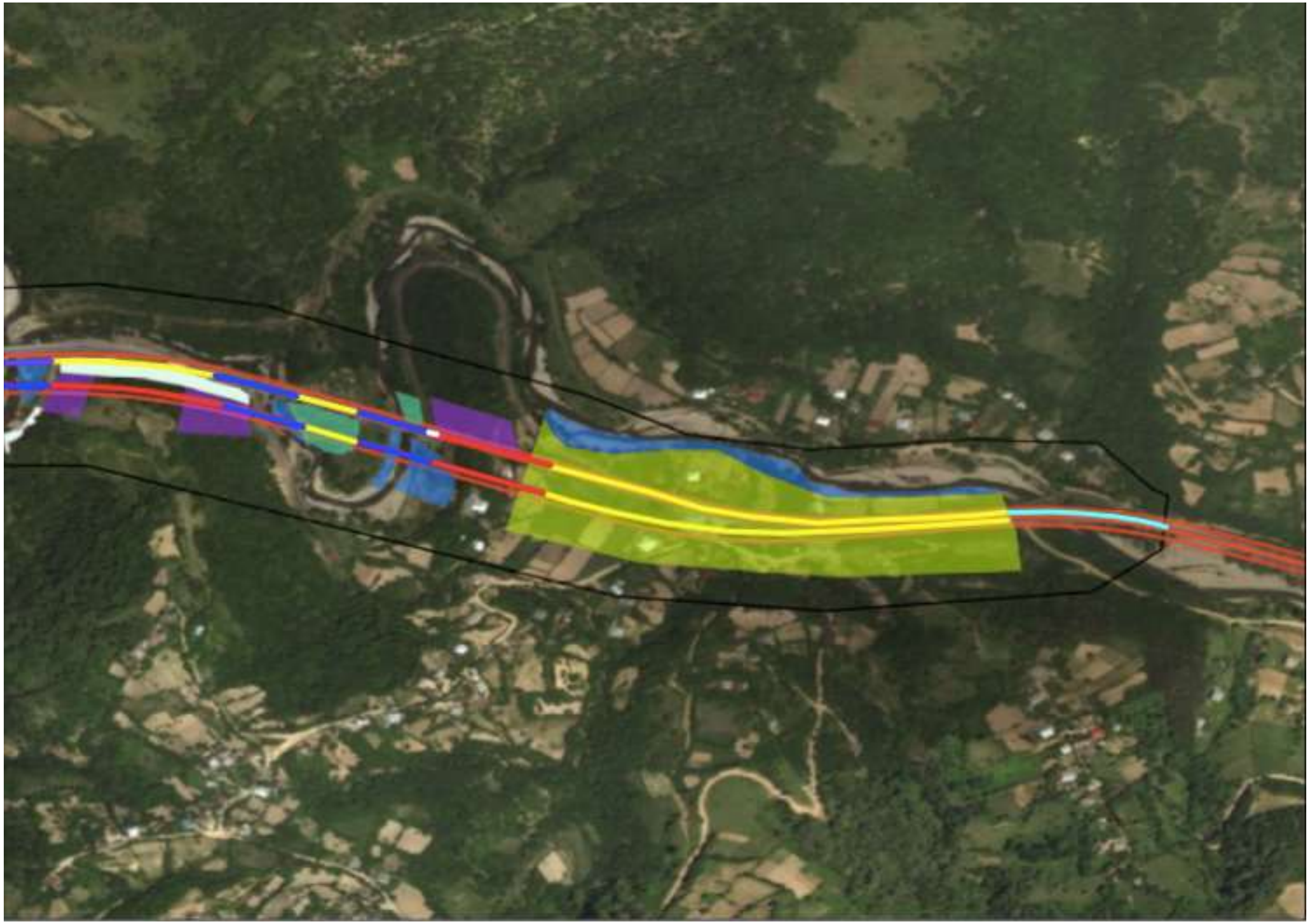


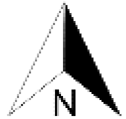
In some sections alignment follows existing road. In this section acacia, black locust and ‘artificial’ plantations (cyprus, cedar) are registered.

Unit 12
UTM T38 0368480E, 46616679N
Habitat: 9160GE-02 Oak or oak-hornbeam forests (Quercitum -Carpinion betuli)
Projection vegetation coverage: 35 %
Species list/ Species cover%

Carpinus caucasica	1
Carpinus orientalis	1
Acer laetum	1
Robinia pseudoacacia	2
Tilia begonifolia	1
Quercus iberica	1
Ficus carica	1
Cupressaceae sp.	1
Cedrus sp.	1

Figure 70: Corridor Habitat (KM0.0 – KM1.4)

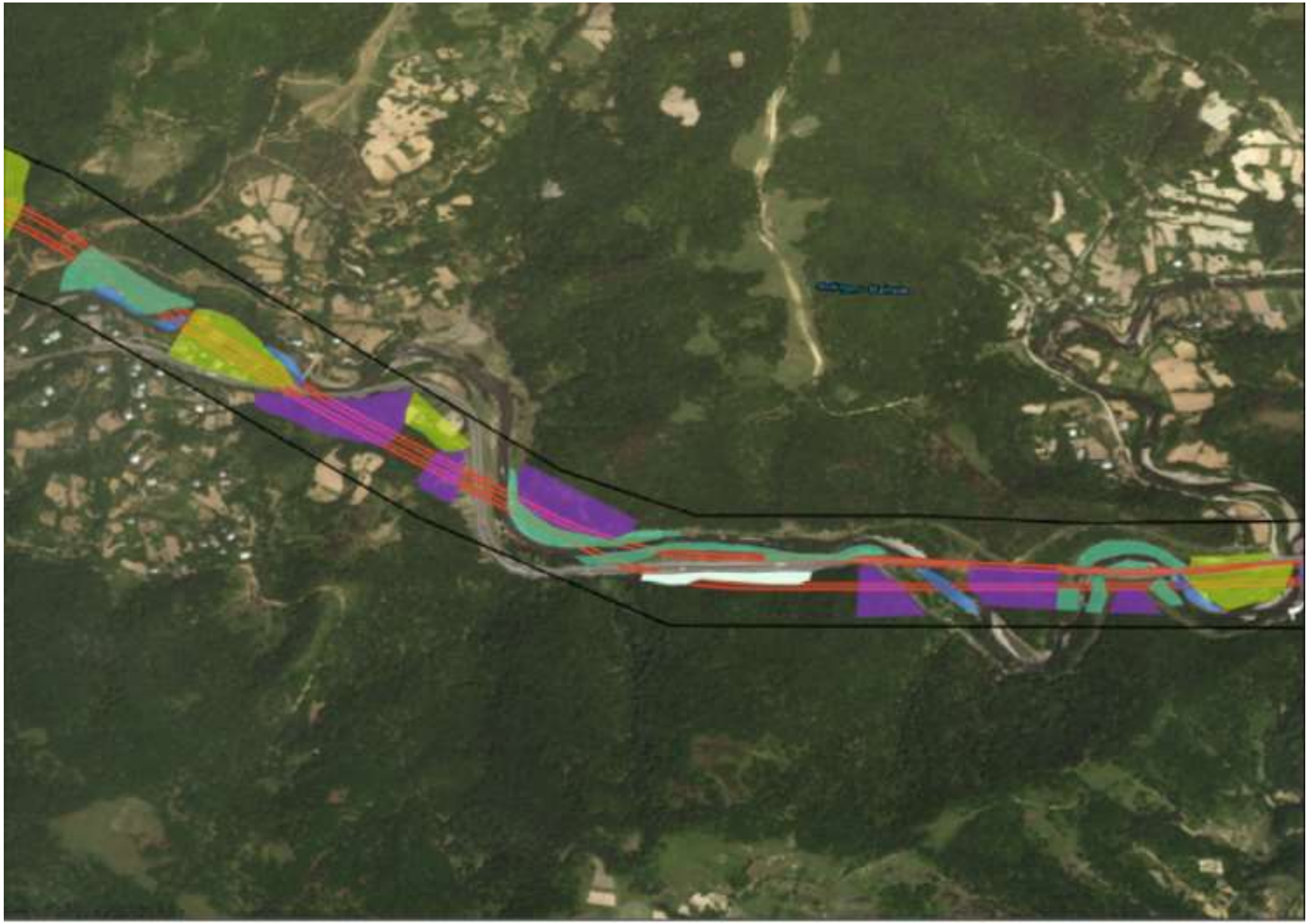


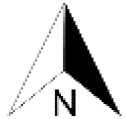


Colour	Code
Green	Vegetation of urban and rural areas (62GE04)
Purple	Oak or oak-hornbeam forests (Quercitum - Carpinion betuli) (9160GE)
Blue	Alluvial forest with Adler trees and Ash (910EO)
Dark blue	Clayey and rock riverine vegetation with duckweed (323GE)
White	Tilio-Acerion forests of slopes, screes and ravines (9180GE)

Note: Areas of no habitat mapping are tunnel locations.

Figure 71: Corridor Habitat (KM1.4 – 3.3)

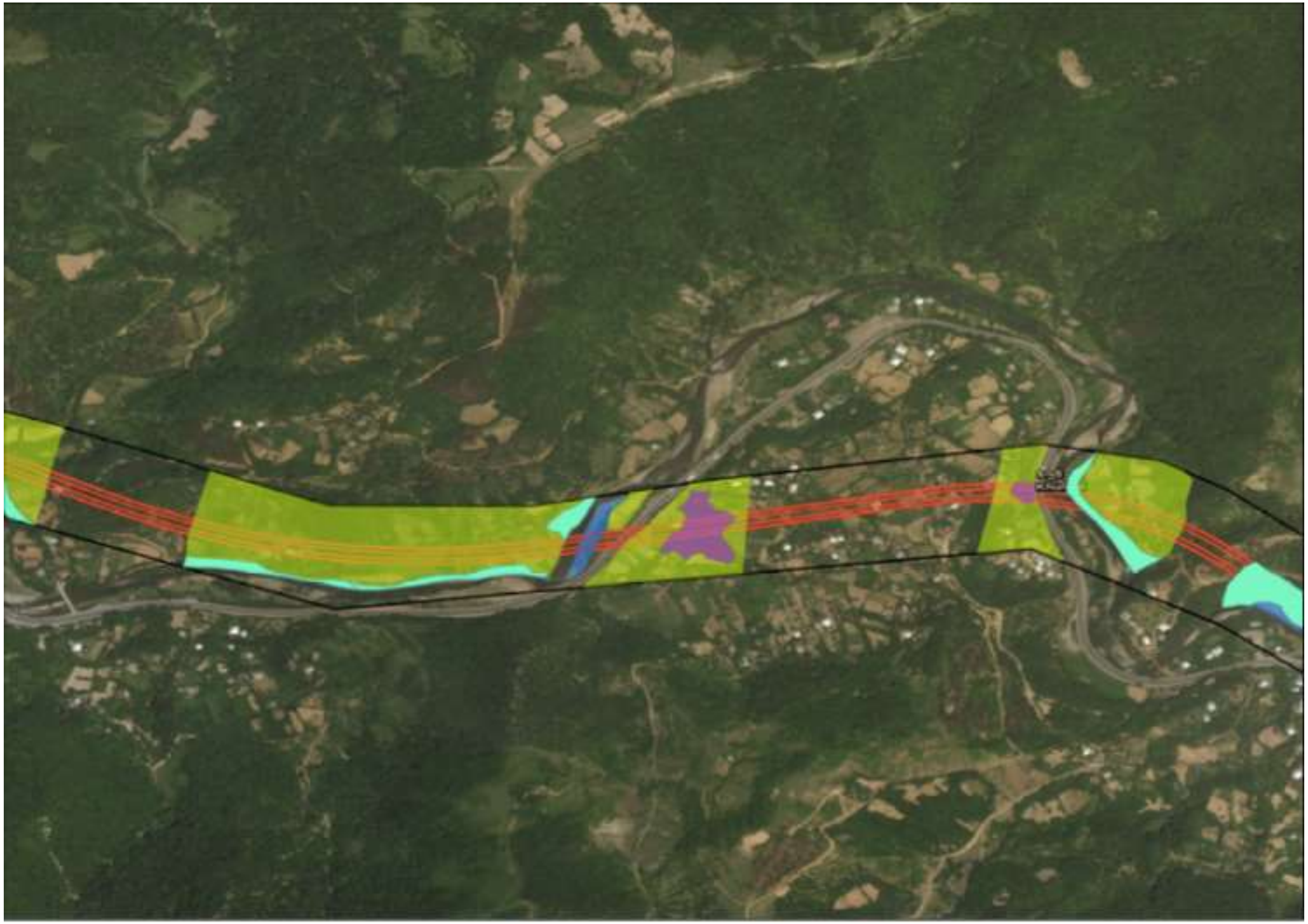


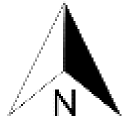


Colour	Code
Green	Vegetation of urban and rural areas (62GE04)
Purple	Oak or oak-hornbeam forests (Quercitum - Carpinion betuli) (9160GE)
Blue	Alluvial forest with Adler trees and Ash (910EO)
Dark blue	Clayey and rock riverine vegetation with duckweed (323GE)
White	Tilio-Acerion forests of slopes, screes and ravines (9180GE)

Note: Areas of no habitat mapping are tunnel locations.

Figure 72: Corridor Habitat (KM3.3 – KM5.3)

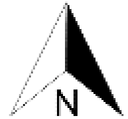




Colour	Code
Green	Vegetation of urban and rural areas (62GE04)
Purple	Oak or oak-hornbeam forests (Quercitum - Carpinion betuli) (9160GE)
Blue	Alluvial forest with Adler trees and Ash (910EO)
Dark blue	Clayey and rock riverine vegetation with duckweed (323GE)
White	Tilio-Acerion forests of slopes, screes and ravines (9180GE)

Note: Areas of no habitat mapping are tunnel locations.

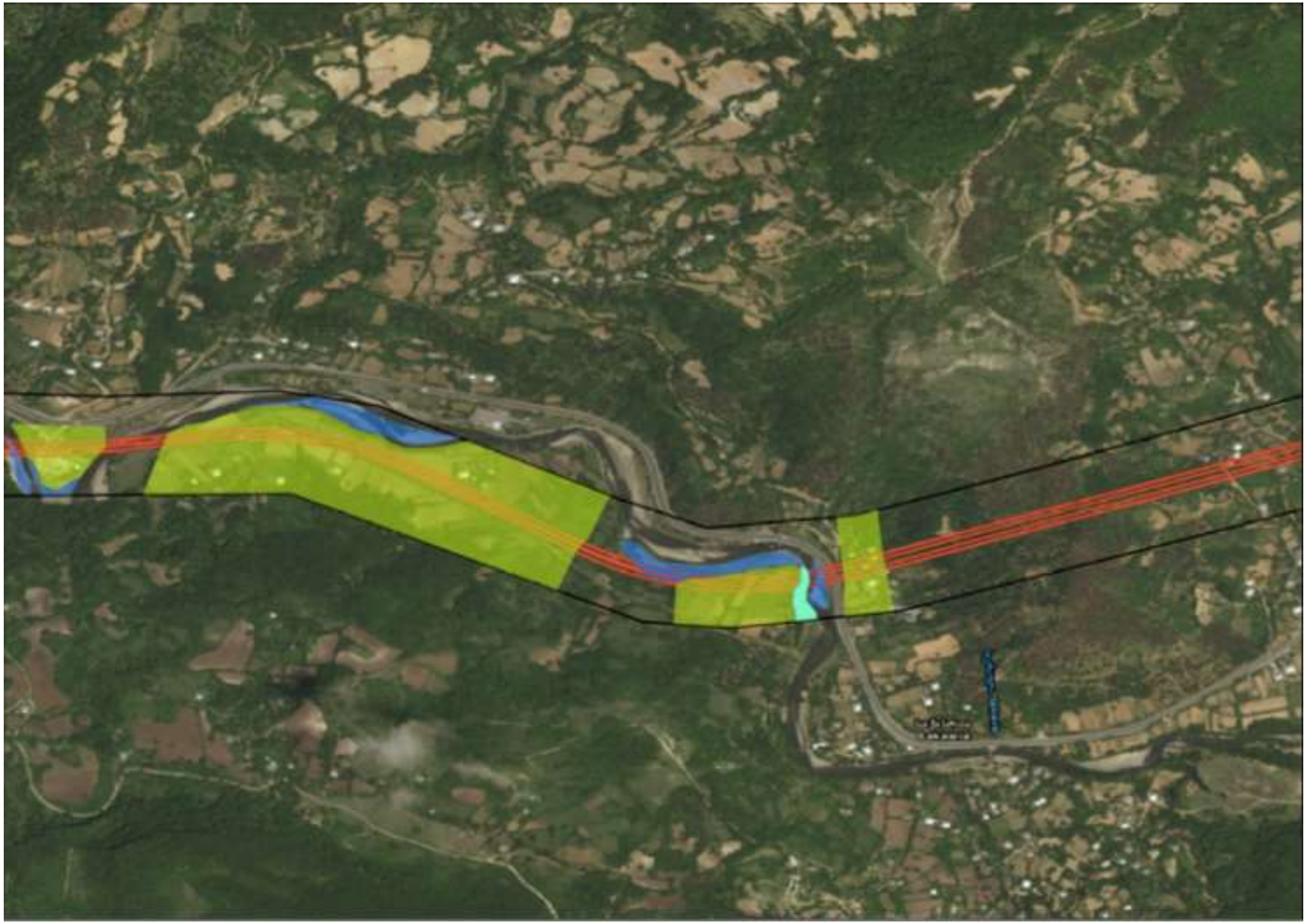
Figure 73: Corridor Habitat (KM5.3 – KM8.0

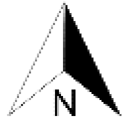


Colour	Code
Green	Vegetation of urban and rural areas (62GE04)
Purple	Oak or oak-hornbeam forests (Quercitum - Carpinion betuli) (9160GE)
Blue	Alluvial forest with Adler trees and Ash (910EO)
Dark blue	Clayey and rock riverine vegetation with duckweed (323GE)
White	Tilio-Acerion forests of slopes, screes and ravines (9180GE)

Note: Areas of no habitat mapping are tunnel locations.

Figure 74: Corridor Habitat (KM8.0 – KM10.0





Colour	Code
Green	Vegetation of urban and rural areas (62GE04)
Purple	Oak or oak-hornbeam forests (Quercitum - Carpinion betuli) (9160GE)
Blue	Alluvial forest with Adler trees and Ash (910EO)
Dark blue	Clayey and rock riverine vegetation with duckweed (323GE)
White	Tilio-Acerion forests of slopes, screes and ravines (9180GE)

Note: Areas of no habitat mapping are tunnel locations.

Figure 75: Corridor Habitat (KM10 – End)

N

Colour	Code
Green	Vegetation of urban and rural areas (62GE04)
Purple	Oak or oak-hornbeam forests (Quercitum - Carpinion betuli) (9160GE)
Blue	Alluvial forest with Adler trees and Ash (910EO)
Dark blue	Clayey and rock riverine vegetation with duckweed (323GE)
White	Tilio-Acerion forests of slopes, screes and ravines (9180GE)

Note: Areas of no habitat mapping are tunnel locations.

438. The Study Area does not meet the criteria for Critical Habitat because based on field survey, literature review and consultation it does not have high biodiversity value and does not support any of the qualifying interests as outlined in the table below. It is not located in a legally protected area or an area officially proposed for protection.

Critical, Natural and Modified Habitat
Critical habitats *are areas with high biodiversity value, including (i) habitat of significant importance to Critically Endangered and/or Endangered species; (ii) habitat of significant importance to endemic and/or restricted-range species; (iii) habitat supporting globally significant concentrations of migratory species and/or congregatory species; (iv) highly threatened and/or unique ecosystems; and/or (v) areas associated with key evolutionary processes.*
Natural habitats *are areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary ecological functions and species composition.*
Modified habitats *are areas that may contain a large proportion of plant and/or animal species of non-native origin, and/or where human activity has substantially modified an area's primary ecological functions and species composition. Modified habitats may include areas managed for agriculture, forest plantations, reclaimed coastal zones, and reclaimed wetlands.* [18]

439. Further, large portions of the Project road are located within tunnels (approximately 4km) which eliminates impacts to habitat in the areas above the tunnels (but not at the portals). Other portions of the road are located within agricultural and urban areas, classified as modified habitat.

440. However, there are numerous areas within the Project buffer zone which can be classified as natural habitat (If the habitat still largely contains the principal characteristics and key elements of its native ecosystem(s), such as complexity, structure and diversity, than it should be considered a natural habitat regardless of the presence of some invasive species, secondary forest, human habitation or other human-induced alteration[19]), these areas are shown below and include the State Forest Fund (SFF) areas identified as part of the SFF inventory.

Table 39: Area of Habitat Affected

Code	ha affected	% of total area in 100m corridor	Note
Vegetation of urban and rural areas (62GE04)	76.8	71.0	Agricultural / Modified
Oak or oak-hornbeam forests (Quercitum -Carpinion betuli) (9160GE)	12.14	11.2	Natural
Alluvial forest with Adler trees and Ash (910EO)	9.45	8.7	Natural

[18] IFC Performance Standard 6 Biodiversity Conservation and Sustainable Management of Living Natural Resources. January, 2012

[19] Guidance Note 6 - Biodiversity Conservation and Sustainable Management of Living Natural Resources. IFC 2012

Code	ha affected	% of total area in 100m corridor	Note
Clayey and rock riverine vegetation with duckweed (323GE)	10.18	9.4	Natural
Tilio-Acerion forests of slopes, screes and ravines (9180GE)	1.14	1.1	Natural
Total	**109.71**		
Total Natural Habitat Affected	**32.91**		

F.2.2 Fauna

441. Mammals - Information available from references (primary and secondary data sources) have been used as a basis for description of the area.

442. According to available information there are two species (Caucasian squirrel, Eurasian otter) considered as vulnerable in Georgia (Georgian Red List) that may be found within the Project area. The Otter is also included in the IUCN red list as nearly threatened (NT). During the site visit the list of species listed above was taken as guidance. Objective of the survey was to double check available information on the site. Particular attention was paid to detection of the species listed under protected category. Therefore, specific focus was on the study of the habitats suitable for these mammals.

443. Otter (*Lutra lutra*) is known to be found in Kvirila/Dzirula river basin, however the sources does not provide any information on community structure and number of species in the area of interest. The Otter is river associated species mainly met in slow flowing sections of the streams/rivers. It isn't uncommon for them to travel great distances on land or through the water. This can be up to 26 square kilometers. However, it is important to remember that otters home range differs from their territory. The actual territory that is distinctly their own is very small. Otters mark their habitat with droppings (spraints). So, they can be registered by smell (smell of fresh cut hay). Generally the otters are not afraid of people and can be met in the limits of residential areas. The aquatic habitats of otters are extremely vulnerable to man-made changes. Canalization of rivers, removal of bank side vegetation, dam construction, draining of wetlands, aquaculture activities and associated man-made impacts on aquatic systems are all unfavorable to otter population.

444. Site surveys undertaken by local ecologists did not reveal actual evidence of otters in the Project area, such as spraints and holts, but they did identify several locations which would provide suitable habitat for otters (see Figure 76 and Figure 77 below for the locations). However, other anecdotal and photographic evidence provided by the ADB shows that otters are present within the Project area, notably at the confluence of the Rikotula and Dzirula rivers (see Figure 78).

Figure 76: Habitat Identified as Suitable for Otters in the Project Area


38 356904.35 E, 4663421.41 N

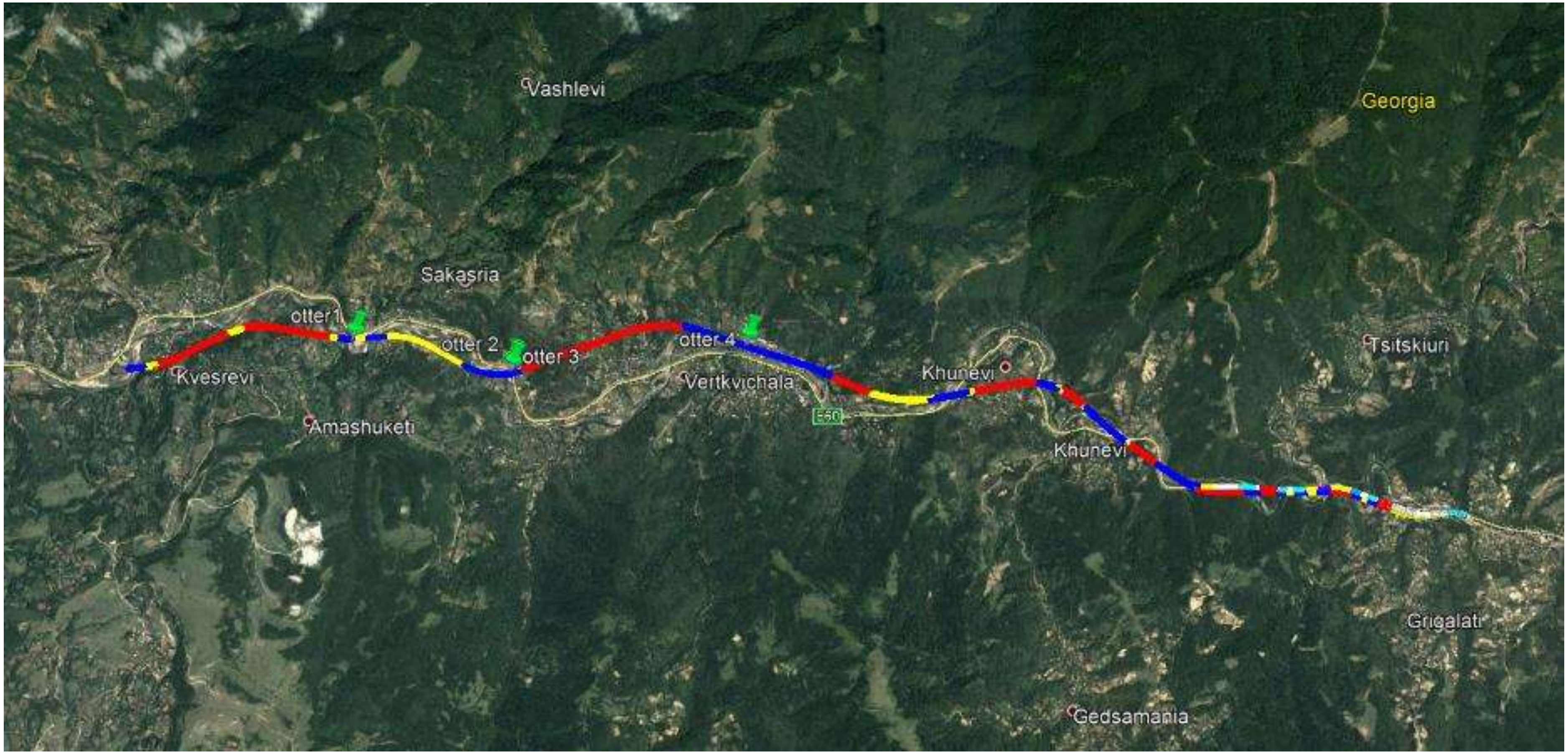

38 358819.37 m E 4663447.48 N


38 360145.62E, 4663181.88 N


38 360156.39 E, 4663157.54 N


38 362158.85 E 4663343.28N

Figure 77: Locations of Habitat Suitable for Otters



Green icons – locations of the sites (see pictures above),
Red line – tunnel
Yellow – new road
Blue – bridge
Light blue – existing bridge
White – existing road

Figure 78: Evidence of the Presence of Otters at the Confluence of Rikotula and Dzirula Rivers, April 2018

Source: Duncan Lang, ADB Environmental Specialist

445. Caucasian squirrel (Sciurus anomalus) can be met in the deciduous forest within the region. Their nests are usually found in the tree hollows, under rocks, inside heaps of stones, and in residential areas, such as graveyards and abandoned cattle sheds. They are diurnal, are not active in winter. The peak of activity is in summer Caucasian squirrels become most active during the early morning to morning and during the two hours before sunset in early summer. Like other tree squirrels, they are territorial. The animal marks territories with urine and faeces. The marks are renewed several times every day. There is no information available regarding home range. Caucasian squirrels are herbivorous; they eat seeds and fruits and therefore, likely have an important influence on the forest ecosystem as seed dispersers.

446. The habitats within the project area, where the squirrel can be found are:
(i) 9160GE Oak or oak-hornbeam forests (Quercitum -Carpinion betuli) and
(ii) 9180 GE Tilio-Acerion forests of slopes, screes and ravines.

447. The mentioned habitats are crossed in 6 locations. In these sections alignment goes mainly via tunnels, and/or run at the edge of the forested area. Presence of squirrels was checked during the range of the site surveys carried out in different hours. The surveys were carried out in August 8-9, 2017; September 22-23, 2017; March 1-2, 2018 and April 22-23, 2018. The site survey sessions included April – the period when the squirrels are most active. The surveyed corridor width was ranging from 50 to 250m depending on location. The presence of the squirrels in the direct impact zone of the project has not been registered.

448. <u>Bats</u> – Bats are considered as vulnerable group. They are rather limited in selection of nesting shelters. Favourable shelters are hollow trees, caves and abandoned buildings. All species of bats observed in Georgia are included in the Annex II of Bonn Convention and protected by the agreement of EUROBATS. Based on this agreement, Georgia is mandatory to protect all bats inhabiting the Project area and in its vicinities. No bat surveys were

completed as part of this EIA, however, based on literary sources the following species will possibly be found within the Project area:

(i) **Lesser horseshoe bat** (*Rhinolophus hipposideros* Bechstein – IUCN Status: LC) It forages close to ground within and along the edges of broadleaf deciduous woodland, which represents its primary foraging habitat, but also in riparian vegetation, Mediterranean and sub-mediterranean shrubland. Its prey consists mainly of midges, moths and craneflies. Foraging activities take place nearly exclusively within woodland areas, while open areas are avoided. Habitat loss and fragmentation may therefore reduce the amount of suitable habitats for the Lesser Horseshoe Bat and pose a threat to this species. Summer roosts (breeding colonies) are found in natural and artificial underground sites and in attics and buildings. In winter it hibernates in underground sites (including cellars, small caves and burrows). A sedentary species, winter and summer roosts are usually found within 5-10 km (longest distance recorded 153 km). Recommended conservation measures include protecting maternity roosting sites, hibernation caves and foraging habitats.

(ii) **Particoloured bat** (*Vespertilio murinus* – IUCN Status: LC) forages in open areas over various habitat types (forest, semi-desert, urban, steppe, agricultural land). It feeds on moths and beetles. Summer roosts tend to be situated in houses or other buildings; also rarely hollow trees, nest boxes, or rock crevices. Winter roost sites include rock fissures, often (as a substitute) crevices in tall buildings (including, or especially, in cities), occasionally tree holes or cellars. Winter roosts are usually in colder sites that are exposed to temperature changes. Migrations of up to 1,780 km have been recorded, although the species is sedentary in a large part of its range. This nocturnal species appears late in the evening, sleeping in narrow crevices during the day. It lives in small colonies and often single individuals are sighted. It hibernates throughout the winter. Young are born in June/July, generally 2 at a time, and are stuck onto the chest of the mother during flight.

(iii) **Common pipistrelle** (*Pipistrellus pipistrellus* Schreber – IUCN Status: LC) forages in a variety of habitats including open woodland and woodland edges, Mediterranean shrublands, semi-desert, farmland, rural gardens and urban areas. It feeds on small moths and flies. Summer roosts are mainly found in buildings and trees, and individuals frequently change roost site through the maternity period. Most winter roost sites are located in crevices in buildings, although cracks in cliffs and caves and possibly holes in trees may also be used. It is not especially migratory in most of its range, but movements of up to 1,123 km have been recorded. In at least parts of its range it seems to benefit from urbanization.

(iv) **Serotine** (*Eptesicus serotinus* Schreber – IUCN Status: LC) is found in a variety of habitats across its wide range including semi-desert, temperate and subtropical dry forest, Mediterranean-type shrubland, farmland and suburban areas. Favoured feeding areas include pasture, parkland, open woodland edge, tall hedgerows, gardens, and forested regions. Feeds on larger beetles, moths and flies. Most summer (maternity) colonies are in buildings and occasionally tree holes or rock fissures. In winter it roosts singly or in small numbers in buildings and rock crevices, or often in underground habitats in north central Europe. Winter roosts are usually in fairly cold, dry sites. It is a largely sedentary species, with movements to 330 km recorded.

Table 40: Mammals Identified Within the Project Area Based on Literary Sources

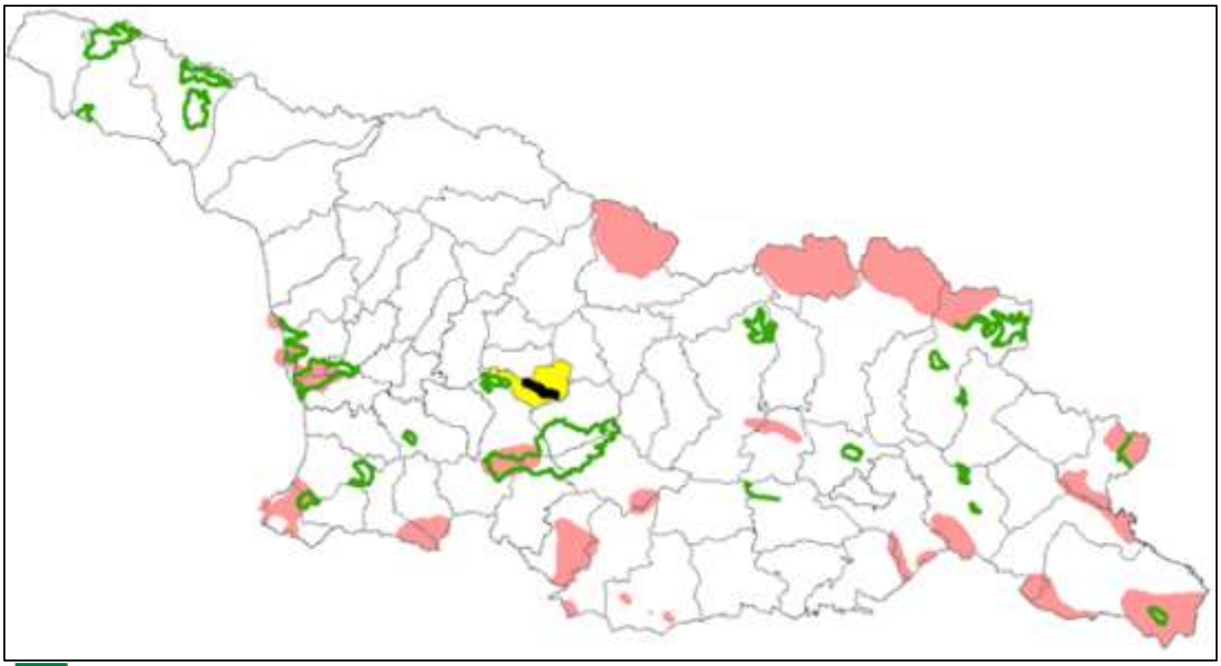
#	Latin name	Common name	GRL	IUCN	Other protection	Number of section
1.	*Erinaceus concolor Martin.*	Southern whitebreasted Hedgehog		LC		1/2/3/4/5
2.	*Suncus etruscus Savi.*	Pygmy whitetoothed shrew		LC	Appendix III of the Bern Convention.	1/2/3
3.	*Rhinolophus hipposideros Bechstein.*	Lesser horseshoe bat		LC	Bonn Convention (Eurobats); Bern Convention; Annex II (and IV) of EU Habitats and Species; Some habitat protection through Natura 2000	1/2/3
4.	*Pipistrellus pipistrellus Schreber.*	Common pipistrelle		LC	Bonn Convention (Eurobats); Bern Convention in parts of its range where these apply, and is included in Annex IV of the EU Habitats and Species Directive.	1/2/3
5.	*Eptesicus serotinus Schreber.*	Serotine		LC	Bonn Convention (Eurobats); Bern Convention in parts of range where these apply. It is included in Annex IV of EU Habitats and Species Directive, and there is some habitat protection through Natura 2000.	1/2/3
6.	*Vespertilio murinus Linnaeus.*	Particoloured bat		LC	Bonn Convention (Eurobats); Bern Convention, in parts of its range where these apply. It is included in Annex IV of EU Habitats and Species Directive	1/2/3//5
7.	*Dryomys nitedula Pallas.*	Forest dormouse		LC	Bern Convention (Appendix III); EU Habitats and Species Directive (Annex IV), in parts of its range where these apply.	1/2/3
8.	*Arvicola terrestris Linnaeus.*	Eurasian water vole		LC		4
9.	*Microtus arvalis Pallas.*	Common vole		LC		1/2/3/4/5
10.	*Terricola nasarovi Shidlovsky.*	Nazarov pine vole		LC		1/2/3
11.	*Sylvaemus uralensis Pallas.*	Pygmy wood mouse				1/2/3
12.	*Mus musculus Linnaeus.*	House mouse		LC		1/3/4/5
13.	*Sciurus anomalus Gmelin.*	Caucasian squirrel	VU	LC	EU Habitats Directive (92/43) IV 21/05/92; Bern Convention II 01/03/02, in parts of its range where these apply. Occurs in protected areas. Population monitoring is recommended, particularly in parts of the range where declines have been noted.	4/5

#	Latin name	Common name	GRL	IUCN	Other protection	Number of section
14.	*Lutra lutra Linnaeus.*	Eurasian otter, Common otter	VU	NT	Appendix I of CITES, Appendix II of the Bern Convention, Annexes II and IV of the EU Habitats and Species Directives.	3
15.	*Mustela nivalis Linnaeus.*	Least weasel		LC	Appendix III of the Bern Convention.	1/2/3/4/5
16.	*Felis silvestris Shreber.*	Wild cat		LC	CITES Appendix II (http://www.cites.org/eng/app/appendices.php); is fully protected across most of its range in Europe and Asia, but only some of its African range; is listed on the EU Habitats and Species Directive (Annex IV) as a "European protected species of animal"; listed in Appendix II of the Bern Convention. It is classed as threatened at the national level in many European range states (IUCN 2007).	4/5
17.	*Canis aureus Linnaeus.*	Golden jackal		LC		2/3/4
18.	*Vulpes vulpes Linnaeus.*	Red fox		LC		1/2/3/4
19.	*Canis lupus*	Wolf		LC	Bern, CITES Appendix II	2/4/5
20.	*Sus scrofa Linnaeus.*	Eurasian wild boar		LC		3/4
21.	*Martes martes*	European pine marten		LC	Appendix III of the Bern Convention and Annex V of the European Union Habitats Directive, and it occurs in a number of protected areas across its range.	4/5

GRL – Red List of Georgia; IUCN - International Union for Conservation of Nature; VU = Vulnerable; LC = Least Concern.
Note: From expert opinion the presence of Brown Bear and Lynx was considered to be unlikely

449. Avifauna - The majority of birds found on the study area are presented by forest, shrubbery and other species, birds related to rocky places and waterfowls. The list of bird species potentially available in the project area (based on the desk top analysis of available data) is given in Table 41 below. None of these species are protected. The territory is not significant habitat for birds and does not include priority habitats for avian species (see Figure 79**).**

Figure 79: Significant Bird Habitat in Georgia



Protected areas
Bird protection areas (IBAs)
Zestaphoni municipality
Study area

Table 41: Birds within the study area, known according to literary sources

#	Latin name	Common name	Georgian Red List	Season	IUCN	Other protection
1.	*Motacilla alba*	White Wagtail	-	YR-R, M	LC	Bern Convention
2.	*Apus apus*	Common Swift	-	BB, M	LC	Bern Convention
3.	*Merops apiaster*	European Bee-eater	-	BB, M	LC	
4.	*Corvus cornix*	Hooded Crow	-	YR-R	LC	
5.	*Garrulus glandarius*	Eurasian Jay	-	YR-R	LC	
6.	*Turdus merula*	Eurasian Blackbird	-	YR-R	LC	Bern Convention
7.	*Delichon urbicum*	House-Martin	-	BB, M	LC	Bern Convention
8.	*Sturnus vulgaris*	Common Starling	-	YR-R, M	LC	
9.	*Columba livia*	Rock Dove	-	YR-R	LC	
10.	*Columba oenas*	Stock Dove	-	YR-R	LC	
11.	*Columba palumbus*	Wood-Pigeon	-	YR-R	LC	
12.	*Hirundo rustica*	Barn Swallow	-	BB, M	LC	Bern Convention
13.	*Oriolus oriolus*	Golden Oriole	-	BB, M	LC	Bern Convention
14.	*Turdus viscivorus*	Mistle Thrush	-	YR-R, M	LC	Bern Convention

#	Latin name	Common name	Georgian Red List	Season	IUCN	Other protection
15.	*Erithacus rubecula*	European Robin	-	YR-R	LC	Bern Convention
16.	*Fringilla coelebs*	Chaffinch	-	YR-R, M	LC	Bern Convention
17.	*Cuculus canorus*	Common Cuckoo	-	BB, M	LC	Bern Convention
18.	*Phoenicurus phoenicurus*	Common Redstart	-	BB, M	LC	Bern Convention
19.	*Passer domesticus*	House Sparrow	-	YR-R	LC	
20.	*Carduelis carduelis*	European Goldfinch	-	YR-R, M	LC	Bern Convention
21.	*Carduelis chloris*	Greenfinch	-	YR-R, M	LC	Bern Convention
22.	*Parus major*	Great Tit	-	YR-R	LC	Bern Convention
23.	*Parus caeruleos*	Blue tit	-	YR-R	LC	Bern Convention
24.	*Lanius collurio*	Red-backed Shrike	-	BB, M	LC	Bern Convention
25.	*Turdus philomelos*	Song Thrush	-	YR-R, M	LC	Bern Convention
26.	*Aegithalos caudatus*	Long-tailed Tit	-	YR-R, M	LC	Bern Convention
27.	*Falco tinnunculus*	Common Kestrel	-	YR-R, M	LC	Bonn Convention, Bern Convention
28.	*Buteo buteo*	Common Buzzard	-	YR-R, M	LC	Bonn Convention, Bern Convention
29.	*Ardea cinerea*	Grey Heron	-	YR-R	LC	Bonn Convention, Bern Convention
30.	*Egretta garzetta*	Little Egret	-	YR-R	LC	
31.	*Nycticorax nycticorax*	Night-Heron	-	BB, M	LC	Bonn Convention, Bern Convention
32.	*Tadorna ferruginea*	Ruddy Shelduck	-	YR-R	LC	
33.	*Anas platyrhynchos*	Mallard	-	YR-R, M	LC	Bonn Convention, Bern Convention
34.	*Milvus migrans*	Black Kite	-	YR-R, M	LC	Bonn Convention, Bern Convention
35.	*Accipiter nisus*	Sparrowhawk	-	YR-R, M	LC	Bonn Convention, Bern Convention
36.	*Accipiter gentilis*	Goshawk	-	YR-R, M	LC	Bonn Convention, Bern Convention
37.	*Larus ridibundus*	Black-headed Gull	-	YR-R, M	LC	
38.	*Upupa epops*	Common Hoopoe	-	BB, M	LC	Bern Convention
39.	*Corvus frugilegus*	Rook	-	YR-R, M	LC	
40.	*Luscinia megarhynchos*	Luscinia megarhynchos	-	BB, M	LC	
41.	*Phylloscopus collybita*	Common Chiffchaff	-	BB, M	LC	
42.	*Sylvia atricapilla*	Blackcap	-	BB, M	LC	

GRL- Red List of Georgia; IUCN - International Union for Conservation of Nature;
YR-R = nests and reproduces in the area, can be found all year round; YR-V = visitor to these areas. It does not reproduce but is here throughout the year. BB = visits the area only for reproduction
M = Migratory; it can get to the area during migration (in autumn and spring)
LC = Least Concern.

450. Surveys were carried out in: Aug 8-9 2017 - summer, Sept 22-23 2017- autumn; March 1-2 2018 – spring; April 2015 - spring (feasibility stage walkover); and April 22-23, 2018. The

schedule allowed a site survey for April which is the start of the breeding period. (Note: Breeding period is April-May, for some species – end of March.). Raptors are not registered in the area, but may be observed there while chasing a prey. Birds registered during the site surveys and information about their presence in the area is presented below.

Table 42: Birds, observed within the project area during the survey

#	Latin name	Common name	Georgian Red List	Season	IUCN	Other protection
1.	*Motacilla alba*	White Wagtail	-	YR-R, M	LC	Bern Convention
2.	*Apus apus*	Common Swift	-	BB, M	LC	Bern Convention
3.	*Merops apiaster*	European Bee-eater	-	BB, M	LC	-
4.	*Charadrius dubius*	Little Ringed Plover	-	YR-R, M	LC	Bonn Convention, Bern Convention
5.	*Larus ridibundus*	Black-headed Gull	-	YR-R, M	LC	Bern Convention
6.	*Corvus cornix*	Hooded Crow	-	YR-R	LC	-
7.	*Garrulus glandarius*	Eurasian Jay	-	YR-R	LC	-
8.	*Turdus merula*	Eurasian Blackbird	-	YR-R	LC	Bern Convention
9.	*Delichon urbicum*	House-Martin	-	BB, M	LC	Bern Convention
10.	*Upupa epops*	Common Hoopoe	-	BB, M	LC	Bern Convention
11.	*Luscinia megarhynchos*	Luscinia megarhynchos	-	BB, M	LC	-
12.	*Turdus viscivorus*	Mistle Thrush	-	YR-R, M	LC	Bern Convention
13.	*Erithacus rubecula*	European Robin	-	YR-R	LC	Bern Convention
14.	*Fringilla coelebs*	Chaffinch	-	YR-R, M	LC	Bern Convention
15.	*Phoenicurus phoenicurus*	Common Redstart	-	BB, M	LC	Bern Convention
16.	*Passer domesticus*	House Sparrow	-	YR-R	LC	-
17.	*Carduelis carduelis*	European Goldfinch	-	YR-R, M	LC	Bern Convention
18.	*Parus major*	Great Tit	-	YR-R	LC	Bern Convention
19.	*Parus caeruleos*	Blue tit	-	YR-R	LC	Bern Convention
20.	*Aegithalos caudatus*	Long-tailed Tit	-	YR-R, M	LC	Bern Convention
21.	*Lanius collurio*	Red-backed Shrike	-	BB, M	LC	Bern Convention
22.	*Phylloscopus collybita*	Common Chiffchaff	-	BB, M	LC	
23.	*Turdus philomelos*	Song Thrush	-	YR-R, M	LC	Bern Convention
24.	*Sylvia atricapilla*	Blackcap	-	BB, M	LC	

GRL- Red List of Georgia; IUCN - International Union for Conservation of Nature;
YR-R = nests and reproduces in the area, can be found all year round.; YR-V = visitor to these areas. It does not reproduce but is here throughout the year. BB = visits the area only for reproduction;
M = Migratory; it can get to the area during migration (in autumn and spring)
LC = Least Concern.

451. The project area is located far from protected areas and areas important for birds (see figure below). The area is not considered as migration corridor.

Figure 80: Overwintering Sites

(Project road in yellow, overwintering sites in red)

452. Reptiles - According to the literary sources, 8 species of reptiles are known to be present in the study area, out of which 2 are lizards, 2 – turtles and 4 – snakes. The only Red-Listed Vulnerable species that is recorded on the nearby territory of the Project road is Mediterranean turtle. This species prefers dry, open scrubby habitats, meadows and pastures, sand dunes, forest, heathlands, and open habitats through its wide range, generally on a sandy-calcareous substrate. The turtle is feeding on leaves, buds, flowers, seeds and fruits of grasses, herbs and shrubs, as well as small invertebrates such as snails, arthropods, and carrion. They emerge from hibernation around March or April depending on the weather. The species are vulnerable to death/injury when in hibernation and less able to escape from disturbance. They are vulnerable to disturbance during breeding season.

Table 43: Reptiles, known within the project area based on literary sources

#	Latin name	Common name	Georgian Red List	IUCN	Other protection
1.	*Natrix natrix* Linnaeus.	Ring snake	LC	LR/LC	Bern Convention
2.	*Natrix tessellate* Laurenti.	Dice snake	LC	LC	Bern Convention
3.	*Coronella austriaca* Laurenti.	Smooth snake	LC	LC	Bern Convention
4.	*Xerotyphlops vermicularis* Strauch.	Blind Snakes	DD	LC	Bern Convention
5.	*Darevskia derjugini*	Artwin Lizard	LC	LC	Bern Convention
6.	*Testudo graeca* Linnaeus	Mediterranean turtle	VU	VU	Bern Convention, the species is included in CITES Appendix II, Habitat Directive

#	Latin name	Common name	Georgian Red List	IUCN	Other protection
7.	*Emys orbicularis*	European Pond Turtle	LC	NT	Bern Convention
8.	*Lacerta strigata*	Striated Lizard	LC	LC	Bern Convention
9.	*Darevskia rudis*	Spiny-Tailed Lizard	LC	LC	Bern Convention
10.	*Anguis colchica*	Caucasian Slow Worm	LC	LC	Bern Convention

VU = Vulnerable; NT = Near Threatened and LC = Least Concern, LR = Low risk, DD-Data Deficient

453. Site surveys were carried out in Aug 8-9 2017- summer, Sept 22-23 2017- autumn, March 1-2 2018 – spring and April 22-23, 2018. Activity of the species depends on weather. In summer, because of the hot weather activity of reptiles was low as they were avoiding overheating. In July and August they can be registered only in the morning and late evening when it is not too hot. During the August and September site survey only the Artwin lizards have been registered. The reptiles usually appear at the end of March. Peak of activity is from mid March until mid June which is the reproduction period. During the March and April surveys the snakes were not registered, however their presence in the areas where lizards are found exists. During the site survey Striated Lizard (4 units). Artwin lizard (3 units) and Slow worm (3 units) have been registered. The Mediterranean turtle was not encountered.

Figure 81: Reptiles Encountered During Site Surveys

Striated Lizard *(Lacerta strigata)*

Derjugin's Lizard/ Artwin Lizard (*Darevskia derjugini*)

Anguis colchica CamonaTvalSi ar aris

454. <u>Amphibians</u> **-** According to the literary sources, the main amphibian species present in the area include:

Table 44: Amphibians, known within the project area based on literary sources

№	Latin name	Common name	GRL	IUCN	Other protection	Section N
1.	*Hyla orientalis* Linnaeus	European Tree Frog	LC	LC	Bern Convention	4/5
2.	*Bufotes viridis*	European green toad	LC	LC	Bern Convention	4/5
3.	*Pelophylax ridibundus* Pallas.	Marsh frog	LC	LC	Bern Convention	3/4
4.	*Rana macrocnemis camerani* Boulenger.	Long-legged Wood Frog	LC	LC	Bern Convention	4/5

GRL- Red List of Georgia; IUCN - International Union for Conservation of Nature; LC = Least Concern

455. During the site survey the listed species have one individual Marsh frog, tadpole and Long-legged wood frog have been registered near the Dzirula riverbed.

Figure 82: Amphibians Identified During Sites Surveys



Marsh frog (*Pelophylax ridibundus*)


Long-legged wood frog (*Rana macrocnemis*)

456. Insects - The insects know to be present in the project area are listed below.

Table 45: Insects known within the project area based on literary sources

#	Latin Name	Common name	Georgian Red List	IUCN
1.	*Nimphalis antiopa*	Mourning-cloak butterfly	NE	NE
2.	*Lampyris noctiluca*	Glow-worm	NE	NE
3.	*Geotrupes spiniger*	Dumbledor beetle	NE	NE
4.	*Purpuricenus budensis*	Red long-horned Beetle	NE	LC
5.	*Polyommatus amandus*	Amanda's blue butterfly	NE	NE
6.	*Polyommatus corydonius*	False chalkhill blue butterfly	NE	NE
7.	*Polyommatus thersites*	Chapman's blue butterfly	NE	NE
8.	*Cercopis intermedia*	Froghopper	NE	NE
9.	*Vanessa atalanta*	Red admiral butterfly	NE	NE
10.	*Mylabris quadripunctata*	Four-spotted blister beetle	NE	NE
11.	*Dorcus parallelipipedus*	Lesser stag beetle	NE	LC
12.	*Libellula depressa*	Broad-bodied chaser	NE	NE
13.	*Pieris rapae*	European cabbage butterfly	NE	NE
14.	*Plebeius argus*	Silver-studded blue butterfly	NE	NE
15.	*Aphis urticata*	Dark green nettle aphid	NE	NE
16.	*Pieris brassicae*	Cabbage butterfly	NE	NE
17.	*Pyrrhocoris apterus*	Firebug	NE	NE
18.	*Lymantria dispar*	Gypsy moth	NE	NE
19.	*Gryllus campestris*	Field cricket	NE	NE
20.	*Decticus verrucivorus*	Wart-biter	NE	NE
21.	*Tettigonia viridissima*	Great green bush-cricket	NE	NE
22.	*Sympetrum sp.*	Meadowhawks	NE	NE
23.	*Panorpa sp.*	Scorpion-flies	NE	NE
24.	*Lampyris noctiluca*	Common glow-worm	NE	NE

GRL- Red List of Georgia; IUCN - International Union for Conservation of Nature; NE-not evaluated

457. Within the project area Red cricket, blue railed damselfly have been met. No butterflies were registered.

Figure 83: Species Encountered During Site Surveys

Meadowhawk (Simpetrum sp.)

Scorpion-fly (Panorpa sp.)

Table 46: Spiders known within the project area based on literary sources

#	Latin name	Common name	Georgian Red List	IUICN
1.	*Pseudeuophrys sp*	jumping spiders	NE	NE
2.	*Trochosa sp.*	wolf spider	NE	NE
3.	*Amaurobius sp.*	araneomorph spiders	NE	NE
4.	*Argiope lobata*	Silver-faced	NE	NE
5.	*Menemerus semilimbatus*	Jumping spiders	NE	NE
6.	*Pardosa hortensis*	Wolf spiders	NE	NE
7.	*Larinioides cornutus*	Furrow orb spider	NE	NE
8.	*Misumena vatia*	Goldenrod crab spider	NE	NE
9.	*Pisaura mirabilis*	Nursery web spider	NE	NE
10.	*Micrommata virescens*	Green huntsman spider	NE	NE
11.	*Agelena labyrynthica*	Eurasian grass spiders	NE	NE
12.	*Asianellus festivus*	Jumping spiders	NE	NE

GRL- Red List of Georgia; IUCN - International Union for Conservation of Nature; NE-not evaluate

F.2.3 Aquatic Ecology

458. **Fish –** Table 47 indicates the fish species that can be found in the Project area based on literary sources and anecdotal information. The Colchic Nase (Capoeta Sieboldi) is listed as vulnerable of the Georgian Red-list.

Table 47: List of fish species available in the Rikotula and Dzirula River

#	Latin name	Common name	Protection status
1	Leuciscus leuciscus Linnaeus, 1758	Common dace	Low commercial value; IUCN – LC
2	Chondrostoma colchicum Derjugin, 1899 /Chondrostoma colchicum (Kessler) Derjugin	Colchic nase	Low commercial value due to limited stock. IUCN – LC
3	Capoeta sieboldi Steindachner, 1864/Varicorhinus sieboldin (Steindachner)	Colchic khramulya	GRL-VU (B2a)
4	Neogobius fluviatilis, Pallas 1814/ Gobius fluviatilis Pallas	Monkey goby	GRL-VU (B2a), IUCN – LC
5	Cobitis taenia Linnaeus, 1758	Spined loach	Bern Convention, Annex III, IUCN –LC
6	Alburnus alburnus, Linnaeus, 1758	Bleak	IUCN - LC

IUCN-The International Union for Conservation of Nature; GRL – Red List of Georgia
LC – Least Concern; NE - Not Evaluated; VU-Vulnerable

Source: N.Ninua, B.Japoshvili, V.Bochorishvili – Fish of Georgia, 2013/R.Elanidze, M.Demetrashvili, Animal worls of Georgia, IV, 1973

459. The active spawning periods of these fish are indicated in Figure 85.

460. Control catches have been carried out in during the March and April surveys. Three locations were checked.

(i) Sp1 - 366940.00 m E, 4662205.00 m N (r.Rikorula).
(ii) Sp2 - 365045.00 m E, 4662651.00 m N (r.Dzirula).
(iii) Sp3 - 362154.00 m E, 4663386.00 m N (r.Dzirula).

Figure 84: Control points in Dzirula and Rikotula rivers, Section F2 of alignment

461. Similarly to composition of the control catches in Section F4 the species registered in studied sections of F2 included Colchic khramulya (3 units) and Chub (2 units). Length 25-35cm, weight 230-350 grams. In addition one Colchic Nase (Capoeta Sieboldi), a Georgian Red-list species, was caught.

Table 48: Species Found as the Result of Fishing in the Project Area

Common name	Latin name	Qty	**Length, cm**	**Weight, g**	**Gender and maturity stage**	**Age**
Barbel	*Barbus tauricus rionica* Kamensky, 1899	1	14.5	52	♂ III	3⁺
Colchic khramulya	*Capoeta sieboldi* Steindachner, 1864	3	18.0	64	♂ III	4⁺
			32	372	♀ V	4⁺
			24	225	♂ V	3⁺
Common dace	*Leuciscus leuciscus* Linnaeus, 1758	1	27	358	♀ V	3
Colchic nase	*Chondrostoma colchicum* Derjugin, 1899	1	17.5	94	♂ III	3⁺

Figure 85: Active Spawning Periods

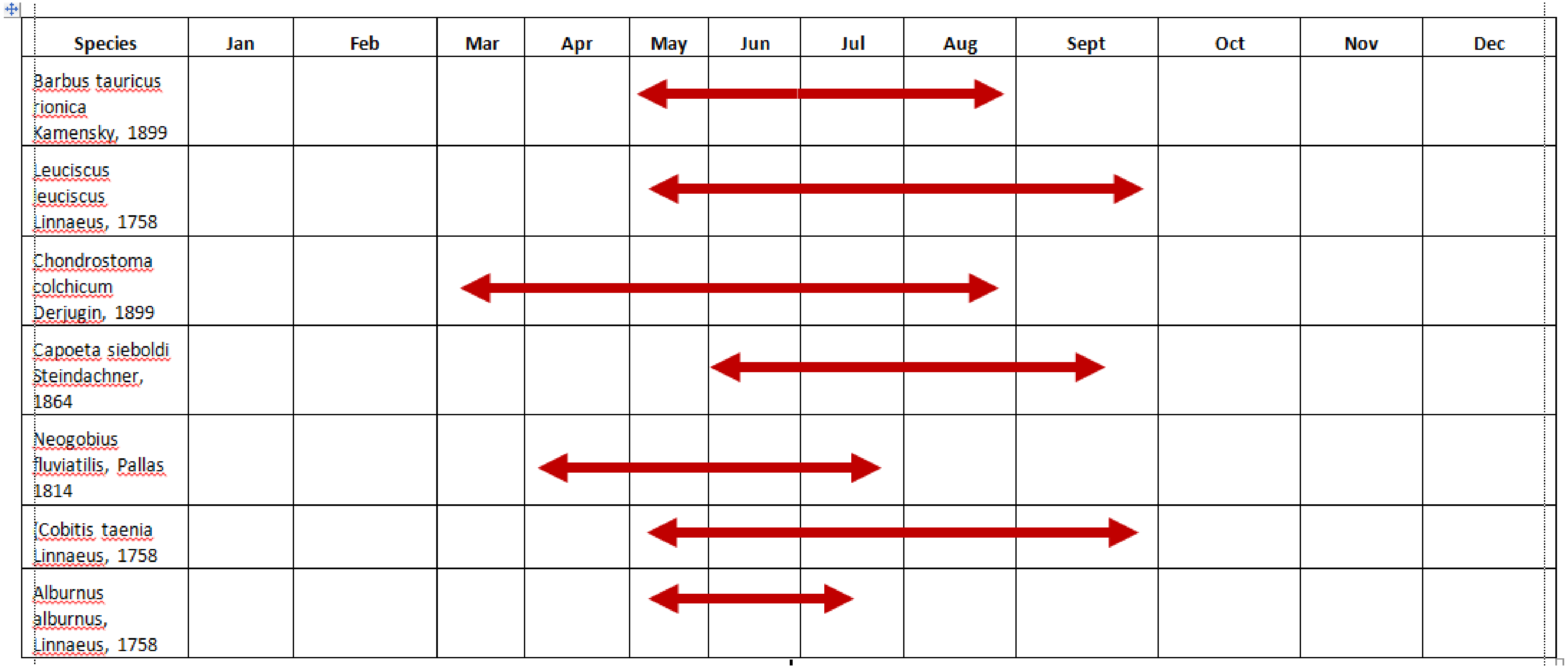


Figure 86: Controlled Catches

Barbel (*Barbus tauricus rionica* Kamensky, 1899), Colchic khramulya (*Capoeta sieboldi* Steindachner, 1864)

Colchic nase (*Chondrostoma colchicum* Derjugin, 1899)

Colchic khramulya (*Capoeta sieboldi* Steindachner, 1864)

Common dace (*Leuciscus leuciscus* Linnaeus, 1758)

462. No fish was obtained during the control catches in the Rikotula river.

463. Hydro chemical and hydro biological survey data - The survey covered locations near the river crossing sections in the Dzirula and Rikotula rivers. The basic characteristics measured on the site are listed below.

Table 49: Chemical Characteristics of the Dzirula and Rikotula Rivers

Dzirula river	
Suspended solids	14 mg/l
Dissolved oxygen	10.8 mg/l
pH	7.0
Water temperature	$+11^0$ C
Air temperature	+210 C
Rikorula river	
Suspended solids	26 mg/l
Dissolved oxygen	6.3 mg/l
pH	6,5
Water temperature	+120 C
Air temperature	+210 C

464. For assessment of availability of fish base for fish, macro-invertebrate and aquatic plants in 18 sections have been checked. On the stones within the riverbed various species were

registered (see Figure 87). The surveys allow us to say that aquatic flora is abundant, whereas colonies of macro-invertebrates are observed in fragmented areas.

Figure 87: Survey Locations

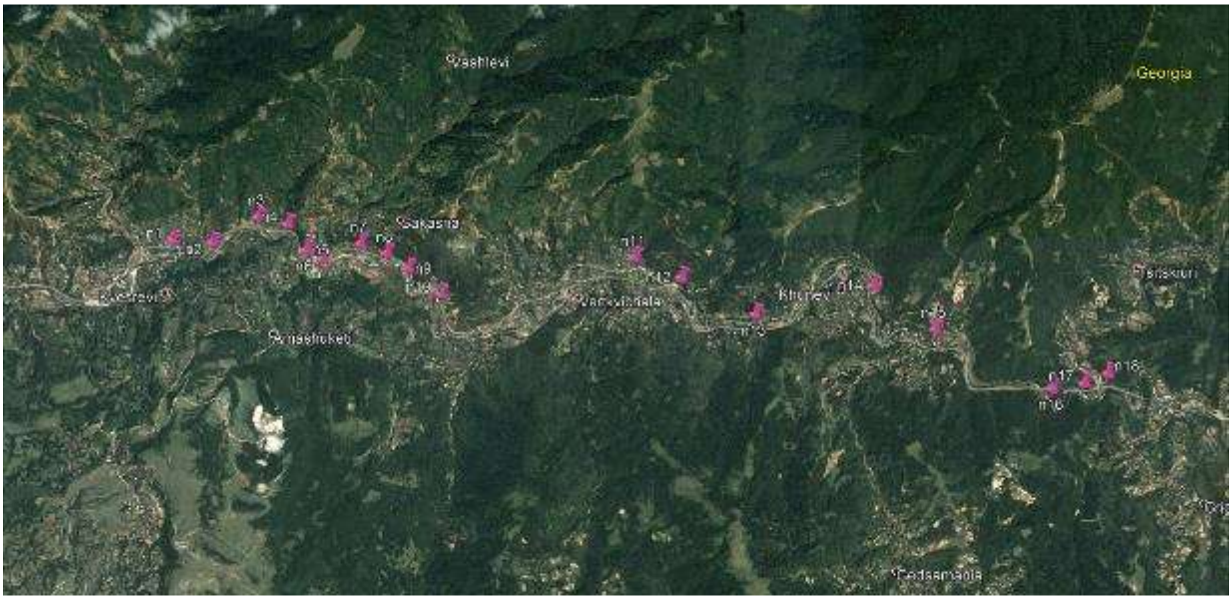


Figure 88: Aquatic Plants and Periphyton Surveyed

Ciironomidae

Chironomidae

Ulothrix

Larva of Culex pipiens Linnaeus, 1758

3 Dugesiidae; Erpobdellidae; Chironomidae

Chironomidae

Erpobdellidae

Ulothrix

Ulothrix

Ulothrix

Ulothrix colonies

Ulotrix colonies

F.2.4 State Forest Fund

465. The State Forest Fund (SFF) is a state-managed/controlled forest area under the management of the MoEPA but is not a protected area. Though it is not protected, for the purpose of controlling its use, the MoEPA requires all trees to be taken of the SFF registration or "de-listed" before they can be cut.

466. According to the ToR for this EIA:
"Particular attention should be given to the presence of land plots registered as the State Forest Fund (SFF). If the right of the way of the selected alignment of the road section overlaps with the territory of the SFF, The consultant should prepare:

- (i) *Cadastral measurement drawing for the relevant plot of the alignment (.shp files);*
- (ii) *According to the effective law, conduct preliminary inventory of timber resources existing at the territory, which should be taken of the SFF registration, or 'de-listed';*
- (iii) *In accordance with the Georgian legislation, provide relevant information on obtaining a cutting permit for species included in the Red List (if any);*
- (iv) *Prepare Tree Compensation Plan according to the de-listing documentation"*

467. The Project area has been surveyed to determine the extent of the SFF that will be affected by the Project.

468. An inventory of the timber resources has also been prepared which is summarized in **Appendix G**. A total of 4,896 trees more than 8cm in diameter were recorded for de-listing, including the following Georgian red-listed species:

- (i) 16 Chestnut (greater than 8cm in diameter).
- (ii) 2 English Walnut (greater than 8cm in diameter).

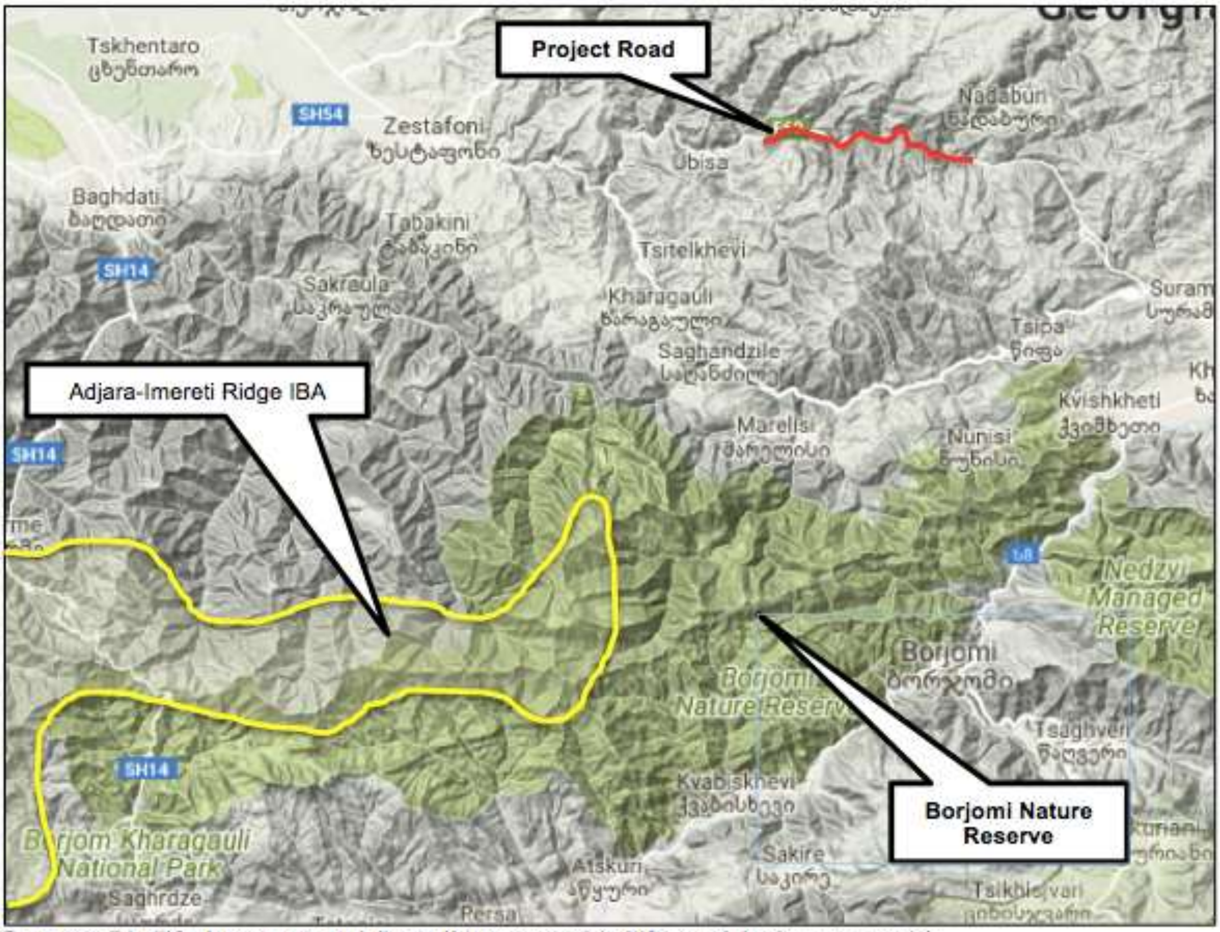
469. In addition a further 46,094 trees less than 8cm in diameter were recorded for de-listing.

470. Details relating to the compensation for tree cutting according to national legislation and compensation in terms of habitat restoration to achieve 'no net loss' is included in **Section G.6.1**.

F.2.5 Protected Areas

471. The nearest protected area is the Borjomi Nature Reserve which is located more than 15 kilometers south of the Project road, see Figure 89.

Figure 89: Protected Areas and IBAs Within the Vicinity of the Project Road



Source: Birdlife International (http://datazone.birdlife.org/site/mapsearch)

472. The nearest Important Bird Area (IBA) to the Project road is the Adjara-Imereti Ridge more than twenty kilometers south of the Project road which overlaps with the Borjomi Nature Reserve. The IBA comprises populations of the following IBA trigger species:

(i) Caucasian Grouse Lyrurus mlokosiewiczi (IUCN Category – NT).
(ii) Corncrake Crex crex (IUCN Category – LC).
(iii) Great Snipe Gallinago media (IUCN Category – NT).
(iv) Eastern Imperial Eagle Aquila heliaca (IUCN Category – VU).
(v) Caspian Snowcock (IUCN Category – LC).[20]

F.3 Economic Development

F.3.1 Industries, Agriculture and Businesses

473. Agriculture - 1.5% of the total area of Kharagauli municipality is used for agricultural purposes. 70.9% of this territory is occupied by pastures and 29.1% is used for ploughing and sowing, annual crops grow over 22.5% of the area, permanent plantings grow over 11,5% and perennial plants grow over 6,6% of the area. Out of agricultural branches, cattle-breeding and bee-keeping are developed the best. Kharagauli municipality is the leading municipality of bee-keeping in Georgia.

[20] https://www.ibatforbusiness.org/kbafactsheet/m18572

474. As part of the Projects social survey 138 families were interviewed and asked what crops they grow on their land. Table 50 provides a list of the crops grown by the households interviewed. The agricultural land affected by the Project is outlined in **Section G.7.2 – Land Use**.

Table 50: Crops Grown By Households in the Project Area

Crop	Number of Families Growing the Crop
Corn	99
Fruits	106
Potato	67
Vegetables	109
Walnut/Hazelnut	77
Gripe	88
Hay	6

475. Industry - During the Soviet times, industry was well-developed in Kharagauli municipality, with food enterprises, mining industry and timber plants, wine, milk and furniture complexes of enterprises. However, industrial activity has declined in the area since then and few large scale industrial activities remain such as the mineral water company "Zvare". Folk trade is highly developed in the municipality including weave baskets, vintage baskets, flower bowls and breadbaskets with lime-tree and cherry-tree bark and nut wicker with high techniques and make pots, jugs, wine bowls and pitchers with clay. They decorate the clay ware by glazing, painting, scratching and with relief figures.

476. Within the Project area, it is important to underline the role of the restaurant and coffee shops along the alignment that, other than employing local people (both men and woman), offer important services for the national and international travellers such as parking rest areas and small workshop repairs that are very important for road safety and travellers comfort. Moreover those services represent a valuable source of income for the locals that sell their products both to the restaurants and directly to the travellers the road.

477. According to the Project social survey, it is envisaged that the road construction will bring more opportunities into the whole area. First of all to the agricultural traditional sector whose products will easily reach the main market places like Tbilisi and Kutaisi, Batumi and Poti. It's also expected a seasonal adjustment of the tourism period stretching and increasing the presence of visitors all along the year encouraging moreover the week end holidays visits. In other words thank to the time travel reduction especially from the metropolitan area of Tbilisi an increase of presence will be significant allowing the consolidation of the tourist sector enlarged industry whose boundaries are not still completely reached allowing other internal localities to be reached easily by a sustainable tourism. That means the possibility to curb the emigration toward the main town and cities encouraging the creation of stable and well remunerated jobs.

478. Finally it can be said that the realization of the Project complies with the integrated geo-tourism development approach outlined in the Strategic Environmental Cultural Heritage and Social Assessment contained in the ITDS (Imereti Tourist Development Project – funded by the World Bank) comprising multi-sectoral interventions, managed vertical investments, coordinated elaboration of tourist circuits and destination sites, targeted support to cost efficient and environment-friendly tourist packages, and protection of local communities and cultural heritage through promotion of responsible tourism.

F.3.2 Infrastructure and Transportation facilities

F.3.2.1 Road, Rail and Air

479. The road network in the Project area is dominated by the existing E-60 which links Tbilisi with Batumi. Numerous local roads feed directly onto the existing E-60 in the Project area, and these roads vary in condition from good to very poor. There are no rail networks or airports within the Project area. The nearest railway station is located in Dzirula more than ten kilometers west of the Project road.

F.3.2.2 Utilities

480. A detailed assessment of the utilities was undertaken by the design consultants. After official correspondence with the companies and utilities in the region it was established that the following companies have utilities services in the Project area:

(i) Telecoms: Delta-Comm, FOPTNET, PCMAX, Silknet.
(ii) Gas supply: Socar Georgia.
(iii) Electricity Transmission and Distribution: Energo-Pro.

481. All the companies provided drawings and information on the precise locations of the utilities to the Design consultant and the RD.

F.3.2.3 Housing Stock

482. The housing stock in the Project area comprises almost exclusively of older one or two storey houses that are distributed mainly along the valley slopes.

F.4 Social and Cultural Resources

F.4.1 Socio-economic conditions

F.4.1.1 Administrative Issues

483. The Project road is located within the Region of Imereti. Imereti occupies a territory of approximately 6,552km^2 (9.4% of Georgia's area). Imereti consists of twelve administrative districts: Kutaisi (the Capital of the region), Tkibuli, Tskaltubo, Chiatura, Baghdati, Vani, Zestaphoni, Terjola, Samtredia, Sachkhere, Kharagauli, Khoni. There are 542 settlements in the region of which: 10 cities (Kutaisi, Tkibuli, Tskaltubo, Chiatura, Baghdati, Vani, Zestaponi, Terjola, Samtredia, Sachkhere, and Khoni); 3 towns (Shorapani, Kulashi and Kharagauli); and 529 villages. The Project road is located within Kharagauli Municipality.

F.4.1.2 Demographics

484. According to the most recent census data (2014), Imereti has a population of 533,906 which is a significant decrease from the 2002 census when the population was recorded as 699,666. The population of Kharagauli was 19,473 the majority of which is classified as rural and only 1,965 as 'urban' (see Table 51 below).

Table 51: Population of Imereti and its Municipalities

	Total Population	Urban	Rural
Imereti	**533,906**	**258,510**	**275,396**
Kutaisi, City of	147,635	147,635	-
Baghdati Municipality	21,582	3,707	17,875
Vani Municipality	24,512	3,744	20,768

	Total Population	Urban	Rural
Zestafoni Municipality	58,401	20,917	37,124
Terjola Municipality	35,563	4,644	30,919
Samtredia Municipality	48,562	27,020	21,542
Sachkhere Municipality	37,775	6,140	31,635
Tkibuli Municipality	20,839	9,770	11,069
Tskaltubo Municipality	56,883	11,281	45,602
Chiatura Municipality	39,884	12,803	27,081
Kharagauli Municipality	**19,473**	**1,965**	**17,508**
Khoni Municipality	23,570	8,987	14,583

485. 99.4% of the population of Imereti are Georgians, the remaining 0.6% is made up of Abkhazians (0.1%), Russians (0.3%), Armenians (0.1%) and Osetians (0.1%). [21] There are no ethnic minorities or indigenous people in the project area.

486. Vulnerable Groups – The following data has been collected as part of the social survey (Table 52). The data indicates that nearly 10% of the households interviewed live below the poverty line.

Table 52: Vulnerable Groups Identified in the Social Survey

Village	Number of Interviewed families	Below Poverty Line		Group of disabilities		Refugees/IDP		Other	
		N of Families	N of people	N of Families	N of people	N of Families	N of people	N of Families	N of people
Makatubani	19	3	13	4	4	0	0	0	0
Sakasria	22	2	8	2	2	2	3	0	0
Vertkvichala	22	1	1	1	4	1	3	0	0
Khunevi	25	3	3	1	1	0	0	2	2
Khevi	17	0	0	1	1	0	0	0	0
Total	105	9	25	9	12	3	6	2	2

Source: Section F2 Draft LARP. March 2018.

F.4.1.3 Employment

487. According to the social survey prepared as part of the Project LARP the employment in the Imereti region is higher than the average of the country (+3.62%). The existence of a strong agricultural sector together with the remnants of industrial activities (especially manufacturing in Kharagauli) and the widespread presence of the tertiary sector (retail, bar, restaurant and cafes, workshop and ancillary services for the transport sector) is the reason of this higher level of employment.

488. The economically active population of Kharagauli municipality is mainly employed at public bodies, in education, timber industry, production, sales and processing of agricultural products and tourism.

489. As for the residents of the villages near the Project road, it's noted that the majority are self-employed and that the unemployment level is high. The main source of income is from agriculture (mostly, cattle-breeding, corn-growing and bee-keeping). The population sell their agricultural products in villages, and in some instances, as a part-time job, a certain proportion of the population sell their agricultural products according to the season at the roadsides of

[21] www.geoxtati.ge. 2014

the highway at some public outlets located along the road (maize, honey, walnuts, nuts, strawberry etc.).

F.4.1.4 Settlements

490. The following settlements can be found within the Project area:

(i) Khevi - The village of Khevi is the starting point of F2 and is located on the western slope of Likhi Ridge, on the bank of river Rikotula, at 520 masl. The village comprises 243 homes with 1,349 residents. The old name of the village is Khevijvari.

(ii) Grigalati - The Village of Grigalati is located on the northern slope of the dividing ridge of the rivers Dzirula and Rikotula, at 600 masl, 48 km from Kharagauli.

(iii) Khunevi - The next settlement on the route toward Zestaponi is the village of Khunevi, 37 Km from Zestaponi and 34 from Kharagauli with a population of 436 inhabitants.

(iv) Vertkichava - The next village touched by the new road and existing alignment is the village of Vertkichava with a total population of 405.

(v) Sakastria - The village has a population of 323 inhabitants.

(vi) Boriti - The next settlements whose territory is traversed by the existing road and new alignment is the village of Boriti, 26 Km from Kharagauli, with a total of 283 inhabitants. Boriti as with other villages along the route, is mainly rural a settlement with some bed & breakfast and traditional Georgian restaurants.

F.4.2 Community Health, Safety & Education

F.4.2.1 Health

491. Dostakari-Beriti Emergency Medical Care Clinic in Boriti is located adjacent to the existing road (see Figure 90). The new alignment will pass more than 300 meters south of the hospital with a tunnel (TUN 2011 AT/TA) at KM11.5.

Figure 90: Dostakari-Beriti Emergency Medical Care Clinic

F.4.2.2 Safety

492. According to data provided by the RD, during the period 2012 – 2016 there were 2,713 collisions, 471 persons killed and 4,913 persons injured spread over the E-60 corridor, from

km 18 to km 302 (284 km in total, from Tbilisi to Khobi) with some notable cluster locations. In other words, it means 1 collision every 16 hours, 1 person killed every 4 days and 1 person injured every 9 hours.

493. Focusing the analysis on the Khevi – Argveta section, 351 collisions, 78 persons killed and 648 persons injured. Finally, along the F2 section 106 collisions occurred, with 25 persons killed and 204 persons injured. This data is summarized in Table 53, whereas Table 54 shows the collisions rates in terms of "crashes per km".

Table 53: Collisions and Casualties in the Period 2012 – 2016

E-60 Road Section	km	Collisions	Injured	Killed
Tbilisi – Khobi	284	2,713	4,913	471
Khevi – Argveta	50	351	648	78
F2	12.2	106	204	25

Table 54: Collisions and Casualties Rates in the Period 2012 – 2016 (per km)

E-60 Road Section	km	Collisions	Injured	Killed
Tbilisi – Khobi	284	9.55	17.30	1.66
Khevi – Argveta	50	7.02	12.96	1.56
F2	12.2	6.63	12.75	1.56

494. Data provided for Section F4 of the E-60 reveal that 24% of collisions involve pedestrians, thus showing that the protection of vulnerable road users is a major issue on the E-60. Regarding the causes of the crashes in section F4, according to data, the main one is defined as "wrong maneuver" (55%). It is interesting to underline that 30% of collisions are caused by dangerous overtaking and 7% by tailgating. These causes are strictly related to the type of cross-section (2 lanes) and the geometry (curvy alignment with few straight sections for safe overtaking).

F.4.2.3 Education and Educational Facilities

495. Three educational facilities are located within the Project area as listed in Table 55 below.

Table 55: Schools in the Project Area (within 1 km)

#	Name	Location	No. of Pupils	Distance (m)	
				From existing alignment	From new alignment
1	Public School of Verkvichchala	Verkvichchala	330	100m south	250m south
2	Public school of village Vashlevi	Vashlevi	150	50m east	50m south
3	Khunevi School	Khunevi	75	25m north	50m south

496. Two of the schools are located within 50 meters of the new alignment as illustrated by Figure 91 and Figure 92.

F.4.3 Waste Management

497. Waste management, in compliance with international standards, has been playing an increasingly important role for Georgia after the country signed the Association Agreement with the EU. Currently solid waste disposal at the landfill is the only form of waste management in Georgia. The situation in regards to domestic and industrial wastewater management is

complicated, as in most cases industrial and non-industrial wastewaters are discharged into surface waters without prior treatment.

498. Inert waste, including construction waste, is partially disposed at non-hazardous waste landfills and is used for filling/leveling activities in the construction of infrastructure facilities. There are no management systems for specific waste, including separated collection systems. However, recycling of specific waste, such as tires, batteries, packaging waste, etc., or disposal (such as asbestos waste) does occur in fragmented and uncoordinated way.

Figure 91: Location of Public school of village Vashlevi (approx. KM8.6)

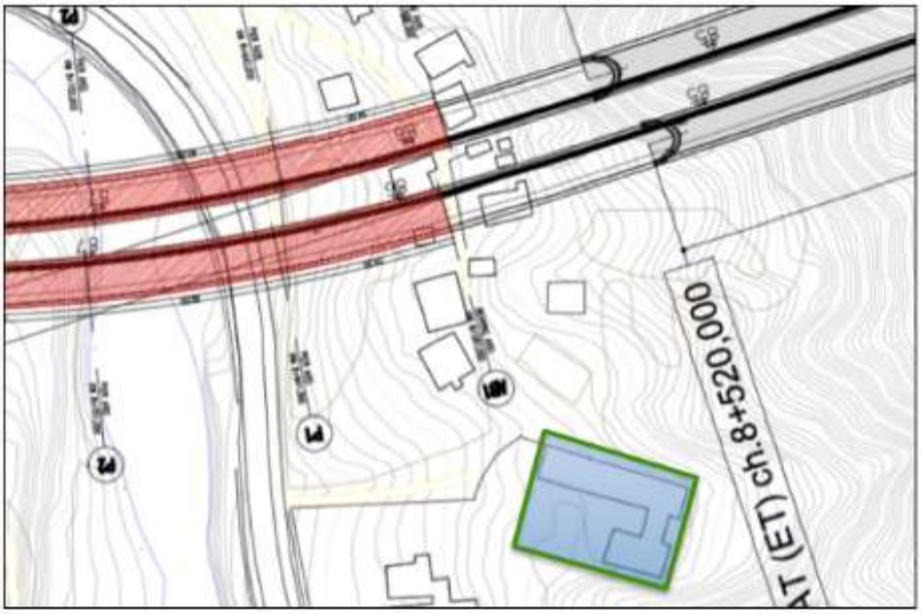


Figure 92: Location of Khunevi School (approximately KM3.5)

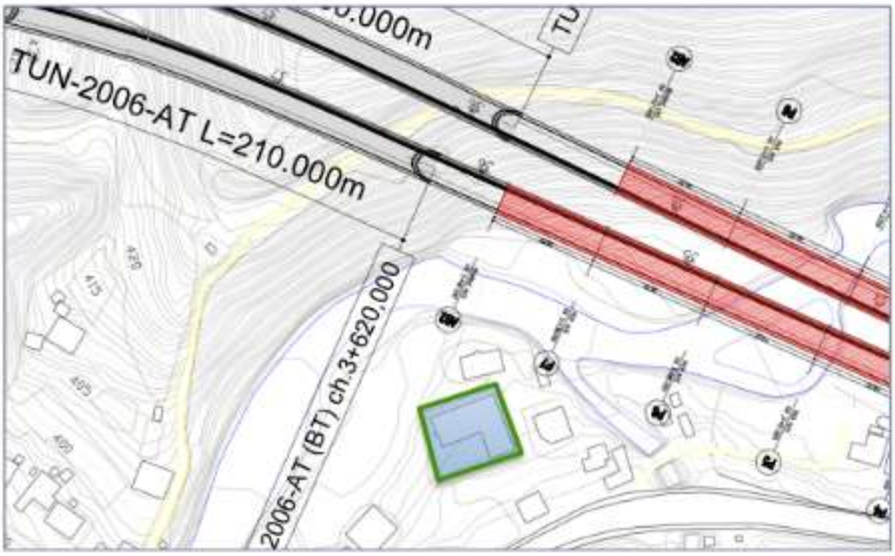


Figure 93: Khunevi School

499. Presently, 56 landfills are recorded in Georgia. Only four of them, one private and three state-owned landfills, comply with international standards and have an Environmental Impact Assessment (EIA) permit. These are; Tbilisi Norio landfill, Rustavi landfill, Borjomi landfill and Privately owned BP landfill.

500. According to the active legislation (Waste Management Code), construction and management of non-hazardous (municipal) landfills (excluding Tbilisi and Adjara Autonomous Republic landfills) is the responsibility of the Waste Management Company of Georgia owned by the Ministry of Regional Development and Infrastructure. The company conducts active measures to improve the conditions of the old/current landfills and construct new regional landfills. As of 2016, the Solid Waste Management Company manages the existing landfills. Twenty of them were closed and 30 of them were improved. The company continues work to construct new regional non-hazardous waste landfills. Tbilservice Group (municipal company established in 2007) manages Tbilisi's landfills.

501. Despite the above, the waste management problem remains very acute. There are still many illegal dumpsites in Georgia. Almost every rural settlement has one or more small dumpsites. They are often located on river banks or near the populated areas, thus posing a threat to human health and the environment.

502. One of the main causes of the above problem is related to the existing waste management system, especially in the rural areas. Specifically, no waste collection and removal services are provided in some of the rural areas, especially in remote villages located far from the municipal centers. Many villages are not equipped with waste containers, which forces local residents to dump their waste in the areas of their choosing. Around 18% of waste generated in the country is dumped into ravines, river banks and other illegal, spontaneously formed, dumpsites near residential areas.

503. Previously there was a landfill site in Zestafoni adjacent to Kvaliti village. The area of the site was 2.2 hectares and received 15,000 m^3/year of waste. However, the Solid Waste Management Company of Georgia closed the Zestaphoni municipal land fill in 2016 due to the fact that it was overloaded Kharagauli Municipality previously used Boriti landfill located in

Boriti Village. The landfill was put into operation in 2005 but is currently closed. [22]As such there appears to be no landfill within the Project area for hazardous and non-hazardous waste.

F.4.4 Physical and Cultural Resources

504. Regional Context - Imereti is an important historical and cultural region of Western Georgia. There are more than 450 historical, archaeological, architectural and natural monuments in the region, which give a full picture of ancient settlements, its cultural development and history. The region is home to 78 Churches, 13 Castles, 39 Archaeological Monuments and 27 Museums.

505. Findings of archaeological excavations show that the first human being in Imereti lived during the lower Palaeolithic period. Numerous flint and obsidian items, including cutting instruments and knives have been discovered in caves and settlements. During the VIII century Kutaisi became the capital of west Georgia and the capital of all Georgia in the X-XII centuries. It was during this period that Imereti had its renaissance. Unique masterpieces of Georgian architecture were created at this time – Bagrati Cathedral and Gelati Monastery Complex (UNESCO heritage site).

506. Project Corridor – Within the Project corridor the following key physical cultural resources have been identified:

(i) **Church** – A small church is located within 20 meters of the existing alignment (see Figure 94: Church). The new alignment will be located approximately 25 meters further south of the existing alignment at KM10.0.

(ii) **Cemetery** – The cemetery is located around 20 meters east of the existing alignment (see Figure 95). The new alignment will pass approximately 125 meters north of the cemetery at KM8.6.

Figure 94: Church

Figure 95: Cemetery

F.4.5 Noise & Vibration

F.4.5.1 General

507. Noise levels within the Project corridor are predominantly a result of vehicle traffic on the existing road. Very little commercial, residential or industrial activities can be observed in these areas that would give rise to significant noise levels.

[22] Second Regional Development Project, Imereti Regional Development Program, Imereti Tourism Development Strategy. Strategic Environmental, Cultural, Historical and Social Assessment. World Bank, 2014

F.4.5.2 Existing Noise & Vibration Levels

508. Baseline vibration monitoring was undertaken in February, 2018 at six locations indicated by Figure 96 and Table 56.

Figure 96: Noise and Vibration Monitoring Locations

Table 56: Vibration Monitoring Locations

#	Point	Coordinates	
		X	Y
1	F2-1	367851	4661799
2	F2-2	365078	4662569
3	F2-3	364623	4662883
4	F2-4	362258	4663231
5	F2-5	360268	4662822
6	F2-6	356695	4663242

509. Table 57 provides the baseline vibration monitoring results. Vibration values in the control points are currently too low to cause any structural or cosmetic damage and/or cause nuisance of the residents. According to the national standard the values are ranked as weakly perceptible.

Table 57: Vibration Monitoring Results

Time	Displacement, mm; peak values			Velocity, mm/s; true RMS/ Transversal vibration value in dBV		
	Longitudinal X	Transversal Y	Vertical Z	Longitudinal X	Transversal Y	Vertical Z
F2-V1						
Day	0.019	0.030	0.000	0.00	0.13/68.3	0.00
Night	0.005	0.002	0.000	0.00	0.05/60	0.00
F2-V2						
Day	0.000	0.000	0.001	0.00	0.06/61.6	0.00
Night	0.002	0.000	0.001	0.00	0.04/58	0.00
F2-V3						
Day	0.000	0.001	0.002	0.05/60	0.07/62.9	0.00
Night	0.000	0.000	0.000	0.00	0.00	0.00
F2-V4						

Time	Displacement, mm; peak values			Velocity, mm/s; true RMS/ Transversal vibration value in dBV		
	Longitudinal X	Transversal Y	Vertical Z	Longitudinal X	Transversal Y	Vertical Z
Day	0.014	0.002	0.001	0.00	0.17	0.00
Night	0.000	0.000	0.000	0.00	0.15/69.5	0.00
F2-V5						
Day	0.001	0.000	0.001	0.00	0.00	0.00
Night	0.000	0.000	0.000	0.00	0.02/52	0.00
F2-V6						
Day	0.001	0.000	0.003	0.00	0.05/60	0.00
Night	0.000	0.002	0.000	0.00	0.01/46	0.00

Note:

Vibration velocity level (Lv) in dB has been defined as follows:
Lv = 20 x log10(V/Vref)
Where:

Lv = velocity level in decibels, mm/s (dBV)
V = RMS velocity amplitude, mm/s
Vref = reference velocity amplitude, mm/s (Vref=0.00005 mm/s. Reference – Order #297/б of the Minister of Labour, Health and Social Affairs on Approval of Standards of Quality of the State of Environment, Document ID 470.230.000.11.119.004.920)

Equipment – VM-6380 3-Axis 3D Digital Vibration Meter Tester VM6380
Main characteristics: Velocity:0.01-400.0 mm/s true RMS ; Acceleration:0.1-400.0 m/s² peak value; Displacement:0.001-4.000mm peak-peak ; Frequency Range for Measuring:10Hz to 10kHz

510. Noise monitoring - Baseline noise monitoring was undertaken in April and May 2018 at thirteen locations indicated by Figue 97. These thirteen receptors were chosen as they represented a good sample of residential properties along the existing and new alignment, thereby allowing the baseline measurements to also be used in the noise model prepared as part of the noise assessment.

Figue 97: Noise Monitoring Locations

Point 1

Coordinates - 42' 05 54.00 N/ 43'24 13.20 E

Noise model Ref. - Receptor R1

Point 2 Coordinates: 42' 05 46.86 N/ 43' 24 07.80 E Noise model Ref. - Receptor L2	
Point 3 Coordinates: 42'06 12.14 N/ 43'22 09.91 E Noise model Ref. – Receptor L7	
Point 4 42' 06 21.95 N/ 43' 21 42.66 E Noise model Ref. - Receptor R14	

Point 5 42’ 06 26.61 N/ 43’ 21 22.84 E Noise model Ref. - Receptor R15	
Point 6 43’ 06 15.88 N / 43’ 20 45.31 E	
Point 7 43’ 06 33.07 N/ 43’ 20 03.43 E Noise model Ref. - Receptor L26	

Point 8 43 19 53.07 N/ 43 19 53.07 E Noise model Ref. - Receptor R28	
Point 9 42 06 27.21 N/ 43 18 35.23 E Noise model Ref. - Receptor L32	
Point 10 42 06 36.25 N/ 43 17 46.40 E Noise model Ref. - Receptor L34	

<table>
<tr><td>Point 11

42 06 41.42 N/ 43 17 35.21 E

Noise model Ref. - Receptor R45</td><td>
</td></tr>
<tr><td>Point 12

42 06 25.81 N/ 43 16 16.43 E

Noise model Ref. - Receptor L36</td><td>
</td></tr>
<tr><td>Point 13

42 06 31.58 N/ 43 16 06.81 E

Noise model Ref. - Receptor R53</td><td>
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</table>

511. Table 58 provides a summary of the baseline noise monitoring results. No clear patterns emerge from the monitoring regarding differences in daytime and nighttime noise. However, it is clear that at many locations the IFC daytime limits are met, but not the nighttime limits. As expected, the monitoring point closest to the existing alignment (point 7) and furthest from the alignment (point 12) received the highest and lowest noise levels respectively.

Table 58: Baseline Noise Monitoring Results – Hourly Leq

Point No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**IFC Standard**
Distance from the Road	65	70	10	50	50	25	5	110	50	165	40	320	25	
7am-8am	51	53	46	50	51	51	49	53	51	50	50	47	55	55
8am-9am	55	53	53	52	51	55	51	47	55	45	56	40	52	55
9am-10am	56	53	59	51	51	56	52	53	56	50	55	48	59	55
10am-11am	51	51	56	49	50	51	59	59	51	59	52	46	56	55
11am-12am	55	57	56	55	55	55	47	59	55	55	56	46	66	55
12am-1pm	52	52	53	50	51	52	56	58	52	52	50	46	52	55
1pm-2pm	49	49	46	48	49	49	70	49	49	49	47	42	60	55
2pm-3pm	55	58	53	55	55	55	76	56	55	53	52	42	58	55
3pm-4pm	56	52	47	53	52	56	78	46	56	45	55	40	60	55
4pm-5pm	54	45	46	46	45	54	68	47	54	49	51	42	52	55
5pm-6pm	50	51	54	50	50	50	68	52	50	51	49	42	58	55
6pm-7pm	66	52	53	50	50	66	57	54	66	51	65	48	58	55
7pm-8pm	55	48	56	49	48	55	72	55	55	55	56	47	56	55
8pm-9pm	63	47	47	49	47	63	61	48	63	45	60	44	58	55
9pm-10pm	52	60	54	58	59	52	62	53	52	57	53	40	60	55
10pm-11pm	51	64	49	60	62	51	65	48	51	46	50	51	50	45
11pm-12pm	51	48	53	47	47	51	54	54	51	52	55	42	48	45
12pm-1am	59	48	59	47	49	59	72	58	59	56	57	44	48	45
1am-2am	48	50	55	45	51	48	43	53	48	53	50	46	49	45
2am-3am	55	50	49	46	58	55	58	47	55	50	53	47	51	45
3am-4am	62	50	47	50	49	62	32	49	62	49	63	43	50	45
4am-5am	49	56	51	55	55	49	32	52	49	49	47	44	58	45
5am-6am	51	47	47	48	48	51	48	47	51	48	53	40	52	45
6am-7am	54	51	52	49	50	54	56	51	54	51	52	46	53	45

512. For the noise prediction model the existing road noise was also modeled (Maps provided in **Appendix M** and iterations completed as part of the development of the model included as **Appendix P**). The following table presents the data at the receptors used as part of the model (also cross referenced in Figue 97: Noise Monitoring Locations, above).

Table 59: Modeled Noise Levels on the Existing Road

Receptor	DAY Lg dB(A)	Night Ln dB(A)
L1	68.2	60.2
L2	55.8	47.8
L3	71.6	63.5
L4	71.4	63.3
L5	63.6	55.6
L6	64.4	56.3
L7	63.8	55.7
L8	63.9	55.9
L9	63.9	55.9
L10	64	55.9
L11	63.9	55.9
L12	59.3	51.3
L13	60.4	52.3
L14	60.7	52.7
L15	61.6	53.5
L16	46.1	38
L17	58.4	50.3
L18	59.3	51.3
L19	59.7	51.6
L20	60.3	52.3
L21	60.8	52.8
L22	63	54.9
L23	63.7	55.7
L24	62.6	54.5
L25	67.3	59.3
L26	65	57
L27	66	58
L28	63.5	55.5
L29	62.1	54.1
L30	61.5	53.4
L31	60.3	52.3
L32	70.1	62.1
L33	70.1	62.1
L34	70.6	62.5
L35	70.4	62.4
L36	61.8	53.8
L37	62.5	54.4
R1	52.7	44.7
R2	64.9	56.9
R3	64.8	56.8
R4	63.3	55.2
R5	61.4	53.4
R6	68.9	60.9
R7	66.2	58.1
R8	66.9	58.8
R9	72	64
R10	48.5	40.5
R11	62.9	54.9

Receptor	DAY	Night
	Lg dB(A)	**Ln dB(A)**
R12	62	53.9
R13	65.4	57.4
R14	60.9	52.9
R15	65.9	57.8
R16	62.4	54.4
R17	47.6	39.6
R18	44.8	36.7
R19	42.2	34.2
R20	45.8	37.8
R21	55.6	47.6
R22	57.2	49.2
R23	69.4	61.4
R24	69.6	61.6
R25	64.6	56.5
R26	65	56.9
R27	65.9	57.9
R28	64	55.9
R29	64.7	56.6
R30	67.5	59.5
R31	63.1	55.1
R32	63.5	55.5
R33	67.4	59.3
R34	67.5	59.5
R35	59.1	51.1
R36	59.9	51.8
R37	60.5	52.5
R38	58.6	50.5
R39	60.4	52.4
R40	60.5	52.5
R41	60.2	52.2
R42	59.9	51.8
R43	61.2	53.2
R44	65.7	57.6
R45	63.1	55
R46	60.3	52.2
R47	60.4	52.3
R48	53.7	45.7
R49	57.3	49.3
R50	63.2	55.1
R51	60	52
R52	61.3	53.2

G. Environmental Impacts and Mitigation Measures

G.1 Introduction

513. During the initial stage of the EIA process, several potential environmental and social impacts of the project were identified. The baseline surveys were conducted keeping in consideration the potential impacts. In this chapter, the potential environmental and social impacts are evaluated. The impacts have been identified based on consideration of the information presented in previous chapters. To avoid unnecessary repetition of supporting information, cross referencing to previous sections is given where necessary. Following the impact assessment, the mitigation measures related to each impact category is presented.

G.2 Impact Assessment Methodology

514. The general methodology used for impact assessment is described in this section. It describes the process of impact identification and definition, significance rating, the mitigation, management and good practice measures.

G.2.1 Identification of Significant Environmental Aspects

515. The description of each impact will have the following features:

- (i) Definition of the impact using an impact statement identifying the Project activity or activities that causes the impact, the pathway or the environmental parameter that is changed by the activity, and the potential receptors of the impact (aspect-pathway-receptor).
- (ii) Description of the sensitivity and importance value of the receiving environment or receptors.
- (iii) Extent of change associated with the impact.
- (iv) Rating of the significance of the impact.
- (v) Description of appropriate mitigation and management measures and potential effectiveness of the proposed measures.
- (vi) Characterization of the level of uncertainty in the impact assessment.
- (vii) The significance of an impact is determined based on the product of the consequence of the impact and the probability of its occurrence. The consequence of an impact, in turn, is a function primarily of three impact characteristics:
  - (a) magnitude
  - (b) spatial scale
  - (c) timeframe

516. Magnitude is determined from quantitative or qualitative evaluation of a number of criteria including:

- (i) Sensitivity of existing or reasonably foreseeable future receptors.
- (ii) Importance value of existing or reasonably foreseeable future receptors, described using the following:
  - (a) inclusion in government policy.
  - (b) level of public concern.
  - (c) number of receptors affected.
  - (d) intrinsic or perceived value placed on the receiving environment by stakeholders.
  - (e) economic value to stakeholders

(iii) Severity or degree of change to the receptor due to impact, measured qualitatively or quantitatively, and through comparison with relevant thresholds:
(a) legal thresholds—established by law or regulation
(b) functional thresholds if exceeded, the impacts will disrupt the functioning of an ecosystem sufficiently to destroy resources important to the nation or biosphere irreversibly and/or irretrievably
(c) normative thresholds – established by social norms, usually at the local or regional level and often tied to social or economic concerns
(d) preference thresholds—preferences for individuals, groups or organizations only, as distinct from society at large
(e) reputational thresholds—the level of risk a company is willing to take when approaching or exceeding the above thresholds

517. Spatial scale is another impact characteristic affecting impact consequence. The spatial scale of impacts can range from localized (confined to the proposed Project Site) to extensive (national or international extent). They also may vary depending on the component being considered.

518. The impact timeframe is the third principal impact characteristic defining impact consequence and relates to either its duration or its frequency (when the impact is intermittent). Impact duration can range from relatively short (less than four years) to long (beyond the life of the Project). Frequency ranges from high (more than 10 times a year) to low (less than once a year). These timeframes will need to be established for each Project based on its specific characteristics and those of the surrounding environment.

519. Once the impact consequence is described on the basis of the above impact characteristics, the probability of impact occurrence is factored in to derive the overall impact significance. The probability relates to the likelihood of the impact occurring, not the probability that the source of the impact occurs. For example, a continuous Project activity may have an unlikely probability of impact if there are no receptors within the area influenced by that activity.

520. The reversibility of each impact at the end of construction and operation are important, as these impacts may need on-going management after operation. The reversibility of each impact at the end of construction and operation will be noted and described alongside the three primary characteristics of magnitude, spatial scale and duration.

521. The characteristics are outlined in Table 60**.**

Table 60: Characteristics Used to Describe Impact

Characteristic	Sub-components	Terms Used to Describe the Impact
Type		Positive (a benefit), negative (a cost) or neutral
Nature		Biophysical, social, cultural, health or economic Direct, indirect or cumulative or induced
Phase of the Project		Construction, operation, decommissioning or post closure

Characteristic	Sub-components	Terms Used to Describe the Impact
Magnitude	Sensitivity of Receptor	High, medium or low capacity to accommodate change High, medium or low conservation importance Vulnerable or threatened Rare, common, unique, endemic
	Importance or value of receptor	High, medium or low concern to some or all stakeholders High, medium or low value to some or all stakeholders (for example, for cultural beliefs) Locally, nationally or internationally important Protected by legislation or policy
	Severity or degree of change to the receptor	Gravity or seriousness of the change to the environment Intensity, influence, power or strength of the change Never, occasionally or always exceeds relevant thresholds
Spatial Scale	Area affected by impact - boundaries at local and regional extents will be different for biophysical and social impacts	Area or Volume covered Distribution Local, regional, transboundary or global
Timeframe	Length of time over which an environmental impact occurs or frequency of impact when intermittent	Short term or long term Intermittent (what frequency) or continuous Temporary or permanent Immediate effect (impact experienced immediately after causative project aspect) or delayed effect (effect of the impact is delayed for a period following the causative project aspect)
Probability - likelihood or chance an impact will occur		Definite (impact will occur with high likelihood of probability) Possible (impact may occur but could be influenced by either natural or project related factors) Unlikely (impact unlikely unless

Characteristic	Sub-components	Terms Used to Describe the Impact
		specific natural or Project related circumstances occur)
Reversibility/Sustainability		Potential for recovery of the endpoint from a negative impact Reversible or irreversible Sustainability for positive impacts
Confidence in impact evaluation (degree of certainty in the significance ascribed to the impact)		Scientific uncertainty – limited understanding of ecosystem (or community) and processes governing change Data uncertainty – restrictions introduced by incomplete or incomparable information, or by insufficient measurement techniques Policy uncertainty – unclear or disputed objectives, standards or guidelines

G.2.2 Impact Significance Rating

522. The impact significance rating process serves two purposes: firstly, it helps to highlight the critical impacts requiring consideration in the approval process; secondly, it serves to show the primary impact characteristics, as defined above, used to evaluate impact significance. The impact significance rating system is presented in Table 61 and described as follows:

(i) **Part A**: Define impact consequence using the three primary impact characteristics of magnitude, spatial scale and duration.
(ii) **Part B**: Use the matrix to determine a rating for impact consequence based on the definitions identified in Part A; and
(iii) **Part C**: Use the matrix to determine the impact significance rating, which is a function of the impact consequence rating (from Part B) and the probability of occurrence.

523. Using the matrix, the significance of each described impact is rated.

Table 61: Method for Rating Significance

PART A: DEFINING CONSEQUENCE IN TERMS OF MAGNITUDE, DURATION AND SPATIAL SCALE			
Definition		Criteria	
MAGNITUDE		Negative	Positive
	Major	• Large number of receptors affected • Receptors highly sensitive and/or are of conservation importance • Substantial deterioration, nuisance or harm to receptors expected • Relevant thresholds often exceeded • Significant public concern expressed during stakeholder consultation • Receiving environment has an inherent value to stakeholders	• Large number of receptors affected • Receptors highly amenable to positive change • Receptors likely to experience a big improvement in their situation • Relevant positive thresholds often exceeded
	Moderate	• Some receptors affected • Receptors slightly sensitive and/or of moderate conservation importance • Measurable deterioration, nuisance or harm to receptors • Relevant thresholds occasionally exceeded • Limited public concern expressed during stakeholder consultation • Limited value attached to the environment	• Some receptors affected • Receptors likely to experience some improvement in their situation • Relevant positive thresholds occasionally exceeded
	Minor	• No or limited receptors within the zone of impact • Receptors not sensitive to change • Minor deterioration, nuisance or harm to receptors • Change not measurable or relevant thresholds never exceeded • Stakeholders have not expressed concerns regarding the receiving environment	• No or limited receptors affected • Receptors not sensitive to change • Minor or no improvement in current situation • Change not measurable • Relevant positive thresholds never exceeded No stakeholder comment expected
TIMEFRAME		Duration of Continuous Aspects	Frequency of Intermittent Aspects
	Short term / low frequency	• Less than 4 years from onset of impact	• Occurs less than once a year

	Medium term / medium frequency	• More than 4 years from onset of impact up to end of life of project (approximately 30 years)	• Occurs less than 10 times a year but more than once a year
	Long term / high frequency	• Impact is experienced during and beyond the life of the project (greater than 30 years)	• Occurs more than 10 times a year
SPATIAL SCALE		Biophysical	Socio-economic
	Small	• Within the defined 'area of influence'	• Within the defined 'area of influence'
	Intermediate	• Within the district in which is the facilities are located	• Within the municipality in which the activity occurs
	Extensive	• Beyond the district in which the facilities are located	• Beyond the municipality in which the activity occurs

PART B: DETERMINING CONSEQUENCE RATING				
MAGNITUDE	TIMEFRAME	SPATIAL SCALE		
		Small	Intermediate	Extensive
Minor	Short term / low frequency	Low	Low	Medium
	Medium term / medium frequency	Low	Low	Medium
	Long term / high frequency	Medium	Medium	Medium
Moderate	Short term / low frequency	Low	Medium	Medium
	Medium term / medium frequency	Medium	Medium	High
	Long term / high frequency	Medium	High	High
Major	Short term / low frequency	Medium	Medium	High
	Medium term / medium frequency	Medium	Medium	High
	Long term / high frequency	High	High	High

PART C: DETERMINING SIGNIFICANCE RATING				
		CONSEQUENCE		
		Low	Medium	High
PROBABILITY (of exposure to impacts)	Definite	Low	Medium	High
	Possible	Low	Medium	High
	Unlikely	Low	Low	Medium

G.3 Mitigation, Management and Good Practice Measures

524. Wherever the Project is likely to result in unacceptable impact on the environment, mitigation measures are proposed (over and above the inherent design measures included in the Project description). In addition, good practice measures may be proposed however these are unlikely to change the impact significance. In the case of positive impacts, management measures are suggested to optimize the benefits to be gained. Where mitigation measures are required the impact will be rated again to show the residual impact after implementation of management controls.

525. The following mitigation hierarchy will be utilized in selecting practical mitigation measures for unacceptable impacts as follows (in order of preference):

- (i) Avoid the impact wherever possible by removing the cause(s).
- (ii) Reduce the impact as far as possible by limiting the cause(s).
- (iii) Ameliorate the impact by protecting the receptor from the cause(s) of the impact.
- (iv) Providing compensatory measures to offset the impact, particularly where an impact is of high significance and none of the above are appropriate.

G.4 Screening of Impacts

526. Based on the impact assessment methodology discussed above, Table 62 presents the possible impacts of the proposed Project. Each impact is discussed further in this chapter.

Table 62: Impact Screening

Aspect	Phase	Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
Air Quality	C	Emissions from stationary sources	Nearby communities	L	M	L	M	MOD	H/F	SMALL	MED	DEF	M
	C	Exhaust Emissions from construction vehicles and generators	Nearby communities	M	M	L	M	MOD	H/F	SMALL	MED	DEF	M
	C	Dust from the movement of vehicles, stockpiles, etc.	Nearby communities / Agric. Crops	M	M	M	M	MOD	H/F	SMALL	MED	DEF	M
	O	Vehicle Emissions from traffic using the road.	Nearby communities	M	H	M	M	MOD	LT	SMALL	MED	DEF	M
Climate Change	C	GHG Emissions from road construction.	Global	H	L	L	-	MIN	H/F	EXT	MED	DEF	M
	O	GHG Emissions from vehicle emissions.	Global	H	L	L	-	MIN	LT	EXT	MED	DEF	M
Soils	C	Soil erosion on unstable slopes caused by poor construction works.	Nearby communities / Water bodies	L	M	M	M	MOD	M/F	INTER	MED	POSS	M
	O	Soil erosion caused by poorly designed erosion protection measures, drainage, etc.	Nearby communities / Water bodies	L	M	M	M	MOD	MT	INTER	MED	POSS	M

Aspect	Phase	Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
	C	Soil contamination via spills and leaks of hazardous liquids from construction camps.	Soil / Water bodies / Ground water	L	M	L	M	MOD	M/F	SMALL	MED	POSS	M
Hydrology	C	Flooding caused by blocking existing drainage structures.	Nearby communities	M	M	M	-	MOD	M/F	SMALL	MED	POSS	M
	O	Flooding caused by poorly designed drainage structures.	Nearby communities	M	M	M	-	MOD	LT	SMALL	MED	POSS	M
	C	Water contamination from construction camps, etc.	Nearby communities / Water bodies	M	M	L	M	MOD	M/F	INTER	MED	POSS	M
	C	Excessive water extraction affecting local water supplies.	Nearby communities / Aquatic wildlife	L	L	L	L	MIN	H/F	SMALL	MED	UNLIKE	L
	O	Ground water supply degraded by new tunnels.	Nearby communities	M	M	L	-	MOD	LT	SMALL	MED	POSS	M
Flora & Fauna	C	Degradation of habitat caused during site clearing.	Terrestrial wildlife	M	H	L	-	MOD	L/F	SMALL	LOW	DEF	L
	C	Tree cutting.	Terrestrial wildlife	H	H	L	M	MAJ	ST	SMALL	MED	DEF	M

Aspect	Phase	Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
	O	Blocking migration routes of animals.	Terrestrial wildlife	L	H	L	-	MOD	MT	SMALL	MED	UNLIKE	L
Infrastructure and Transport	C	Damage to access roads caused by construction vehicles.	Nearby communities / Road Users	M	L	M	-	MOD	MT	INTER	MED	POSS	M
	C	Traffic delays due to road works.	Nearby communities / Road Users	M	M	M	-	MOD	H/F	SMALL	MED	DEF	M
	C	Limited accessibility to properties as road works block access.	Nearby communities	M	M	L	-	MOD	MT	SMALL	MED	POSS	M
	C	Temporary disruption to utilities while they are removed to make way for construction works.	Nearby communities	M	M	L	-	MOD	MT	SMALL	MED	DEF	M
Land Use	C	Loss of land and property due to the new road.	Nearby communities	H	H	H	-	MAJ	MT	SMALL	MED	DEF	M
	C	Disruption to businesses caused by reduced access to the business.	Nearby communities	M	H	H	-	MAJ	H/F	SMALL	HIGH	POSS	H
	O	Reduced income for businesses no longer located by the road.	Nearby communities	M	H	H	-	MAJ	MT	SMALL	MED	POSS	M

Aspect	Phase	Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
	O	Induced changes.	Nearby communities	M	M	L	-	MIN	LT	SMALL	MED	UNLIKE	L
Waste	C	Pollution from hazardous waste from construction camps, etc.	Nearby communities / Water bodies	M	M	L	H	MOD	H/F	INTER	HIGH	POSS	H
	C	Pollution from inert waste from construction camps, etc.	Nearby communities / Water bodies	M	M	L	H	MOD	H/F	INTER	HIGH	POSS	H
	C	Tunnel and embankment spoil	Communitie s /	H	H	H	M	MAJ	ST	INTER	MED	DEF	M
OHS / Community Health and Safety	C	Accidents and injuries during the construction phase.	Communitie s / Contractors staff	H	H	H	H	MAJ	H/F	INTER	HIGH	POSS	H
	C	STD's contracted and spread by workers.	Nearby communities / Contractors staff	M	H	L	-	MOD	L/F	INTER	MED	POSS	M
Emergenci es	C	Fires, explosions, etc, at site.	Nearby communities / Contractors staff	M	H	L	M	MOD	S/T	SMALL	LOW	POSS	L
PCR	C	Damage to PCR caused during construction.	PCR site and its users	M	M	L	-	MOD	H/F	SMALL	MED	POSS	M

Aspect	Phase	Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
	O	Effects to PCR in terms of elevated noise, dust, etc.	PCR site and its users	M	M	L	-	MOD	MT	SMALL	MED	UNLIKE	L
Noise	C	Elevated noise levels from construction equipment.	Contractors staff / Nearby communities	H	H	L	H	MAJ	H/F	SMALL	HIGH	DEF	H
	O	Elevated noise levels from vehicles using the road.	Nearby communities	H	H	M	H	MAJ	M/T	SMALL	MED	DEF	M
Vibration	C	Damage to properties caused during blasting and piling.	Nearby communities	M	H	M	H	MAJ	M/F	SMALL	MED	POSS	M
	O	Damage to properties from vehicle movement vibration.	Nearby communities	L	H	M	L	MOD	MT	SMALL	MED	UNLIKE	L

Key: H: High / M: Medium / L: Low / MAJ: Major / MOD: Moderate / MIN: Minimum / H/F: High Frequency / M/F: Low Frequency / L/F: Low Frequency / LT: Long term / MT: Medium Term / ST: Short term / MED: Medium / DEF: Definitely / POSS: Possible: / UNLIKE: Unlikely

G.5 Physical Resources

G.5.1 Air quality

Potential Air Quality Impacts

527. The potential impacts of the Project to air quality are described as follows:

Design and Pre-construction Phase

528. The road rehabilitation works are generally intermittent and not permanent in a specific site, the works move along the Project road as work progresses and as such air quality impacts will be short term in specific locations. However, fugitive emissions will be emitted on a longer-term basis from stationary sources such as asphalt plants. These sites can however be selected prior to construction and be placed in an area where it can cause the least impact on human and ecologic receptors.

Construction Phase

529. During construction, air quality is likely to be degraded by a range of operational activities including:

- (i) Exhaust emissions from the operation of construction machinery (e.g. Nitrogen Oxides (NO_X), Sulfur Oxides (SO_X) and Carbon Monoxide (CO));
- (ii) Open burning of waste materials; and
- (iii) Dust generated from haul roads, unpaved roads, exposed soils and material stock-piles.

530. Dust is the major air quality problem from construction sites. Dust is a problem for a variety of reasons, as outlined below:

- (i) Inconvenience to local people. For example, people may have to re-wash laundry that has been put outdoors to dry, and wash windows, curtains and vehicles. Dust can contaminate meat hanging up in open-air butchers and other food that is exposed to it in homes, shops and open-air restaurants, giving food a gritty texture.
- (ii) Health and safety problems. Dust may affect health by irritating eyes and worsening the health of people with asthma. Dust can reduce visibility for drivers on roads. It can also be blown for long distances by the wind.
- (iii) Crop damage. Even low concentrations of dust can affect plant and fruit growth as far away as one kilometer from a construction site. Plant growth is particularly susceptible to dusts that are highly alkaline, for example limestone and cement dust. Dust deposited during light rainfall can cause the soil surface to form a crust increasing run-off.
- (iv) Impact on ecology. Dust blowing onto watercourses may damage ecology by increasing sedimentation, reducing sunlight and suffocating fish. It may also affect plant growth and change the species of plants growing in an area. Dust may also damage trees and other vegetation planted as part of the construction contract.
- (v) Damage to plant and equipment. Within the construction site, dust can cause mechanical or electrical problems in sensitive equipment such as computers. It can also increase abrasion of moving parts in equipment and clogging of air filters.

Operational Phase

531. The main source of air pollution during the operational phase will be vehicles moving on the highway. The main pollutants are: CO; NO_X; hydrocarbons (HC); SO_2; carbon dioxide (CO_2); and particulate matter (PM). These compounds can damage health and/or the environment. The concentration of pollutants generated by vehicles depends on factors such as the number, type and speed of vehicles. The effect of air pollution on local people depends on the distance between them and the road, wind direction, topography and other factors. The main direct effects are in the area closest to the road as the rapid dispersion and dilution of exhaust gases quickly reduces their concentrations to levels at which risks are minimal.

532. The impacts associated with air quality in the operational phase of the Project have been assessed using an air dispersion model. The findings of which are presented below.

533. Pollutants Modeled - The pollutants kept into considerations are the ones characterizing the emissions from vehicles: NO_2, NO_X, PM_{10}, $PM_{2,5}$, CO, SO_2 e C_6H_6. The below indicates the limits taken into consideration.

Table 63: Pollutants Modeled & Reference Limits

	MPC/guideline values/limits	Average period	CO, µg/m3	NO_2, µg/m3	SO_2, µg/m3	PM10, µg/m3	PM 2.5, µg/m3	TSP, µg/m3
1	National limit – max.permiss. one time (volley) concentration (MPC), µg/m^3	24 h	3000	40	50	n/a	n/a	150
		30 min	5000	200	500	n/a	n/a	500
2	IFC/WHO (updated 2016) – guideline value, µg/m3	1 year	n/a	40	50	20	10	n/a
		8h	10000	n/a	n/a	n/a	n/a	n/a
		24 h	n/a	n/a	20	50	25	120
		1h	30000	200	n/a	n/a	n/a	n/a
		30 min	60000	n/a	n/a	n/a	n/a	n/a
		10 min	100000	n/a	500	n/a	n/a	n/a
3	EU limit, µg/m3	1 year	n/a	40	n/a	40	25	n/a
		8h	10000	n/a	n/a	n/a	n/a	n/a
		24 h	n/a	n/a	125	n/a	n/a	n/a
		1h	n/a	200	350	n/a	n/a	n/a

534. Time frame of the model - The modelling has been developed for each of the below scenarios:

(i) Scenario year 2019
(ii) Scenario year 2034.

535. The number of vehicles has been divided in 24 hours according to the provided traffic flow; the results of the modelling are represented into values of concentration/time (hourly levels) for the considered pollutants in correspondence of the selected receptors.

536. Spatial domain and receptors - The model takes into consideration an area far larger than the road strips and has been enlarged according to the morphology, the distribution of settlements and potential receptors for a total of about 20 square kilometres. The domain is a rectangle having dimensions of 6 km x 3.5 km; calculations have been carried out on the basis of progressive advancements for the road. Five main receptors have been inserted at the north and south of the road. They have been used for the considerations in terms of respect or excess of allowable limits.

537. Results - The results of the modelling are organized as follows:
   (i) Scenario 2019 (probable start of road service).
   (ii) Scenario 2034.

538. The values of the concentration of pollutants are calculated in correspondence of the five selected sensitive receptors to act as reference points across the Project corridor for the model. Each of these five receptors are located in the main villages within the Project corridor. The average yearly values and the values considered of reference by the present day legislation are put into evidence together to verify the threshold of acceptability. It must be noted that the values only refer to the traffic in the new road, and do not consider any other external source.

Table 64: Average yearly contribution of the road traffic to the background (concentration in µg/m^3) 2019

Receptors	PM10	PM2.5	NO2	NOX	CO	SO2	C6H6
Public School of Verkvichchala	0.227	0.173	4.56	9.94	1.67	0.004	0.007
Public School of Vashlevi	0.179	0.135	3.06	7.15	1.27	0.003	0.006
Khunevi School	0.207	0.157	4.41	9.24	1.50	0.003	0.007
Boriti School	0.177	0.134	6.07	10.22	1.28	0.003	0.006
Church	0.188	0.143	6.33	10.71	1.36	0.003	0.006

539. The above values represent the contribution of the traffic to the background values in the year 2019 when the road is expected to enter in full service.

540. Scenario for the interval years 2019 to 2034 - The following estimations have been calculated according to Table 64, which reports the estimated increments/year of the average monthly concentration for the expected traffic increments. When background values are available (from the baseline monitoring undertaken as part of this EIA) they are considered into the calculations.

541. The average resulting values are presented in the below Table 65 which shows the increments, the background and the final expect values.

Table 65: PM$_{10}$ (µg/m^3) Comparison of expected values at 2019, background and limits

Receptor	Δ estimated increment 2019 (aver.) PM10	Background level	Total	IFC Guideline Value (year)
Public School of Verkvichchala	0.227	17	17.227	20.0
Public School of Vashlevi	0.179	17	17.179	20.0
Khunevi School	0.207	17	17.207	20.0
Boriti School	0.177	17	17.177	20.0
Church	0.188	17	17.188	20.0

542. The data analysis confirms that the emission of PM$_{10}$ generated by the traffic, at 2019 will not exceed the allowable limits. It must be taken into account that the largest part of the traffic generating the background will be diverted into the new road, for that the above scenario has to be considered very conservative.

543. The application of increment of emissions determined by the expected increase of traffic, permitted to develop the following table (Table 66) where the yearly increment of pollution for the considered pollutants is put into evidence. This data is also mapped for NO_2 and PM10 in **Appendix Q.**

Table 66: Yearly scenarios 2019 to 2034 for Air Quality Parameters

PM10 (µg/m³) *							
year	Public School of Verkvichchala	Public School of Vashlevi	Khunevi School	Boriti School	Church	IFC Guideline Value	EU Limit
2019	17.227	17.179	17.207	17.177	17.188	20	40
2034	17.308	17.249	17.280	17.240	17.255	20	40
NO_2 (µg/m³) **							
2019	4.56	3.06	4.41	6.07	6.33	40	40
2034	4.86	3.32	4.68	6.24	6.51	40	40
CO (µg/m³) **							
2019	1.67	1.27	1.50	1.28	1.36	-	-
2034	2.28	1.75	2.05	1.77	1.87	-	-
PM2.5 (µg/m³) **							
2019	0.173	0.135	0.157	0.134	0.143	10	25
2034	0.236	0.184	0.213	0.183	0.194	10	25
SO_2 (µg/m³) **							
2019	0.004	0.003	0.003	0.003	0.003	-	-
2034	0.005	0.004	0.005	0.004	0.004	-	-
C6H6 (µg/m³) **							
2019	0.007	0.006	0.007	0.006	0.006	-	-
2034	0.01	0.008	0.009	0.008	0.008	-	-

* Including background at 2019
** No background

544. The analysis of the impact on operational phase air quality determined by the traffic on the new road suggests that there are no negative impacts on the environment. In addition to the fact that the maximum allowable limits are not surpassed, it must be taken into account that the road provides benefits in term of vehicular emission due to the smoother drive and optimized alignment.

545. The emissions of vehicles on a highway are lower than vehicles driving a urban type road as the existing one where the frequent bends, inclination and traffic congestions do not allow a fluid drive. If a similar traffic flow should transit via the existing road, the emissions would be almost 20% higher.

546. The new road will have a positive impact on the air quality in term of reduced emissions compared to a similar flow of traffic along the existing one; it can also be pointed out that no air quality limits will be exceeded even considering that the composition of the fleet of vehicles is maintained. The higher values are recorded to the south of the road due to the main wind directions and morphology, these values are anyhow lower than the limits.

Management & Mitigation Actions

<u>Pre-construction Phase</u>

547. Locations for rock crushing facilities, concrete batching yards and asphalt plants will require approval from the Engineer, MoEPA and the RD during the Pre-construction phase. Efforts will be made to ensure that these facilities are as near to the Project road as practical to avoid unnecessary journeys and potential dust issues from vehicle movements during construction works on unpaved roads in urban areas. Haul routes will be prepared and submitted to the Engineer as part of his Traffic Management Plan (TMP).

548. To prevent impacts arising from asphalt plants, construction camps, batching plants and rock crushing plants, they will be prohibited within 500 meters of any urban area or sensitive receptor (school, hospital, etc). The locations of these facilities will be indicated within the Contractors SEMP. Baseline air quality monitoring will also be undertaken by the Contractor during the pre-construction phase as described below under the recommended monitoring. Where practical, they should also be located as far away from agricultural plots as possible, although given the constraints of the Project area ensuring sites are not close to agricultural plots may not always be possible.

549. To adequately manage air quality impacts the Contractor will be responsible for the preparation of an Air Quality Plan, submitted to the Engineer as part of the SEMP. The plan will detail the actions to be taken to minimize dust generation (e.g. spraying un-surfaced roads with water (including the types of equipment, sources of water, locations for watering and schedule), covering stock-piles, etc) and will identify the type, age and standard of equipment to be used and will also provide details of the air quality monitoring program for baseline and routine monitoring. The Plan will also include contingencies for the accidental release of toxic air pollutants.

<u>Construction Phase</u>

550. The Contractor will be responsible, through compliance with this EMP and his SEMP, for the following;

- (i) Exhaust emissions - No furnaces, boilers or other similar plant or equipment using any fuel that may produce air pollutants will be installed without prior written consent of the Engineer. Construction equipment will be maintained to a good standard and fitted with pollution control devices regularly monitored by the Contractor and Engineer.
- (ii) Open burning of waste materials - No burning of debris or other materials will occur on the Site.
- (iii) Dust generated from haul roads, unpaved roads, material stock piles, etc:
  - (a) The Contractor will ensure and that material stockpiles will be located in sheltered areas and be covered with tarpaulins or other such suitable covering to prevent material becoming airborne.
  - (b) All trucks used for transporting materials to and from the site will be covered with canvas tarpaulins, or other acceptable type cover (which will be properly secured) to prevent debris and/or materials from falling from or being blown off the vehicle(s).
  - (c) Hard surfaces will be required in construction areas with regular movements of vehicles.
  - (d) Effective use of water sprays will be implemented (e.g., Carry out watering for dust control at least 3 times a day: in the morning, at noon, and in the afternoon during dry weather with temperatures of over 25°C, or in windy weather. Avoid overwatering as this may make the surrounding muddy). All water used for controlling dust will be free of odor and pollution.
  - (e) Earthwork operation to be suspended when the wind speed exceeds 20 km/h in areas within 500 m of any community.

551. In addition, any new concrete batching plant, rock crushing facility and asphalt mixing plant will be the subject of separate environmental application under the responsibility of the Contractor. The Engineer will ensure that no such facility becomes operational without the required permits.

552. The Contractor is also responsible for the preparation of a Health and Safety Plan. The Plan, required as part of the SEMP, will include contingencies for the accidental release of toxic air pollutants.

553. Emissions from on-road and off-road vehicles should comply with national or regional programs. In the absence of these, the following should be considered:

(i) Regardless of the size or type of vehicle, owners / operators should implement the manufacturer recommended engine maintenance programmes.

(ii) Drivers should be instructed on the benefits of driving practices that reduced both the risk of accidents and fuel consumption, including measured acceleration and driving within safe speed limits.

(iii) Implement a regular vehicle maintenance and repair program.

Operational Phase

554. Ensure continued maintenance of tunnel ventilation system.

Residual Impact Significance

Construction Phase – ***MINOR***

If the mitigation measures suggested are implemented, the residual impacts of the Project will be minor.

Operational Phase – ***LOW***

Air quality during the operational phase will not be significantly impacted by the Project road.

G.5.2 Climate Change

Potential Impacts Caused by the Project

555. Greenhouse Gas (GHGs) Emissions – The Greenhouse Gas (GHG) emissions resulting from road construction have been estimated to be 2.14 ktCO2/km for a 26m wide road. Including operational and maintenance issues over a 40 year period this figure rises to 3.94 ktCO2/km. Given a road length of 12.2 km, this would result in 48,068 tCO2 of GHG emissions from the construction and O&M phases of the Project over a 40 year period.

Table 67: Estimated Energy Consumption, CO2 Emissions and GHG Emissions for a Concrete Pavement 13 m wide.

Phase	Energy Consumption, TJ/km (26m pavement)	CO_2 Emissions ktCO_2/km (26m pavement)	All GHG Emissions ktCO_2/km (26m pavement)
Construction	11.51 (23.02)	1.00 (2.00)	1.07 (2.14)
Maintenance – 40 years	2.99 (5.98)	0.19 (0.38)	0.20 (0.40)

Operation – 40 years	12.60 (25.20)	0.66 (1.32)	0.70 (1.40)
Total	27.09 (54.18)	1.85 (3.70)	1.97 (3.94)

Methodology based on IEA ETSAP – Technology Brief T14 –August 2011

556. GHG emissions from traffic using the road have been calculated using the traffic forecasts presented in **Section B**. The existing road traffic is estimated to generate around 259 tons of CO_2 per day, or 94,661 tons of CO_2 per annum. A decrease of 13% of GHG emissions can be achieved when driving at 90 km/h as opposed to transient driving at 60 km/h. If we apply this condition to the traffic forecasts in 2037 a figure of approximately 186,000 tons of CO_2 would be generated by traffic using the road per year.

557. However, future emissions should not just be assessed by looking at how they increase on the new road, but also compared with how they would have increased on the existing road given the same projected traffic increases. As noted above he emissions of vehicles on a highway are lower than vehicles driving a urban type road similar to the existing one where the frequent bends and inclination as well as some traffic congestions do not allow a fluid drive. If a similar traffic flow should transit via the existing road, the emissions would be almost 20% higher.

Potential Impacts Upon the Project

558. The following section is extracted from the Climate Risk and Vulnerability Assessment & Independent Proof Check prepared by the ADB in April 2018.

Components at High- and Moderate-Risk from Climate Impacts

559. **Bridges** – By 2050, precipitation is expected to decrease by 4.5%, and by 2100, it will decrease by 13%. At the same time, extreme rainfall events are projected to become more frequent and intense. This may lead to increased scouring and riverbank erosion. In addition, the bridge deck drainage capacity may be overwhelmed and create unsafe driving conditions.

560. By 2100, annual river runoff may decrease by about 13%, and normal water levels in the river channels may be lower by as much as -1.1 m. Water level and flow fluctuations may lead to changes in sub-surface conditions that could affect foundation settlement and pier bearing capacity.

561. By 2050, summer (July – September) temperatures are projected to increase by up to 4.5°C, and the number of consecutive hot days (i.e., days with maximum temperature over 25°C, and days with daily minimum temperatures over 20°C) will become more frequent, which may impact bridge structure and bridge deck paving material.

562. The expected changes in temperatures will stress the bridge deck paving material, which is expected to be a BM. The increase in maximum air temperatures may soften the BM, and the likelihood of shorter winters will reduce the service life of the BM mixture due to abrasion and wear.

563. In addition, an increase in the number, duration and extent of wildfires in the surrounding vegetated and forested areas is expected. The ambient heat generated from these may also affect bridge structures and materials, bridge deck conditions, and may also create unsafe driving conditions.

564. **Tunnels** – By 2050, precipitation is expected to decrease by 4.5%, and by 2100, it will decrease by 13%. At the same time, extreme rainfall events are projected to become more

frequent and intense. This may affect overflow drainage capacity and create unsafe driving conditions.

565. By 2050, summer (July – September) temperatures are projected to increase by up to 4.5°C, and the number of consecutive hot days (i.e., days with maximum temperature over 25°C, and days with daily minimum temperatures over 20°C) will become more frequent. While droughty conditions are projected to occur more frequently, it is possible that an additional increase of at least 2% in relative air humidity may occur due to changes on the frequency of extreme rainfall events. This may impact tunnel waterproofing, tunnel lining and ambient air temperatures within the tunnels.

566. In addition, an increase in the number, duration and extent of wildfires in the surrounding hill slopes is expected. The ambient heat generated from the wildfires may affect conditions within the tunnels, and may also create unsafe driving conditions.

567. An increase in droughty conditions combined with more frequent extreme rainfall events will increase risk of flash floods, mudflows and landslides on the surrounding slopes. For F2, the projected risk range for landslides is between 94% in the west and 143% in the east, while the projected risk range for mudflows and flash-floods is between 15% in the east and 23% in the west. An increase in debris flows along the road corridor is likely. These may impact access to the tunnels.

568. **Cut Sections -** By 2050, precipitation is expected to decrease by 4.5%, and by 2100, it will decrease by 13%. At the same time, extreme rainfall events are projected to become more frequent and intense. Changes to ground water levels and flows may also lead to changes in sub-surface conditions.

569. By 2050, summer (July – September) temperatures are projected to increase by up to 4.5°C, and the number of consecutive hot days (i.e., days with maximum temperature over 25°C, and days with daily minimum temperatures over 20°C) will become more frequent, which will lead to an increase in the number, duration and extent of wildfires in the surrounding vegetated and forested areas.

570. An increase in droughty conditions combined with more frequent extreme rainfall events will increase risk of flash floods, mudflows and landslides on the surrounding slopes. For F2, the projected risk range for landslides is between 94% in the west and 143% in the east, while the projected risk range for mudflows and flash-floods is between 15% in the east and 23% in the west. An increase in debris flows and drainage obstructions is likely.

571. **Surface Water Management** - By 2050, precipitation is expected to decrease by 4.5%, and by 2100, it will decrease by 13%. At the same time, extreme rainfall events are projected to become more frequent and intense. Intense and long-duration rainfall can be regarded as the most critical loading condition. The frequency of such events is projected to increase, which may create loads that exceed the original design parameters.

572. By 2100, annual river runoff may decrease by about 13%, and normal water levels in the river channels may be lower by as much as -1.1 m. In addition, an increase in the number, duration and extent of wildfires in the surrounding vegetated and forested areas is expected. This will likely increase the debris load near drainage channels and openings. Because of changing climatic conditions, projected debris loads, changing land use patterns, and uncertainties in hydrologic estimates, culvert size and capacity should be expansive.

573. An increase in droughty conditions combined with more frequent extreme rainfall events will increase risk of flash floods, mudflows and landslides on the surrounding slopes. For F2, the projected risk range for landslides is between 94% in the west and 143% in the

east, while the projected risk range for mudflows and flash-floods is between 15% in the east and 23% in the west. An increase in debris flows and drainage obstructions is likely.

Components at Low-Risk from Climate Impacts

574. **Road Surface** - Nearly all climate parameters affect the road surface. Even under normal climate change conditions, rigid pavements suffer from thermal-expansion stresses.

575. Thermal-expansion stresses, such as scaling, D-cracking, pumping, faulting, curling, corner cracking and ‘punch-outs, are the primary concern due to air temperatures, including absolute yearly maximal and the number of heat days. Curling deformation, resulting in thermal-expansion stresses in the concrete slab, is a characteristic phenomenon under environmental and repeated vehicle loads. Distortion of the slab, due to both upward and downward curling, may occur when the top surface of the slab is cooler than the base course, and also when there is a higher temperature on the top surface, leading to separation of the base course from the concrete. Distress of the pavement in the form of joint deterioration, or cracking, also contributes to void formation by allowing moisture infiltration. The combination of distress and layer voids will further reduce the pavement load carrying capacity. Changes in the capacity of the base course, or subgrade, as a second-order response may also add new stresses to the road surface.

576. While an overall increase in temperature is projected, these are not expected to severely impact the road surface since the projected temperatures are within the German Pavement Design Guideline (RStO 12) reference temperature range (-20°–50°C) used in the pavement design.

577. The increase in the number of consecutive hot days (i.e., days with maximum temperature over 25°C, and days with daily minimum temperatures over 20°C), and the increase in the number, duration and extent of wildfires on the surrounding slopes, may require second level responses.

578. **Interchanges and Access Roads** - There is insufficient information to properly assess climate risks to the interchanges, and the approach and connecting roads.

579. The majority of climate parameters affect BM surfaces, though the increase in the number of hot days and nights is of particular concern. As BM surfaces have a short design life and can be replaced relatively easily, they are not considered a medium- or high-risk component. Changes in air and ground temperatures may also affect the subgrade of the approach and connecting roads, but not to an extent that would result in medium- or high-risk component.

580. **Road Embankment and Road Base** - Most climate events affect the road embankment to some degree. The climate load includes changing ground water levels, that can induce consolidation settlement; ground temperature; ground water regimes; snow cover; and surface vegetation that can reduce their service life. By 2050, precipitation is expected to decrease by 4.5%, and by 2100, it will decrease by 13%. Increasing temperatures and changes in precipitation patterns may impact ground and surface water flows, leading to consolidation settlement.

581. By 2050, summer (July – September) temperatures are projected to increase by up to 4.5°C, and the number of consecutive hot days (i.e., days with maximum temperature over 25°C, and days with daily minimum temperatures over 20°C) will become more frequent, may accelerate soil warming, and in some soil types, creating soil heave.

582. In contrast to the road embankment, the road base is not directly exposed to the atmosphere, and therefore is less impacted by short-term climate events. Changes in the road base capacity would mostly result from loss in strength or formation of voids due to internal erosion, especially if the road surface is cracked.

583. Changes in surface and ground water levels and their impact on the road base and the road embankment, as a second-order response to changes in precipitation levels are difficult to predict, but should be considered.

Management Actions

584. A number of recommendations were made as part of the climate risk assessment. The following table provides those recommendations along with the responses of the Detailed Design Consultant.

Table 68: Climate Change Recommendations and Responses

Recommendation	Detailed Design Consultant Reply
Bridges	
A review of the bridge pier design parameters in light of the potential changes in in soil conditions, with implications for foundation settlement, should be undertaken prior to finalization of the Design Reports.	All piers are designed in order to avoid settlements on the long run and plinths are generally in the floodplain. Plinths in the flowing section of the river, whenever unavoidable, are founded on piles and with the upper face below the riverbed level, as per best practice; the risk of foundations being exposed is consequently minimum. Intervention of protection of the plinths in the floodplain in case of future river bed changes is quite simple and not expensive, so we suggest to monitor this aspect and act accordingly just in case. Recommendations for the Employer will be included in the "Recommendations for the management of the highway" document, in order to give an instrument of monitoring and managing the maintenance.
The recurrence interval for the bridge drainage system should be upgraded to a 50-year recurrence interval, and the drainage calculations revisited, to ensure concurrency with the other elements of the drainage system.	The shown value "30 years" at paragraph 4.5 of the Design Report is a typo mistake, indeed as you can check the discharge per unit area considered is that effectively used for all other drainage elements. i.e. 50 years (50,5 m3/s/km2).
As part of road maintenance and key indicator monitoring, bridge deck retrofitting trigger levels – to recognize the point at which impacts are beginning to be experienced at specific locations – should be developed for initiation of management responses.	Bridge deck retrofitting trigger levels will be included in the "Recommendation for the management of the highway" document
Tunnels	
Verify that the parameters for the waterproofing and ventilation systems include potentially higher humidity values.	Waterproofing inside a tunnel is designed to prevent water circulating in the rocks from entering the tunnel, and, if properly executed, it should not be considered as a main humidity values rise driver. The humidity values are not a problem for these tunnels since they are unidirectional, so they do not affect the ventilation system or the smoke.
A 50-year recurrence interval for the tunnel drainage system should be used for consistency with other drainage system parameters, and all design calculations reviewed.	Highway platform drainage inside tunnels is designed to manage possible accidental losses of hazardous liquids from trucks as a consequence of an accident. In fact this is a close system, with "no-fire-inlet" manholes to avoid the spread of the flame and a

Recommendation	Detailed Design Consultant Reply
	storage tank at the lower portal. Tank that won't discharge on the rivers but will be emptied by means of pumps. Having neither direct precipitation nor runoff inflow in the tunnel, the relevant drainage is not an issue and it is not correlated to any specific hydrological return period.
The potential for higher levels of channel obstruction should be explicitly integrated into the drainage system design, due to increased mass movement and erosion activities.	See above. Moreover, at each portal there is a drainage system collecting water coming both from the platform and from the slope and discharging it in the river, by means of pipes or culverts, before entering the tunnel. In any case sediments are not expected to enter in a significant amount the tunnel drainage system.
The design of the tunnel portals and wing walls should be reviewed for suitability for higher levels of mass movement and erosion activities.	All the slopes at the portal, when not covered with material coming from excavation (slope 7 on 4), are protected with net, dimensioned case by case, based on the geotechnical conditions.
Cut Sections	
A decrease in the cut slope gradient, and a concurrent increase in the overall slope buffer area, is recommended.	The choice of the cut slope is a compromise between the geotechnical constraints and the occupation of land. Reducing the slope of the cuts in many cases will cause larger road footprint (often more than a hundred meters), which would not acceptable for its landscaping and resettlement impacts and for the volumes of spoil material generated. In any case the geotechnical verification (not present in the draft) have been carried out with conservative safety coefficient.
Increased use of hydro seeding on all the cut slopes, not just their upper most area, is recommended.	The steepness of the slope (almost vertical) and the presence of rock don't allow the use of hydro seeding. This would more be the case of a "vertical garden", which is not a technology practiced in Georgia. That's why the designer's choice was the more industrial, but effective steel net protection.
Surface Water Management Structures	
A consistent 50-year recurrence interval for the road drainage system should be used throughout the design, and all design calculations reviewed.	50 years return period is used as clearly stated in the design documents (check paragraphs 4.1, 4.2, 4.3 and 4.4; statement at paragraph 4.5 about the 30 years RP is, again, only a typo mistake).
Assumptions and calculations for areas with high degree of mass movement and high potential for channel obstruction should be explicitly integrated into the drainage system design.	Mass movements are mostly unpredictable, as well as the yearly amount of debris flow. We only can suggest to the Employer to monitor these phenomena and to act accordingly, in case of event. Monitor of mass movement will be included in the "Recommendation for the management of the highway" document.
Use of box culverts, which are better at managing debris flows and related obstructions than pipe-based systems, is recommended.	Indeed, only box culverts are adopted all along the motorway for hill slope water (see table 3.7.1. of the hydraulic report). Further, given that a design solution with external ditches has been chosen for both embankment/fill and cut section, the motorway platform always lies higher than external ditches, so that drainage pipes are not expected to convey significant debris flow.

585. Given the above, the only management measures required are:

- Ensuring the items outlined above are included in the "Recommendations for the management of the highway" document, and

- Measure and report annual GHG emissions given that the projected emissions will be above 100,000 tCO_{2eq}/yr.

Residual Impact Significance

Construction Phase – ***MINOR***

Operational Phase – ***LOW/MEDIUM***

Residual impacts from the generation of GHGs will remain throughout the lifecycle of the Project. This is an unavoidable consequence of the Project, but as noted in other sections of this report, more fuel efficient cars may, in the future lead to a decrease in the emissions generated on the Project road. The Detailed Design Consultant have considered the recommendations of the climate risk assessment and will add them to the "Recommendation for the management of the highway" document where applicable. No other actions are considered necessary to address climate change issues.

G.5.3 Soils

Potential Impacts

586. Potential impacts to soils include:
   (i) Loss of Topsoil - Several impacts to topsoil may occur during the construction phase, including; removal of top soil for construction outside the ROW; compaction of topsoil; loss of top soil by wind and water erosion and covering of top soil by project works.
   (ii) Erosion - It is possible, that without adequate protection measures soil erosion could occur on road embankments and bridge embankments. It is also possible, that stockpiles of soil located close to surface waters could infiltrate the water courses during heavy rainfall and cause siltation of the rivers.
   (iii) Borrow Pits – No borrow pits are required under this Project as the quality and quantity of spoil material from tunnels and other cuts is suitable for construction purposes.
   (iv) Induced Changes - It is possible that construction of the new road could induce development along the corridor to some extent, but in general the purpose of the Project is to improve the existing E-60 corridor to provide safer and quicker journey times which will help facilitate the movement of people and goods locally and regionally. It is considered unlikely that significant new commercial, industrial or residential developments would arise along this portion of the corridor as a result of the Project that in turn may lead to conversion of agricultural land or other impacts to productive soils.
   (v) Contamination Due to Spills or Hazardous Materials - Potential soil contamination is a possibility resulting from poorly managed fuels, oils and other hazardous liquids used during the project works.

Management & Mitigation Actions

Construction Phase

587. Potential adverse impacts will be avoided or otherwise mitigated by ensuring the Contractor complies with the following:
   (i) Erosion - During construction, the Contractor will be responsible for ensuring material that is less susceptible to erosion will be selected for placement around bridges and culverts. In addition, he will ensure re-vegetation of exposed areas

including; (i) selection of fast growing and grazing resistant species of local grasses and shrubs; (ii) immediate re-vegetation of all slopes and embankments if not covered with gabion baskets; (iii) placement of fiber mats to encourage vegetation growth. The Engineer and the Contractor will both be responsible for ensuring that embankments are monitored continuously during construction for signs of erosion. These actions and activities will be included in the Contractors Clearance, Re-vegetation and Restoration Management Plan.

(ii) Topsoil – To reduce impacts to topsoil the following measures will be employed by the Contractor; locate topsoil stockpiles outside drainage lines and protect stockpiles from erosion; construct diversion channels and silt fences around the topsoil stockpiles to prevent erosion and loss of topsoil; rip ground surface prior to the spreading of topsoil; and remove unwanted materials from topsoil such as roots of trees, rubble and waste etc. Specifically regarding soil compaction, the Contractor will confine operation of heavy equipment within the ROW, as much as possible, to avoid soil compaction and damage to privately owned land. If in case private lands are disturbed, the contractor should promptly inform the owner and agree on the ways to remedy the situation.

(iii) Contamination Due to Spills or Hazardous Materials. The Contractor, with oversight from the Engineer, will ensure that:

(a) All fuel and chemical storage (if any) will be sited on an impervious base within a bund and secured by fencing. The storage area will be located away from any watercourse or wetlands. The base and bund walls will be impermeable and of sufficient capacity to contain 110% of the volume of tank (or one tank if more than one tank is located in the bund).

(b) The construction camp maintenance yard will be constructed on impervious hardstanding with adequate drainage to collect spills, there will be no vehicle maintenance activities on open ground.

(c) Filling and refueling will be strictly controlled and subject to formal procedures. Drip pans will be placed under all filling and fueling areas. Waste oils will be stored and disposed of by a licensed contractor.

(d) All valves and trigger guns will be resistant to unauthorized interference and vandalism and be turned off and securely locked when not in use.

(e) The contents of any tank or drum will be clearly marked. Measures will be taken to ensure that no contaminated discharges enter any soils.

(f) No bitumen drums or containers, full or used, will be stored on open ground. They will only be stored on impervious hardstanding.

(g) Areas using bitumen will be constructed on impervious hardstanding to prevent seepage of oils into the soils.

(h) No bitumen drums or containers, full or used, will be stored on open ground. They will only be stored on impervious hard standing.

(i) Areas using bitumen will be constructed on impervious hard standing to prevent seepage of oils into the soils.

Residual Impact Significance

Construction Phase – ***MINOR***

If the mitigation measures suggested are implemented, the residual impacts of the Project will be minor.

Operational Phase – ***LOW***

The erosion protection measures outlined above will prevent impacts occurring into the operational phase of the Project.

G.5.4 Hydrology

Potential Impacts

Pre-construction Phase

588. The following potential impacts to hydrological conditions exist within the Project corridor:

(i) Drainage & Flooding - Inadequate assessment of the hydrological conditions in the Project Area and poor design could result in damage to Project structures, including bridges and culverts. This in turn would result in several impacts including cost to rebuild the structures, potential flooding of agricultural land and property and impacts to surface water quality.

(ii) Construction Camps – Improper siting and design of construction camps can have negative impacts to hydrology, both surface and groundwater, through improper disposal of liquid waste and spills of hazardous liquids.

589. The span of the bridges is designed to avoid, as far as possible, the presence of foundation piles in the riverbed. That said, it is important to point out that the intervention is located in a complicated orography (a narrow valley with a central stream) and that the geometric standards of the route have imposed strong constraints that oblige to pass over the river, to have no greater environmental impact on forests or populated areas.

Construction Phase

590. Bridge Construction - Bridge construction activities may increase silt load in the river during construction at bridge sites and may result in accidental spillage of concrete and liquid waste into the river. This may impact upon the biodiversity of the rivers. Excavation of river bed materials will be required during the construction of the bridge piers (Approximately 56 piers out of around 160 in total will be constructed within the river itself).

591. Hazardous Liquids - From the construction activities, there will be significant use of fuel and lubricant and other hazardous liquids such as paints. Without standardized materials handling and storage protocol in place, spills and contamination of groundwater and soils is possible. Other impacts to groundwater could occur from the washing out of concrete mixers onto bare soils and a lack of oil and grease interceptor tanks in camp drainage systems.

592. Water Use – Technical water may be sourced from the Dzirula and Rikotula rivers. The required amounts, potentially 200 m^3 per day (0.002 m^3/s) are insignificant given the flow rates of these major rivers (The lowest flow in the Dzirula is during August with a flow of

approximately 3.445 m^3/s). However, where necessary the relevant permits will be obtained for surface water abstraction.

593. Tunnel Construction – Impacts associated with tunnel construction are discussed under **Section G.7.5** below.

594. No fisheries have been identified within the Project area, or residents that rely on fishing as a livelihood. As such no impacts to livelihoods or fisheries or activities downstream are anticipated. Recreational fishing was noted in the Dzirula river during site visits. Impacts to recreational fishing are anticipated to be short term and minor.

Operational Phase

595. In rare circumstances there could be a major spill of oil / fuel from tanker trucks. Such spills could impact significantly on the Dzirula and Rikotula rivers given the proximity of the road to these surface water courses in many locations along the alignment.

596. Drainage of run-off from bridge decks could flow directly to the rivers if correct drainage is not installed on the bridges. This could be a problem if the bridges have accumulated oils and grease during dry periods and they are suddenly washed out during heavy rainfall.

Management & Mitigation Actions

Pre-construction Phase

597. Drainage and Flooding - Consideration in the design phase has be given to the issue of drainage and culverts to ensure that drainage patterns are improved from the existing conditions and that increased run-off does not occur or result in flooding of areas previously undisturbed. During design, all drainage works have been designed based on the historical flood data and flood forecasting. A design discharge of 50 years return period is considered for culverts, and 100 years of bridges.

598. It is also strongly recommended that the RD considers including the use of oil separators within the road drainage system to capture any spills of oil / fuel and also to filter hydrocarbon run-off from the road in general.

599. Bridges - All bridges will be designed for the life expectancy of 100 years. The design loading and design of all structural components will conform to the bridge design standards provided in the Employer's Special Requirements.

600. The bridges shall be designed with dry paths under the bridge on either side of the streams to facilitate movements of people, livestock and wildlife, the latter primarily at night when people are not around.

601. Bridge designs will ensure that drainage from bridge decks over 50 meters do not discharge directly to the watercourses beneath the bridges. The bridge run-off waters will lead to an interceptor tank, or filter pond adjacent to the bridge in order to trap oil and grease run-off so that it cannot enter any portion of the Dzirula and Rikotula rivers. The bridge design and layout must also be aesthetically pleasing and in harmony with the existing environment. Finally, the Contractor, through his Environmental Manager, will be responsible for consulting with MoEPA to confirm the fish spawning period (see Table Figure 85) in relation to the bridge construction works to ensure that all works are scheduled to take place periods least likely to affect the fish spawning period. The Contractor shall also prepare a Bridge Construction Plan prior to the starting of works at any bridge construction site. The Plan shall include items relating to the construction schedule, construction techniques, work areas, equipment use,

siting of hazardous liquids and waste materials, provision of coffer dams, fish spawning periods, results of any other fauna surveys, e.g. for otters, procedures for fueling of vehicles, sediment management, methods to reduce turbidity, OHS measures, etc.

602. Construction Camps – In the first instance, no construction camp, permanent or temporary, will be located within 500 meters of any river, or irrigation channel (not including drainage channels) identified in this report, including the Dzirula and any of its tributaries. The Contractor will also be responsible for the preparation of a Construction Camp Site Plan which will form part of the SEMP. The Plan will indicate the system proposed and the locations of related facilities in the site, including latrines, holding areas, septic tanks, etc. The Contractor will ensure the following conditions are met within the Plan:

- (i) Wastewater arising on the site will be collected, removed from the site via a suitable and properly designed temporary drainage system and disposed of at a location and in a way that will cause neither pollution nor nuisance.
- (ii) There will be no direct discharge of sanitary or wash water to surface water, including the surface water courses identified in this report, including the Dzirula and its tributaries. Disposal of materials such as, but not limited to, lubricating oil and onto the ground or water bodies will be prohibited.
- (iii) Liquid material storage containment areas will not drain directly to surface water (including wetlands).
- (iv) Lubricating and fuel oil spills will be cleaned up immediately and spill cleanup materials will be maintained (including spill kits) across the Contractors construction camp and ancillary facilities, e.g. asphalt plant.
- (v) Construction and work sites will be equipped with sanitary latrines that do not pollute surface waters.
- (vi) Discharge of sediment-laden construction water directly into surface watercourses or wetlands will be forbidden. Sediment laden construction water will be discharged into settling lagoons or tanks prior to final discharge.
- (vii) Spill cleanup equipment will be maintained on site. The following conditions to avoid adverse impacts due to improper fuel and chemical storage:
- (viii) Fueling operations will occur only within containment areas.
- (ix) All fuel and chemical storage (if any) will be sited on an impervious base within a bund and secured by fencing. The storage area will be located away from any watercourse or wetlands. The base and bund walls will be impermeable and of sufficient capacity to contain 110% of the volume of tanks.
- (x) Filling and refueling will be strictly controlled and subject to formal procedures and will take place within areas surrounded by bunds to contain spills / leaks of potentially contaminating liquids.
- (xi) All valves and trigger guns will be resistant to unauthorized interference and vandalism and be turned off and securely locked when not in use.
- (xii) The contents of any tank or drum will be clearly marked. Measures will be taken to ensure that no contaminated discharges enter any drain or watercourses.
- (xiii) Disposal of lubricating oil and other potentially hazardous liquids onto the ground or water bodies will be prohibited.
- (xiv) Should any accidental spills occur immediate cleanup will be undertaken and all cleanup materials stored in a secure area for disposal. Disposal of such was will be undertaken by a waste management company contracted by the Contractor. The waste management company must have the required licenses to transport and dispose of hazardous waste before any such waste is removed from the site. The Contractor will keep copies of the company's licenses and provide waste transfer manifests at his camp site for routine inspection by the Engineer.

<u>Construction Phase</u>

603. Construction Camps and Storage Areas – The Engineer will undertake regular monitoring of the Contractors construction camp and storage areas to ensure compliance with the SEMP and the Contractors Construction Camp Site Plan.

604. Site plans will be devised to ensure that, insofar as possible, all temporary construction facilities are located at least 100 meters away from any surface water course. If determined warranted by the Engineer, the Contractor will provide a wash pit or a wheel washing and/or vehicle cleaning facility at the exits from the Contractors camp sites. If so requested, the Contractor will ensure that all vehicles are properly cleaned (bodies and tires are free of sand and mud) prior to leaving the site areas. The Contractor will provide necessary cleaning facilities on site and ensure that no water or debris from such cleaning operations is deposited off-site.

605. Bridge Construction - Concerning bridge construction works, the Contractor will:

- (i) Divert the water flow near the bridge piers.
- (ii) Provide coffer dams, silt fences, sediment barriers or other devices to prevent migration of silt during construction within streams.
- (iii) Perform dewatering and cleaning of cofferdams to prevent siltation by pumping from cofferdams to a settling basin or a containment unit.
- (iv) Carry out bridge construction works without interrupting the traffic on the Project Road with the provision of suitable diversions.
- (v) Ensure no waste materials are dumped in the river, including re-enforced concrete debris.
- (vi) Place generators more than 20 meters from the river.
- (vii) Ensure that no concrete waste is dumped in the river.
- (viii) Carefully collect all polystyrene (from expansion joints) so that it does not litter the local environment.
- (ix) Ensure that no hazardous liquids are placed within 10 meters of the river.
- (x) Provide portable toilets at bridge construction sites to prevent defecation by workers into the river.
- (xi) Ensure that workers are provided with correct PPE including harnesses.
- (xii) During piling works ensure that pumped water is filtered through a silt trap before being discharged to the river.
- (xiii) Provide areas where concrete mixers can wash out leftover concrete without polluting the environment. This may be in the form of a lined settling pond at each bridge site. Drivers will be informed of these locations and the requirements to use these settling ponds on a routine basis by the Engineer. Dried waste from the settling ponds can be used as backfill for culverts, etc.

606. Drainage and Flooding - During the construction phase the Contractor will be required to construct, maintain, remove and reinstate as necessary temporary drainage works and take all other precautions necessary for the avoidance of damage to properties and land by flooding and silt washed down from the works. Should any operation being performed by the Contractor interrupt existing irrigation systems, the Contractors will restore the irrigation appurtenances to their original working conditions within 24 hours of being notified of the interruption. The Contractor will also be responsible for ensuring that no construction materials or construction waste block existing drainage channels within the Project corridor. The Engineer will be responsible for routine monitoring of drainage channels to ensure they remain free of waste and debris.

607. Tunnel Construction - Mitigation associated with tunnel construction are discussed under **Section G.7.5** below.

<u>Operational Phase</u>

608. During the operational phase of the Project, the RD will be responsible for monitoring drainage along the road to ensure that it does result in increased run-off and flooding. The RD will be responsible for rectifying this issue if it occurs.

609. During routine maintenance, the Contractor shall:

(i) Perform maintenance paving of the road sections and bridge decks only in dry weather to prevent runoff contamination.
(ii) Use staging techniques to reduce the spread of paving materials during the repair of potholes and worn pavement. These can include covering storm drain inlets and manholes during paving operations, using erosion and sediment controls to decrease runoff from repair sites, and using drip pans, absorbent materials and other pollution prevention materials to limit leaks of paving materials and fluids from paving machines.
(iii) Comply with mitigation measures defined for water protection during construction.
(iv) Remove all waste, material, machinery and tool from the area after completion of works.
(v) Reinstate disturbed areas – if the case.

Residual Impact Significance
Construction Phase – ***MINOR***
If the mitigation measures suggested are implemented, there will be no significant residual impacts.
Operational Phase – ***LOW/MEDIUM***
It is noted that the Project requires interceptor tanks for bridge run-off and this could also be applied to the road drainage network in general, if not residual impacts will occur during the operational phase as polluted road water run-off drains directly into surface water courses.

G.5.5 Natural Hazards

Potential Impacts

610. No significant issues have been identified relating to landslides that cannot be managed by incorporation of the design measures outlined in **Section F.1.4 Natural Hazards.**

611. The project is located in a seismically active area. The Detailed Design Consultants have experience of designing roads in seismically active areas and have ensured that all designs are compliant with the relevant seismic standards of the GoG.

612. Potential flood events are discussed above under **Section G.5.4 - Hydrology**) and increased precipitation is discussed above under **Section G.5.2 Climate Change.**

Management & Mitigation Actions

613. None required.

Residual Impact Significance
Construction Phase – ***NONE***

No residual impacts are anticipated.

Operational Phase – ***NONE***

G.6 Ecological Resources

G.6.1 Biodiversity

Potential Impacts

614. The main concerns for impacts on biodiversity are outlined below

Impacts from Site Clearance

615. Site Clearance Impacts on Habitat - The main effects of site clearance/preparation and movement of equipment include loss of habitat. The ecological receptors most affected include those that have limited mobility such as terrestrial flora, reptiles and amphibians. Loss of habitat can also affect more mobile species which lose breeding, nesting and feeding sites. The spread of invasive plant species is facilitated by disturbances such as site clearance and this results in a risk to the native, endemic and relict flora.

616. The removal of vegetation, including up-rooting of shrubs and cutting of trees, will result in loss of plants, contributing to a decline in their numbers, as well as loss of habitat for species of mammals, birds, insects and herpetofauna that they provide. Fauna with limited mobility, such as reptiles, are at a greater risk of direct mortality due to Project- related activities such as movement of equipment.

617. Site clearance/preparation and movement of equipment results in the removal of top soil which can negative influence several soil functions which are relevant in nature and environmental protection, e.g. carbon storage, and a decrease in biological activity.

618. Reptiles and amphibians have limited ranges and are unable to travel long distances unlike birds and mammals. As a result any individuals found within the Project area are at risk of either being killed by Project-related activities, or having suitable habitat destroyed and perishing as a result of their inability to re-locate.

619. Loss of habitat results in the loss of breeding, feeding and nesting sites for all species including highly mobile ones.

620. Site Clearance Impacts on State Forest Fund and Trees - A number of trees will need to be cut within the Project area, both on private land and within State Forest Fund areas. Other trees (potentially including Georgian red-listed species) are located adjacent to the boundary of the site and may be damaged accidentally by construction works.

Impacts on Ecosystems

621. Ecosystems can be divided into terrestrial and aquatic ecosystems.

(i) The impact on terrestrial ecosystems will be limited, with the main one being due to loss of habitat from construction of the Project as described above and below under natural habitat.
(ii) The spread of invasive species, however, if not prevented, will have an impact on the terrestrial ecosystem, especially on the composition of native flora.

Under disturbed conditions invasive species will be able out-compete native flora and alter the plant community composition permanently.

(iii) Irresponsible waste disposal will result in impacts on both terrestrial and aquatic ecosystems. Dumping on soil will reduce soil quality and inhibit biological activity, whilst dumping in water bodies will reduce water quality, which will impact the aquatic ecosystem. Contamination of both ecosystems will result in adverse impacts on the food chain for both terrestrial and aquatic organisms. This issue is discussed separately below and under the **Section G.7.3 Waste Management**.

Impacts on Wildlife Habitat

622. Impacts on wildlife habitat include habitat loss and pollution from noise, dust and irresponsible dumping of waste.

(i) Site clearance carried out for the Project will result in loss of habitat that is presently being used by wildlife. This issue is discussed above.

(ii) Construction activities will result in generation of noise and dust which will drive wildlife away from areas surrounding the Project site. The EIA includes specific measures for noise and dust that will mitigate these impacts, see **Section G.5.1 Air Quality** and **Section G.8.8 Noise**.

(iii) Improper waste disposal will result in pollution which will contaminate soil and water resulting in a reduction in quality of habitat available for wildlife. This issue is discussed as part of **Section G.7.3 Waste Management**.

623. Regarding aquatic habitat, the actual area in the river to be lost from bridge piers or retaining walls will be minimal compared to the wider aquatic habitat available in the Dzirula River, well below 1% of the habitat available within the Project area. While habitat loss will cause local impacts to aquatic flora /fauna as rivers are dynamic systems it is expected that the river will make a full recovery following construction.

Impacts on Natural Habitat

624. The Project will clear approximately 33 hectares of natural habitat for construction of the road. According to IFC[23] "The client (i.e. RD) will not significantly convert or degrade natural habitats".

625. Significant conversion or degradation is classified by the IFC as; (i) the elimination or severe diminution of the integrity of a habitat caused by a major and/or long-term change in land or water use; or (ii) a modification that substantially minimizes the habitat's ability to maintain viable populations of its native species.

626. The Project is not anticipated to significantly degrade habitat in the Project area based on this definition as the natural habitat to be lost represents a minimal area when considering the natural habitat remaining in the wider area which constitutes 100s of thousands of hectares of which the project area loss represents far less than 1%.

627. It has also been discussed previously in this report that the designs of sections F1 and F3 of the E-60 have already been completed, or are being finalized and section F2 links these other two sections, as such there are no alternative corridors to follow. The Project road has been designed to satisfy a range of criteria, including engineering (including road safety), economics as well as socio-environmental aspects. To ensure the Project was feasible from all of these perspectives the road was designed, as far as possible, to improve geometry and

[23] IFC Performance Standard 6. Biodiversity Conservation and Sustainable Management of Living Natural Resources. 2012

driving conditions whilst also ensuring suitable access for the local population by keeping the existing road operational. Natural habitat can be found all along this portion of the narrow valley and moving the alignment to avoid natural habitat would be practically impossible and would almost certainly result in the road alignment following very close to the existing road which would have greater impacts on residential areas resulting in resettlement, noise and access impacts.

628. The road design does include a number of long tunnels which reduces the amount of impact to natural habitat by limiting land clearance to areas around tunnel portals. It should also be noted that stakeholder consultation has been undertaken regarding the type and scale of impacts anticipated as a result of the Project, and that the clearing of natural habitat will be mitigated to ensure ‘no net loss’ of habitat as outlined below.

<u>Habitat Fragmentation</u>

629. The Project road has been designed in such a way that there will be no significant fragmentation of habitat during the operational phase of the Project. The majority of the roads alignment traverses either bridges or tunnels, meaning that wildlife can easily pass above the road, or under it to access the Rikotula and Dzirula rivers. However, during the construction there may be some minor, short term fragmentation of habitat caused by access roads and other temporary facilities.

<u>Impacts to Protected Species</u>

630. The following species IUCN Red-list Species (VU, NT, EN, CR) and Georgian Red list species have been identified that are, or may be present within the Project area:

(i) *Testudo graeca Linnaeus - Mediterranean turtle (IUCN / GRL – VU)*
(ii) *Emys orbicularis - European Pond Turtle (IUCN – NT)*
(iii) *Sciurus anomalus Gmelin – Caucasian Squirrel (GRL – VU)*
(iv) *Lutra lutra Linnaeus – Eurasian Otter (GRL – VU)*
(v) *Capoeta Sieboldi - Colchic Nase (GRL – VU)*

631. Site clearance activities, pollution and waste generation can have significant negative impacts to these species and therefore requires careful mitigation. However, review of the habitat along the alignment indicates it is not optimum for existence of the Caucasian squirrel. Therefore construction and subsequent presence (operation) of the highway is not anticipated to change the population trend of this species.

<u>Impacts from Pollution and Waste Generation</u>

632. Pollution and improper disposal of waste, generated during construction activities, poses a threat to surrounding fauna. The ecological receptors at risk are not only those that have limited mobility but also more mobile receptors, such as fish and bird fauna which pass through the Project area. Improper waste disposal can result in dumping on vegetation and contamination of soil which can result spread of contaminants into the ecosystem. Water bodies can also be contaminated. Both land and water pollution can result in contamination of the food chain. Pollution of water channels can put at risk both aquatic and terrestrial ecosystems. Pollution from noise and dust from construction activities will result in presently suitable habitat nearby becoming uninhabitable. It can also cause loss of suitable foraging and breeding sites.

633. Pollution of the Dzirula river can result in contamination of sites that may currently be suitable habitat for feeding and breeding of fish species.

634. A number of bridges will be constructed across the Dzirula and Rikotula rivers. Works involve the construction of bridge abutments and bridge piers which in many instances will be

undertaken in the river itself or on the river banks. Temporary impacts on fish may result from sedimentation and water turbidity in the immediate vicinity of the construction work area (especially around the bridge construction zones), and the potential for minor introduction of pollutants from construction operations.

Impacts from Light Pollution

635. Light pollution may have impact on bats. Since these species are nocturnal light may disrupt bat commuting routes or deter bats from feeding areas. Besides the light may cause delay in emerging from the roosts in the evening and reduce foraging ability. On the other hand light can be beneficial for insectivorous species, since light attracts insects. However, it can also make them more vulnerable to predation by nocturnal birds such as owls.

Impacts Resulting from Lack of Regulation

636. Staff involved on-site, such as workers and site managers, can engage in poaching and illegal exploitation of wildlife. This can result in the targeting of species of conservation importance including those currently under legal protection from hunting and exploitation.

Mitigation Measures

Site Clearance

637. General Tree Protection - Prior to the commencement of works the Contractor shall stake the boundary of the entire work site, including intersections and areas under bridges (this excludes within rivers and tunnels, but not tunnel portals). The Contractor shall then identify through a site survey if any Georgian Red-listed tree species are located within 5 meters of the site boundary. This survey will form part of the Contractors Clearance, Re-vegetation and Restoration Management Plan. If any of these trees are identified the contractor will be required to place wood fencing around the tree in order to protect the tree during construction works, including its root zones. The Engineer will inspect all of the tree protection measures on a regular basis.

638. Cutting of Trees on Private Land - Compensation shall be paid to all affected tree owners as per the Project LARP.

639. Cutting of Trees in State Forest Fund Land – An inventory of the species to be de-listed has been prepared as part of this EIA and is provided in full as part of **Appendix G**.

640. A total of 4,896 trees over 8cm in diameter have been identified in State Forest Fund areas and a further 40,094 under 8cm in diameter. Of these, 16 are Georgian Red-listed species greater than 8cm in diameter. The trees cut in these areas will need to follow the procedures for de-listing, cutting and removal as described below.

641. The RD is responsible for supplying the inventory of the species to be de-listed to the National Forest Agency in writing in order to complete the de-listing process. The RD shall also apply to the MoEPA in writing regarding the identified Red-List species in the project area so that they may also be de-listed from the SFF. Compensation payments for the tree cutting in SFF areas will paid to the Government as follows:

(i) User (RD) shall pay onetime payment for the use of forest land during implementation of land activities. The payment shall be paid according to Table 2 of Appendix 7 of The Resolution No.242 of Government of Georgia on Approval of Rules for Forest Use taking into account the area of used land.

(ii) User (RD) shall pay compensation for cutting the trees according to the Table 1 of Appendix 7 of The Resolution No.242 of Government of Georgia on Approval of Rules for Forest Use.
(iii) In case of cutting the red list trees the user (RD) shall pay compensation four times as great than the amount shown in the table 1 of Appendix 7 of The Resolution No.242 of Government of Georgia on Approval of Rules for Forest Use.
(iv) The payment shall be made before beginning of forest usage.

642. The National Forest Agency provides free service for special marking and issuing timber origin certificate for transportation of timber resources. The timber resources obtained as a result of cutting of the trees from the SFF, shall be sorted out according to species by the Contractor and collected at the area indicated by National Forest Agency and transferred to the National Forest Agency by the Contractor to a specified state property land plot.

643. No compensation in the form of re-planting is required under this resolution unless specified by the MoEPA in the Conclusion of Ecological Expertise. Nevertheless, for ADB, compensation planting will be required to meet requirements set out in SPS (2009) regarding the loss of natural habitat and that projects should cause ‘no net loss’ to biodiversity

<u>Habitat</u>

644. The EIA has identified the different habitats affected and the size of each habitat to be cleared. To mitigate this impact the Project shall undertake a three phase approach.
(i) Firstly, the Contractor, as part of his Clearance, Re-vegetation and Restoration Management Plan, shall prepare a Biodiversity Action Plan (BAP) for the restoration of habitat within the Project corridor to include the impacted habitat identified in this report. This is of particular importance in the riparian environments where bridge construction occurs. The plan should be prepared by qualified national biodiversity specialists. A template for the BAP is provided by **Appendix S**.
(ii) Secondly, the Contractor shall prepare, as part of his BAP measures to restore habitat at his spoil disposal sites, including, if practical the spoil site identified close to Boriti. It is important that, whatever site is chosen as a spoil location site, further natural habitat is not degraded. If this is the case additional habitat restoration will be required according to point 3 below.
(iii) Third and finally, the Contractor will consult with MoEPA to identify potential areas within the vicinity of the Project area where habitat restoration programs would be beneficial.
(iv) Plant maintenance as part of such programs will be carried out for at least two years in the plantation areas. The Contractor will be responsible for the maintenance of these areas. If the maintenance period extends after the completion of the Contractors contract period the RD will be responsible for contracting an operator to maintain the trees for the remaining period. During the Construction phase the Engineer will undertake monthly monitoring of the re-planted areas and report on the success rate of the re-planted trees, which should be above 80%. If the success rate falls below 80% the Contractor will re-plant on a 1:1 basis to compensate for losses. The Contractor will be responsible for paying for any compensational re-planting. In summary, the Project shall ensure no net loss of habitat occurs by restoring, reinstating or replanting at least the following area of habitat:

Table 69: Habitat to be Restored, Reinstated or Replanted

Code	hectares to be restored, reinstated or replanted
Oak or oak-hornbeam forests (Quercitum -Carpinion betuli) (9160GE)	12.14
Alluvial forest with Adler trees and Ash (910EO)	9.45
Clayey and rock riverine vegetation with duckweed (323GE)	10.18
Tilio-Acerion forests of slopes, screes and ravines (9180GE)	1.14

<u>IUCN / GRL Species (Protected Species)</u>

645. Mitigation Measures are proposed in Table 70 below.

Table 70: IUCN / GRL Species Mitigation Measures

Species	Mitigation
Lutra lutra Linnaeus – Eurasian Otter	Prior to the start of construction in river beds, or close to river embankments (within 10 meters), the Contractor shall undertake a site survey (using a local ecologist) to ensure that there are no otter holts in these areas. If holts are found in these areas the Contractor will prepare a method statement for the management of these areas which will be sent to the Engineer for review and approval. The method statement should included at least the following measures: • Marking the areas where otters are registered. • Implementation of works so to retains otter habitats in the water body and bank where feasible. • Constructing artificial holts to replace those that will be damaged or removed. • Implementation of works at daylight to allow a separation of human activity from the main peaks of otter activity (dawn/dusk). • Implementation of pollution prevention measures (soil and water) such as - arrangement of temporary surface water run-off control system consisting of settling ponds and drainage ditches, as well as other measures for soil, water, vegetation/flora and fauna impact mitigation listed in the EIA. • Avoiding significant change in lighting. This can be achieved by retaining the bank-side vegetation. In case necessary, additional planting along the bank-top to provide further screening to reduce light impact. Note: This will also work during operation. In addition to planting, to reduce impact during operation of the road location of the poles on design and construction stage should be selected so to be at a distance from the riverbed. • Arranging barriers in the sensitive areas to avoid accidental road kills (using otter-proof fences to stop otters getting into development sites) Note: The otter fence shall consist of a post, mesh and wire and ply board. The posts shall be ≥ 1.5m high, spaced at 2m intervals. Netting shall be mounted onto the supporting wire (welded wire mesh (2.0mm wire)) – gauge 50x50mm and 2000mm wide. The mesh shall be buried to 300mm and at top turned out at 45 degrees to the outrigger line. This mesh will thus be resistant to animal activity from the river side. On the upper slope side of the fence 10mm ply boards (1500 wide) shall be nailed to the support posts to provide damage protection and screening. • Tool-box briefings to contractors prior to those works commencing. • If live otters are encountered contractor is to cease work and contact the ecologist who will then liaise with the appropriate regulatory officers to discuss the encounter and how best to proceed from that point. • Mitigation relating to noise, air quality and water pollution are addressed under their specific headings within this section of the report.
Sciurus anomalus	Although squirrels are not anticipated to be found in the Project area, as a precaution measure the construction contractor must be aware of the need to follow requirements listed below:

Gmelin – Caucasian Squirrel	• Checking all mature trees scheduled removal and other potential nest areas for the presence of dreys . (Survey must be done shortly before operations to locate active dreys). • Before commencing of works, obtaining evidence that the drey (if any) is no longer in use. • Felling and removal of trees in a manner that minimises the likelihood of killing adult squirrels. • Implementation of works in the period when likelihood of encountering dependent young is the least. • Max preservation of vegetation - keeping to the boundaries of the RoW and worksites; fencing of sensitive areas bordering the RoW to reduce the risk of impact and land take required for vehicular movements and construction works. • Adoption of best practices to avoid light pollution, emissions/dust, ensure compliance with good waste management practices. • It should be taken into consideration that the degree of disturbance is likely to be greatest for dreys where young squirrels are present. • If the area around the drey tree is cleared it is likely that the drey will no longer be suitable. Adults can move readily but young squirrels may not be old enough to move. If mother moves them herself it is rather stressful and sometimes risky process. • It should be taken into consideration that the degree of disturbance is likely to be greatest for dreys where young squirrels are present. • If the area around the drey tree is cleared it is likely that the drey will no longer be suitable. Adults can move readily but young squirrels may not be old enough to move. If mother moves them herself it is rather stressful and sometimes risky process. • As mentioned above, presence of squirrel in the project impact zone has not been observed. Given that the forest zones are mainly bypassed by means of the tunnels and that a part of the road coincides with existing road sections, the new infrastructure will not cause fragmentation.
Capoeta Sieboldi - Colchic Nase (GRL – VU)	• Per fish mitigation measures as outlined in Table 71. • Ensure works occur outside of fish spawning periods (June to September)
Testudo graeca Linnaeus - Mediterranean turtle	If turtles are found within the work site, individuals must be removed to a safe distance (not less than 50m) from the works area. Eggs/hatchlings must be placed in a box (Note: sand substrata in the box must be provided) and moved to suitable nearby habitat where a nest will be created.
Emys orbicularis - European Pond Turtle	

<u>Other Fauna</u>

646. Table 71 below provides mitigation measures for other species

Table 71: Other Species Mitigation Measures

Species	Mitigation
Fish	• Use of sites designated for dumping to avoid polluting ecologically important aquatic habitat. • Use of sites designated for dumping will also prevent contamination of the aquatic food chain. • Hunting and poaching should be prevented to protect species of conservation importance and minimize loss of wildlife, which will already be undergoing habitat loss due to the Project.

	• The Contractor shall consult with the MoEPA to confirm when works in rivers should be suspended in order to limit impacts to fish spawning periods. In addition, mitigation measures outlined in **Section G.5.5 – Hydrology**, will reduce the potential for impacts in surface waters.
***Reptiles & Amphibians (*herpetofauna)**	• Re-plantation will result in some habitat restoration. Reptile and amphibian species that will re-locate may return once planted vegetation is established. • Any herpetofauna species observed during construction activities should be re-located with assistance from a biodiversity expert to ensure proper handling. • Use of sites designated for dumping to avoid polluting ecologically important areas such as habitat for wildlife. • Use of sites designated for dumping will also result in prevention of contamination of the food chain. • Noise pollution should be minimized to reduce the disturbance to herpetofauna species as far as possible. • Dust pollution should be minimized to reduce disturbance to herpetofauna species as far as possible. • Hunting and poaching should be prevented to protect species of conservation importance and minimize loss of wildlife, which will already be undergoing habitat loss due to the Project.
Birds	• Re-plantation will result in some habitat restoration. Wildlife that will re-locate may return once planted vegetation is established • Use of sites designated for dumping to avoid polluting ecologically important areas such as habitat for wildlife • Use of sites designated for dumping will also result in prevention of contamination of the food chain, especially of water bodies which are very important for bird fauna in and around the Study Area • Noise pollution should be minimized to reduce the disturbance to birds as far as possible • Dust pollution should be minimized to reduce disturbance to birds as far as possible • Hunting and poaching should be prevented to protect species of conservation importance and minimize loss of wildlife, which will already be undergoing habitat loss due to the Project

647. In addition to the above species specific measures, the following shall apply:

(i) Site Surveys – Prior to the clearing of vegetation at any site (and prior to works in in existing tunnels and at bridge sites) the Contractor will undertake site surveys of the area to be cleared using national biodiversity specialists. The findings of the surveys and the proposed mitigation and management measures will be included in the Contractors BAP. Depending upon the results of the surveys the following shall apply:

(a) Re-location of any specimens found during the surveys will be provided with the help of biodiversity experts to ensure proper handling. This is especially important for species of conservation importance. The practice will provide the best possible chance of survival for wildlife. The Biodiversity experts shall devise effective relocation plans, taking species-specific factors into consideration, to maximize the chances of success.

(b) If herpetofauna species are observed in the Project area during the surveys, they should be removed to other suitable habitat, with the help biodiversity experts to ensure proper handling. Herpetofauna species are most at risk because of their limited ability to re-locate. These species are at higher risk because of their limited ranges.

(c) If bird nests are observed during the site surveys (and also during construction), they should be carefully removed and placed in suitable habitat, with the help of biodiversity experts to ensure proper handling. An expert can help identify the species the nests belong to. If it is a species of conservation importance, special care should be taken. This will reduce the risk of mortality faced by them as a result of Project-related activities.

(d) If roosting sites for bat species are identified, first priority needs to be given to protecting the roosting sites. Since the majority of roosts are used only on seasonal basis, the most common/effective method of avoiding the impact is planning of works for less sensitive period of time. Optimum time for implementation of works in the area where hibernation roosts are found is May-October. However, in the absence of this option, biodiversity experts should be consulted and if required the bats should be re-located with the help of experts to ensure proper handling and development of a plan for relocation that maximizes chances of its success. Research into relocation of bats is limited with documented success of relocations even more so. It is recommended that the following characteristics be taken into consideration for the species being relocated, to both assess feasibility and develop an effective relocation protocol:
- Dispersal from the release site.
- Size of the founder group.
- Habitat quality at the release site.
- Disease transmission.
- Anthropogenic effects on the founder population.
- Post-release monitoring.

Bat boxes can be considered as mitigation measure. However, it should be taken onto account preferences – for instance Lesser horseshoe bat can not use bat boxes whereas Common pipistrelle can use tree crevice-type box with 25-35 crevices and or tree hollow-type box (note: the latter type is rarely used as maternity roost).

(ii) Bridges should be designed with dry paths under the bridge on either side of the streams to facilitate movements of livestock and wildlife, the latter primarily at night when people are not around.

(iii) Poaching of wildlife shall be strictly prohibited.

(iv) The Contractor will be responsible for providing training sessions to his workers relating to environmental protection (including the ban on poaching).

(v) Ensure that lower wattage lamps are used in street-lights which direct light downwards to reduce glare.

(vi) Waste should be disposed without dumping on vegetation or allowing it to contaminate waterways. This will prevent contamination of habitat and the spread of pollution through the food chain.

(vii) Noise and dust pollution should be managed using the specific noise and air quality mitigation measures outlined in this EIA.

<u>Operational Phase</u>

648. During the operational phase of the Project, the RD shall:

(i) Register and analyze road kills. Develop additional mitigation measures if found to be necessary.

(ii) During maintenance works strictly comply with wildlife/vegetation impact mitigation measures set for construction stage.

(iii) Prohibit poaching (ensure that tunnel operator staff is aware of the ban).

Residual Impact Significance

HABITAT

*<u>Construction Phase</u> – **MODERATE/MAJOR***

The clearing of a large portion of natural habitat will have significant impacts to biodiversity in the area. The restoration and re-planting programs should go a long way to mitigating these impacts, but in some locations, such as river banks, residual impacts will remain. In addition, short term fragmentation of habitat maybe caused by access roads and other temporary construction facilities. In addition, the Clearance, Re-vegetation and Restoration Management Plan and its Biodiversity Action Plan will help manage potential impacts to habitat.

*<u>Operational Phase</u> – **MEDIUM/HIGH***

In the short term the residual impacts will be medium/high as the habitat is cleared. It will take a number of years for the habitat to be restored and for re-planted areas to develop into something similar to the habitats they are replacing. However, in the longer term, the significance of the impacts will reduce as these areas mature.

Residual Impact Significance

FAUNA

*<u>Construction Phase</u> – **MINOR/MEDIUM***

Site clearance will impact upon fauna in the Project corridor, including, for instance Otters. Further surveys of fauna prior to the start of construction to identify potentially affected species and action plans to manage these issues will help reduce the residual impacts.

*<u>Operational Phase</u> – **LOW***

Accidents involving wildlife are likely to be minor given the fact that animals will be able to cross above and below the road for most of its extent.

Residual Impact Significance

AQUATIC FLORA & FAUNA

*<u>Construction Phase</u> – **MODERATE***

A number of bridge piers will be constructed within the Dzirula and Rikotula rivers. In addition bridge abutments will also encroach into the river in some locations. Even though mitigation measures outlined above will help reduce the significance of the impact, residual impacts will still remain as aquatic flora and fauna, including the GRL Colchic Nase are disturbed by the Project works.

*<u>Operational Phase</u> – **LOW/MEDIUM***

The actual area in the river to be lost from bridge piers or retaining walls will be minimal compared to the wider aquatic habitat available in the Dzirula River, well below 1% of the habitat available. While habitat loss will cause local impacts to aquatic flora /fauna as rivers are dynamic systems it is expected that the river will make a full recovery following construction.

G.6.2 Forest Reserves and Protected areas

Potential Impacts

649. No protected areas or forest reserves are located within the Project area, or within the vicinity of section F2. No induced impacts are anticipated.

Management & Mitigation Actions

650. Despite the fact no protected areas or forest reserves are located within the vicinity of the Project road and it is unlikely that haul routes would traverse such areas, it is still considered prudent to include a condition within this EIA that no construction activities, including camps, haul routes, etc will be allowed within, or through protected areas, or reserves.

Residual Impact Significance

Construction Phase – ***NONE***

No residual impacts are anticipated if the mitigation measures outlined above are implemented correctly.

Operational Phase – ***NONE***

G.7 Economic Development

G.7.1 Transportation Facilities & Utilities

Potential Impacts

Transportation Facilities

Construction Phase

651. Two of the main impacts resulting from Project works will be short term road diversions and some temporary blocking of access to properties during the construction phase.

652. In some locations closure of access roads will be needed and may occur for periods between one and two hours and as such is not a significant issue as long as the local population are given notice of the delays and suitable detours are provided. Longer-term road closures maybe required while the new road is constructed across existing roads. This issue is discussed above under section **B.13 – Temporary Roads**.

653. Blocking of access to properties will be temporary while structures, such as side drains and culverts, are constructed, however alternative access to properties will be provided at all times by the Contractor.

Operational Phase

654. The road has been designed in a way so that it has relatively little impact upon the existing road, or other local roads due to the fact that it is a new alignment often passing through tunnels and over bridges. Where the new alignment does interfere with the existing road, new local roads have been designed (see **Appendix F**) along with several interchanges to ensure that access to the existing road remains open.

655. Notwithstanding the above, the potential beneficial impacts to transport are significant. The road, when complete, will offer reduced travel times to major urban areas, smoother ride (resulting in less vehicle maintenance and less damage to perishable goods) and safer driving conditions. In addition, the traffic volumes on the existing road will reduce significantly resulting in less accidents on the existing road.

Utilities

656. Electricity transmission and distribution lines, gas pipes and telecoms lines are located within the Project corridor as noted in **Section F.3.2.2**. All of the companies have provided drawings and information on the location of the utilities. This information will be provided to the Contractor for coordination of with the relevant utility operator.

Management & Mitigation Actions

Transportation

Pre-construction Phase

657. To mitigate the potential impacts the Contractor will:

(i) Submit a Traffic Management Plan to local traffic authorities prior to mobilization and include the plan as part of his SEMP. The TMP shall include plans of haul routes and access roads used for construction traffic which will be strictly adhered to with oversight from the Engineer;

(ii) As part of his TMP, the Contractor shall provide haul routes to spoil disposal sites which, as far as is practical, avoid populated areas.

658. The volume of construction traffic is considered to be intensive truck traffic and will need to be managed both in terms of surface damage. A road condition survey of all roads included in the Contractors TMP will be conducted by the Engineer prior to construction in order to gauge any damage to the road as a result of the intensive heavy traffic during the construction phase. Before completion of the Project the Engineer shall repeat the survey to determine which, if any roads need to be repaired by the Contractor.

Construction Phase

659. The Contractor shall:

(i) Provide information to the public about the scope and schedule of construction activities and expected disruptions and access restrictions at least 24 hours before the disruptions;

(ii) Allow for adequate traffic flow around construction areas via diversions or temporary access roads;

(iii) If temporary access roads are to be constructed with a gravel surface they shall be routinely watered by the Contractor during dry weather to reduce dust impacts; and

(iv) Provide adequate traffic signs, appropriate lighting, well-designed traffic safety signs, barriers and flag persons for traffic control.

(v) Access roads for batching plants, etc, should be maintained during the construction phase and rehabilitated at the end of construction.

Utilities

Construction Phase

660. During construction all gas supply and electricity networks in the Project area shall be kept operational, particularly during the winter months. Some lines and pipes may require temporary relocation during the construction phase and as such the Contractor will be responsible for liaising with the relevant utilities operators to ensure they remain operational. Should utilities need relocating in a different location the Contractor will consult with the relevant utilities and local community to ensure that there is no change in supply as a result of these changes.

Residual Impact Significance

Construction Phase – ***MINOR***

No residual impacts are anticipated if the TMP and the other mitigation measures outlined above are implemented correctly.

Operational Phase – ***LOW***

If the mitigation measures suggested are implemented, the residual impacts of the Project will be low. As noted above, the Project road has been designed in such a way that access to the existing road will be more or less maintained into the operational phase of the Project (with the exception of the start of the road which overlaps with the existing E-60) and where the new road crosses local roads new roads will be constructed.

G.7.2 Land use

Potential Impacts

661. The Project road passes through a rural landscape for most of its extent and also through numerous tunnels. However, a number of private properties and land parcels will be impacted many of which are used for agricultural purposes.

662. A Draft Land Acquisition and Resettlement Plan (LARP) has been prepared according to Georgian Laws, the ADB SPS (2009) and the Resettlement Policy Framework of the East West Highway Improvement Corridor Project which was prepared by the RD with support from the World Bank (developed and disclosed in 2016 under the parent EWHCI Project).

663. The affected areas, structures, trees and agricultural plots identified by the Draft LARP are summarized below (Table 72**).** According to the draft LARP there is no business under impact of Project and the Project will not impact on objects of public or cultural importance. 36 vulnerable families will be directly affected by the Project and provisions for these families have been included in the LARP.

Table 72: Summary of Impacts According to the Draft LARP

#	**Impacts**	**Unit**	**Amount**
Land Tenure Patterns			
1	**Total Land parcels affected**	**№**	307
2	**Total land Area to be acquired**	**Sq.m**	283,889
3	**Category 1**. Private Registered Plots	**№**	218
		Sq.m	198,285
4	**Category 2.** Private Legalizable	**№**	87
		sq.m	84,260

#	Impacts	Unit	Amount
5	**Category 3.** State Owned Illegally Used by Private Users (Non-legalizable).	**№**	N/A
		Sqm	N/A
6	**Category 4.** State Owned (Not Used by Private Users)	**№**	2
		Sq.m	1,344
Agricultural Patterns			
7	Beans	**Sq.m**	147673
8	Corn	**Sq.m**	151346
9	Pumpkin	**Sq.m**	123272
10	Soybean	**Sq.m**	124424
11	Other vegetables	**Sq.m**	6105
12	Affected Trees	**№**	5772
Affected Structures			
13	Residential houses	**№**	39
14	Auxiliary buildings	**№**	9
Affected Households			
15	Severely affected Households	№	161
16	Vulnerable Households	№	53
17	Resettled households	№	39
18	AHs losing non-legalizable land plots	№	N/A
19	AH losing Jobs	№	0
20	Total AH	№	217
21	Total Affected Persons	№	976

664. The draft LARP estimates the total cost of resettlement and compensation to be around 10.7m Gel. Table 73 below provides a breakdown of the costs.

Table 73: Resettlement and Compensation Budget

Name	Unit cost	Amount	Total cost (Gel)
Land parcels	Various	283,889	4,659,475
Structures	Various	-	3,963,000
Trees	Various	5,772	561,298
Crop	Various	552819	193,179
Severe impact allowance	Subsistence minimum for 3 months (349.5x3)	161	168,808.50
Relocation/Shifting allowance	Subsistence minimum for 3 months (349.5x3)+ Transportation cost (200 Gel)	39	48,691.50
Vulnerability allowance	Subsistence minimum for 3 months (349.5x3)	53	55,571
External and Internal monitoring	-		120,000
Sum			**9,770,023**

Name	Unit cost	Amount	Total cost (Gel)
Unexpected costs	10%		977002.25
Total			**10,747,025**

665. The time bound implementation schedule of the LARP has been prepared in consultation with the RD. All activities related to the LARP have been planned to ensure that compensation is paid prior to displacement and commencement of civil works construction. Payment of compensation and allowances under LARP will commence after a number of preparatory tasks have been completed. These tasks are:

(i) Signing of contracts with APs.
(ii) Disclosure and consultation.
(iii) Capacity building training of LAR institutions, APs and NGOs.
(iv) Grievance resolution.
(v) Requisition to ETCIC for payment of compensation and allowances.
(vi) Transfer of compensation and allowance to APs' bank account and registration of land in PR on RD name.
(vii) Relocation of affected structures/ assets.
(viii) Compliance review and reporting.
(ix) Notice to proceed for Civil works construction.
(x) Monitoring.

666. The RD is the Executing Agency and has the lead responsibility for road construction, as well as the implementation of the LARP. In addition to the RD, a number of other government departments and private agents will play an instrumental role in the design, construction and operation of the project. Pursuant to the active legislation, the MoEPA is responsible for environmental issues. The Ministry of Justice is responsible for legal matters regarding land ownership, and National Agency of Public Registry (NAPR) within the Ministry of Justice is in charge of the registration of land ownership and its transfer through purchase agreement from landowners to the RD. The local government at Sakrebulo and village level will also be involved.

667. <u>Livestock and Agriculture</u> – As noted in the draft LARP, a number of agricultural plots will be affected by the Project. In addition to this the Project road could also result in other impacts to agricultural land during the construction phase, these include:

(i) Dust – This issue and its impacts on crops are discussed above under **Item G.5.1 Air Quality**. Mitigation suggested involves correct siting of dust producing areas, such as batching plants, away from agricultural land and dampening of stockpiles and access roads during construction. Implementation of the mitigations measures in this EIA relating to facilities such as batching plants, will further reduce the possibility of significant impacts arising.
(ii) Temporary Land Take – Apart from the areas identified in the draft LARP, land for access roads, construction camps and temporary storage areas will also be required.
(iii) Accidents involving livestock – In most portions of the site herding of livestock along the road will not be possible as access to these areas will be extremely difficult. In addition, most livestock can be herded either above tunnels, or below bridges. Two underpasses are also proposed along the route which can also be used by livestock.

Management & Mitigation Actions

668. The key mitigation for land use is implementation of the LARP. Regarding temporary land take for areas such as construction camps, the Contractor will pay the rates specified in the LARP to landowners for the use of these areas. In addition, where practical all additional

construction related areas such as construction camps, etc, should, as far as possible, avoid being site on agricultural land.

Residual Impact Significance
<u>*Construction Phase*</u> – ***MINOR/MODERATE***
No residual impacts are anticipated if the LARP is implemented correctly. However, there will still be disruption to the local community during the LARP implementation process. A GRM has been prepared to manage complaints received during this process.
<u>*Operational Phase*</u> – ***NONE***
No residual impacts are anticipated if the LARP is implemented correctly.

G.7.3 Waste Management

Potential Impacts

669. General Construction Waste - Road construction will inevitably generate solid and liquid waste products including:

(i) Inert waste – for example, concrete, metal, wood and plastics.
(ii) Hazardous waste – acids and alkaline solutions, waste oils and oily sludge, batteries, and bitumen.

670. In addition, uncontrolled discharges of sewage and ‘grey water’ (e.g. from washrooms and canteens) from construction sites and worker’s camps may also cause odors and pollute local water resources. As well as being a cause of complaints by the local population, this may lead to contravention of local regulations and fines being imposed on the Contractor.

671. The main construction waste produced will waste concrete (solid and sludge) and possible asphalt, depending upon how much can be re-used as sub-base material. Table 74 indicates the main types of waste and an estimate of volumes (based on similar road construction projects).

Table 74: Waste Types and Estimated Volumes

#	Waste Type	Hazardous	Estimated Volume
1	Concrete	No	200 m^3
2	Asphalt	No	Currently unknown
3	Bituminous Mixtures	Yes	1 t
4	Wood	No	10 t
5	Uncontaminated Metal	No	5 t
6	Uncontaminated Plastic	No	1 t
7	Contaminated metal (paint tins, etc.)	Yes	2 t
8	Contaminated plastic (oil containers)	Yes	3 t
9	Domestic waste (food stuffs)	No	5 t
10	Domestic Waste (non-foodstuff)	No	40 t
11	Sewage Water	Yes	150 m^3
12	Tyres	Yes	150 t
13	Hazardous liquid waste	Yes	20 m^3
14	Hazardous solid waste	Yes	10 t

672. It is noted that the waste management situation in Georgia is still developing, and that the waste management facilities in the Project area have been closed. Accordingly, the Contractor needs to ensure that waste materials are disposed of in a manner that does not cause pollution to the environmental or result in potential health impacts.

673. Tunnel and Other Spoil Material – a large volume of spoil material will be generated from the tunneling works. Estimates provided by the Consultant indicate that the following amounts of spoil material will be generated:

(i) Portal – 161,000 m^3
(ii) Tunnel – 935,000 m^3
(iii) Earthworks – 1,010,000 m^3
(iv) Local roads and interchanges – 135,000 m^3
(v) Total: 2,241,000 m^3

674. Where practical the spoil will be re-used as embankment material. Estimates indicate that approximately 327,959 m^3 can be re-used as embankment material, which would leave approximately **1,913,050 m^3** as static balance.

Management & Mitigation Actions

675. To ensure waste management is adequately controlled during both the construction and operational phase of the Project, the Contractor shall be responsible for ensuring that the waste hierarchy is followed including prevention, minimization, reuse and recycling. Specifically the Contractor will be responsible for the following measures:

(i) <u>Waste Management Plan (WMP)</u> – The WMP shall include items relating to the safe handling and management of:
  (a) Domestic waste
  (b) Food waste
  (c) Recycled Waste
  (d) Plastic
  (e) Metals
  (f) Wood
  (g) Construction Waste
  (h) Hazardous Waste
  (i) Liquid Waste

(ii) <u>Recycling and Reuse</u> – Where possible, surplus materials will be reused or recycled – this should include asphalt, concrete, wood, plastic, metal and glass. A plan for the recycling of materials should be included in the WMP. As noted above, 327,959 m^3 of spoil material will be re-used for embankments thereby eliminating the requirement for the use of borrow pits and quarries under the Project.

(iii) <u>Storage of Hazardous Wastes</u> – Oils, fuels and chemicals are substances which are hazardous to human health. They need to be stored properly in correctly labeled containers, both within the construction camp and also at construction areas. Oil and fuel should be stored in tanks with lined bunds to contain spillage (the bund should be able to contain at least 110% of the volume of the largest storage tank within the bund).

(iv) <u>Waste Disposal</u> – Waste, both hazardous and non-hazardous, shall be collected and disposed of by a licensed waste management contractor. The Contractor will keep copies of the waste management company's licenses on file at his site office. The Contractor shall also keep a record of the waste volumes and types removed from the site and the waste transfer notes provided by the waste management contractor.

<u>Waste Spoil Material</u> – A screening exercise has been undertaken to identify suitable disposal locations for the 1,913,050 m^3 of spoil material. A preferred site has been identified close to Boriti. It is recommended that the Contractor uses this site for the disposal of spoil material as it is considered to be the most suitable option from and environmental, social and financial perspective. However, it is noted that the Contractor does have the choice to select other spoil locations.

If the Contractor intends to use this site there are several actions he must follow:

(a) Complete the Spoil Disposal Site Assessment attached as **Appendix O**.
(b) Submit the assessment to ADB and RD for review and approval.
(c) Upon approval of the site from ADB and RD, in line with the Georgian EIA regulation, the spoil storage areas shall be agreed with the local municipality and MoEPA.
(d) As soon as agreements are provided MoEPA will request an EIA for the Project.
(e) The Contractor will prepare and submit an EIA to MoEPA for review and approval. The EIA will need to be compliant with the national regulations and will include all necessary studies and surveys to meet this requirement, e.g. biodiversity surveys, archaeological survey, etc.
(f) In addition to the EIA, the Contractor shall prepare a Spoil Disposal Plan for Arrangement of Spoil Disposal Area and a Re-cultivation Plan. This plan shall be prepared in accordance with regulation N 424 on Approval the Rules for Removal, Storage and Use of Topsoil and Re-cultivation. The plan shall be based upon the findings and information contained in the Spoil Disposal Site Assessment.
(g) The plan will indicate:
    - The location of disposal area (layout, coordinates etc).
    - Agreement with the land owner.
    - Category of the land.
    - Distance from the surface water source.
    - Prepare a route Risk Assessment (Providing information on route of spoil transportation and means of transport (including routes avoiding, where possible, sensitive receptors)).
    - Schedule of the timing of material transport (excluding night-time transport on local roads (but not the existing E-60) between 10pm and 6am).
    - Any necessary improvements to local roads to cater for the increased level and types of trucks using the roads.
    - The measures for stripping and storing of topsoil.
    - The scheme of dumping.
    - The maximum height of disposed soil and anti erosion measures.
    - Describe re-cultivation of disposal area.
    - Provide coordinates of the spoil area.
    - Provide profile drawings of the spoil area.
    - Provide time stamped photographs of the pre-disposal site conditions.
(h) The Plan will also be provided to the RD and the Engineer as part of his SEMP. No spoil storage will be allowed until the RD and the Engineer

have approved the plan and all licenses and approvals have been received from MoEPA.

If the Contractor wished to use an alternative site he will be responsible for following the same procedures above. No spoil storage will be allowed until the RD and the Engineer have approved the plan and all necessary permits and approvals have been received from MoEPA.

Transport of Spoil from Tunnels - Tunnels TUN-2001 TA/AT, TUN-2002 TA/AT, TUN-2003 TA/AT, TUN-2004 TA/AT, TUN-2005 TA/AT and TUN-2007 TA/AT shall start at portals located adjacent or within 25 meters to the existing E-60 road and as such materials can be moved directly from the portals to the disposal areas using the existing road. Tunnels TUN-2006 TA/AT, TUN-2008 TA/AT, TUN-2009 TA/AT (eastern portal only), TUN-2010 TA/AT and TUN-2011 TA/AT are located on the other side of the Dzirula river to the existing E-60 road, or a long distance from the E-60. Materials from these tunnels will need to be transported along local roads, some of which may need to be upgraded to accommodate the trucks using these roads. The Contractor will be responsible for upgrading any local roads and ensuring that they are maintained to acceptable levels to allow local traffic to continue to use these roads during all weather. If any access roads are gravelled they will be regularly sprayed with water during the construction phase to limit the impacts of dust.

(v) Liquid Waste – The issue of liquid waste, including concrete sludge, camp run-off water, vehicle washing water, batching plant wastewater, etc., is discussed above under item G.5.5 – Hydrology and G.7.4 Construction Camps.

Operational Phase

676. The RD shall:

(i) Install waste collection bins in technical buildings area.
(ii) Use garbage bins fitted with lids to avoid scattering around and attraction of scavengers.
(iii) Segregate hazardous, non-hazardous and reusable waste streams.
(iv) Manage and dispose hazardous waste according to the type and the class of hazard. Note: for hazardous waste removal licensed company must be contracted.
(v) Until removal (temporarily) waste must be stored within secure facilities with weatherproof flooring and roofing.
(vi) Dispose garbage according to agreement with licensed waste management contractors.

Residual Impact Residual Impact Significance

Construction Phase – ***MINOR/MODERATE***

In general, if the mitigation measures suggested are implemented residual impacts will be minor. However, restoration of any spoil disposal area will take a number of years and as such the residual impacts for the spoil disposal areas are considered minor/medium.

Operational Phase – ***NONE***

There will be no residual impacts in the operational phase as long as the Contractor follows his reinstatement plans for the spoil disposal sites.

G.7.4 Construction Camps, Asphalt Plants, Batching Plants & Temporary Storage Sites

Potential Impacts

677. Construction camps constitute a temporary land use change and raise issues related to activities such as impacts to air quality; poor sanitation arrangement and improper methods used for disposal of solid wastes and effluent; and transmission of communicable diseases to the local people by the construction workers due to inappropriate health monitoring facilities. Specific issues may arise as a result of the following:

678. Design and Siting - Improper siting and design of construction camps can have negative impacts to hydrology through inappropriate disposal of liquid waste and spills of hazardous liquids. Poor management of sanitary waste and accidental spills of hazardous liquids from construction camps can also have negative impacts on ground and surface water. Rock crushing plants and concrete batching plants can also have impacts on sensitive receptors located downwind of the sites if the plants are too close to the urban areas.

679. Concrete Batching Plants - Potential pollutants in batching plant wastewater include cement, sand, aggregates and petroleum products. The main sources of wastewater at batching plants are; contaminated storm water runoff, dust control sprinklers, the agitator washout station, the agitator charging station, the slumping station, and cleaning and washing areas. These substances can adversely affect the environment by:

(i) Increasing water pH.
(ii) Increasing the turbidity of waterways (turbidity is a measure of the cloudiness of a suspension).

680. Asphalt Plants – Several impacts are associated with asphalt plants:

(i) Emissions – including dust from the transport and handling of aggregates and emissions from the combustion process in the dryer.
(ii) Noise - Noise occurs at different places in the process for examples in the conveyor belts, dryer and mixer drum, internal and external traffic. The noise is estimated to be in the range of 90 to 100 dBA (Leq) at a few metres from the equipment.
(iii) Storage of Bitumen – Drums of bitumen will be stored safely and securely to prevent accidents and pollution.
(iv) Storage and Use of Hazardous Materials – Some materials used during asphalt production, such as Kraton, can be explosive or a fire hazard. These materials need to be stored and managed appropriately.
(v) Health and Safety - Asphalt Plants can be very dangerous, accidents may occur at any time. Hence it is important to have a proper policy for the Health and Safety Issues.
(vi) Vehicle Movement – a large number of trucks will be required to transport the hot asphalt from the plant to the work site, this may be a distance of up to 25 kilometers.

681. Temporary Storage Sites – These areas will be used to store materials and equipment on a temporary basis as an alternative to storing materials at the camp. Materials may also need to be stored close to work sites to allow quick and easy access to these materials, e.g. stockpiles of aggregates, pre-cast culverts, etc. None of the materials stored in these areas will be hazardous materials.

Management & Mitigation Actions

682. Construction Camps – The location of construction camps and facilities is not known at this stage of the Project and will be a decision for the Contractor to make based on a range of issues, such as availability of land, cost, access, etc, as well as environmental and social issues. However, a range of good practices measures can be applied to these sites to ensure that they have minimal impacts on the environment and the local communities.

683. Prior to commencement of works, the contractor must identify the location of the camp and undertake environmental and social screening of the site to ensure that no significant environmental or social issues will arise as a result of the use of the site. The results of the screening will be provided to the Engineer and RD for their review and approval. If the Engineer and RD are satisfied with the results of the screening exercise the Contractor shall then agree on/receive a permit for its use from the state or the land owner. No construction camp will be located within one kilometer of an urban area and at least 50 m from any surface water course.

684. The Contractor will be responsible for the preparation of a Construction Camp Site Plan which will form part of the SEMP. The Plan will indicate the system proposed and the locations of related facilities in the site, including latrines, holding areas, etc. The Contractor will ensure the following conditions are met within the Plan:

- (i) Rain-water run-off arising on the site will be collected, removed from the site via a suitable and properly designed temporary drainage system and disposed of at a location and in a manner that will cause neither pollution nor nuisance. The drainage system will be fitted with oil and grease interceptors.
- (ii) There will be no direct discharge of sanitary or wash water to surface water.
- (iii) In the absence of functioning sewerage and sewage treatment facilities it is recommended that the Contractor provides his own on-site septic tanks. There will be no direct discharge of untreated sanitary or oily wastewater to surface water bodies.
- (iv) Licensed contractors will be required to collect and disposal of liquid waste from the septic tanks on regular basis.
- (v) Disposal of materials such as, but not limited to, lubricating oil and onto the ground or water bodies will be prohibited.
- (vi) Liquid material storage containment areas will not drain directly to surface water.
- (vii) Waste water from vehicle washing bays will be free of pollutants if the wash bay has been constructed correctly.
- (viii) Lubricating and fuel oil spills will be cleaned up immediately and spill cleanup materials will be maintained at the storage area.
- (ix) Construction and work sites will be equipped with sanitary latrines that do not pollute surface waters and are connected to septic tanks, or waste water treatment facilities.
- (x) Discharge of sediment-laden construction water directly into surface watercourses will be forbidden. Sediment laden construction water will be discharged into settling lagoons or tanks prior to final discharge.
- (xi) Washing out concrete trucks at construction sites will be prohibited unless specific concrete washout areas are provided for this purpose at the construction site (e.g. a bridge site). The washouts will be impermeable and emptied when 75% full.
- (xii) Spill cleanup equipment will be maintained on site (including at the site maintenance yard and vehicle fueling areas). The following conditions to avoid adverse impacts due to improper fuel and chemical storage:
  - (a) Fueling operations will occur only within containment areas.
  - (b) All fuel and chemical storage (if any) will be sited on an impervious base within a bund and secured by fencing. The covered storage area will be located away from any watercourse or wetlands. The base and bund

walls will be impermeable and of sufficient capacity to contain 110% of the volume of tanks.

(c) Filling and refueling will be strictly controlled and subject to formal procedures and will take place within areas surrounded by bunds to contain spills / leaks of potentially contaminating liquids.

(d) All valves and trigger guns will be resistant to unauthorized interference and vandalism and be turned off and securely locked when not in use.

(e) The contents of any tank or drum will be clearly marked. Measures will be taken to ensure that no contaminated discharges enter any drain or watercourses.

(f) Disposal of lubricating oil and other potentially hazardous liquids onto the ground or water bodies will be prohibited.

(g) Should any accidental spills occur immediate cleanup will be undertaken and all cleanup materials stored in a secure area for disposal to a site authorized to dispose of hazardous waste.

685. If determined warranted by the Engineer, the Contractor will provide a wash pit or a wheel washing and/or vehicle cleaning facility at the exits from the sites. If so requested, the Contractor will ensure that all vehicles are properly cleaned (bodies and tires are free of sand and mud) prior to leaving the site areas. The Contractor will provide necessary cleaning facilities on site and ensure that no water or debris from such cleaning operations is deposited off-site. The Engineer will undertake regular monitoring of the construction camps to ensure compliance with the SEMP and the Construction Camp Site Plan.

686. The Contractor will be responsible to maintain and cleanup campsites and respect the rights of local landowners. If located outside the ROW, written agreements with local landowners for temporary use of the property will be required and sites must be restored to a level acceptable to the owner within a predetermined time period.

687. The Contractor will also ensure that potable water for construction camps and workers meets the necessary water quality standards of the GoG. If groundwater is to be used it will be tested weekly to ensure that the water quality meets the GoG drinking water standards specified in **Section D**.

688. <u>Concrete Batching Plants</u> – The following measures will be followed to limit the potential for pollution from batching plants:

(i) To limit impacts from dust, the following conditions will apply:

(a) Batching plants will be located downwind of urban areas and not within one kilometer of any urban area.

(b) The entire batching area traversed by vehicles – including driveways leading into and out of the area – will be paved with a hard, impervious material.

(c) Sand and aggregates will be delivered in a dampened state, using covered trucks. If the materials have dried out during transit they will be re-wetted before being dumped into the storage bunker.

(d) Sand and aggregates will be stored in a hopper or bunker which shields the materials from winds. The bunker should enclose the stockpile on three sides. The walls should extend one metre above the height of the maximum quantity of raw material kept on site, and extend two metres beyond the front of the stockpile.

(e) The hopper or bunker will be fitted with water sprays, which keep the stored material damp at all times. Monitor the water content of the stockpile to ensure it is maintained in a damp condition.

(f) Overhead storage bins will be totally enclosed. The swivel chute area and transfer point from the conveyor will also be enclosed.

(g) Rubber curtain seals may be needed to protect the opening of the overhead bin from winds.

(h) Conveyor belts which are exposed to the wind and used for raw material transfer will be effectively enclosed, to ensure dust is not blown off the conveyor during transit. Conveyor transfer points and hopper discharge areas will be fully enclosed.

(i) Conveyor belts will be fitted with belt cleaners on the return side of the belt.

(j) Weigh hoppers at front-end loader plants will be roofed and have weigh hoppers shrouded on three sides, to protect the contents from the wind. The raw materials transferred by the front end loader should be damp, as they are taken from a dampened stockpile.

(k) Store cement in sealed, dust-tight storage silos. All hatches, inspection points and duct work will be dust-tight.

(l) Silos will be equipped with a high-level sensor alarm and an automatic delivery shut-down switch to prevent overfilling.

(m) Cement dust emissions from the silo during filling operations must be minimised. The minimum acceptable performance is obtained using a fabric filter dust collector.

(n) Totally enclose the cement weigh hopper, to ensure that dust cannot escape to the atmosphere.

(o) An inspection of all dust control components will be performed routinely – for example, at least weekly.

(ii) All contaminated storm water and process wastewater will be collected and retained on site.

(iii) All sources of wastewater will be paved and bunded. The specific areas that will be paved and bunded include; the agitator washout area, the truck washing area, the concrete batching area, and any other area that may generate storm water contaminated with cement dust or residues.

(iv) Contaminated storm water and process wastewater will be captured and recycled by a system with the following specifications:

(a) The system's storage capacity must be sufficient to store the runoff from the bunded areas generated by 20 mm of rain.

(b) Water captured by the bunds will be diverted to a collection pit and then pumped to a storage tank for recycling.

(c) An outlet (overflow drain) in the bund, one metre upstream of the collection pit, will divert excess rainwater from the bunded area when the pit fills due to heavy rain (more than 20 mm of rain over 24 hours).

(d) Collection pits should contain a sloping sludge interceptor, to separate water and sediments. The sloping surface enables easy removal of sludge and sediments.

(e) Wastewater will be pumped from the collection pit to a recycling tank. The pit will have a primary pump triggered by a float switch and a backup pump which automatically activates if the primary fails.

(f) Wastewater stored in the recycling tank needs to be reused at the earliest possible opportunity. This will restore the system's storage capacity, ready to deal with wastewater generated by the next rainfall event. Uses for recycling tank water include concrete batching, spraying over stockpiles for dust control and washing out agitators.

689. <u>Asphalt Plants</u> – the following measures will be applied by the Contractor:

(i) Emissions & Noise:

(a) Asphalt plants will be located downwind of urban areas and not within one kilometer of any urban area.

- (b) Adequate Personal Protective Equipment (PPE) will be provided to staff working in areas of high noise and emissions.

(ii) Storage and Use of Hazardous Materials (including bitumen):

- (a) Ensure all hazardous materials are stored (including within suitable sized bunds for liquids), handled and disposed of according to their Material Safety Data Sheet (MSDS).
- (b) Copies of MSDS will be kept on site with all hazardous materials.
- (c) The Contractor will keep a log of the type and volume of all hazardous wastes on site.
- (d) The Contractor will keep a plan of site indicating where all hazardous materials are stored.

(iii) Vehicle Movement:

- (a) The Contractor will include the asphalt plant in his Traffic Management Plan, including haul routes from the plant.

(iv) Health and Safety:

- (a) To prevent bitumen burns it will be compulsory for the workers handling hot bitumen to wear full-body protection.
- (b) All transportation, handling and storage of bitumen will be handled safely by experienced personnel.
- (c) The dust from the manufacturing process may pose respiratory hazards, hence protective air mask will be provided to the operators for the loading and unloading of aggregates.
- (d) Ear-muffs will be provided those working on the plant.
- (e) First Aid kit will be available on site for the workers in case of emergency.
- (f) The MSDS for each chemical product will be made accessible onsite and displayed.

690. Temporary Storage Areas – The Contractor will be responsible for preparing a method statement for the opening, operation and reinstatement of any temporary storage area he uses. The method statement shall be prepared and submitted to the Engineer for approval before any such site can be used. Many of these sites will be located close to rivers, and as such the Contractor will ensure that the method statements include specific measures to ensure no pollution of the rivers, including banning of the storage of hazardous liquids in these areas. The method statement shall also clearing illustrate the conditions of the site prior to its clearing and use, so that it can be fully re-instated to its former conditions. The method statement shall also indicate what type of vegetation has been cleared at the site, and where this has occurred, the Contractor shall be responsible for replanting of any trees cut in these areas on a 1:3 basis.

Residual Impact Significance

Construction Phase – ***MINOR***

If the mitigation measures suggested are implemented residual impacts will be minor

Operational Phase – ***LOW***

If the mitigation measures suggested are implemented residual impacts will be low as long as reinstatement plans are followed correctly.

G.7.5 Tunnels

Potential Impacts

691. The main typical environmental problems linked to the construction of underground works are listed below:

(i) Triggering of surface settlements, structures collapses and slope instabilities
(ii) Drying up of springs and groundwater alterations
(iii) Storage and use of excavated materials (Addressed in **Section G.7.3 – Waste Management** above).
(iv) Noise & Vibration (Addressed in **Section G.8.7 – Vibration** and **G.8.8 Noise** below).
(v) Pollution of groundwater, mainly after the realization of stabilization works by injections.

692. Surface Settlements - The opening of underground works can lead to a deformation of the soils and rocks around the excavation area in some instances. Such deformations may trigger sudden collapses, subsidence and sinking that can damage both the work under construction and pre-existing nearby structures. The extent of settlements depends on the following elements:

(i) Excavation technique.
(ii) Dimension and geometry of the excavation.
(iii) Type of excavated material.

693. Analysis undertaken by the Design Consultants have indicated that settlement of less than 5mm will occur above the tunnels in the F2 section. The analysis indicates that settlement will not impact upon structures above these tunnels and structural damage is not to be expected unless some unforeseen situation occurs or unless the Contractor doesn’t work properly. It is however possible that cosmetic damage could occur such as small cracks in plaster in wall joints.

694. Dewatering - A key aspect of dewatering systems for tunnel and shaft construction is that they will generate water from pumped wells or from sumps and drains within the tunnel. Some of this water, particularly from sumps, will be ‘dirty water’ and will require some form of treatment (most commonly to remove suspended solids) before it can be disposed of. Some of the water may be ‘clean water’ (particularly from dewatering wells or tunnel drains) that may require little or no treatment.

695. Drying up of Groundwater – Tunnels located below the water table can seep into excavations that are below the water table, which can result in groundwater drawdown around the structures during construction and operation. This in turn may impact upon water levels in wells and natural springs (or artesian wells). Drawdown can also potentially impact the flow of rivers, although in the case of the Dzirula and Rikotula rivers this is not likely to be significant due to their high discharge rates. These phenomena can persist even after the tunnel construction if the final alignment is not completely waterproof.

696. Site visits were undertaken in the Project area by the LCF to determine what the status of ground water use was in the local community. The results of the site visits indicated that few groundwater wells are located in the Project area and that most water is supplied to homes and businesses through a piped system which transfers groundwater from several kilometers away further up in the mountains. Accordingly, it appears that tunnel construction is unlikely to have any significant impacts on the local community in terms of groundwater depletion.

Management & Mitigation Actions

697. Drying up of Groundwater – Although site visits have indicated that there are few wells in the Project area and that most of the community receive water from a piped network it is still

considered prudent to monitor the status of groundwater drawdown during the construction phase.

698. The Contractor will be responsible for the development of a ground water management plan for each tunnel which shall be submitted for approval by the Engineer at least four weeks prior to the start of tunnelling works.

699. The plan shall include a map of all ground water wells within the Project area that maybe affected by each tunnel.

700. The Plan shall include routine monitoring of the groundwater levels in wells against baseline water levels (measured by the Contractor before the start of tunnel works) in the Project area which will be undertaken on a weekly basis by the Contractor within the vicinity of each tunnel he is excavating. If drawdown levels in wells are significant the Contractor will provide a temporary source of potable water to the affected persons until the construction works are finished. The Contractor shall continue to monitor the water levels in the affected wells for a period of 12 months after construction is completed at the tunnel sites. If the wells begin to recharge to their pre-construction levels no further actions will be necessary. However, if the water fails to re-charge to pre-construction levels alternative water supply will be provided to the affected parties, this may include for example, increasing the depth of their wells, or piped water from another location, which, as noted above, appears to be a fairly effective option.

701. <u>Dewatering</u> – The Contractor will pass all drainage water from the tunnel through a settlement tank. Weekly monitoring of the water quality from the tank will be undertaken by the Contractor to assess for any pollution. If the drainage water meets drinking water standards it can be considered for re-use in any potentially depleted wells during the construction phase.

Residual Impact Significance

<u>Construction Phase</u> – ***MINOR***

If the mitigation measures suggested are implemented residual impacts will be minor.

<u>Operational Phase</u> – ***LOW***

It is possible that the construction of tunnels could depleted groundwater and affect groundwater users. If this is the case affected villagers will be supplied with an alternative source of potable water if this occurs.

G.8 Social and Cultural Aspects

G.8.1 Employment Creation, Skills Enhancement and Local Business Opportunities

Potential Impacts

702. The Project is expected to generate positive impacts on the local economy and livelihoods in terms of employment and skills enhancement and local business opportunities through the procurement of goods and services.

703. Positive impacts will be primarily associated with the construction phase and therefore temporary in nature. The termination of construction contracts will occur once construction

activities are completed. Workers who have relocated to the area for the Project are likely to leave the area in search of other opportunities, especially if they are permanent employees of Contractors and subcontractors.

704. Those who have worked on the Project will have an advantage when seeking alternative jobs on similar projects due to the experience and any training received through this Project.

705. The construction phase will last approximately 30 months and it is expected that approximately 600 direct employment opportunities will be available during the peak of construction. The breakdown of skills required during the construction phase will be as follows:

(i) Skilled labour: 58%;
(ii) Semi-skilled labour: 20%; and
(iii) Unskilled labour: 22%.

706. Local procurement will benefit the hospitality and service industries primarily, such as catering, cleaning, transport and security services. Local businesses will benefit during the construction phase as there will be increased spending within the area by the wage labor who will have improved buying power while employed by the Project.

707. According to the Project social survey, it is envisaged that in the long term, the Project will bring more opportunities into the whole area. First of all to the agricultural traditional sector whose products will easily reach the main market places like Tbilisi and Kutaisi, Batumi and Poti. It is also expected a seasonal adjustment of the tourism period stretching and increasing the presence of visitors all along the year encouraging moreover the week end holidays visits. This in turn could possibly curb the emigration toward the main town and cities through the creation of stable and well remunerated jobs. It can also be said that the realization of the Project complies with the integrated geo-tourism development approach outlined in the Strategic Environmental Cultural Heritage and Social Assessment contained in the ITDS (Imereti Tourist Development Project – funded by the World Bank) comprising multi-sectoral interventions, managed vertical investments, coordinated elaboration of tourist circuits and destination sites, targeted support to cost efficient and environment-friendly tourist packages, and protection of local communities and cultural heritage through promotion of responsible tourism.

708. During the operational phase of the Project diversion of traffic from the existing road to the new alignment may affect some roadside business in the Project areas including small roadside shops and restaurants. The level of trade with road users will fall, but they will still be able to provide their services to the local community. Access to the existing road will be provided by two interchanges in section F2 along with the intersection in Boriti allowing road users to visit restaurants along the old alignment.

Residual Impact Significance

Construction Phase – ***NONE***

If the mitigation measures suggested are implemented residual impacts will be minor.

Operational Phase – ***LOW/MEDIUM***

After the Project construction phase many local workers may be without employment. However, the Project will have provided them, in many instances, with additional skills and experience to work on similar projects in other locations. Local businesses supplying the Contractors and their staff may also see a fall in trade, this is an unavoidable consequence of the Project.

G.8.2 Community Health and Safety

Potential Impacts

709. The presence of the Project could affect the health, safety and security of the communities in the area of influence as a result of worker-community interactions, in-migration to the area, increased incomes in the local community that may be used for drugs, alcohol and prostitution, the risk of injury associated with construction and operational activities, increased pressure on health care resources and changes to the environment.

Construction Phase Impacts

710. Potential impacts due to the proposed construction can be identified as follows:

- (i) Workforce, Jobseekers and Social Conflict. In some instances the local population may not be able to provide the necessary skilled workers for the Project. In such cases workers from other regions, or other countries may be employed by the Contractor. This could lead to social tensions and potential conflict if these workers are not aware of local customs and practices. An increase in disposable income within the Project area (among Project workers, both local and external) may also result in a change in spending habits and behavior resulting in increase in alcohol and drug abuse, increased incidences of prostitution and casual sexual relations, which poses a threat to community health and safety.
- (ii) Pressure on Social Infrastructure and Services. During the construction phase workers will be accommodated on-site and as such there will be no pressure on local housing stock. In addition, the Contractor will also have his own on-site medical facilities. Any serious injuries will be treated in Zestaphoni.
- (iii) Road Safety. Construction of the Project Road will require a large amount of vehicle movements, locally and regionally. These could potentially result in road traffic accidents between vehicles, pedestrians and vehicles and livestock and vehicles if suitable plans and mitigation is not in place. This is especially relevant around the first intersection close to Boriti public school.
- (iv) Air quality and noise. Potential air and noise issues and their impacts to the local population are discussed above under items **G.5.1 – Air Quality**, **Item G.7.4 – Construction Camps and Batching Plants** and **Item G.8.8 – Noise.**
- (v) Blasting - Depending in the rock type and explosive strength, rocks can fly up to 50m and can potentially damage structures. For the above reason, surface blasting or blasting near the mouth of the tunnel is not recommended.

Operational Phase Impacts

711. Road Safety. The road has been designed in such a way that locals will not need to cross the new alignment on foot, as they do with the existing road. Access will be maintained to the existing road and people will be able to pass beneath bridges or above tunnels. Accidents involving collisions between pedestrians and vehicles are therefore likely to be rare. The geometry of the new road, improved drainage and two-lanes will also provide safer driving conditions for road users, although as traffic volumes increase the total number of vehicle accidents may increase, especially as average speeds are likely to increase.

712. Khunevi and Vashlevi schools are located very close to the new alignment and the existing road. The majority of the traffic using the existing road will be transferred to the new alignment which means that traffic on the existing road will be reduced leading to safer

conditions for children coming to and from the schools which are accessed via the existing road.

713. Community Severance. In general, the new alignment traverses a series of tunnels and bridges, thereby limiting the potential for community severance. In addition, new access roads have been provided in the design to ensure that locals can still navigate easily to the existing road. At the start of the Project road three houses on the north side of the road (KM0.6 - KM0.7) will be expropriated as the design was unable to accommodate access to these properties. .

714. In addition, a number of small vehicle / pedestian bridges can be noted crossing the Dzirula river beneath planned bridge structures, notably at KM3.2, KM6.6 and KM9.9 (pedestrian only). None of these bridges are planned to be removed as part of the Project.

715. Air Quality & Noise – These issues, including the impacts to Boriti public school, are discussed in detail under items **G.5.1 – Air Quality** and **Item G.8.8 – Noise.**

Management & Mitigation Actions

Pre-construction Phase

716. Prior to start of site works residents, business representatives in the project area, local authorities and other stakeholders, including NGOs, who are likely to be affected by the project or are interested in the project) shall be informed on the construction schedule and activities, potential environmental impacts and mitigation measures through public meetings at each affected community.

Construction Phase Mitigation

717. Mitigation measures to limit community health and safety impacts include:

718. Road Safety – The Contractor will be responsible for preparing a traffic management plan (TMP) for the construction phase of the Project. Special attention should be given in the TMP to the Public School of Verkvichchala, Public school of village Vashlevi and the Khunevi School, including speed restrictions for construction traffic outside the schools (50 kph). Drivers operating in these areas will be given specific instruction and toolbox training sessions reminding them not to exceed this speed limit in these areas. In addition, School Safety Sessions will be completed by the Contractors H&S team and community liaison on 6-month basis throughout construction and an initial session prior to start of works to provide road safety awareness to children. During these sessions the school children shall also be provided with reflective badges to fit to clothing or school bags. Lastly, construction traffic will not be allowed to park within 100 meters of the entrance of the schools.

719. Blasting - The Project will conduct construction blasting consistent with Georgian and international safety standards. Blasting will be conducted using standard mining industry practices and procedures to ensure safety of personnel and equipment. This includes establishing a safety zone around the blast area, say to a distance of 500 m (actual distance will be established by the Contractor and approved by the Engineer based on the safety standards) and evacuating it. Prior to blasting works properties located in potential impact zone will be checked. The status – recorded. Inspection will also help to determine blasting method and dosage. Type, 'size' of the charge, selection of time between detonations, design (e.g. closer hole spacing, smaller diameter holes), presplitting blasting, perimeter blasting and millisecond blasting technique can be used in sensitive locations to minimize blasting effect.

720. Community Severance - The Contractor will ensure that all access bridges remain open during the Construction phase, or if this is not practical for safety reasons, he shall provide alternative crossing in these areas.

721. Social Conflicts. The Contractor shall provide regular health and safety training to their workers which will include sessions on social and cultural awareness. The Contractor will also sub-contract an organization to develop and implement an HIV/AIDS policy and information document for all workers directly related to the Project. The information document will address factual health issues as well as behavior change issues around the transmission and infection of HIV/AIDS. In addition, the Contractor shall develop an induction program, including a Code of Conduct, for all workers directly related to the Project. A copy of the Code of Conduct is to be presented to all workers and signed by each person. The Code of Conduct must address the following aspects:

- (i) Respect for local residents and customs;
- (ii) Zero tolerance of bribery or corruption;
- (iii) Zero tolerance of illegal activities by construction personnel including:
  - (a) unlicensed prostitution;
  - (b) illegal sale or purchase of alcohol;
  - (c) sale, purchase or consumption of drugs; and
  - (d) illegal gambling or fighting.
- (iv) No alcohol and drugs policy during working time or at times that will affect ability to work; and
- (v) Description of disciplinary measures for infringement of the Code and company rules. If workers are found to be in contravention of the Code of Conduct, which they signed at the commencement of their contract, they will face disciplinary procedures that could result in dismissal.
- (vi) In addition, Project security guards shall not to violate the safety of local residents or other individuals involved in the project.

722. In addition, the Contractor will be responsible for holding monthly community meetings within the Project area throughout the construction period. The monthly meetings will be held in the villages along the alignment and will provide a forum for locals to discuss specific issues, such as noise and dust, with the Contractor before making complaints formal through the Grievance Redress Mechanism. The minutes of meetings shall be recorded and a list of participants prepared (including signatures). Photos of each event shall be taken (with timestamps). The Contractor shall prepare a short monthly summary of the meetings including all of the above information and submit it for review to the Engineer and RD within a week of the meeting.

Residual Impact Significance

Construction Phase – ***MINOR***

If the mitigation measures suggested are implemented residual impacts will be minor.

Operational Phase – ***LOW***

The main residual risks associated with the Project on the local community relate to noise which are discussed below. From the perspective of the schools, they should benefit from decreased traffic volumes on the existing road which will lead to increased road safety in the areas outside of the schools.

G.8.3 Workers' Rights & Occupational Health and Safety

723. Occupational Health and Safety - Accidents are common during a project of this size and scale. Accidents can occur if workers are not adequately trained or qualified for the job or if they have incorrect safety equipment and clothing.

724. Sexually Transmitted Diseases – See **Section G.8.2** above for impacts and mitigation relating to STDs.

725. Worker Rights - Workers' rights including occupational health and safety need to be considered to avoid accidents and injuries, loss of man-hours, labor abuses and to ensure fair treatment, remuneration and working and living conditions. These issues need to be considered not only for workers who are directly employed by the Project but also sub-contractors.

Potential Impacts

726. The Project is expected to create more than 600 direct employment opportunities during the peak of the construction period, which will be approximately 36 months in duration. The majority of workers will be engaged by the Contractor and will consist of a semi-skilled to skilled workforce.

727. The expected impacts on worker rights and H&S as a result of construction, activities and Project operation are as follows:

- (i) Risk to workers H&S due to hazardous construction activities and other general construction activities, e.g. traffic accidents; and
- (ii) Violation of workers' rights.

728. Construction activities will involve the operation of heavy equipment and trucks, working at height, construction traffic, use of electric devices, handling of hazardous materials and other hazardous activities. Due to the nature of the activities being undertaken during construction, worker H&S is a key risk with the potential for accidents that may result in injuries and fatalities as well as lost man-hours. It is also important to ensure that workers have access to safe water supplies.

Management & Mitigation Actions

729. An OHS Plan will be prepared by the Contractor to manage worker safety (a template OHS plan is provided in **Appendix R**). The Plan will include the following items:

- (i) Safety Training Program. A Safety Training Program is required and will be delivered by a qualified H&S expert. The program will consist of:
  - (a) Initial Safety Induction Course: All workmen will be required to attend a safety induction course before they are allowed access to the Site.
  - (b) Periodic Safety Training Courses: Period safety course will be conducted not less than once every six months. All Contractor (and any sub-contractor) employees will be required to participate in relevant training courses appropriate to the nature, scale and duration of the works. Training courses for all workmen on the Site and at all levels of supervision and management. A list of training participants names and time-stamped photographic evidence of the training will be provided by the Contractor to the Engineer for his records.
  - (c) Safety Meetings. Regular safety meetings will be conducted on a monthly basis. The Engineer will be notified of all safety meetings in advance. The Engineer may attend in person or by representative at his discretion. The minutes of all safety meetings will be taken and sent to

the Engineer within seven (7) days of the meeting and will include a list of participants names and time-stamped photographic evidence of the training.

(d) Safety Inspections. The Contractor will regularly inspect, test and maintain all safety equipment (including firefighting equipment), scaffolds, guardrails, working platforms, hoists, ladders and other means of access, lifting, lighting, signing and guarding equipment. Lights and signs will be kept clear of obstructions and legible to read. Equipment, which is damaged, dirty, incorrectly positioned or not in working order, will be repaired or replaced immediately by the Contractor.

(e) PPE – Workers will be provided (before they commence works) with of appropriate PPE suitable for electrical work such as safety boots, helmets, gloves, protective clothes, goggles, and ear protection at no cost to the workers. Life vests will be provided for all staff working around, or above rivers.

(ii) The Contractor shall keep a log of both training records and safety incidents including near misses.

(iii) All construction plant and equipment used on or around the Site will be fitted with appropriate safety devices. These will include but not be limited to:

- Effective safety catches for crane hooks and other lifting devices, and
- Functioning automatic warning devices and, where applicable, an up-to-date test certificate, for cranes and hoists.

(iv) Zones with noise level above 80 dBA must be marked with safety signs and appropriate PPE must be worn by workers.

(v) Portable toilet facilities for workers at road work sites will be provided.

(vi) Fencing on all areas of excavation greater than 2 m deep will be installed along with warning signs.

(vii) Ensure sufficient fresh air supply to confined work spaces.

(viii) Keep air inlet filters clean and free of dust and microorganisms.

(ix) Ensure reversing signals are installed on all construction vehicles.

(x) Implement fall prevention and protection measures whenever a worker is exposed to the hazard of falling more than two meters, falling into operating machinery or through an opening in a work surface. Note: fall prevention/protection measures may include installation of guardrails with mid-rails and toe boards at the edge of any fall hazard area, proper use of ladders and scaffolds by trained employees, use of fall prevention devices, including safety belt and lanyard travel limiting devices to prevent access to fall hazard, fall protection devices such as full body harnesses, etc.

(xi) Mark the areas where risk of injuries from falling objects exist with rope or flagging to minimize risks and injuries.

(xii) Provide spotters. Employ flag persons to control traffic when construction equipment is entering or leaving the work area.

730. All Project sub-contractors will be supplied with copies of the SEMP. Provisions will be incorporated into all sub-contracts to ensure the compliance with the SEMP at all tiers of the sub-contracting. All subcontractors will be required to appoint a safety representative who will be available on the Site throughout the operational period of the respective sub-contract unless the Engineers approval to the contrary is given in writing. In the event of the Engineers approval being given, the Engineer, without prejudice to their other duties and responsibilities, will ensure, as far as is practically possible, that employees of sub-contractors of all tiers are conversant with appropriate parts of the SEMP. To implement the above items the Contractor will designate a qualified environmental, health and safety personnel.

731. Water supply – If groundwater is to be used as potable water it will be tested weekly to ensure that the water quality meets the GoG drinking water standards specified in **Section C**.

Residual Impact Significance
Construction Phase – ***MINOR***
If the mitigation measures suggested are implemented residual impacts will be minor.
Operational Phase – ***NONE***

G.8.4 Emergency Response Planning

Potential Impacts

732. Emergency situations may arise during the construction phase of the Project, for example, fires and explosions (through poor management and storage of fuels and chemicals).

Management & Mitigation Actions

Construction Phase

733. The Contractor will be responsible for preparation of an Emergency Response Plan (ERP) which will include sections relating to:

- (i) Containment of hazardous materials;
- (ii) Oil and fuel spills;
- (iii) Fire, gas leaks and explosions;
- (iv) Work-site accidents;
- (v) Community /civil unrest and strike action; and
- (vi) Earthquake and other natural hazards.

734. The plan will detail the process for handling, and subsequently reporting, emergencies, and specify the organizational structure (including responsibilities of nominated personnel). The plan will be submitted to the Engineer for approval. Implementation of the plan will be monitored by the Engineer. Any emergencies, and how they were handled, will be reported in monthly progress reports by the Contractor to the Engineer. The Engineer will also provide periodic monitoring of the Contractors works throughout construction to ensure the ERP is implemented effectively.

Residual Impact Significance
Construction Phase – ***MINOR***
If the mitigation measures suggested are implemented residual impacts will be minor.
Operational Phase – ***NONE***

G.8.5 Physical and Cultural Resources

Potential Impacts

735. As noted by **Section F.4.4** no physical cultural resources have been identified within the Project corridor that are likely to be impacted by Project works except for the small church at KM10.0 and the Cemetery at KM8.6. Ias noted in the section on Alternatives, a small cemetery was also noted close to the access road for the spoil disposal site. As part of the assessment for this spoil disposal site, potential impacts to this site assessed and mitigated. It is possible, given the rich cultural heritage of Georgia, that chance finds could occur during excavation works.

Management & Mitigation Actions

736. During the construction phase works shall be schedule that no works occur within 250 meters of the Church on Sundays, or during religious holidays. Fencing around the cemetery shall also be provided throughout the construction phase to ensure there is no encroachment into this area.

737. In the event of any chance finds during the construction works procedures shall apply that are governed by GoG legislation and guidelines. A chance finds procedure shall also be developed by the Contractor. **Appendix E** provides a sample chance find procedure which the Contractor could adopt.

Residual Impact Significance

<u>Construction Phase</u> – ***MINOR***

If the mitigation measures suggested are implemented residual impacts will be minor.

<u>Operational Phase</u> – ***NONE***

No impacts in terms of noise or air quality are anticipated given the mitigation measures outlines as part of this EIA.

G.8.6 Visual Impact

Potential Impacts

738. Visual impacts are the effects on people of the changes in available views through intrusion or obstruction and whether important opportunities to enjoy views may be improved or reduced. Visual impact to nearby receptors of the Project include:

(i) Degradation of aesthetic value of the area due to construction activities; and
(ii) Permanent change in visual character due to proposed Project.

739. The Project Area largely consists of valleys with large trees and bushes of heights greater than 2 m. The hilly landscape greatly restricts visibility to a less than one km at receptor locations.

740. The construction phase visual impact will be local and temporary. The activities during construction that will affect the aesthetics of the area include excavation, and storing of material in stockpiles and dumping at the waste disposal areas.

741. However, when in place, the new alignment will change the landscape substantially as shown by Figure 98 below. The elevated interchanges and retaining walls in some sections, along with areas of cut slopes will impact upon the view along the valley.

Figure 98: Bridge BRI-2010

Figure 99: Tunnel TUN-2008

742. Many of the road users will be transport vehicles and people moving between urban centers such as Kutaisi and Tbilisi. The impact on them will be short term and limited to the travel time only. Besides, for some of the passengers the landscape may be not familiar, so for them the change will not be crucial. The main impacts will be to the local villagers and tourists, although this portion of the road is not specifically known for its tourist industry.

Management & Mitigation Measures

743. Tree re-planting, as indicated under **Item G.6.1 – Flora**, will go some way to restoring the natural landscape of the area. However, this will not alleviate all of the visual impacts

associated with the elevated interchanges and bridges. Nonetheless, the following mitigation measures are required.

(i) Undertake landscaping after the completion of the activities to match in with surrounding landscape; and
(ii) Reinstate vegetation according to plans.

Residual Impact Significance

Construction Phase – ***MINOR***

Operational Phase – ***LOW/MEDIUM***

Cut slopes, embankments, concrete bridges and tunnels will have an impact on the landscape within the valley throughout the Project lifecycle. The mitigation measures outlined above may go someway to enhancing the aesthetic value of the Project especially as vegetation grows back around construction zones, and in all likelihood any negative opinion of the new road in terms of visual impact will decrease over time as people get used to the altered landscape.

G.8.7 Vibration

Potential Construction Vibration Impacts

744. Ground-borne vibration is the oscillatory motion of the ground about some equilibrium position, and can be described in terms either of displacement, velocity or acceleration. Because human sensitivity to vibration typically corresponds best to the amplitude of vibration velocity within the low frequency range of most concern (roughly 5- 100 Hertz), vibration velocity is the preferred measure for evaluating ground-borne vibration from transit projects.

745. Vibration from the construction activities is a cause concern to the community. The effects of vibration varies and depends on the magnitude of the vibration source, the particular ground conditions between the source and receiver, presence of rocks or other large structures in the area. The intensity, duration, frequency and number of occurrences of a vibration all play an important role in both the annoyance levels caused and the strains induced in structures.

746. The effects of vibration includes annoyance, sleep disturbance, and potential damage to structures. The Georgian Standards for vibration are provided in Table 21.

747. The proposed criteria for damage to buildings are shown in Table 75. These are derived from British Standard BS 6472 and are German Standards DIN 4150-3:1999.

Table 75: Criteria for Structural Damage Due to Vibration.

No damage likely	PPV <5mm/s
Cosmetic damage risk	PPV 5 to 15 mm/s
Structural damage risk	PPV > 15 mm/s

748. The following section discusses the issue of vibration under four headings:

(i) General construction
(ii) Tunnel excavation
(iii) Bridge piling
(iv) Trenching.

749. Potential impacts of tunneling, bridge piling and trenching have been assessed using a vibration model which is summarized below.

750. **General Construction** - Table 76 provides an indication of the approximate vibration levels that may be expected for various vibration sources.

Table 76: Approximate Vibration Levels at Various Sources

Activity	Typical Levels of Ground Vibration
Vibratory rollers	Up to 1.5 mm/s at distances of 25 m Higher levels could occur at closer distances; however, no damage would be expected for any building at distances greater than approximately 12 m (for a medium to heavy roller)
Hydraulic rock breakers	4.50 mm/s at 5 m 1.30 mm/s at 10 m 0.4 mm/s at 20 m 0.10 mm/s at 50 m
Compactor	20 mm/s at distances of approximately 5 m, 2 mm/s at distances of 15m. at distances greater than 30 m, vibration is usually below 0.3 mm/s
Bulldozers	1 to 2 mm/s at distances of approximately 5 m. at distances greater than 20 m. vibration is usually below 0.32 mm/s
Air track drill	4 to 5 mm/s at a distance of approximately 5 m, and 1.5 mm/s at 10 m. at distances greater than 25 m, vibration is usually below 0.6 mm/s and at 50 m or more, vibration is usually below 0.1 mms
Truck traffic (over normal smooth surfaces)	0.01 to 0.2 mm/s at the footing of buildings located 10 to 20 m from a roadway
Truck traffic (over irregular surfaces)	0.1 to 2.0 mm/s at the footings of buildings located 10 m to 20 m from a roadway

751. These levels are well below the threshold of any possibility of damage to normal structures due to vibrations from typical construction activities related to roller, compactors, and movement of construction equipment.

752. **Tunnel Excavation** - There are several tunnels in the Lot F2 and the all of them are driven through hard rock of gabbro type by blasting or mechanical excavation by heavy hydraulic hammers.

Table 77: Location and characteristics of tunnels

Tunnel		Carr.	LENGTH	CHAINAGES				Notes	Lithology	Excavation
				START	START UNDERGROUND	END UNDERGROUND	END			
TUN	2001	AT	110.40	0+800,0	0+829,0	0+881,6	0+900,4		Gabbro (higher strength)	Blasting
		TA	113.90	0+793,0			0+906,9	existing		
TUN	2002	AT	186.40	1+129,3	1+135,8	1+309,3	1315.8		Gabbro (higher strength)	Blasting
		-								
TUN	2003	AT	126.30	1+756,7	1+771,4	1+870,9	1+882,9		Gabbro (higher strength)	Blasting
		TA	150.30	1+765,3			1+915,6	existing		
TUN	2004	AT	400.00	2+050			2+450		Gabbro (higher strength)	Blasting
		-								
TUN	2005	AT	311.20	2+837,4	2+854,0	3+133,2	3+148,5		Gabbro (higher strength)	Blasting
		TA	266.00	2+838,6	2+854,0	3+088,4	3+104,6			
TUN	2006	AT	227.40	3+610,5	3+617,0	3+823,4	3+837,9		Granite (lower strength)	Mech excavation
		TA	277.70	3+575,0	3+581,5	3+836,2	3+852,7			
TUN	2007	AT	520.00	4+080			4+600		Granite (lower strength)	Mech excavation
		TA	510.00	4+090			4+600			
TUN	2008	AT	274.90	5+509,5	5+526,0	5+784,4	5+768,9		Granite (lower strength)	Mech excavation
		TA	310.10	5+462,1	5+476,9	5+755,9	5+772,1			
TUN	2009	AT	1300.00	7+220			8+520		Granite (lower strength)	Mech excavation
		TA	1330.00	7+210			8+540			
TUN	2010	AT	710.00	10+320			11+030		Granite (lower strength)	Mech excavation
		TA	660.00	10+330			10+990			
TUN	2011	AT	670.00	11+160			11+830		Granite (lower strength)	Mech excavation
		TA	610.00	11+180			11+790			

753. Tunnel Blasting - In case of blasting, the below tables (**Table 78** and **Table 79***)* (Courtesy of TERROCK Consulting Engineers Blasting-Vibration Course) allow to calculate the vibration level (mm/s) in the soil in accordance to charge and distance.

754. These values do not take into consideration the attenuation effect of the topmost alterated soil but only the propagation in hard rock.

Table 78: Granite (10 mm/s)

VIBRATION LIMIT TABLE
FOR PPV = 10.00 mm/s

SITE LAW CONSTANT = 7927.00
SITE LAW EXPONENT = -1.97

DIST/m	CHARGE/kg
10	0.11
15	0.26
20	0.46
30	1.03
50	2.85
70	5.58
100	11.40
150	25.64
200	45.58
300	102.56
500	284.89
700	558.39
1000	1139.57
1500	2564.04
2000	4558.29
3000	10256.16
5000	28489.31
7000	55839.07

Table 79: Overburden (5 mm/s)

VIBRATION LIMIT TABLE
FOR PPV = 5.00 mm/s

SITE LAW CONSTANT = 2500.00
SITE LAW EXPONENT = -1.60

DIST/m	CHARGE/kg
10	0.04
15	0.10
20	0.17
30	0.38
50	1.06
70	2.07
100	4.23
150	9.52
200	16.92
300	38.07
500	105.74
700	207.24
1000	422.95
1500	951.63
2000	1691.79
3000	3806.54
5000	10573.71
7000	20724.48

*The overburden is the material covering the Granite.

755. All the numerous formula available in the scientific literature refer to the below general formula, with minor modifications:

$$PPV = k\left(\frac{R}{Q^n}\right)^{-b}$$

Where:

PPV = peak particle velocity (mm/s);
k = site constant
R = distance to the point of concern (m);
Q = maximum instantaneous charge weight;
b = rock properties constant;
n = constant that depends on the geometry of the explosive.

756. Recently Kumar et al (2016), have developed a new model which take into consideration many engineering properties of rock to develop a more accurate model to calculate the PPV.

757. The considered parameters are:

(i) unit weight,
(ii) uniaxial compressive strength (UCS)
(iii) and rock quality designation (RQD)

758. For its modernity and recognized higher accuracy, this model has been applied in the Report for the calculation of PPV:

$$PPV = \frac{f_c^{0.642}}{\gamma}\left(\frac{R}{Q^{1/2}}\right)^{-1.463}$$

Where:

PPV = peak particle velocity (mm/s);

f_c = UCS of rock

R = distance to the point of concern (m);

Q = maximum instantaneous charge weight (kg);

γ = unit weight (kN/m^3).

With f_c = 059476RQD+0.00893 RQD^2 for RQD ≤ 75
and f_c= -7.91562 RQD+0.12152 RQD^2 for RQD ≥75

759. RQD (Rock Quality Designation) parameters have been obtained by the engineering Report, whereas for the rock, a density of 2,3 g/cm^3 has been used according to the geomechanical tests.

760. The following parameters have been assumed:
(i) Tunnel section 90 m^2
(ii) Borehole depth: 5m
(iii) Rock blasted per step: 450 m^3
(iv) Powder factor :0,65 (kg/ $m^{3)}$
(v) Max. Istant. Charge: 292.

761. Due to the general type of rock associated to fractures, as seen in the geological sections referring to tunnels; a Powder Factor of 0,6-0,7 has been utilized in the calculations.

762. In accordance to the above formula *above*, the below table can be applied:

Table 80: PPV velocity at different distances from blasting point

Distance from blasting point (m)	Range of Estimated PPV mm/s
50	20-22
60	15-16
70	12-13,5
80	8-9
90	7-7,5
100	5-5,5
110	4

763. According to existing regulations values of 5 mm/s must be considered for building safety. In accordance to that a safe distance of about 100-110 m from blasting point has to be

considered for cosmetic damages and a distance of 60-65 metres for major/structural damages. Tailored blasting techniques optimizing charge load and delay and the presence of overburden, which plays an important role for attenuation, suggest that the distance could be reduced to 80-90 metres in case of 3-5 metres of overburden.

764. In addition, the shallow and poor foundations of the buildings do not allow a good soil-structure coupling with the effect of a further attenuation of the energy transmitted to the building.

765. Tunnelling by mechanical excavation - If tunnelling is made by hammering, (Figure 100) or other means of mechanical excavation, vibration levels could be referred to the ones considered for trenching and also according to the table for TBM (Tunnel Boring Machine) presented in the below table (Figure 101) using as reference the blue dotted line referring to a similar hard rock formation.

Figure 100: Scheme of main direction of propagation of vibrations for tunnelling activities

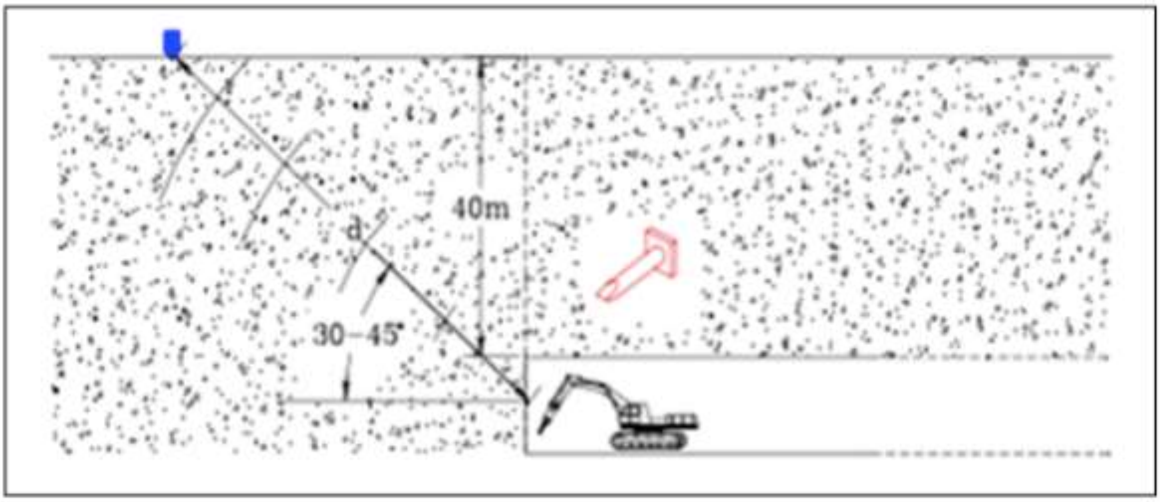
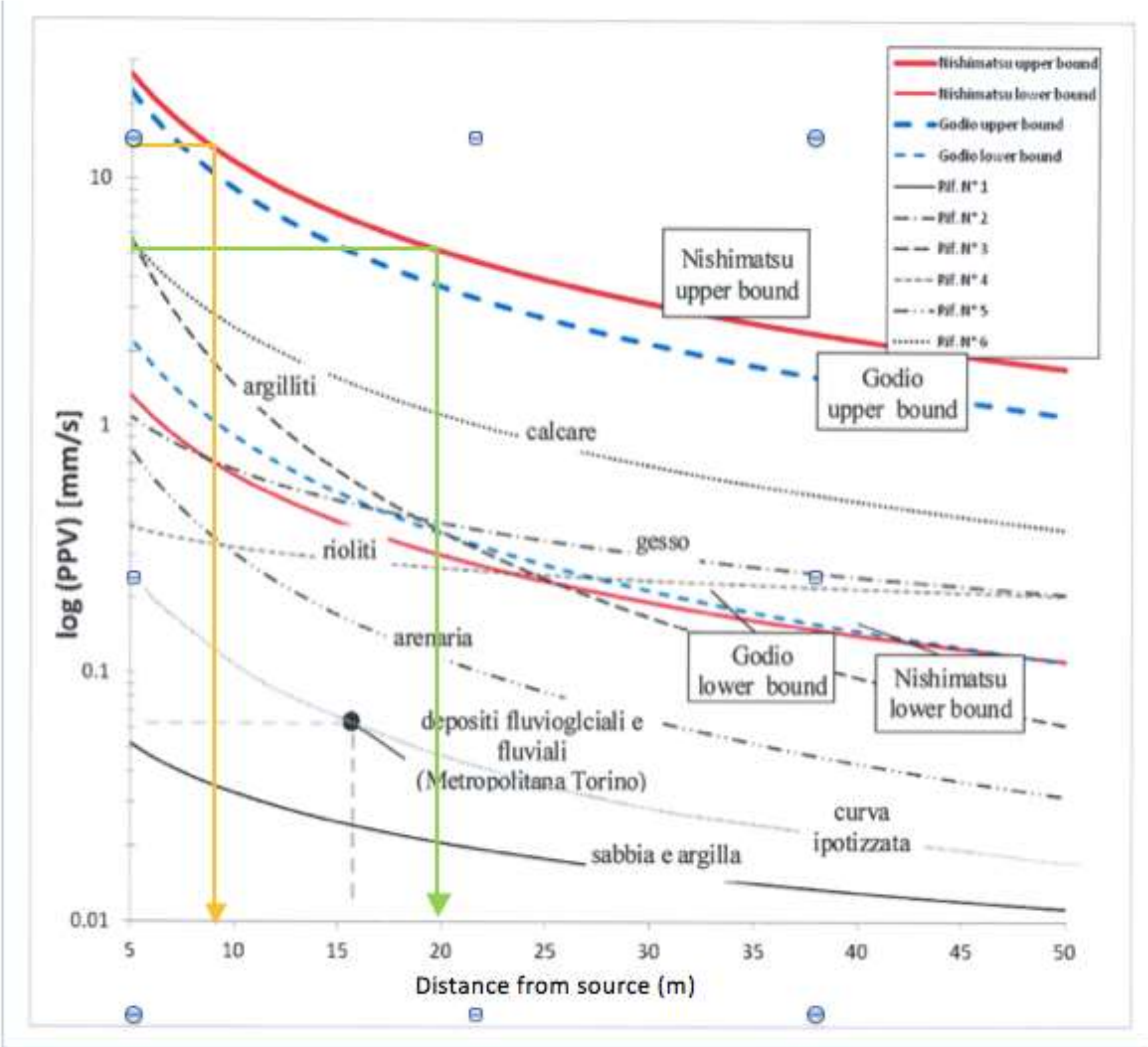


Figure 101: PPV for TBM in different types of rocks (from Italian Railway Co. RFI)



766. As shown by the green line, in accordance to the above table, a safe distance of 20-25 m for PPV value of 5 mm/s can be considered for tunnelling activities by mechanical excavation.

767. According to the yellow line, PPV value of 15 mm/s is reached at less than 10 m from the hammering point.

768. **Piling** - There are several bridges to be constructed, some foundations will directly be built on pits excavated in hard rock, other will be built on piles. Details are presented below.

Table 81: Location and Characteristics of Bridges.

BRIDGES AXIS TA						L. TOT	Lithology	Thickness of the soil or of the overburden	Foundation
BRI	2	1	01	TA	PSC	132.08	Granite (lower strength)	Low	Shallow
BRI	2	1	02	TA	PSC	66.00	Gabbro (higher strength)	Low/Medium	Shallow
BRI	2	1	03	TA	PSC	66.00	Gabbro (higher strength)	Very low	Shallow
BRI	2	1	04	TA	PSC	99.00	Gabbro (higher strength)	Low/Medium	Shallow

BRIDGES AXIS TA						**L. TOT**	**Lithology**	**Thickness of the soil or of the overburden**	**Foundation**
BRI	2	1	05	TA	PSC	99.00	Gabbro (higher strength)	Low	Shallow
BRI	2	1	06	TA	PSC	66.00	Gabbro (higher strength)	Low	Shallow
BRI	2	1	07	TA	PSC	131.65	Gabbro (higher strength)	Medium/High	Shallow/Piles
BRI	2	1	08	TA	PSC	99.00	Gabbro (higher strength)	Very low	Shallow
BRI	2	1	09	TA	PSC	372.00	Gabbro (higher strength)	Low/Medium	Shallow/Piles
BRI	2	1	10	TA	PSC	429.70	Gabbro (higher strength) Tbilisi Granite (lower strength) Argveta	Medium/High	Shallow/Piles
BRI	2	1	11	TA	PSC	132.00	Granite (lower strength)	Medium	Shallow/Piles
BRI	2	1	12	TA	PSC	231.80	Granite (lower strength)	Low/Medium	Shallow/Piles
BRI	2	1	13	TA	STEEL	1296.00	Granite (lower strength)	Medium/High	Piles
BRI	2	1	14	TA	STEEL	462.00	Granite (lower strength)	Medium	Shallow/Piles
BRI	2	1	15	TA	PSC	33.00	Granite (lower strength)	Medium	Shallow/Piles
BRI	2	1	16	TA	STEEL	144.00	Granite (lower strength)	Medium/High	Piles
BRI	2	1	17	TA	PSC	133.70	Granite (lower strength)	Low/Medium	Shallow/Piles
BRI	2	1	18	TA	PSC	165.00	Granite (lower strength)	Medium/High	Piles
BRIDGES AXIS AT						TOT			
BRI	2	1	1	AT	PSC	134.90	Granite (lower strength)	Very low	Shallow
BRI	2	1	2	AT	PSC	99.00	Gabbro (higher strength)	Low	Shallow
BRI	2	1	3	AT	PSC	66.00	Gabbro (higher strength)	Very low	Shallow
BRI	2	1	4	AT	PSC	99.00	Gabbro (higher strength)	Medium	Shallow/Piles
BRI	2	1	5	AT	PSC	99.00	Gabbro (higher strength)	Low	Shallow
BRI	2	1	6	AT	PSC	66.00	Gabbro (higher strength)	Low	Shallow
BRI	2	1	7	AT	PSC	131.55	Gabbro (higher strength)	Medium	Shallow
BRI	2	1	9	AT	PSC	286.35	Gabbro (higher strength)	Medium	Shallow/Piles
BRI	2	1	10	AT	PSC	425.35	Gabbro (higher strength) Tbilisi Granite (lower strength) Argveta	Medium	Piles
BRI	2	1	11	AT	PSC	134.35	Granite (lower strength)	Medium	Shallow/Piles
BRI	2	1	12	AT	PSC	313.45	Granite (lower strength)	Medium	Shallow/Piles
BRI	2	1	13	AT	STEEL	1362.00	Granite (lower strength)	Medium/High	Piles
BRI	2	1	14	AT	STEEL	450.00	Granite (lower strength)	Medium	Shallow/Piles
BRI	2	1	15	AT	PSC	33.00	Granite (lower strength)	Medium	Shallow/Piles

BRIDGES AXIS TA						**L. TOT**	**Lithology**	**Thickness of the soil or of the overburden**	**Foundation**
BRI	2	1	16	AT	STEEL	144.00	Granite (lower strength)	Medium/High	Piles
BRI	2	1	17	AT	PSC	132.00	Granite (lower strength)	Medium	Shallow/Piles
BRI	2	1	18	AT	PSC	165.00	Granite (lower strength)	Medium/High	Piles

769. Waves emanating from source such as a pile in the ground includes elastic waves in the form of compression waves, shear wave, and surface waves. Compression waves are considered to propagate from the area of the pile toe, expanding outwards over a spherical wave front with a geometric damping coefficient of 1.0. The vertical shear waves emanates from shaft friction and expanding around a conical surface. The waves are shown in Figure 102 and Figure 103.

770. Vibrations generated by friction pile driving can be characterized as a vertical shear wave with a conical wave- front. Therefore, the source can be classified as a point source generating body wave and the travel distance can be estimated as a horizontal distance from the source.

Figure 102: Propagation Ground Vibrations Generated by Piling

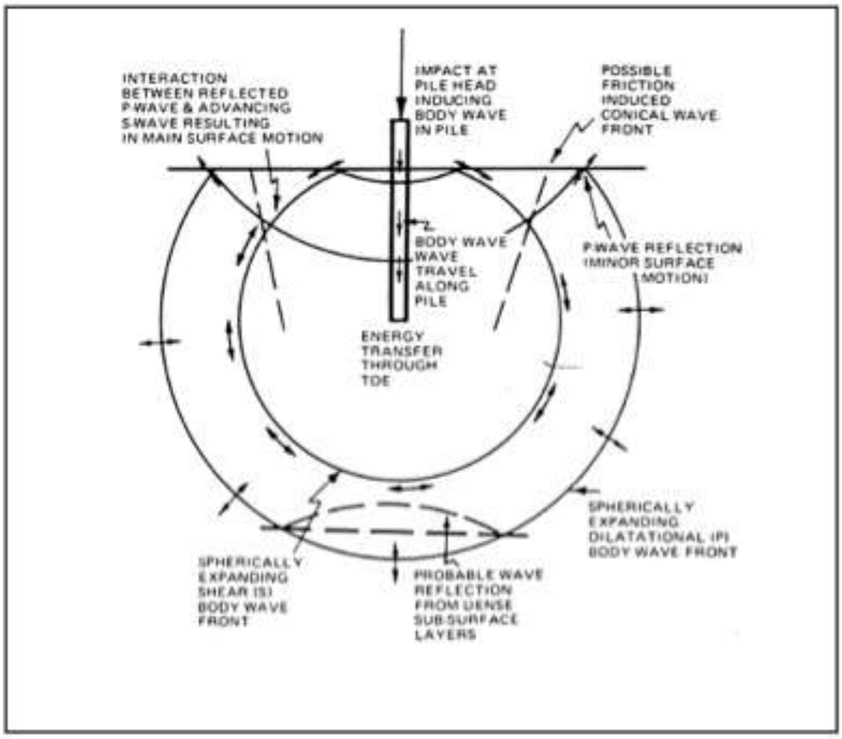


Figure 103: Propagation and Attenuation Characteristics of Various Ground Vibrations

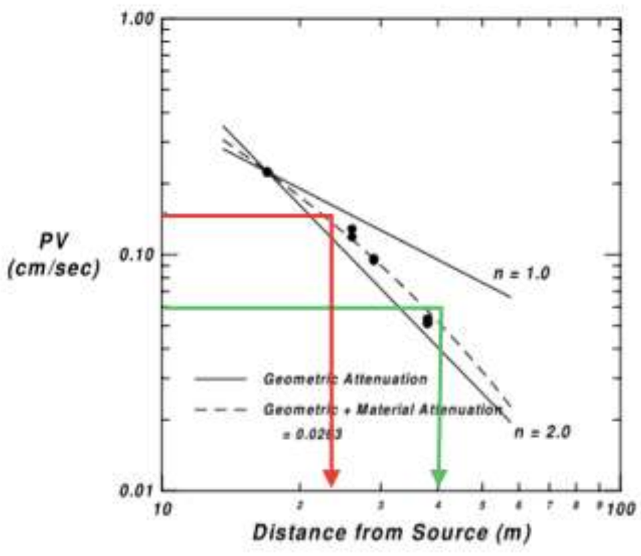


Fig. 13 Attenuation with distance of friction pile driving induced vibration.

771. According to soil characteristics and scientific literature, the PPV=5 Limit (green line) can be set at 40 m, and PPV = 15 mm/s at 20-25 m., those values are in accordance with other tables available in the scientific community.

772. **Surface blasting (trenching and demolition)** - In case of blasting activities of granitic rocks, the below table, (Courtesy of TERROCK Consult. Engineers. Blasting-Vibration Course, modified for editing purposes), provides a useful guide for the calculation of the effects of blasting of rock walls in terms of PPV, Distance and Charge. The safe area, below 5 mm/s, is contained in the green triangle.)

Figure 104: Vibration Estimation for Granite Quarries

Charge Weight Per Delay / kg	Distance From Charge / m: 0.5	1	2	5	10	20	50	100	200	500	1000
0.025	825	211	53.8	8.84	2.26	0.58	0.09	0.02	0.01	0.00	0.00
0.050	1633	417	106	17.5	4.47	1.14	0.19	0.05	0.01	0.00	0.00
0.075	2435	622	159	26.1	6.66	1.70	0.28	0.07	0.02	0.00	0.00
0.100	3233	825	211	34.6	8.84	2.26	0.37	0.09	0.02	0.00	0.00
0.150	4820	1230	314	51.6	13.2	3.37	0.55	0.14	0.04	0.01	0.00
0.250	7972	2035	519	85.4	21.8	5.57	0.92	0.23	0.06	0.01	0.00
0.500	****	4028	1028	169	43.2	11.0	1.81	0.46	0.12	0.02	0.00
0.750	****	6005	1533	252	64.3	16.4	2.70	0.69	0.18	0.03	0.01
1.000	****	7972	2035	335	85.4	21.8	3.59	0.92	0.23	0.04	0.01
1.500	****	****	3034	499	127	32.5	5.35	1.36	0.35	0.06	0.01
2.500	****	****	5018	825	211	53.8	8.84	2.26	0.58	0.09	0.02
5.000	****	****	9932	1633	417	106	17.5	4.47	1.14	0.19	0.05
7.500	****	****	****	2435	622	159	26.1	6.66	1.70	0.28	0.07
10.000	****	****	****	3233	825	211	34.6	8.84	2.26	0.37	0.09
15.000	****	****	****	4820	1230	314	51.6	13.2	3.37	0.55	0.14
25.000	****	****	****	7972	2035	519	85.4	21.8	5.57	0.92	0.23
50.000	****	****	****	****	4028	1028	169	43.2	11.0	1.81	0.46
75.000	****	****	****	****	6005	1533	252	64.3	16.4	2.70	0.69
100.000	****	****	****	****	7972	2035	335	85.4	21.8	3.59	0.92
150.000	****	****	****	****	****	3034	499	127	32.5	5.35	1.36
250.000	****	****	****	****	****	5018	825	211	53.8	8.84	2.26
500.000	****	****	****	****	****	9932	1633	417	106	17.5	4.47

site law exponent = -1.97 site law constant = 7972

773. Calculations have been also done using the EDUMINING Interactive software Blasting Safety - Peak Particle Velocity Thresholds which allow to calculate PPV or distances/level of damages by the insertion of several blasting parameters (indicated in the figures by the red dots).

774. According to the above analysis a conservative safety distance of 60 m should be considered for PPV = 5 mms and about 15 to 20 m for PPV= 15 mm/s.

775. Trenching by mechanical excavation - As seen in the discussion about the tunnelling by mechanical excavation, the effects of hammering are propagating with an angle of about 30-45° respect to the direction of the alignment of the hammer.

776. In this case the propagation of vibrations mainly occurs along the forward direction, with a minimal component of backward ground roll but a large part of energy is backscattered in form of noise.

777. When hammering is selected as demolition technique the rock is in general affected by unconformities of strata/layering which are used as mobilization planes.

778. For this reason there is a certain attenuation of the energy if compared with propagation in competent rock. If the energy of the hammer and the rate of energization are known there are also empiric formula to calculate the transmitted energy. In general these calculations always fits with the provided tables which constitute the base for the evaluation of energy propagation. Once more the presence of overburden and the type of foundations play a important role for the final effects on the buildings.

779. **Findings** - The modeling has analyzed the vibration induced by the excavation, tunneling and trenching activities, its propagation inside the hard rock formation and the attenuation provided by the cushion of alterated/weathered rock and arable/vegetal soil. In addition to that the type of foundations of the buildings, shallow and small, will determine an additional damping factor which is not calculated in the model.

780. Isolines of different colors per type of activity and means of excavation, have been drawn by calculation of the interference at the surface with radial surfaces representing the wave propagation (propagation of vibrations). The propagation for Tunnel Blasting can be represented by a cylinder (formed by the sequence of wave front) set along the tunnel axis to which represents shock waves during the advancement of the tunnel. Each radial plane inside the cylinder has a sequence of parallel (but not equidistant- due to the exponential attenuation) isolines representing different levels of PPV. For that we should imagine a horizontal cylinder having a radius of more than 100 m representing the distribution of PPV with the PPV =5 mm/s occurring at 100 m from the axe of the cylinder (the blasting point). The intersection of the surface morphology with the cylinder at 100m generates the isolines of PPV 5mm; whereas the PPV=15 mm/s are generated by a cylinder with radius of 60m.

781. The same could be represented for piling, but using a vertical cylinder, which represents the wave propagation, having a diameter of 40 m with the limit of 5 mms PPV located at 40 m from insertion point .Where applicable, the attenuation factor of the surface soil has been applied and in this case the isolines gets closer to the point of energization.

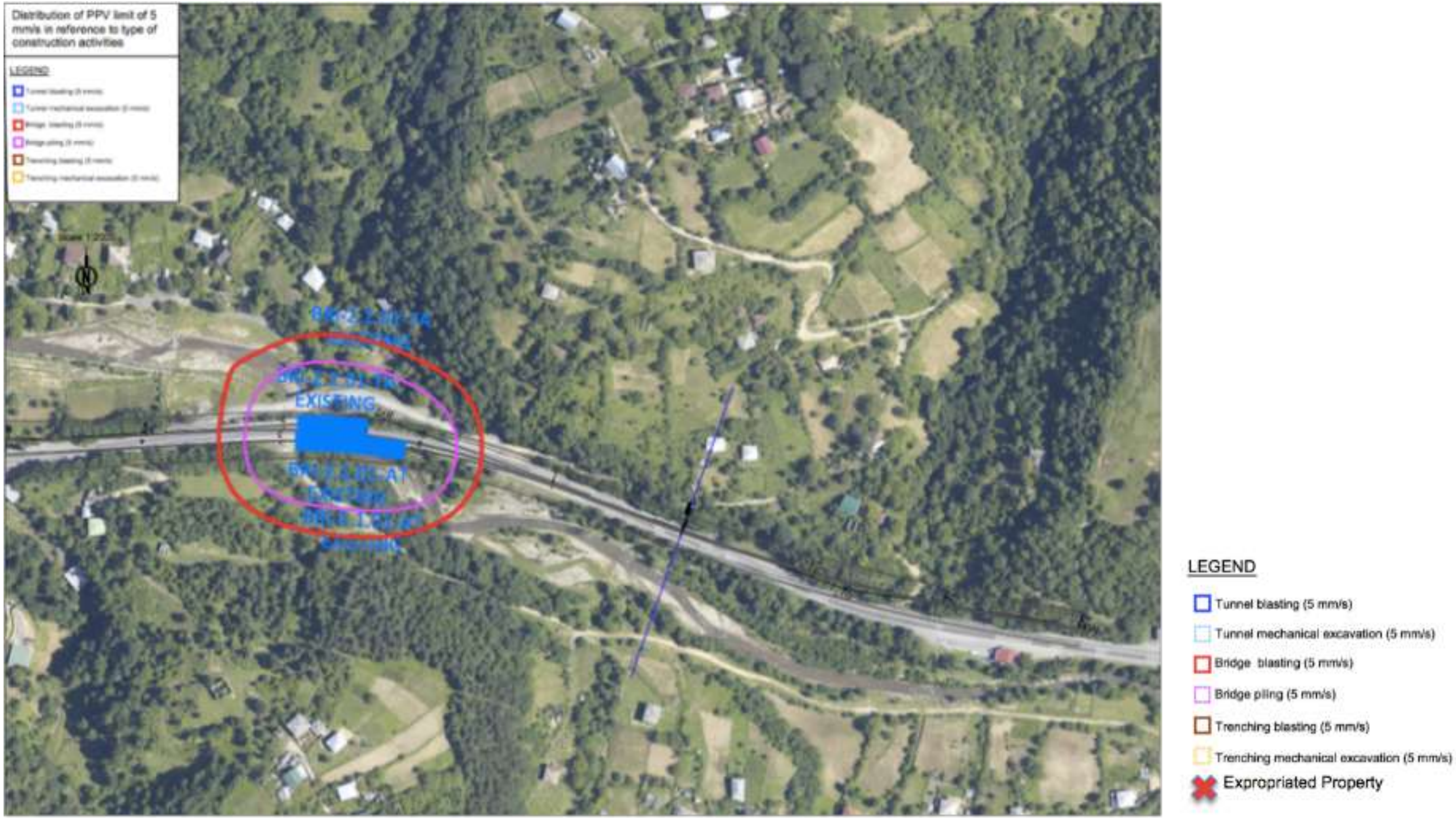


Figure 105: Distribution of PPV Limit of 5 mm/s

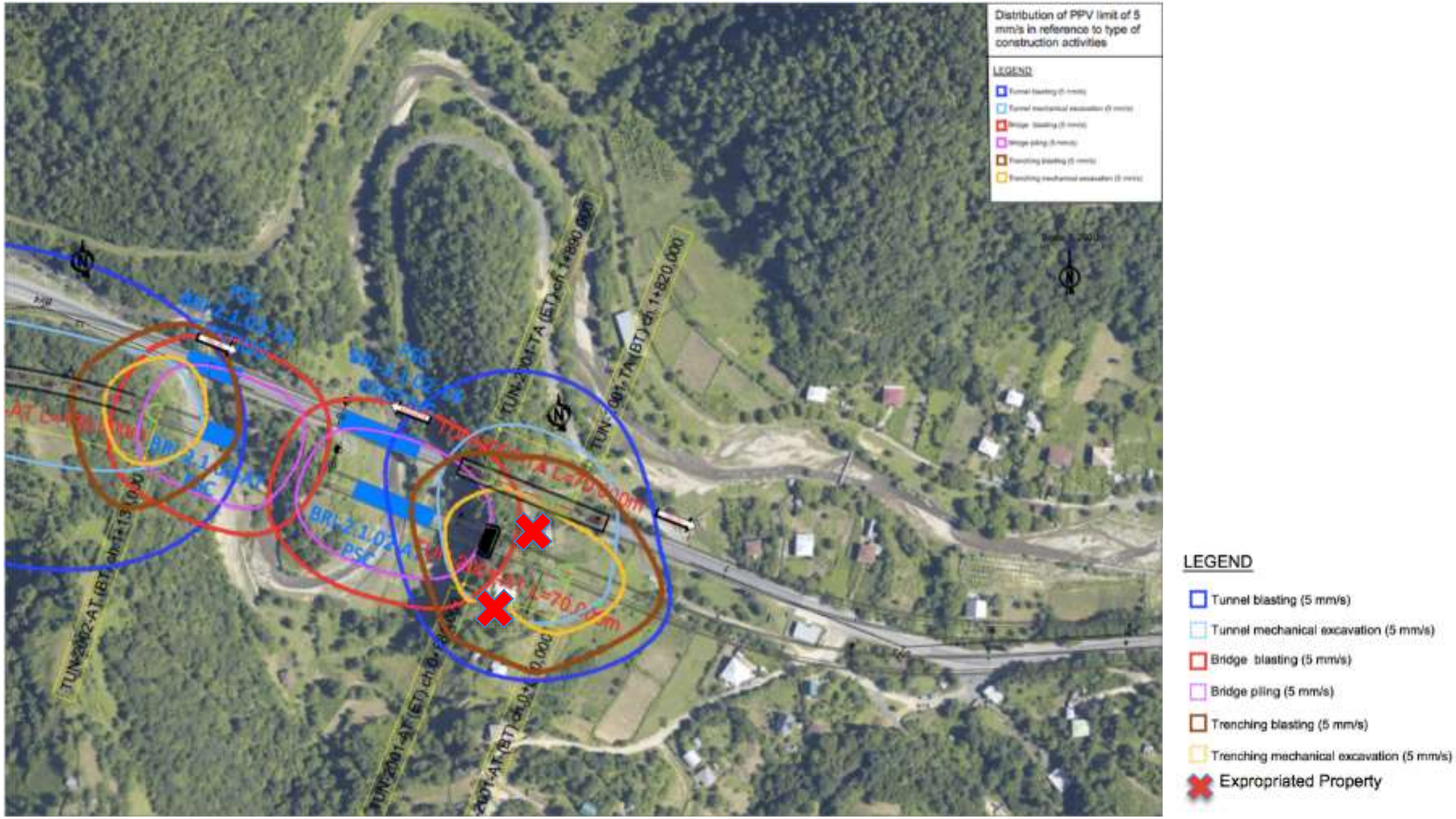


Figure 106: Distribution of PPV Limit of 5 mm/s

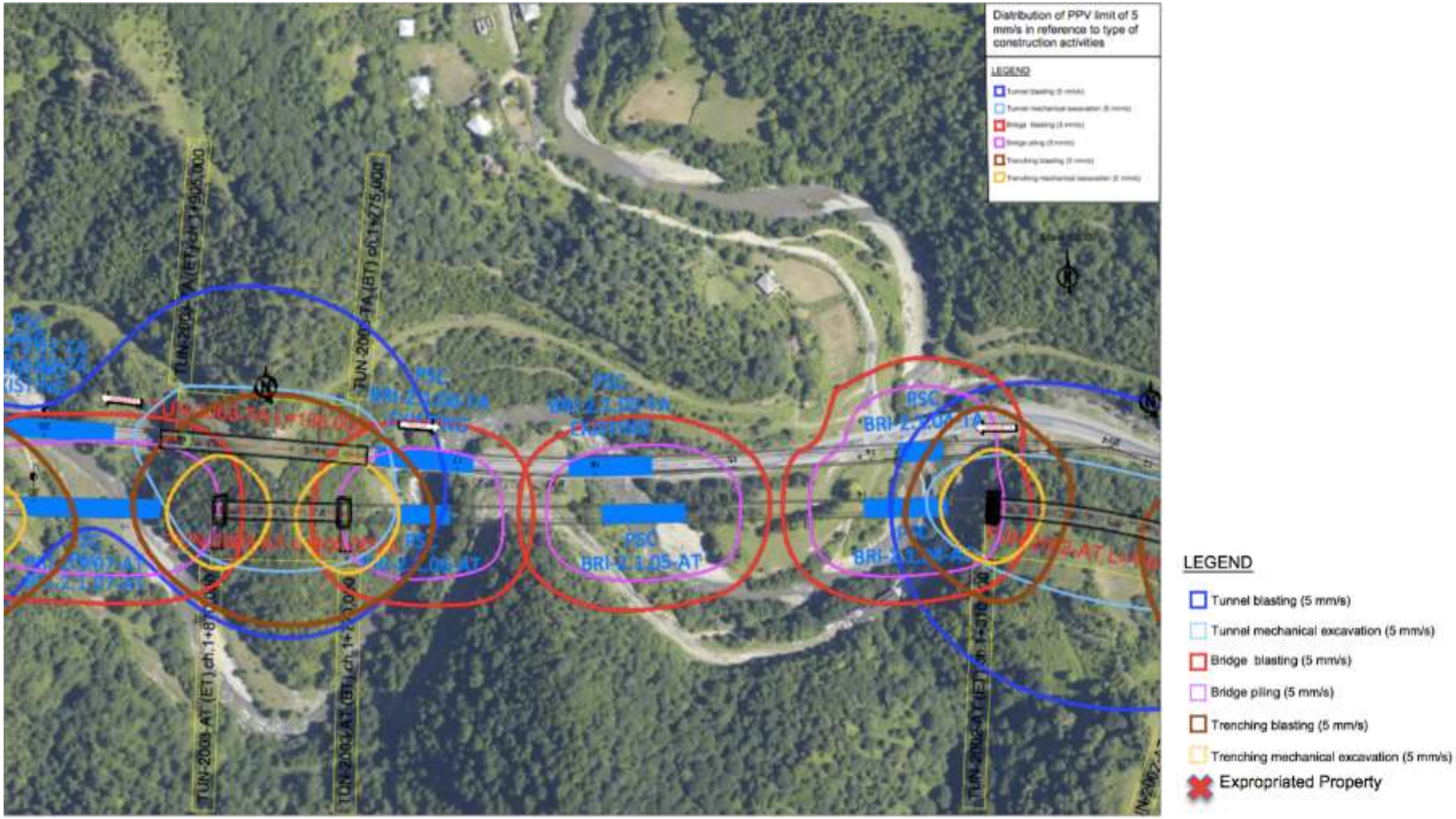


Figure 107: Distribution of PPV Limit of 5 mm/s

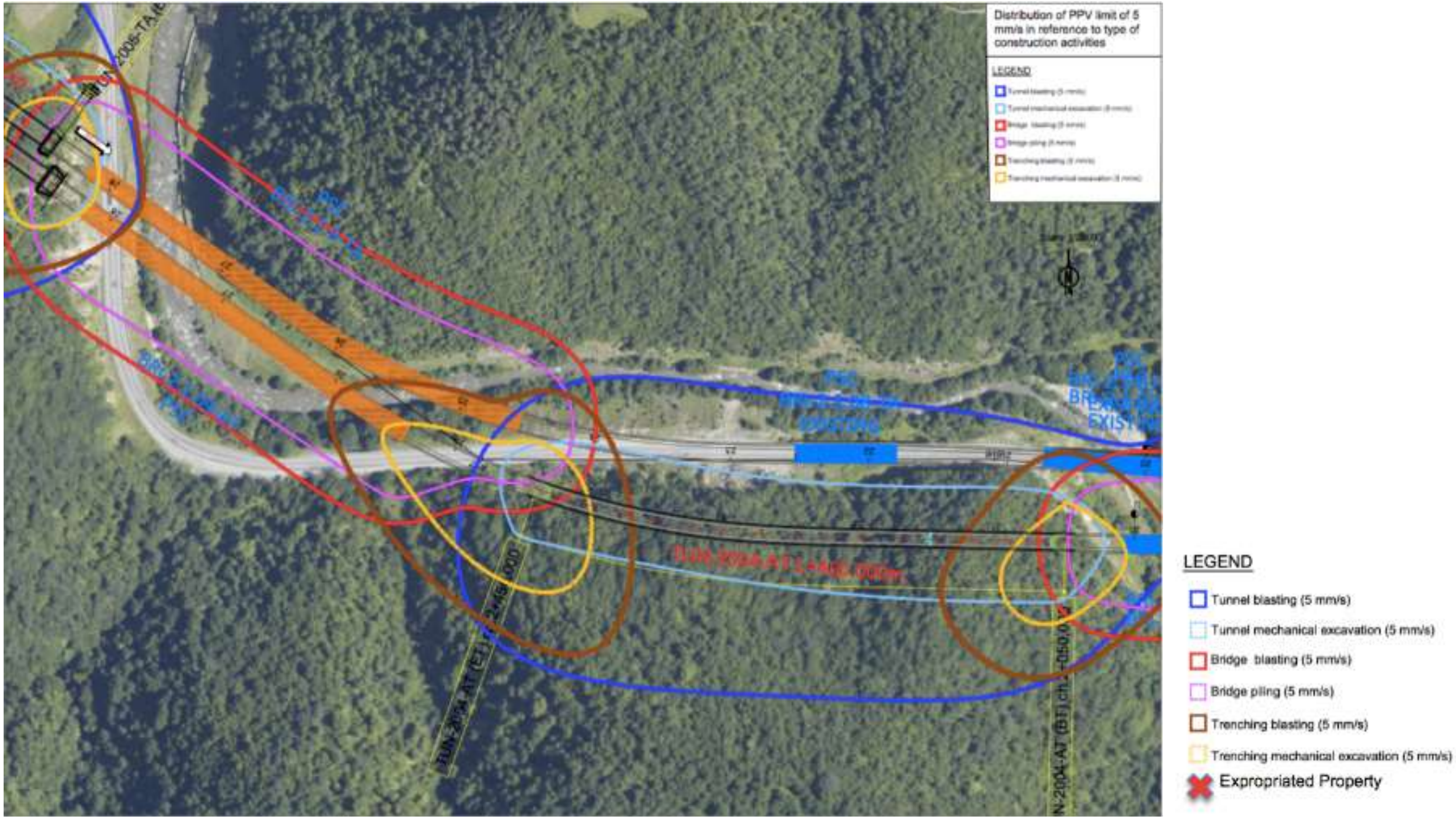


Figure 108: Distribution of PPV Limit of 5 mm/s

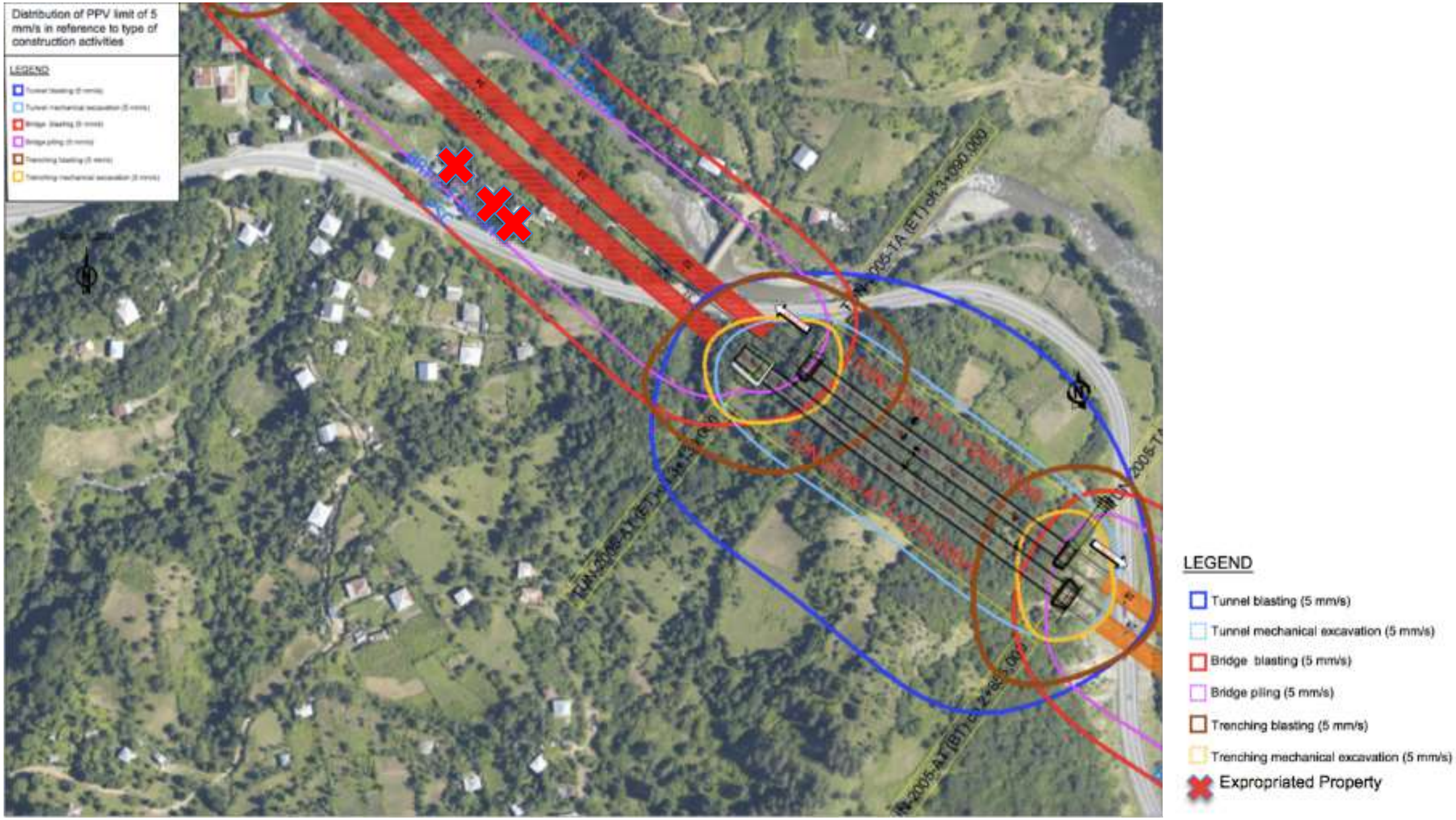


Figure 109: Distribution of PPV Limit of 5 mm/s

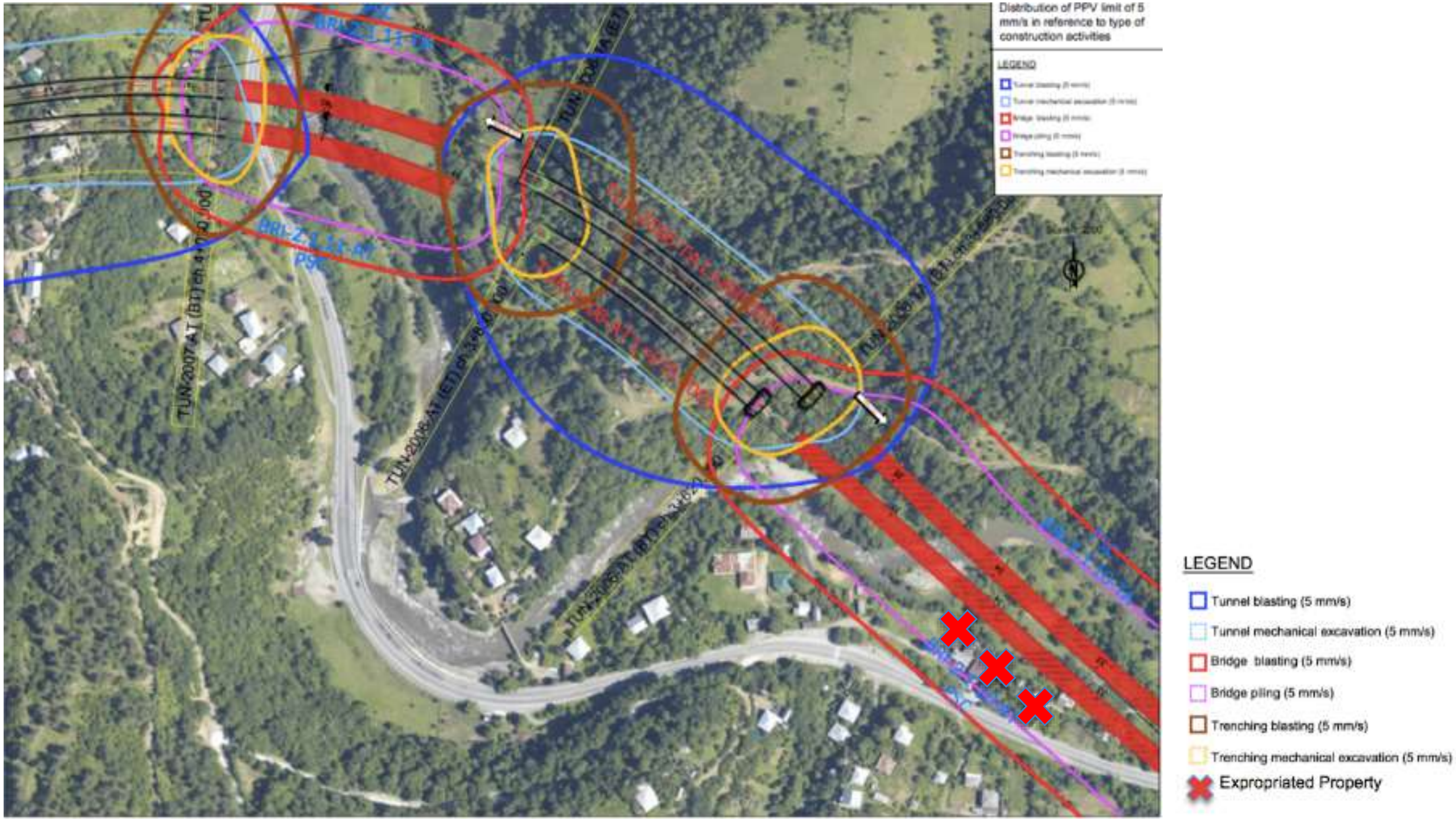


Figure 110: Distribution of PPV Limit of 5 mm/s

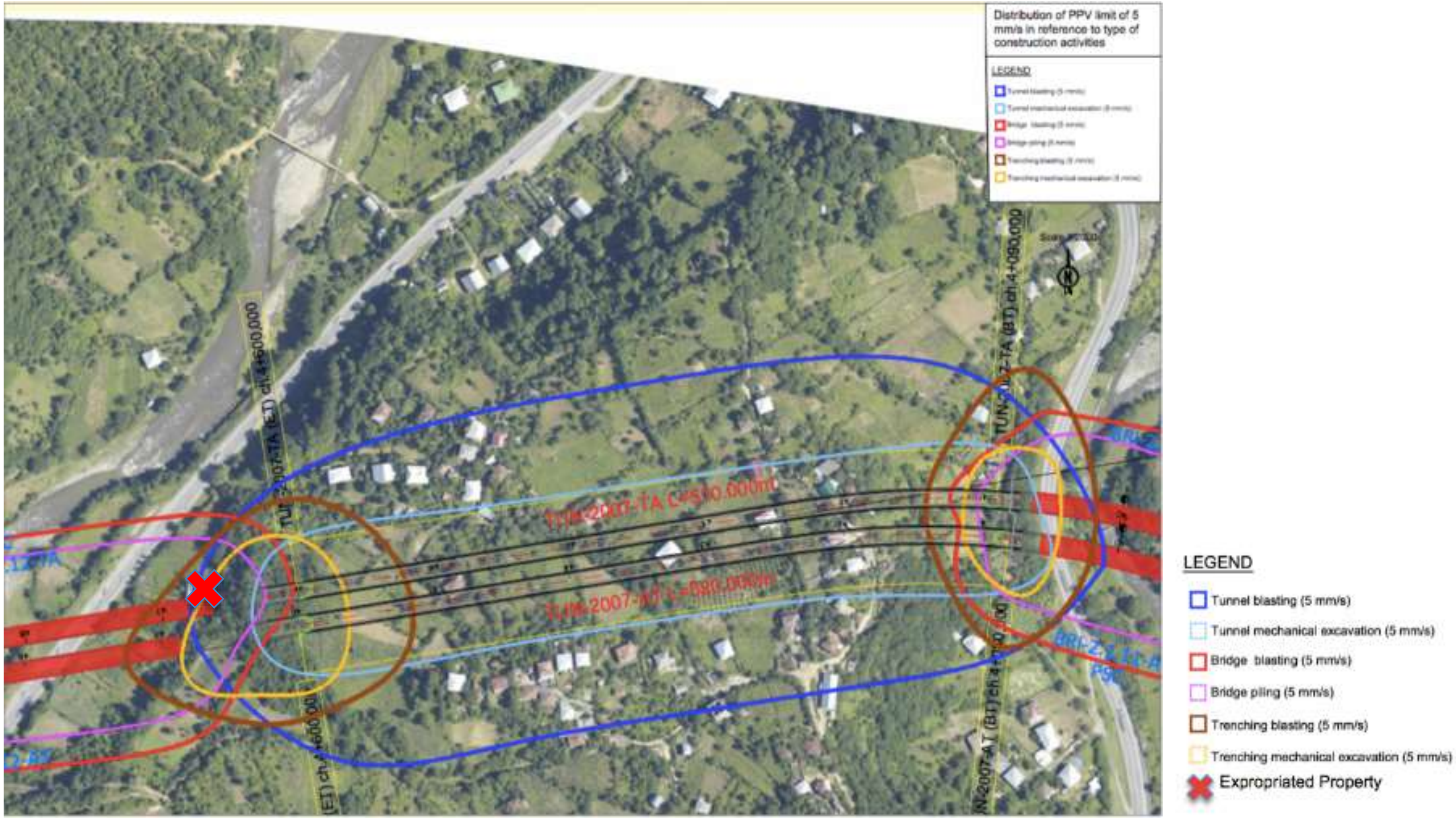


Figure 111: Distribution of PPV Limit of 5 mm/s

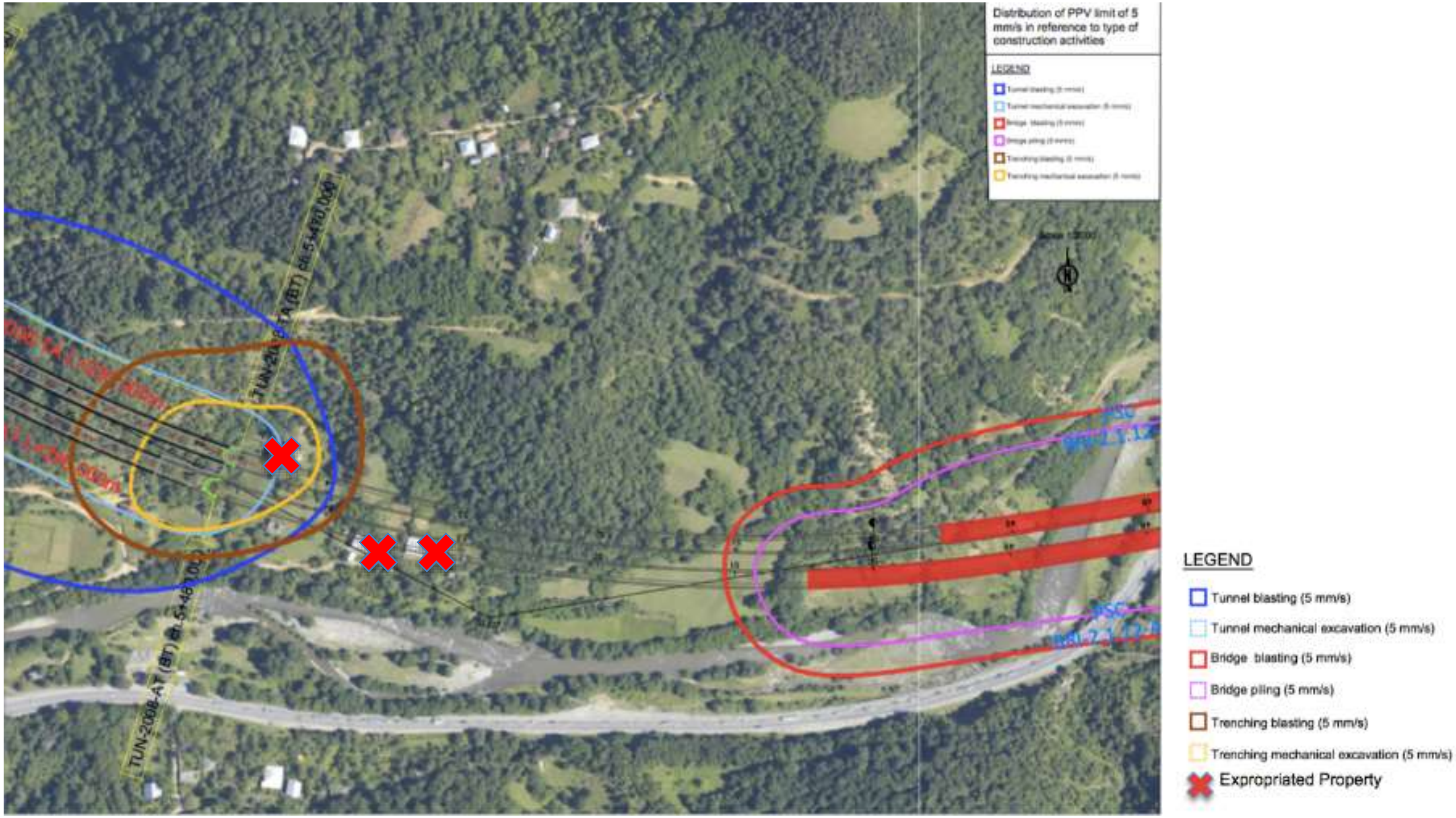


Figure 112: Distribution of PPV Limit of 5 mm/s

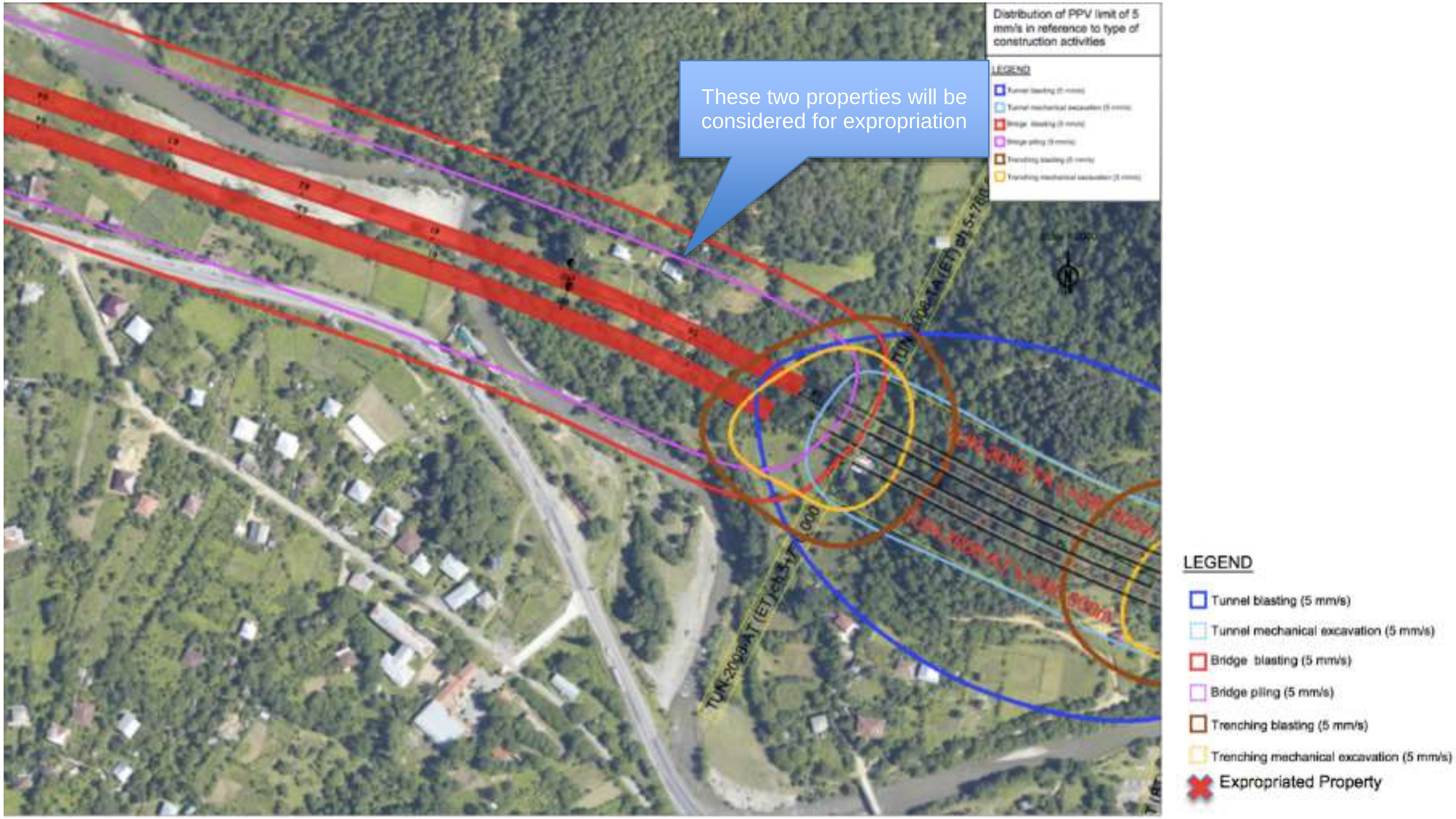


Figure 113: Distribution of PPV Limit of 5 mm/s

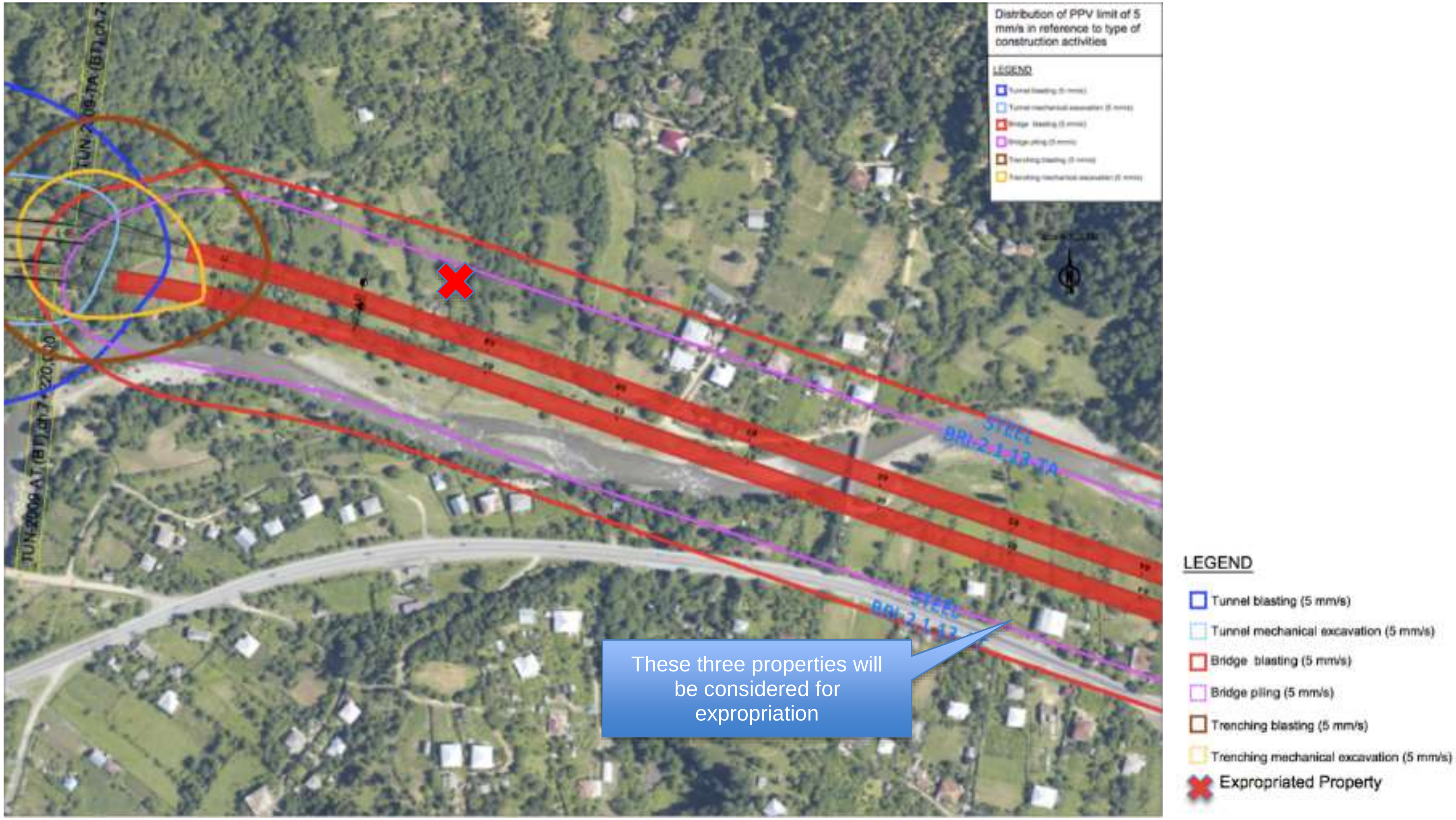


Figure 114: Distribution of PPV Limit of 5 mm/s

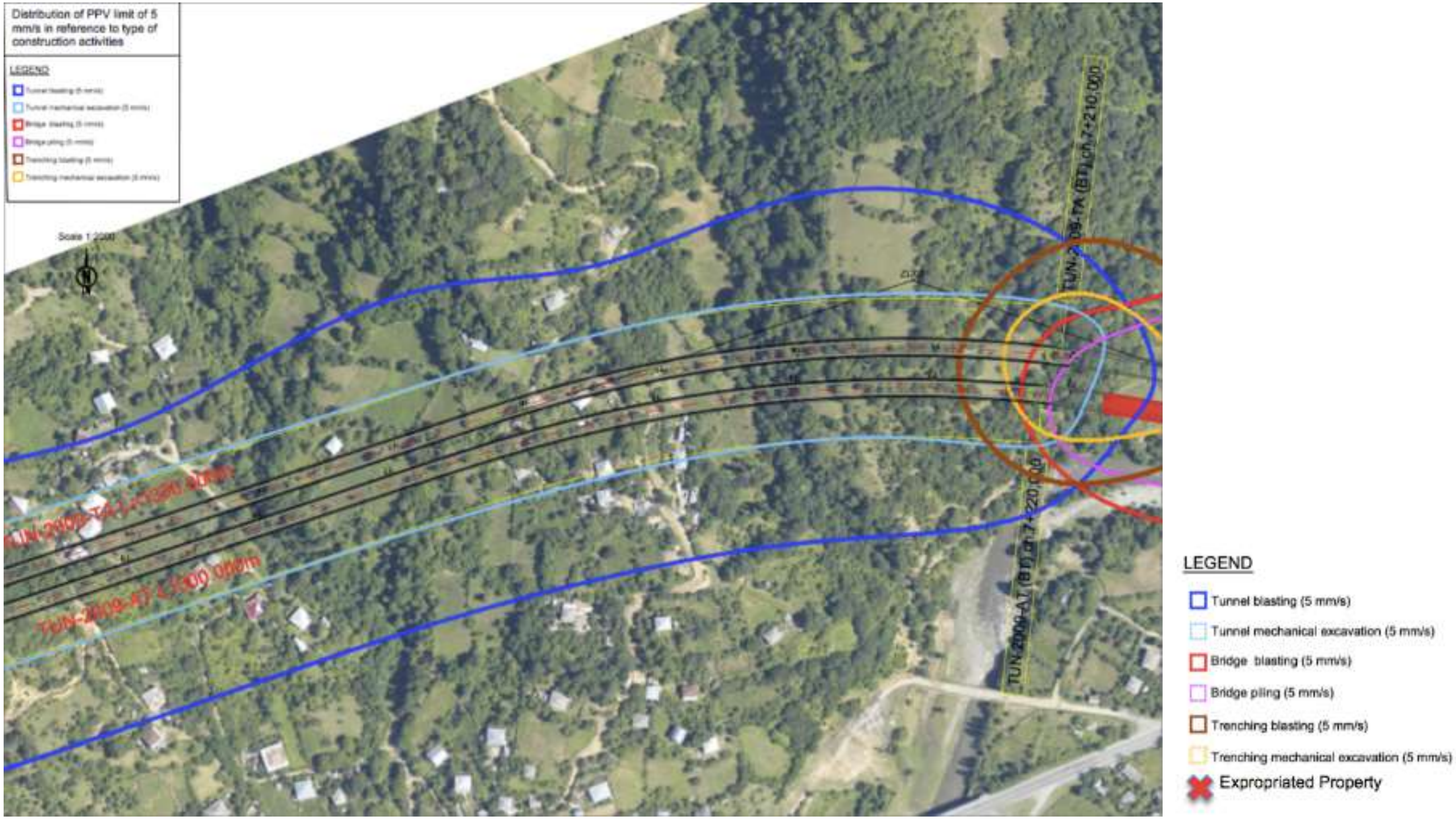


Figure 115: Distribution of PPV Limit of 5 mm/s

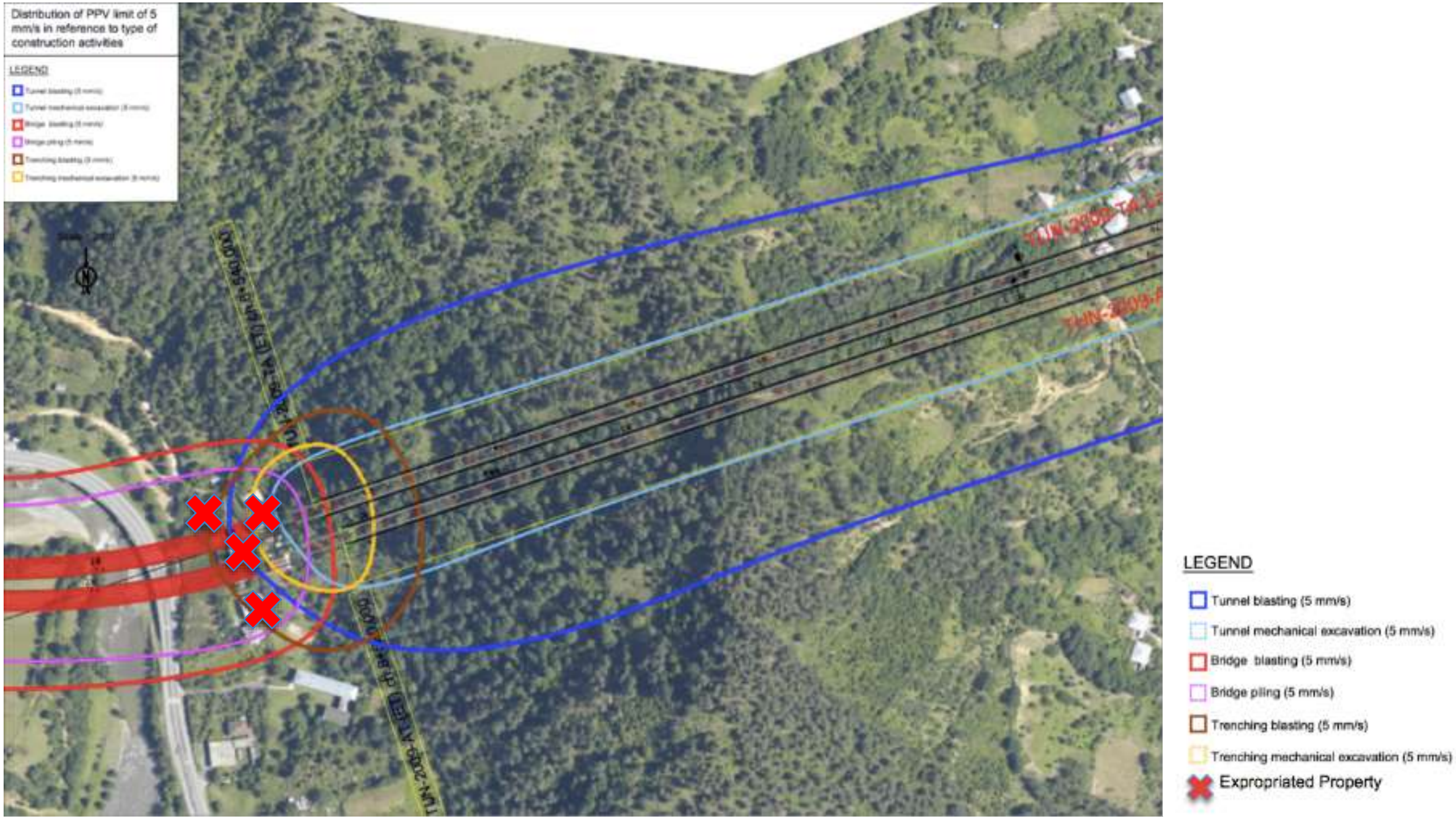


Figure 116: Distribution of PPV Limit of 5 mm/s

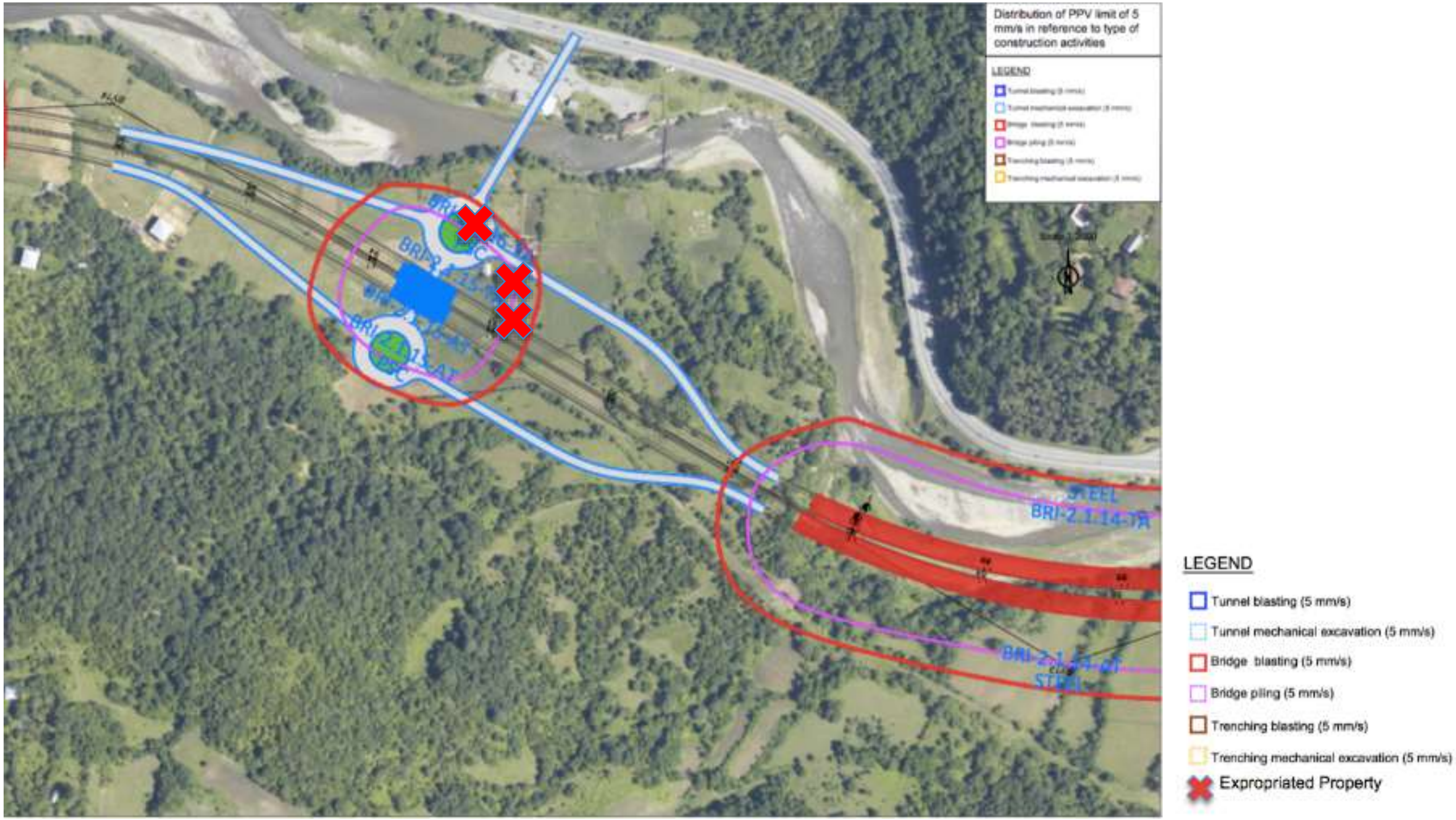


Figure 117: Distribution of PPV Limit of 5 mm/s

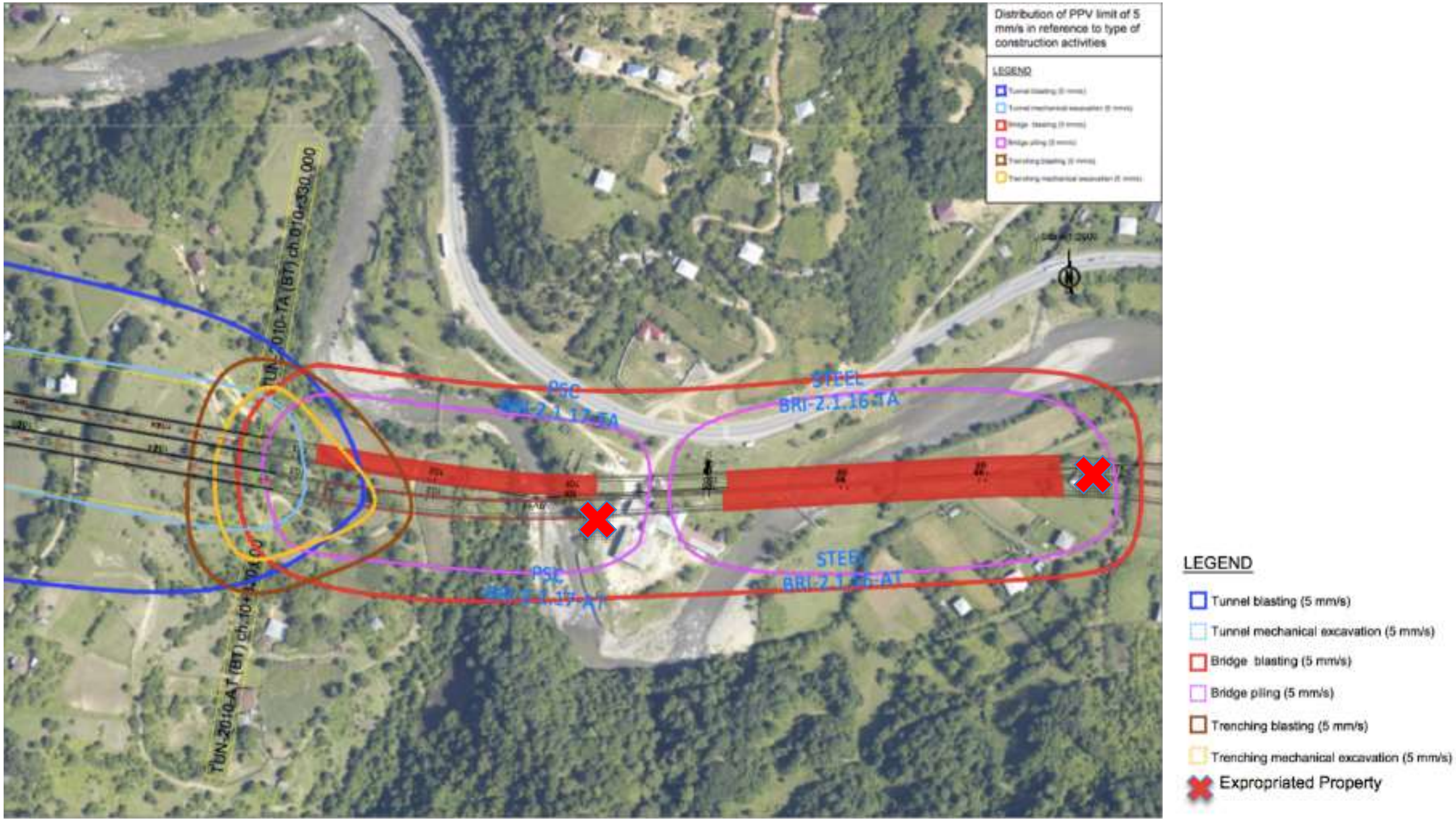


Figure 118: Distribution of PPV Limit of 5 mm/s

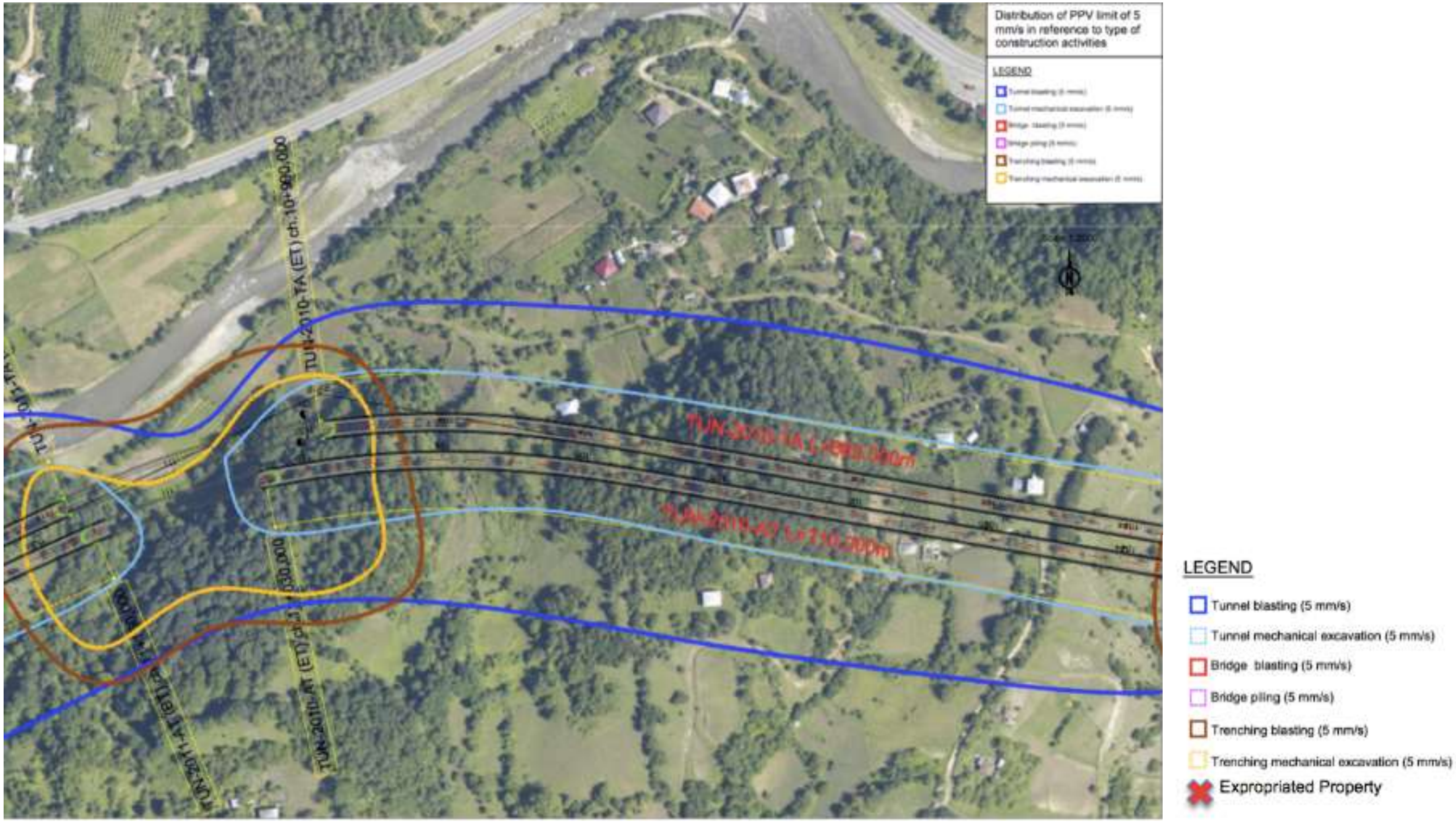


Figure 119: Distribution of PPV Limit of 5 mm/s

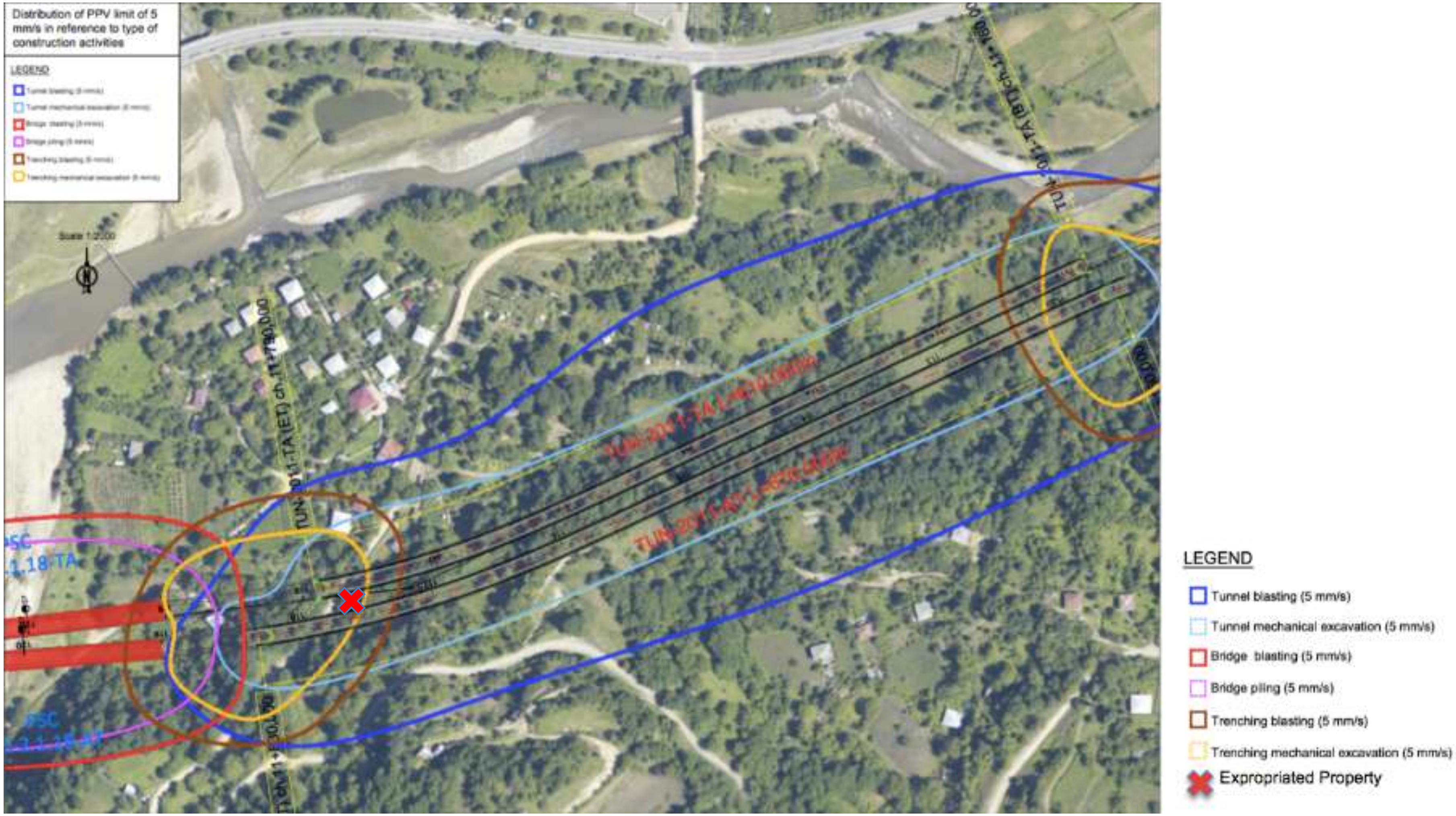


Figure 120: Distribution of PPV Limit of 5 mm/s

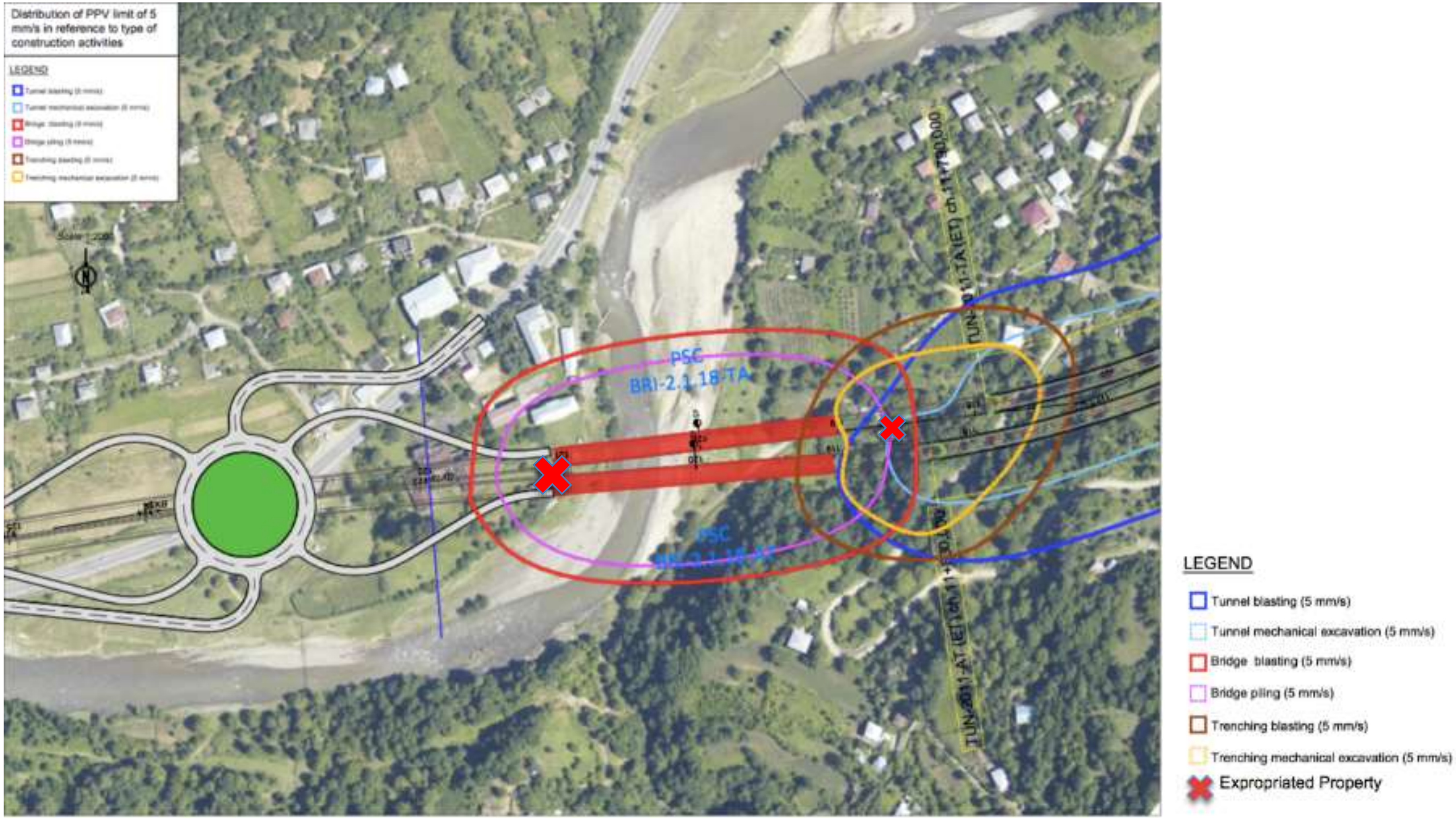


Figure 121: Distribution of PPV Limit of 5 mm/s

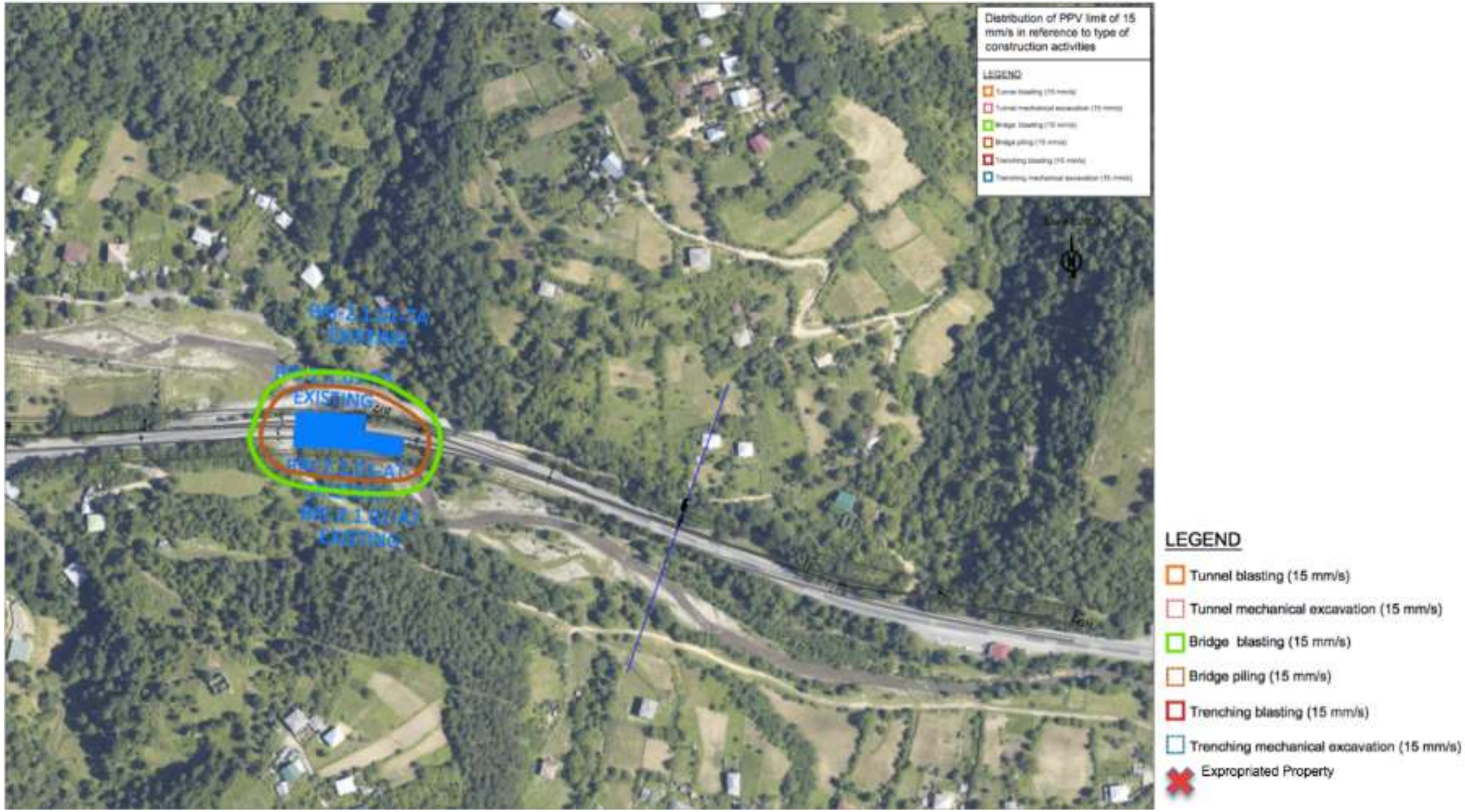


Figure 122: Distribution of PPV Limit of 15 mm/s

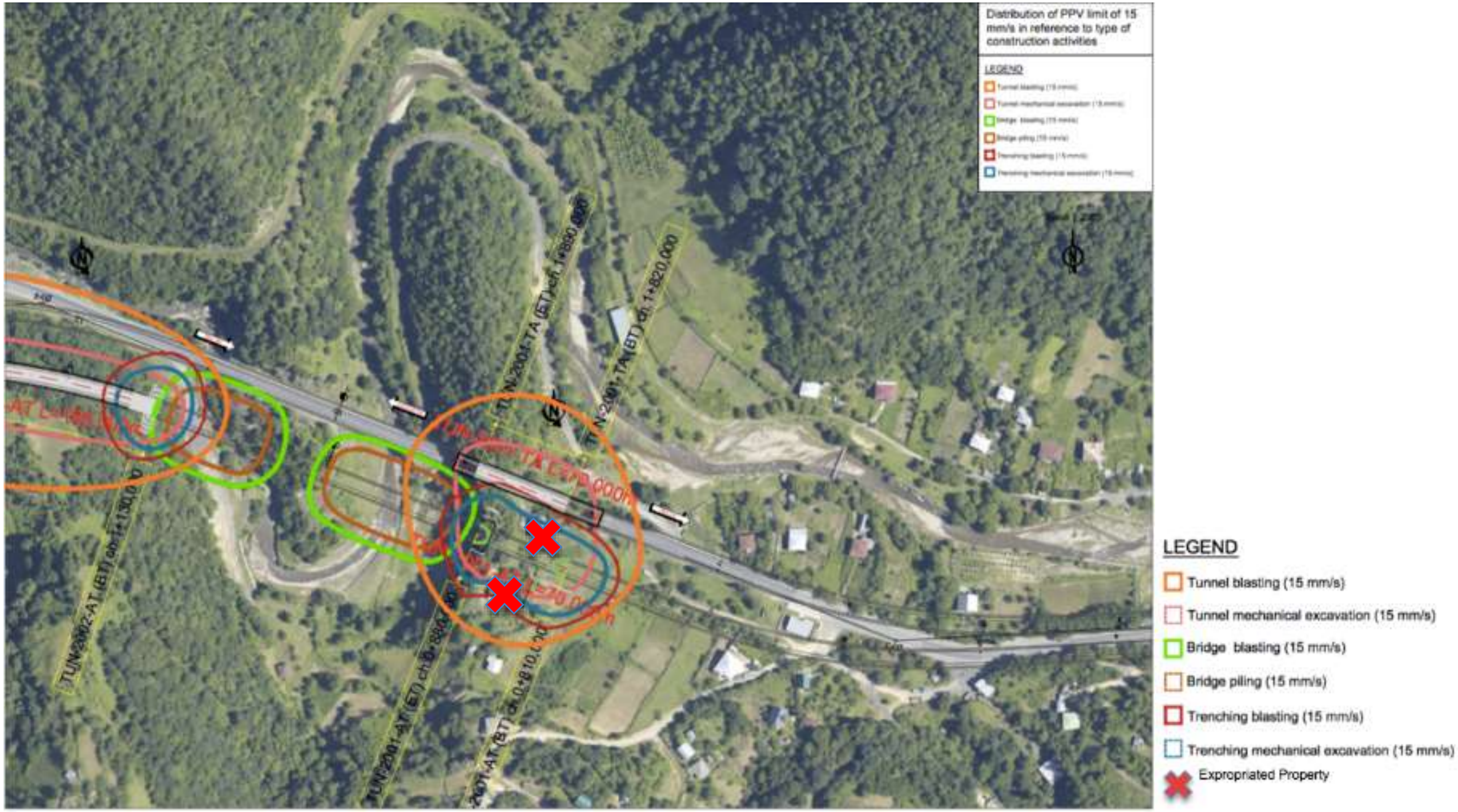


Figure 123: Distribution of PPV Limit of 15 mm/s

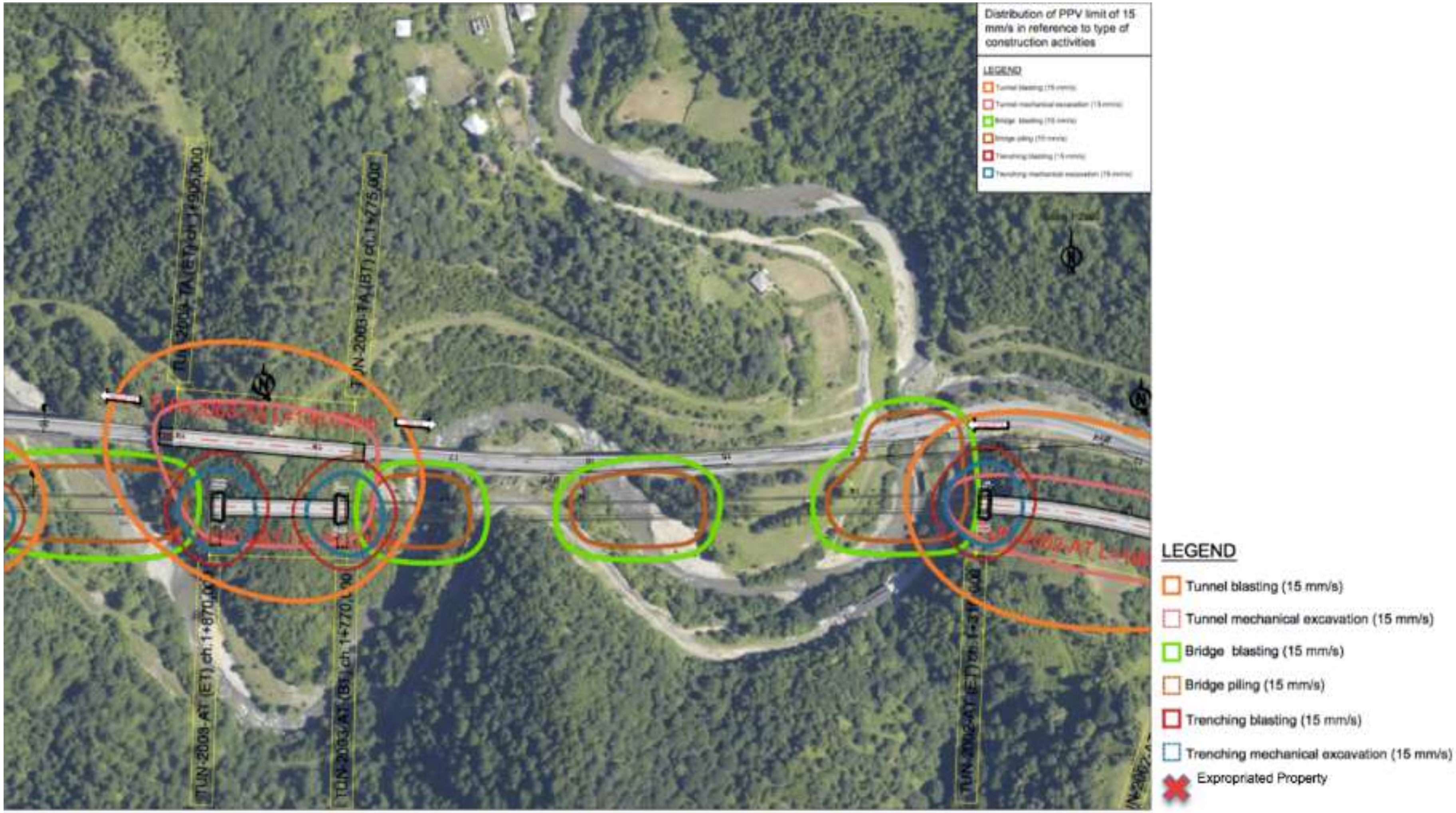


Figure 124: Distribution of PPV Limit of 15 mm/s

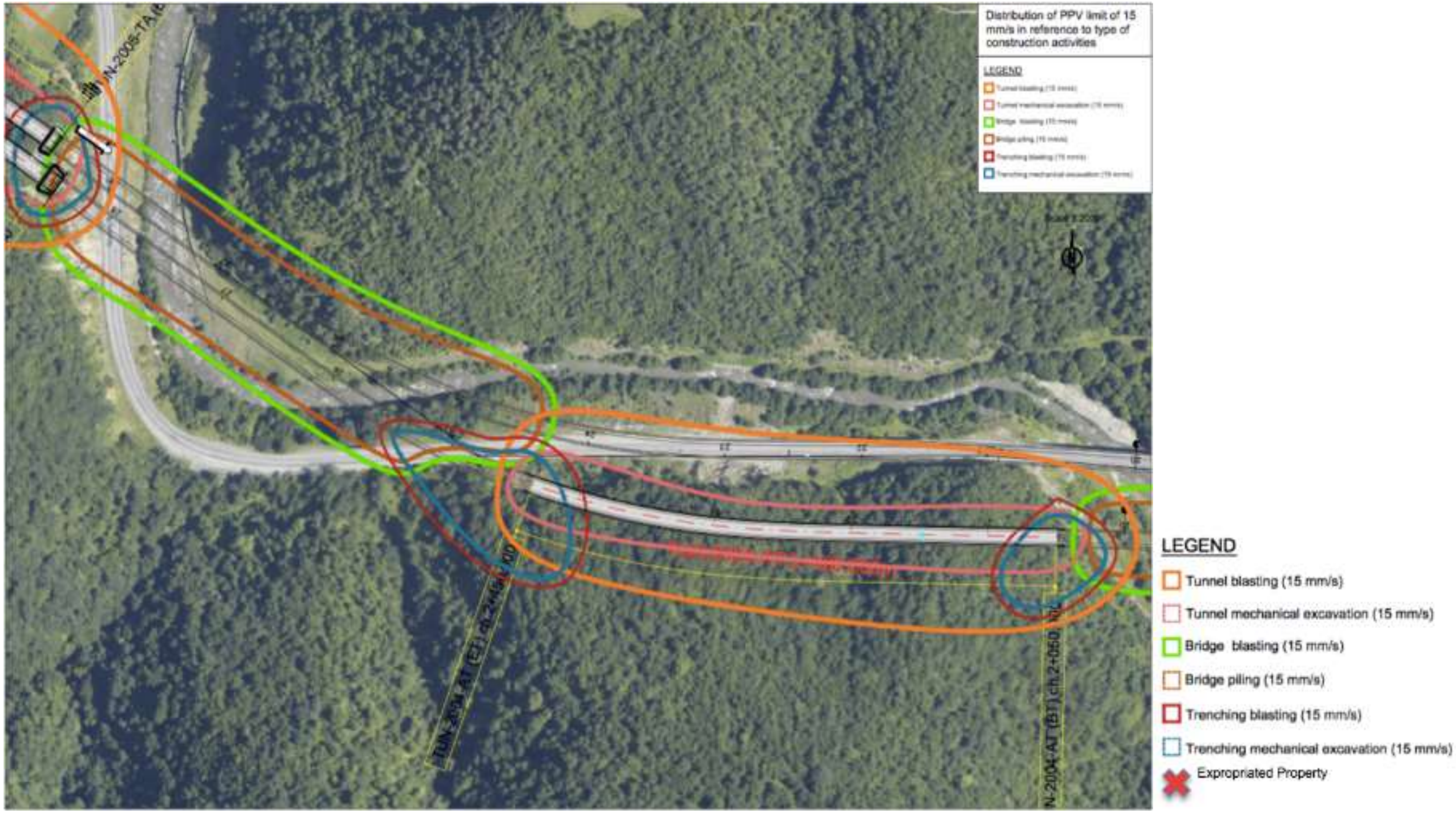


Figure 125: Distribution of PPV Limit of 15 mm/s

Figure 126: Distribution of PPV Limit of 15 mm/s

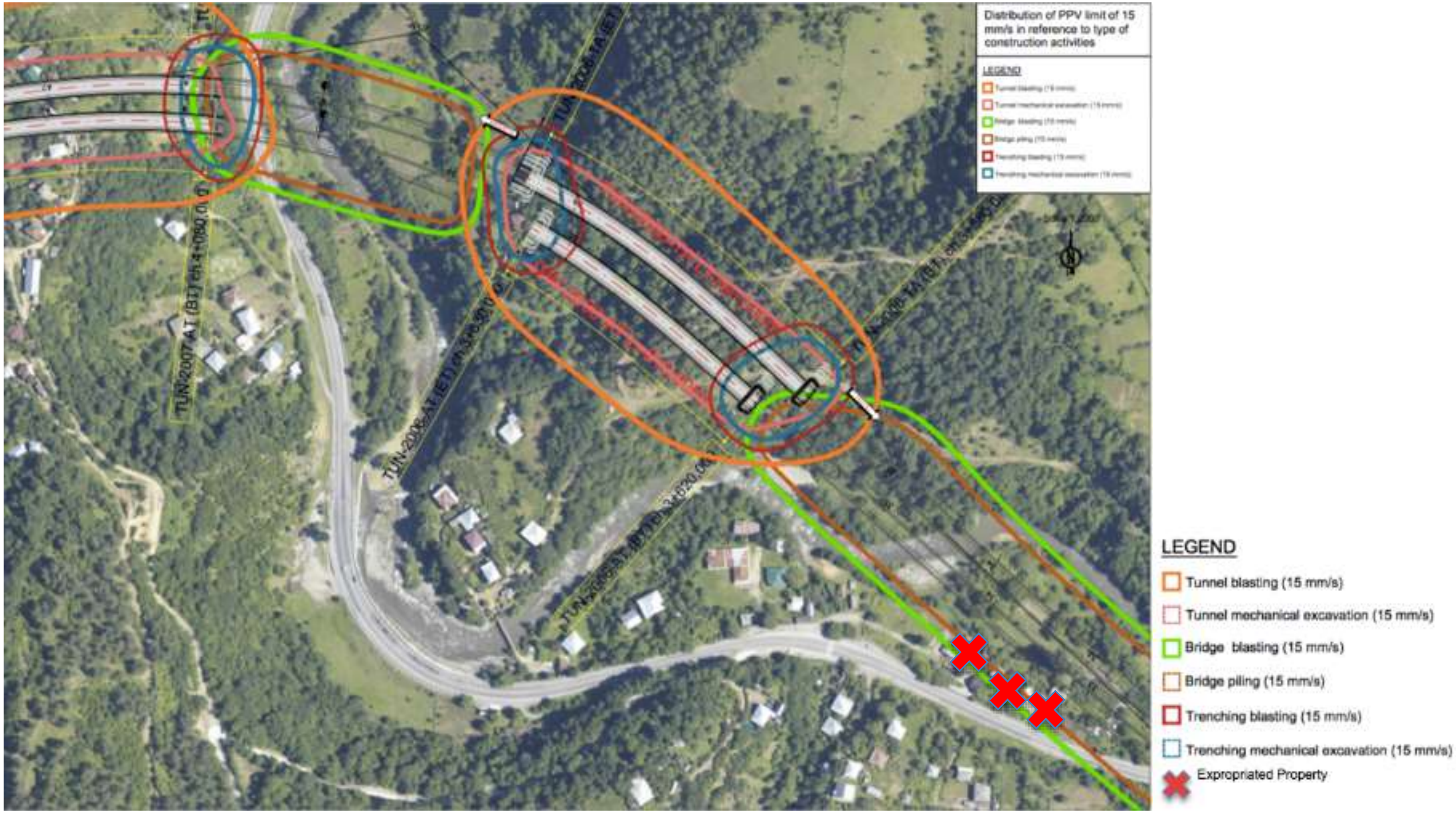


Figure 127: Distribution of PPV Limit of 15 mm/s

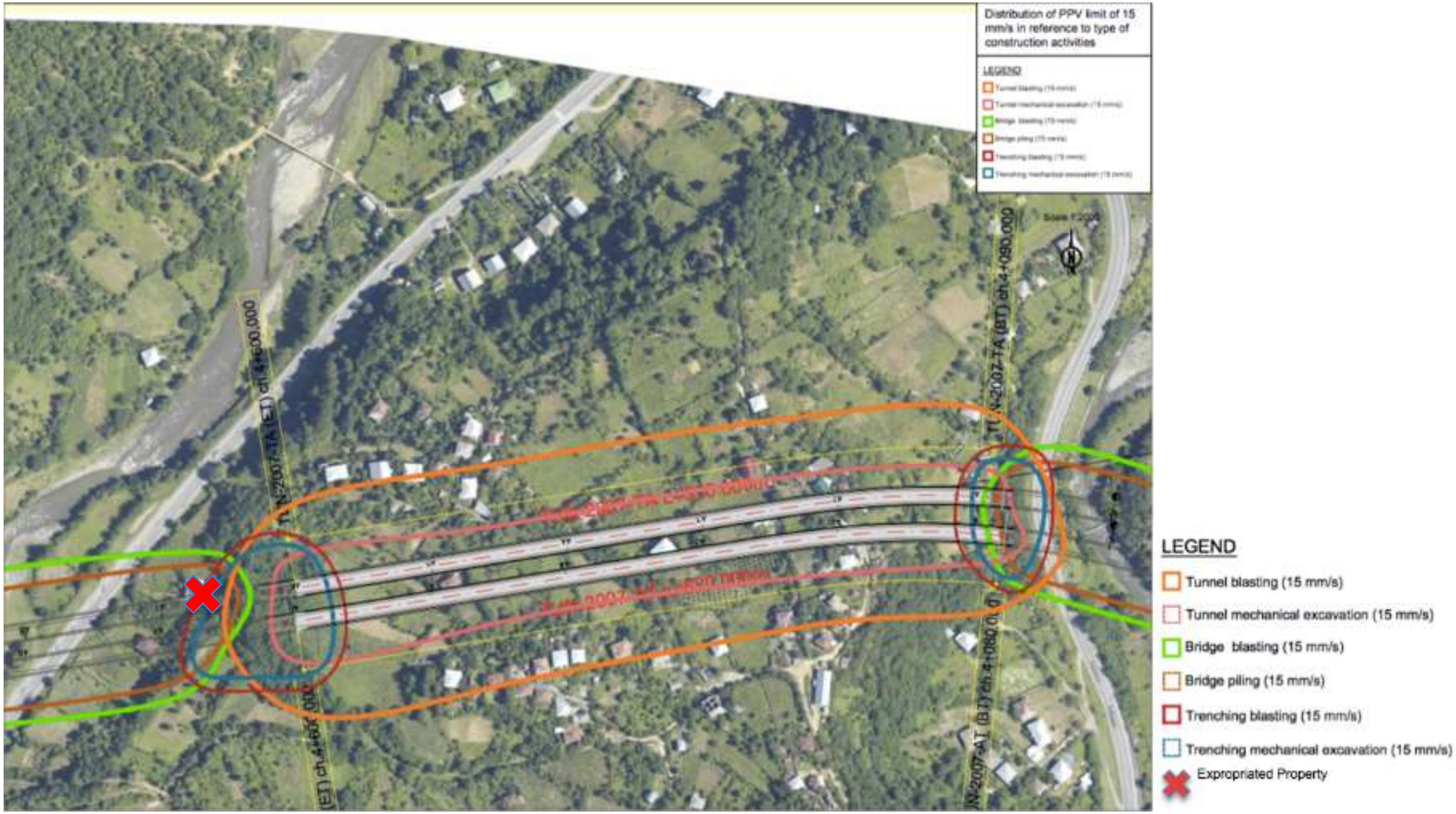


Figure 128: Distribution of PPV Limit of 15 mm/s

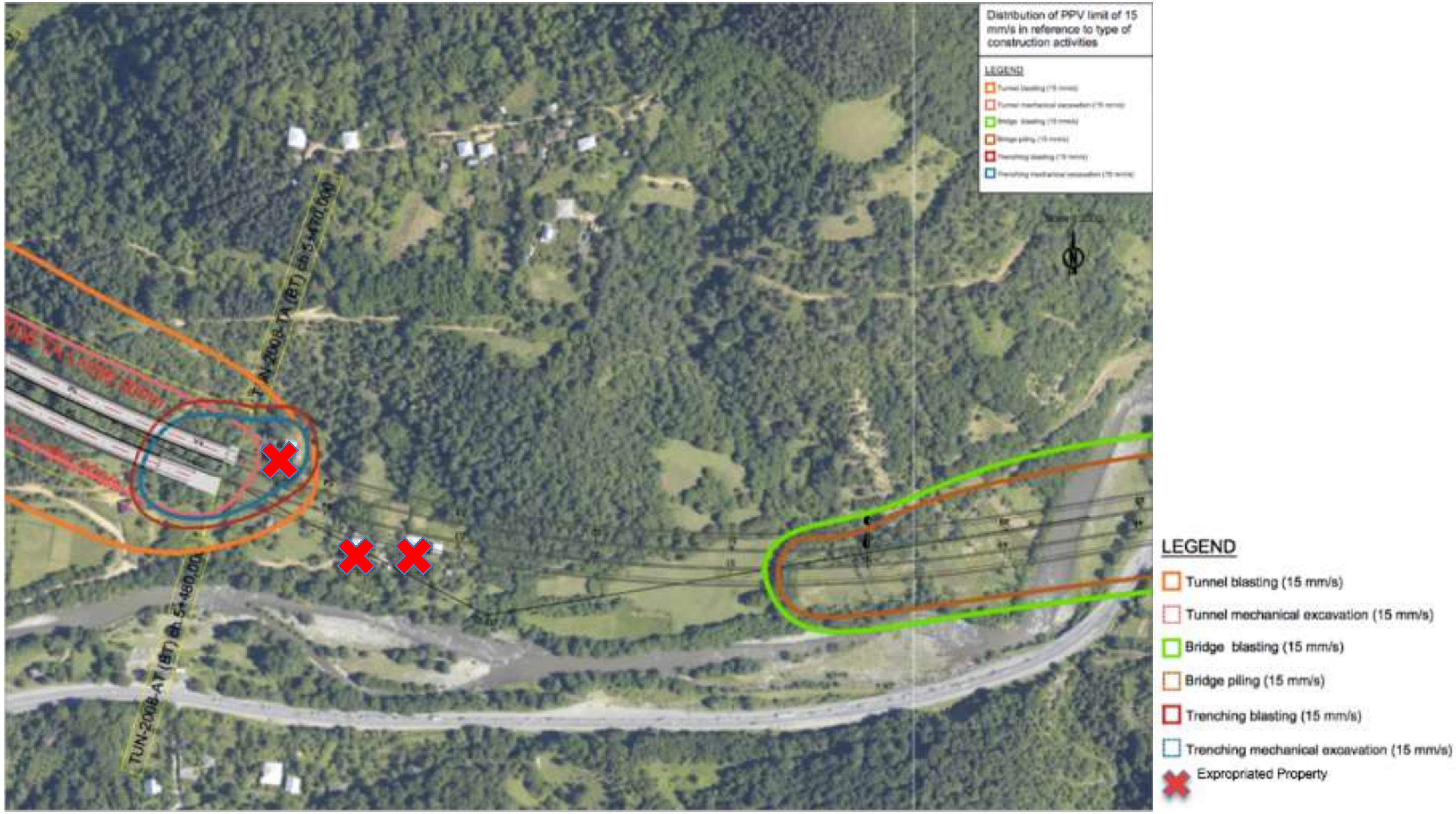


Figure 129: Distribution of PPV Limit of 15 mm/s

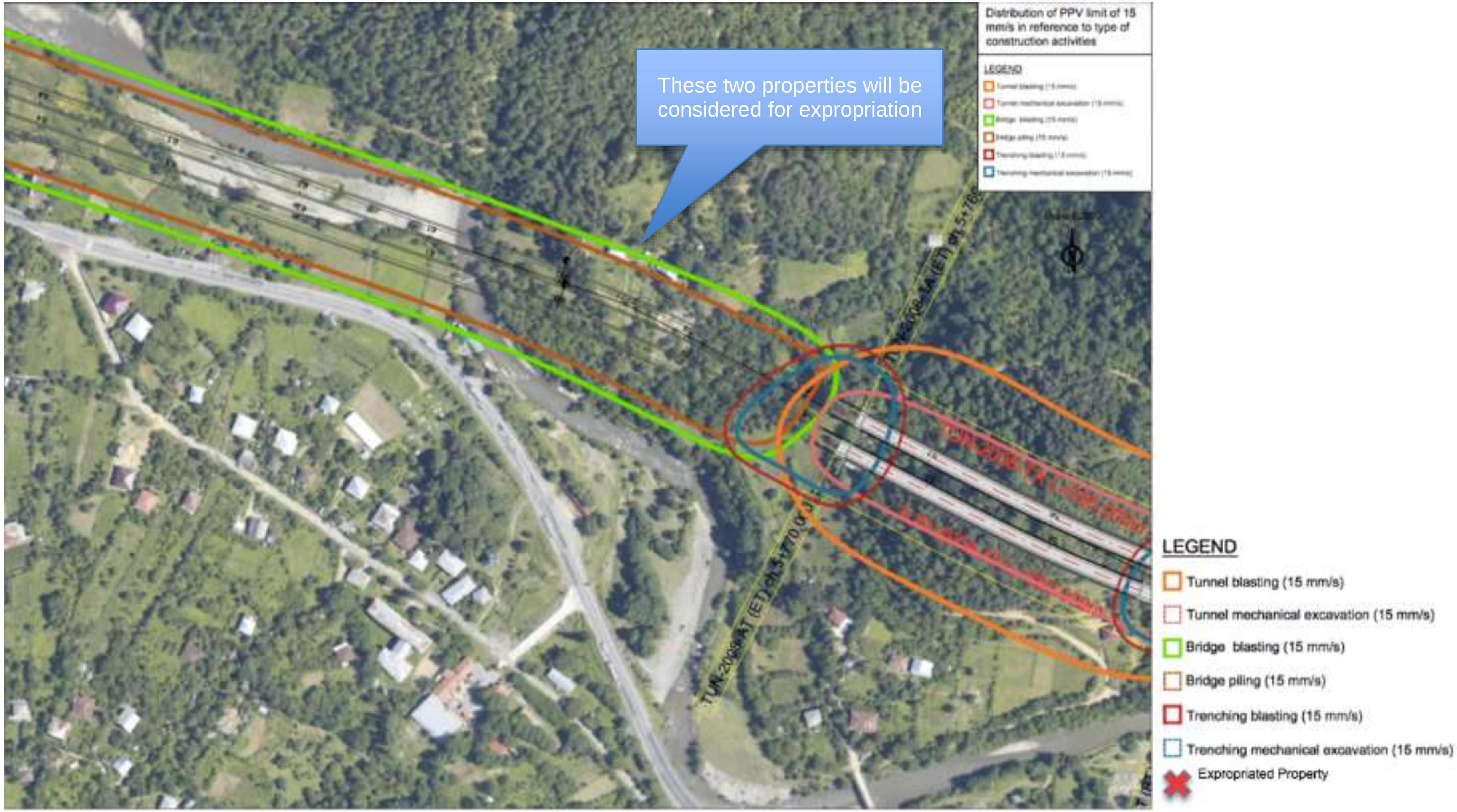


Figure 130: Distribution of PPV Limit of 15 mm/s

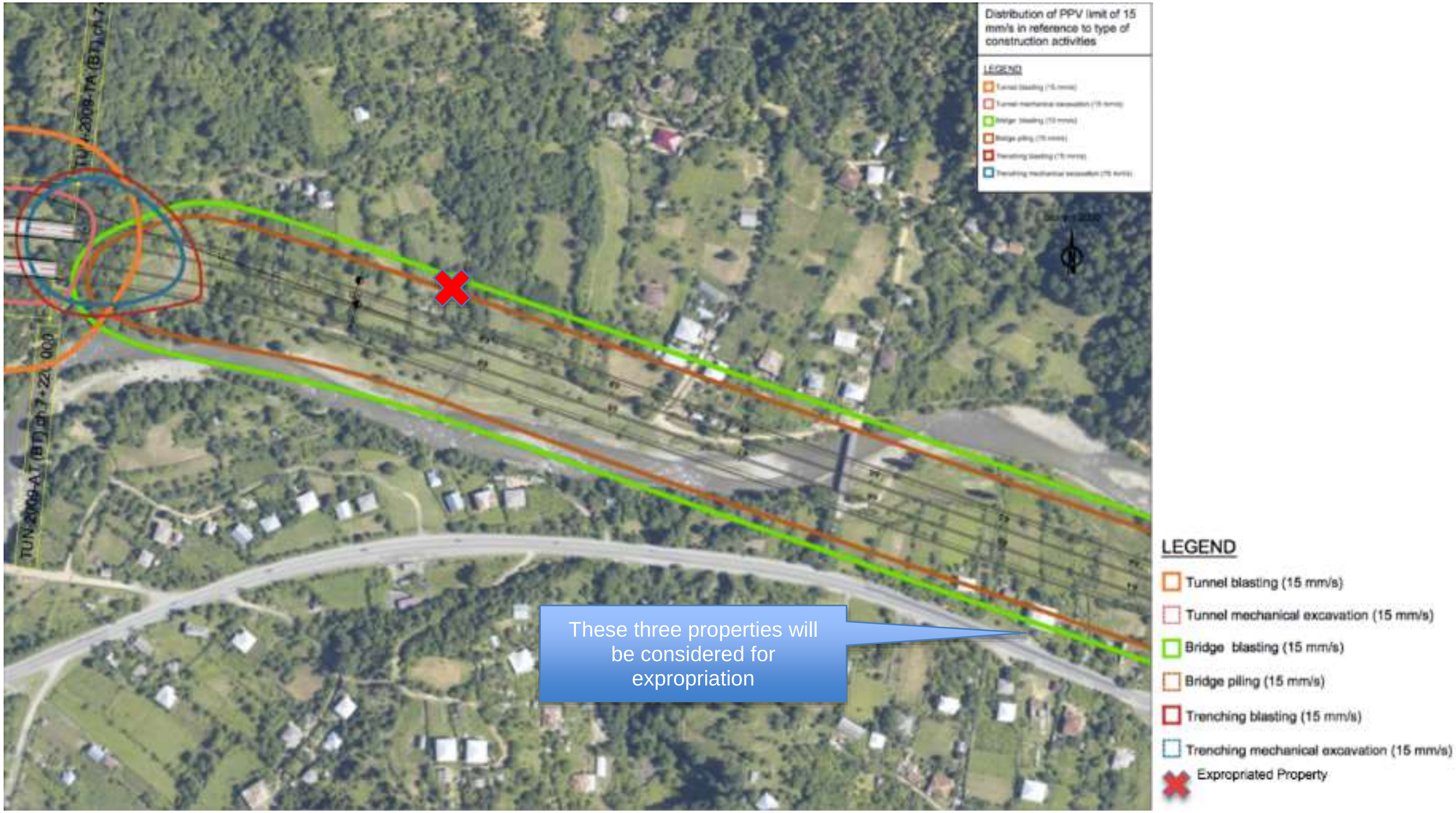


Figure 131: Distribution of PPV Limit of 15 mm/s

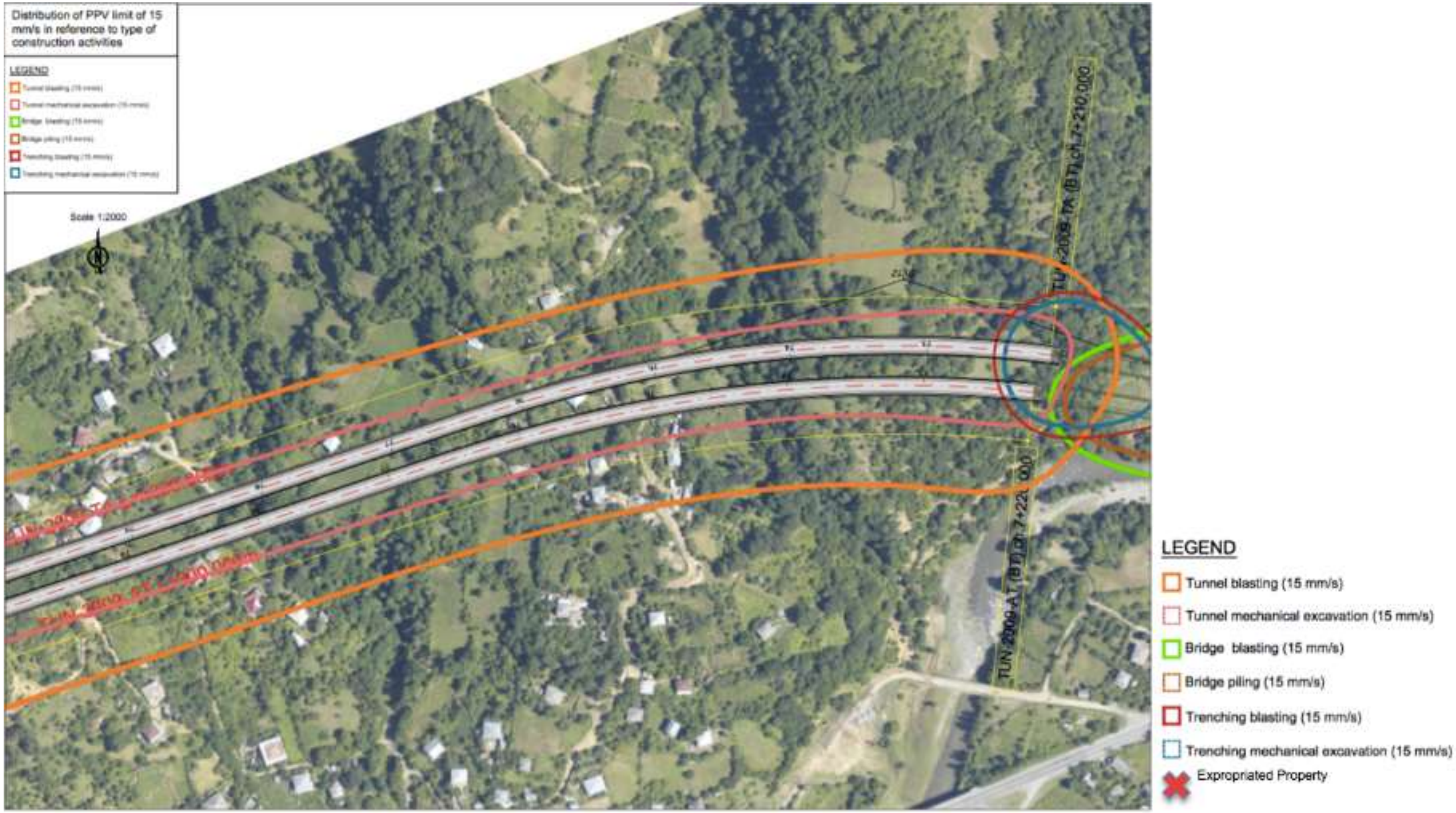


Figure 132: Distribution of PPV Limit of 15 mm/s

Figure 133: Distribution of PPV Limit of 15 mm/s

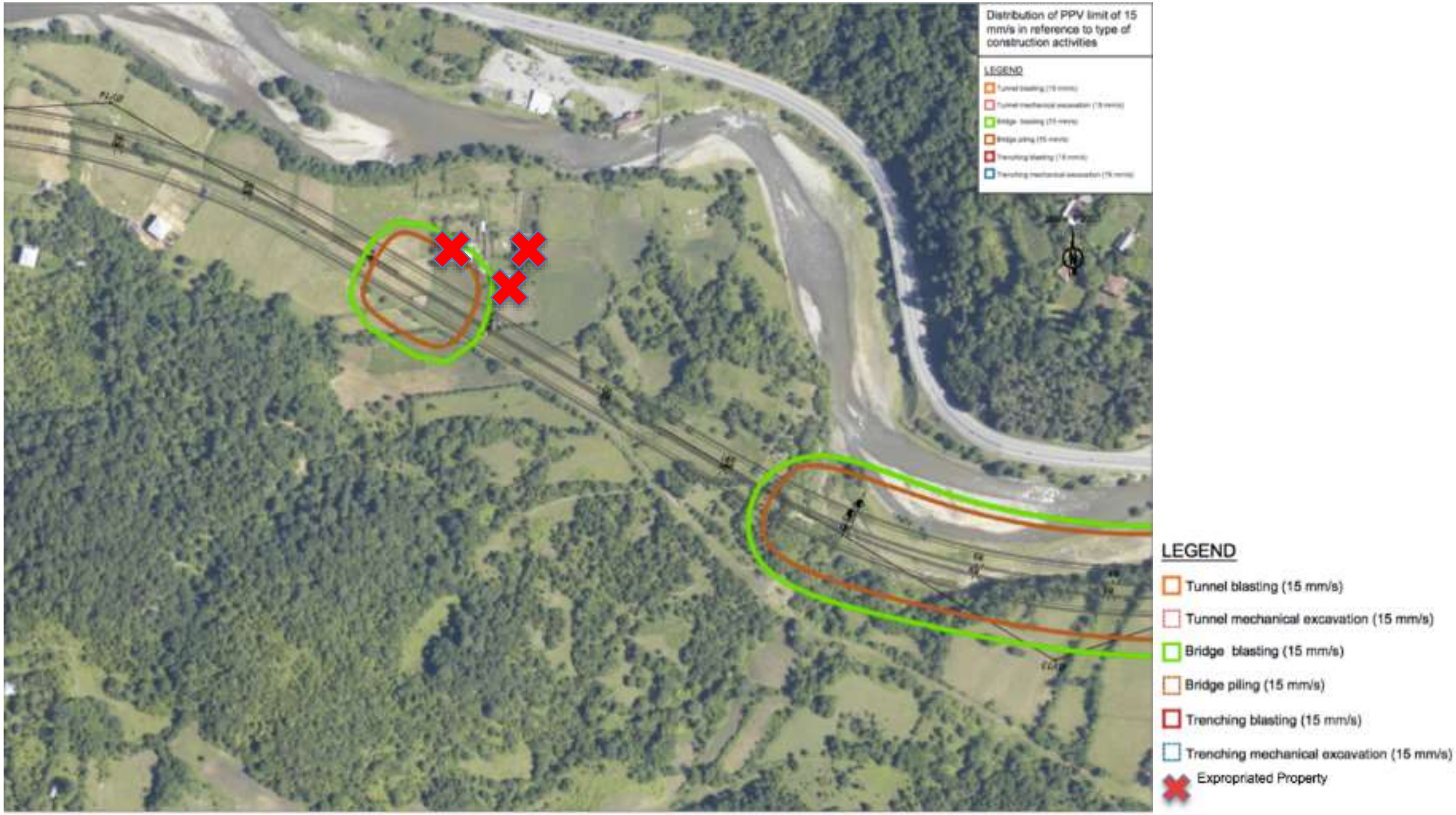


Figure 134: Distribution of PPV Limit of 15 mm/s

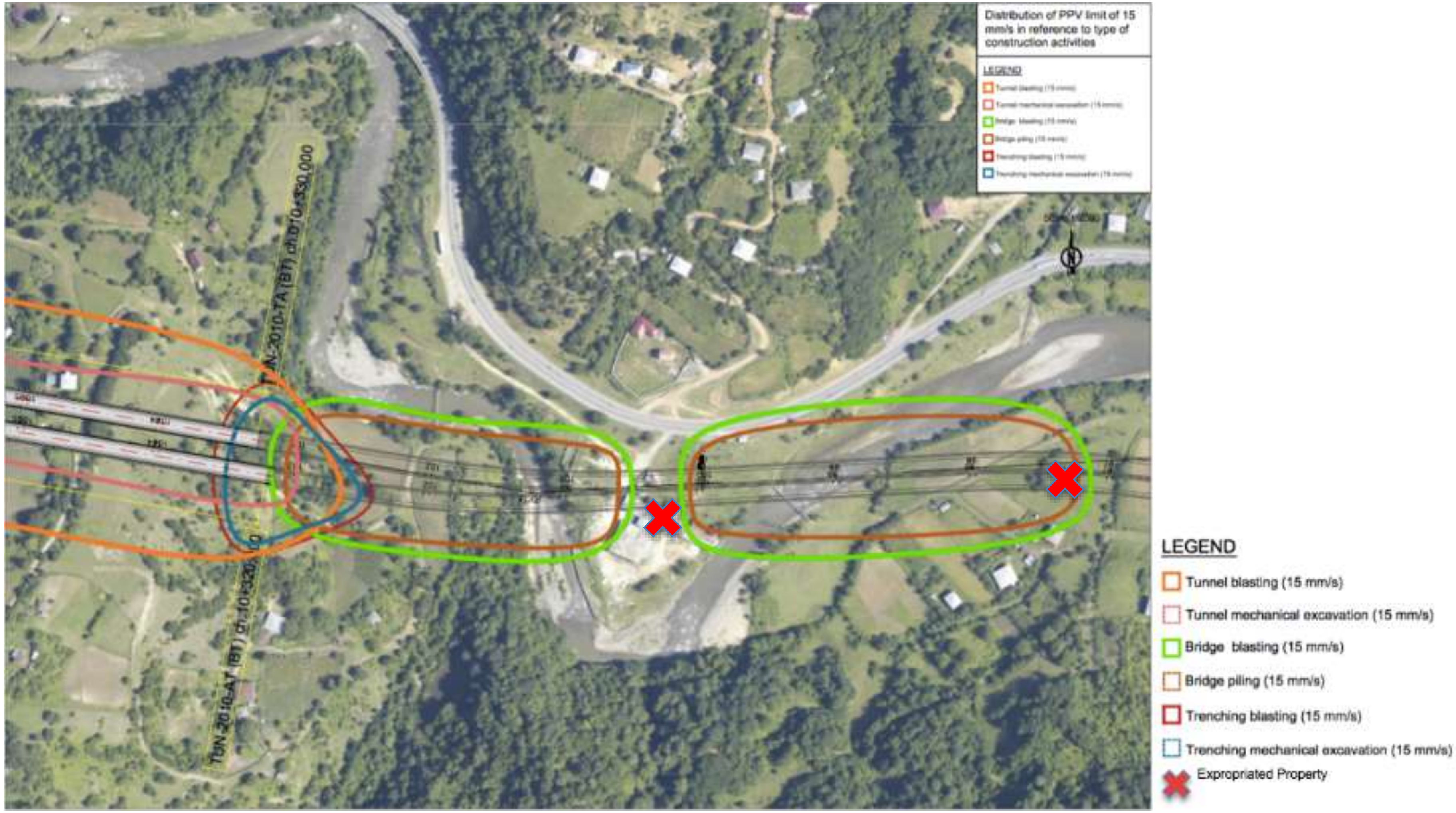


Figure 135: Distribution of PPV Limit of 15 mm/s

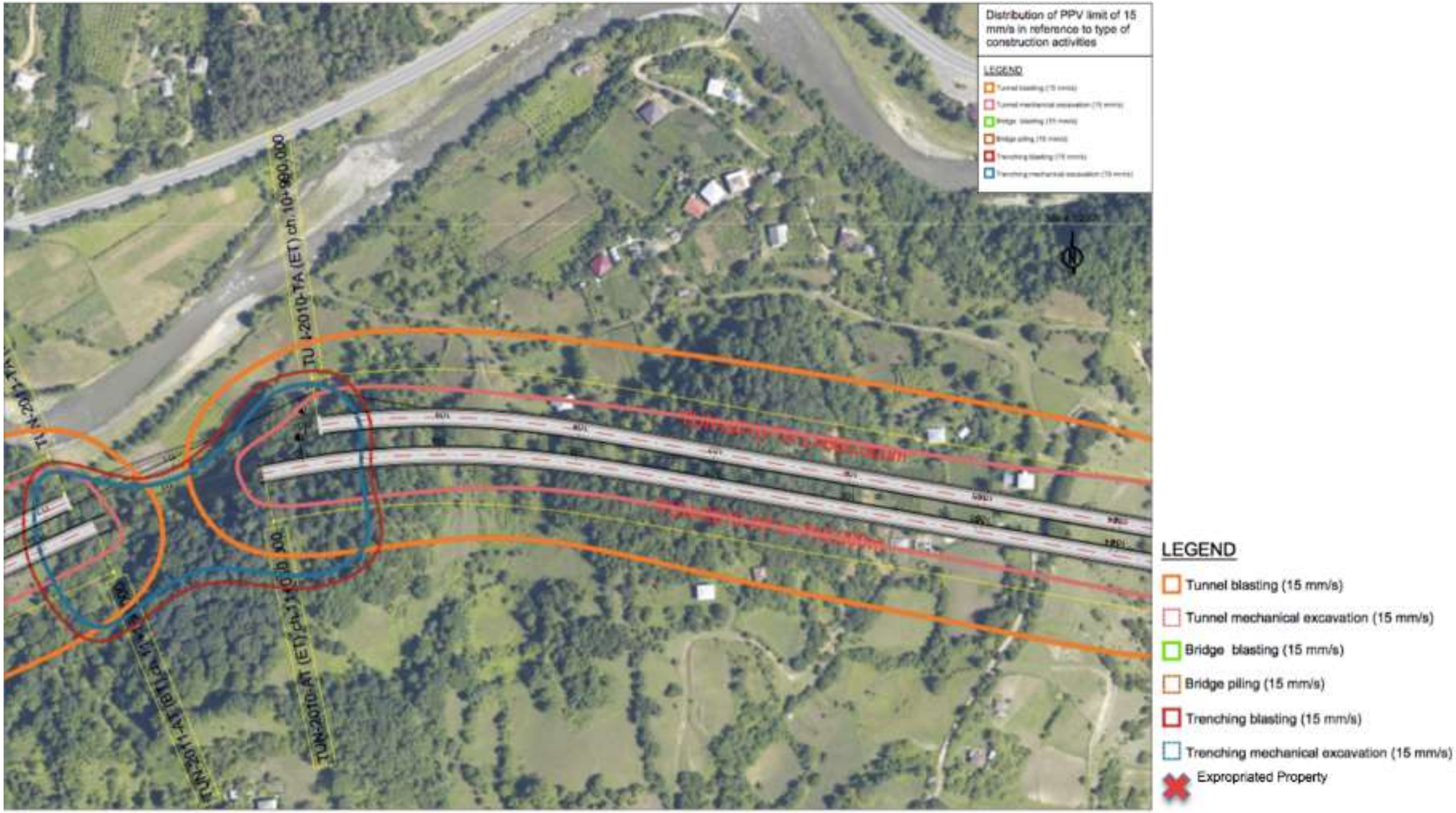


Figure 136: Distribution of PPV Limit of 15 mm/s

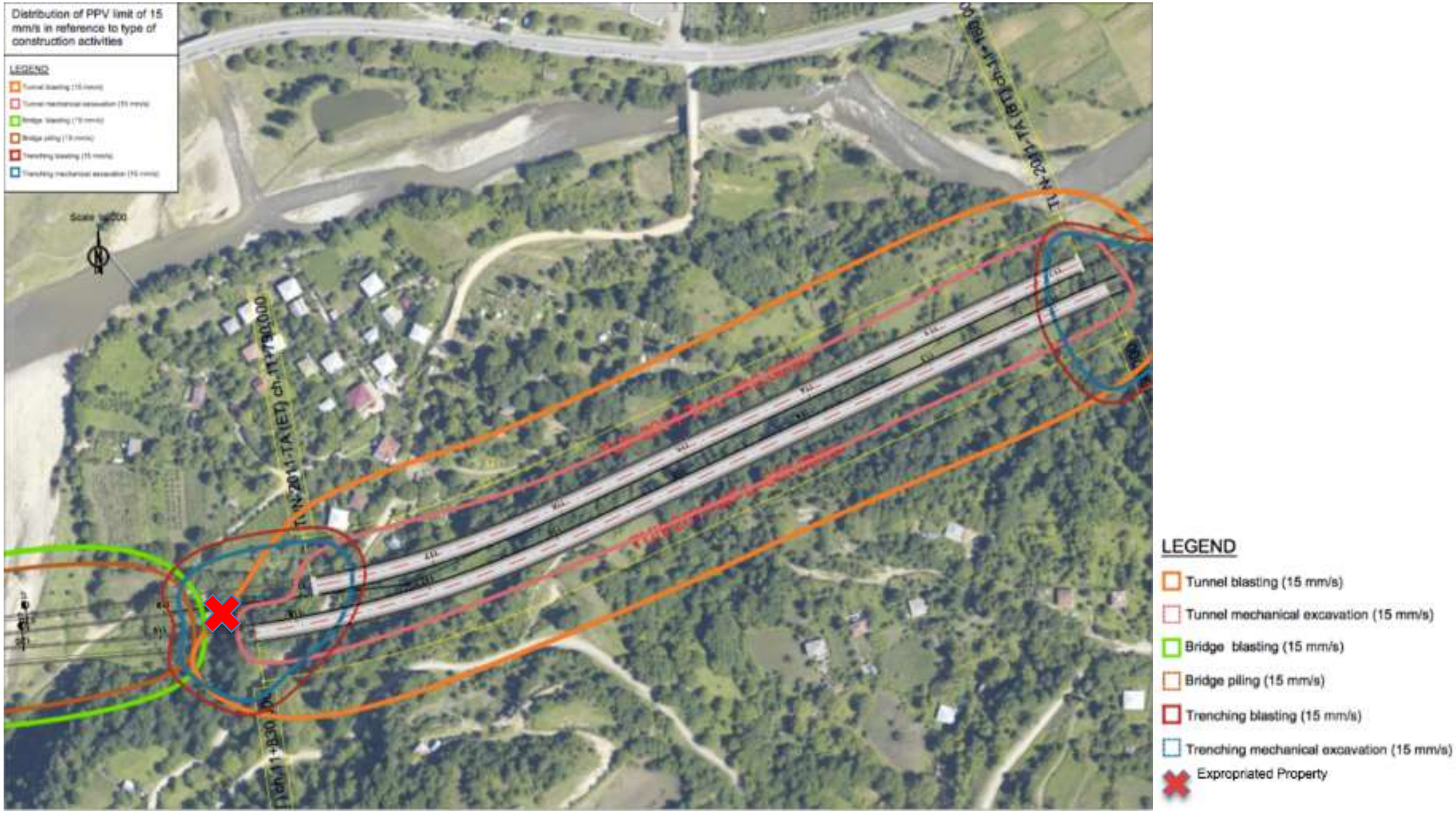


Figure 137: Distribution of PPV Limit of 15 mm/s

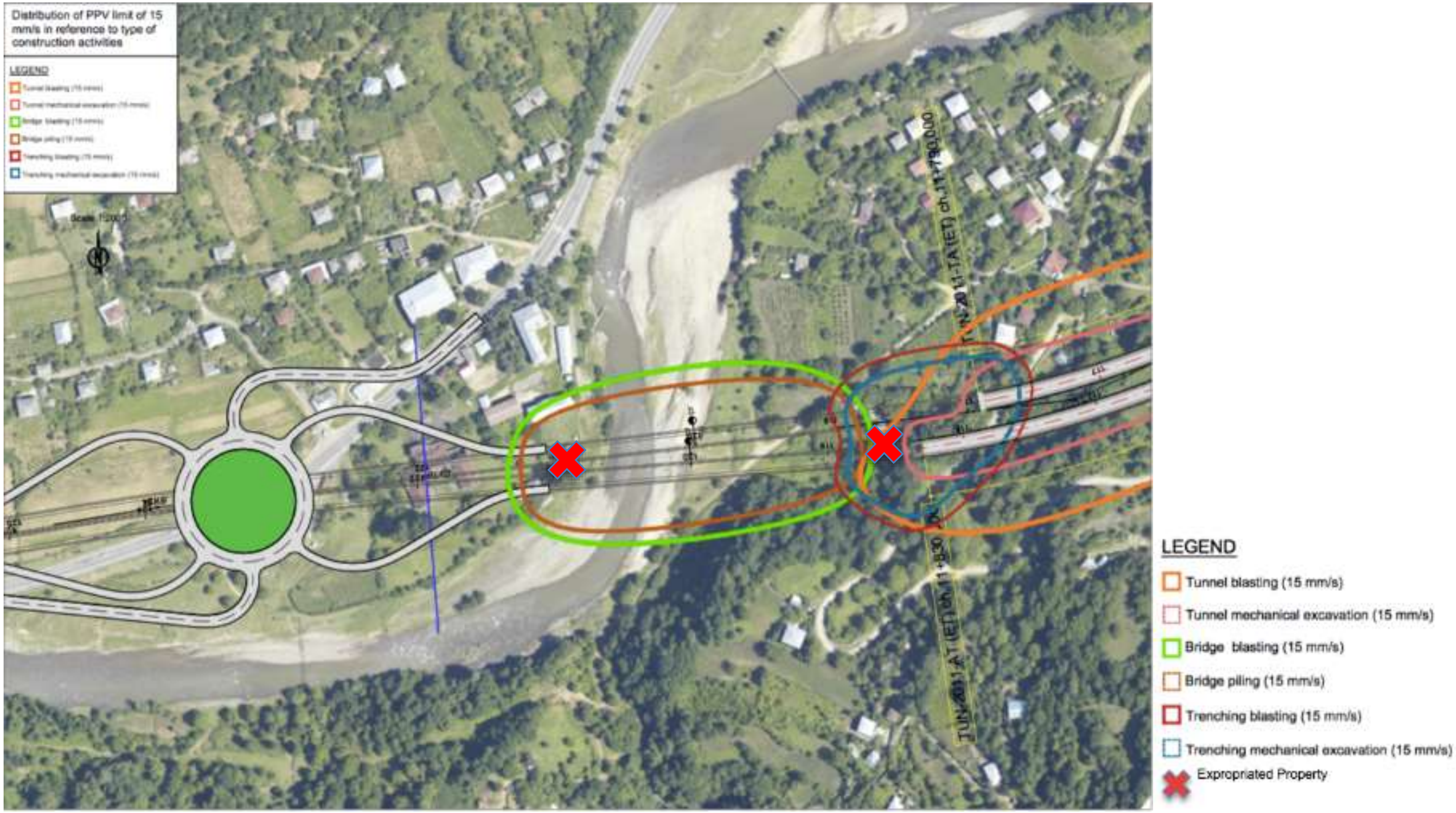


Figure 138: Distribution of PPV Limit of 15 mm/s

782. **Tunneling** - Tunneling will be constructed in volcanic rock formations such as gabbro and granite A conservative situation, considering propagation inside hard rock with a minimal attenuation, a stronger attenuation in the fractured rock and in the weathered near the surface and topsoil, has been taken into account. We have assumed, according to the geotechnical drillings, a coverage of 2-5 meters of weathered rock and/or alluvial soil plus 1 m of topsoil.

783. Blasting **-** Details of blasting activities are not yet defined in term of charge design (pattern, weight and delay) but the scientific literature provides many useful tables to be applied in different type of rocks. In particular there are manuals such as the already mentioned “Blasting-Vibration Course TERROCK Consulting Engineers” and “Transport and Construction Vibrations Guidance manual” (CALTRANS, Calif. Dept. of Transp, 2013). The calculations done and the support of the scientific literature, recommend a safety distance of 100 m for PPV= 5 mm/s threshold and a safe distance of 65 m for PPV = 15 mm/s. Results of PPV calculation are presented in Table 82: Areas where buildings are present inside the PPV= 5 and 15 mm/s limits for tunneling excavation.

784. Mechanical excavation (as a conservative approach a TBM computation has been applied) - Tunnel excavation by mechanical means will cause a complete different situation in terms of energy, frequency and even direction of the propagation of energy. For the calculation of vibration, besides taking into account the energy (in term of PPV) generated by the hammer also the option TBM has been evaluated. In accordance to the above considerations, a safety distance of 30 m has been considered for PPV=5 mm/s and less than 20m for PPV= 15 mm/s. The below Table 82: Areas where buildings are present inside the PPV= 5 and 15 mm/s limits for tunneling excavation shows the safety distances for tunneling by blasting and mechanical excavation and the number of buildings inside the PPV = 5 mm/s and 15 mm/s limits.

Table 82: Areas where buildings are present inside the PPV= 5 and 15 mm/s limits for tunneling excavations

Tunnel	PPV limit 5 mm/s		PPV limit 15 mm/s	
	N° of affected buildings / Mechanical excavation-Progressive distance (m)	N° of affected buildings / Blasting-Progressive distance (m)	N° of affected buildings / Mechanical excavation-Progressive distance (m)	N° of affected buildings / Blasting-Progressive distance (m)
TUN-2001	0	0	0	1
TUN-2002	0	0	0	0
TUN-2003	0	0	0	0
TUN-2004	0	0	0	0
TUN-2005	0	0	0	0
TUN-2006	0	0	0	0
TUN-2007	7	24	8	36
TUN-2008	0	0	0	0
TUN-2009	4	12	8	17
TUN-2010	3	4	3	6

Tunnel	PPV limit 5 mm/s		PPV limit 15 mm/s	
	N° of affected buildings / Mechanical excavation-Progressive distance (m)	**N° of affected buildings / Blasting-Progressive distance (m)**	**N° of affected buildings / Mechanical excavation-Progressive distance (m)**	**N° of affected buildings / Blasting- Progressive distance (m)**
TUN-2011	1	1	1	4
Total	**16**	**42**	**20**	**64**

Bridges foundations

785. Blasting - Blasting is supposed to be used to create an empty volume inside the rock where the foundation plinth has to be built. It is expected the depth of the rock to be blasted to be in the order of a few meters; for that the largest part of the energy is discharged in the vertical direction and the main component of the energy wave is parallel to the subsoil. For that, a safety distance of 60 m can be considered in a conservative way; it is in fact expected that the energy of the blasting charges could be smaller than the one considered in the table for PPV=5 mm/s; the limit PPV =15 m can be set at 30 m. Calculations have been done considering a shorter duration of blasting activities a rock volume of 100 m^3 (5x5m and drilling 4 m) with load charge of 0,4 kg/ m^3 for a total charge of 40 kg. and a discharge of energy mostly in the vertical direction; this source can also be considered more impulsive compared to the longer stress caused by tunneling; in this case the air shockwave and the projection of debris pays a great importance.

786. Piling - foundations on piles will be constructed where the soil does not guarantee a sufficient bearing capacity, for that it can be assumed that we are in presence of materials providing a high attenuation of vibrations. A safety distance of 40 m has been considered from the point of insertion of the pile for PPV = 5 mm/s and a distance of about 20 m for PPV = 15 mm/s (to be verified in detail for each position being highly depending on soil characteristics). The table below shows the safety distances for bridge foundations by blasting and piling and the areas where buildings are present inside the 5 mm/s and 15 mm/s limits.

Table 83: Areas where buildings are present inside the PPV= 5 and 15 mm/s limits for Bridge Construction

Bridge	PPV limit 5 mm/s		PPV limit 15 mm/s	
	N° of affected buildings / Mechanical excavation-Progressive distance (m)	**N° of affected buildings / Blasting-Progressive distance (m)**	**N° of affected buildings / Mechanical excavation-Progressive distance (m)**	**N° of affected buildings / Blasting- Progressive distance (m)**
BRI-2001	0	0	0	0
BRI-2002	0	0	0	0

Bridge	**PPV limit 5 mm/s**		**PPV limit 15 mm/s**	
	N° of affected buildings / Mechanical excavation-Progressive distance (m)	**N° of affected buildings / Blasting-Progressive distance (m)**	**N° of affected buildings / Mechanical excavation-Progressive distance (m)**	**N° of affected buildings / Blasting- Progressive distance (m)**
BRI-2003	0	0	0	0
BRI-2004	0	0	0	0
BRI-2005	0	0	0	0
BRI-2006	0	0	0	0
BRI-2007	0	0	0	0
BRI-2008	0	0	0	0
BRI-2009	0	0	0	0
BRI-2010	0	0	0	1
BRI-2011	0	0	0	0
BRI-2012	0	0	0	0
BRI-2013	5*	7*	7*	13*
BRI-2014	0	0	1	1
BRI-2015	0	0	0	0
BRI-2016	0	1	1	2
BRI-2017	0	0	0	0
BRI-2018	0	0	2	4
Total	**5***	**8***	**11**	**20**

*Five of these receptors are currently being considered for expropriation.

787. **Conclusions** - Calculations have been done in a very conservative way without the calculation of soil-foundation interaction and without a detailed knowledge of the thickness of weathered rock/soft alluvial soil at each receptor.

788. The model shows that, for tunnels TUN-2001 to TUN-2006 and TUN-2008, there will be no receptors affected by structural damage (due to their absence or expropriation). In these locations blasting is acceptable. In the remaining tunnels, blasting has the potential to cause structural damage to as many as 42 properties, this is reduced to 16 when using mechanical excavation. The conclusions for cosmetic damage are very similar, with no impacts to TUN-2002 - TUN-2006 and TUN-2008 and only one receptor impacted next to TUN-2001. The number of receptors potentially subject to cosmetic damage is 64 with the use of blasting, reducing to 20 with the use of mechanical excavation technique.

789. For bridge construction the model, both blasting and piling were modeled. However, only piling is considered relevant to the Project. Only 5 potential receptors have been identified that may

suffer structural damage from piling, but all five receptors are very close to the bridge and are being considered for expropriation. A total of eleven receptors may suffer potential cosmetic damage, but this will reduce to six if the properties mentioned above are expropriated.

Potential Operational Vibration Impacts

790. Highway traffic is not likely to have any measurable impact on the structures or on comfort. The Federal Highway Administration of the USA has determined that “All studies the highway agencies have done to assess the impact of operational traffic induced vibrations have shown that both measured and predicted vibration levels are less than any known criteria for structural damage to buildings. In fact, normal living activities (e.g., closing doors, walking across floors, operating appliances) within a building have been shown to create greater levels of vibration than highway traffic.” [24]

Design Phase Vibration Management & Mitigation

791. The model has identified several areas within the following tunnels where tunneling may potentially lead to structural damage:

(i) TUN-2007 KM4+125 – KM4+400
(ii) TUN-2009 KM7+430 – KM8+000
(iii) TUN-2010 KM10+800 – KM 10+550
(iv) TUN-2011 KM11+700 – KM11+750

792. The Detailed Design team has been made aware of these issues and the recommendation that all tunneling activities in these areas have to be done by Roadheader excavation (which is the less invasive mean of excavation) has been included in the Design Report. The use of Roadheader will also limit the potential for cosmetic damage in these locations.

Construction Phase Vibration Management & Mitigation

793. It is certain that there will be no possible impacts at a number of tunnels due to the fact there are no receptors. As such no specific mitigation measures are required at these tunnels apart from standard measures relating to safety. However, in the event that complaints are received from the community about vibration during the blasting phase the Contractor shall review his method of blasting and if required decrease the energy of blasting, or if this is ineffective, cease blasting and employ another less invasive method (Roadheader).

794. No structural damage is anticipated in the remaining tunnels where the use of Roadheader technique is envisaged in the design.

795. Prior to the start of construction, the Contractor shall develop a detailed tunneling plan as part of the overall construction schedule. The plan shall specify, to a reasonable level of accuracy, the schedule for boring of each tunnel. The plan shall include the properties identified above that may potentially be affected by cosmetic damage.

[24] http://www.fhwa.dot.gov/environMent/noise/regulations_and_guidance/analysis_and_abatement_guidance/polguide09.cfm

796. A survey will be undertaken to determine the pre-tunneling conditions of the buildings. The survey will be commissioned by the Engineer and will identify and record any existing damage to the structures. The survey will cover the following aspects:

- (i) Overall condition of the structures, both exterior and interior.
- (ii) Documentation of defects observed in the structure using digital imagery along with notes, measurements and sketches.
- (iii) Documentation of pre-existing cracks using digital imagery along with notes, measurements and sketches. Where cracks are identified in a building tape shall put across them so that if the crack widens the tape will snap. The tape can be stamped and a date put on so it cannot be tampered with.
- (iv) The findings of the survey shall be agreed upon by the property owner who shall be in attendance during the survey and will sign official documentation agreeing to the findings of the survey.

797. The survey will be accompanied with consultations with the affected household to explain the extent and reason for the survey, and the process for reporting any grievances regarding vibration impacts. The households should be provided with materials that summarize the grievance redress process.

798. If there are any claims or reports of cosmetic damage, the affected house will be surveyed against the pre-Project survey and repairs will be undertaken as appropriate.

799. There will be no structural damage resulting from bridge construction if the identified five properties are expropriated. However, the Contractor shall also complete pre-construction surveys at for the bridges as per the tunnels methodology above in order to resolve complaints the event of any cosmetic damage.

800. Regarding vibration nuisance if complaints are received from the community, the Contractor will be obliged to cease works and consult with the community regarding the complaints and if necessary use an alternative technique.

Mitigation Plan

801. The following are key mitigation measures for the management of blasting:

- (i) No blasting will be carried out within 100 m of the portal of the tunnel.
- (ii) Blasting will be scheduled during the day only.
- (iii) Local communities will be informed of blasting timetable in advance and will be provided adequate notice of when blasts are required outside of the planned schedule.
- (iv) Throughout the blasting activity, vibration sensors will be installed at strategic locations to monitor the impact of blasting and to ensure that the vibration levels are within the adopted criteria. The monitoring plan will be part of the Blasting Management Plan.

802. Unlike other construction activities, it is recognized that the impact of blasting on the community can be significant or can be perceived as significant by the community. It is therefore vital that regular and meaningful contact with the community shall be maintained and their grievance shall be attended to in a timely manner. In this regard:

803. A meaningful community engagement plan will be developed. The plan will cover identify the affected community; the key contact persons; frequency of engagement; the information to be

shared; the responsibilities to manage the plan; and the notice period to be giving to the community for various blasting related generating activities.

804. The Grievance Redress Mechanism will be used to record, investigate, and respond to any complaints. Investigation of the complaints will be undertaken by the Engineer

Vibration Monitoring

805. The Vibration Monitoring Plan will include monitoring of vibration levels and frequency around the blasting sites. The objectives of the monitoring will be to:

(i) Ensure that vibration levels in the communities are within the adopted criteria levels;
(ii) Maintain record of vibration to settle any potential conflicts; and
(iii) Monitor changes in the vibration levels due to possible changes in the rock formation and take appropriate corrective actions.

806. Vibration data will be documented, reviewed, and preserved. It will be regularly shared with the RD, ADB, MoEPA and the community as part of the monthly progress report.

Residual Impacts

Construction Phase – ***MINOR***

Despite the fact that comprehensive mitigation measures have been set to manage construction vibration there may still be instances where construction works may result in unanticipated vibration. However, these will only be temporary and localized. Good oversight from the Contractors HSE team and the Engineers environmental manager should limit the impact of these types of incidents.

Operational Phase – ***NONE***

No residual impacts from vibration are anticipated.

G.8.8 Noise

Potential Construction Noise Impacts

807. The potential noise related issue during construction of the project is disturbance to sensitive receptors in the Project area.

808. Noise levels within the Project area range depending upon the location. Baseline noise monitoring undertaken for this EIA indicates that noise levels range from 55 to 78 dBA adjacent to the existing road.

809. The noise during the construction phase depends on the stage of construction work and equipment used at the site. The construction activities generating significant levels of noise can be divided as follows:

(i) Site clearing and preparation;

(ii) Excavation and tunnel construction;
(iii) Bored piling and concrete placement; and
(iv) Erection of bridges.

810. The main sources of noise and vibration during construction of the project are as follows:
(i) Construction machinery;
(ii) Drilling activities;
(iii) Blasting;
(iv) Haulage and general vehicle movements;
(v) Concrete mixing and aggregate production systems; and
(vi) Construction Camps / Ancillary Facilities.

811. The criteria for Determining Significance is the World Bank Group guidelines for noise require that the sound level in residential areas (and other sensitive receptors, such as schools and hospitals) should not exceed 55 dB(A) during the day and 45 dB(A) during the night. During construction period, it is possible that these standards will be exceeded for short duration during the day.

812. Construction noise levels at receptors would fluctuate depending on the type and number of equipment, their duration of use and the distance from receptor. In this analysis, first the noise level due to each piece of equipment, which is likely to be used in the construction, is calculated. The peak noise levels of construction equipment mainly used at a typical construction site, are shown in Table 84. The list includes all equipment except vehicles and some minor pieces of equipment.

Table 84: Typical Noise Levels from Construction Equipment

Equipment	Actual Max (dBA)	Usage Factor (%)
Roads – Preparation Stage		
Dozer	81.7	30
Excavator	80.7	30
Grader	85	30
Roller	80.0	15
Rock Drill	81.0	15
Dump Truck	76.5	30
Roads - Completion stage		
Compressor	77.2	30
Paver	77.2	30
Roller	80.0	15
Tractor	84.0	30
Concrete Mixer Truck	78.8	30
Tunnel Mouth		
Jackhammer	88.9	50
Tunnel		
Blasting	94.0	1
Bridge		
Boring Jack Power Unit	83.0	20

Source: Source: Batumi Bypass EIA. ADB 2017.

813. Using this data, the expected noise level, Leq(8-hr), is calculated. The predicted noise levels at 100 m from the source are shown in Table 85. It shows that the highest equivalent noise level for an 8-hour shift due to a single piece of equipment at a receptor, at a typical distance of 100 m from the source will be about 61 dB(A) during preparation stage. When more than one piece of equipment are working simultaneously, the noise level at the receptor will increase. The attenuation due to

topographic factors could be up to 2 dB(A). Good maintenance of equipment with installation of noise mufflers may also reduce the noise.

Table 85: Predicted Noise Level for Construction Equipment (dBA)

Equipment	Actual Max	Usage Factor (%)	Leq (dBA) at Various Distance					
			50m	100m	200m	300m	400m	500m
Road – Preparation Stage								
Dozer	81.7	30	64.2	58.1	52.1	48.6	46.1	44.2
Excavator	80.7	30	63.2	57.1	51.1	47.6	45.1	43.2
Grader	85	30	67.5	61.4	55.4	51.9	49.4	47.5
Roller	80.0	15	59.4	53.4	47.4	43.9	41.4	39.4
Rock Drill	81.0	15	60.4	54.4	48.4	44.9	42.4	40.4
Dump Truck	76.5	30	59.0	52.9	46.9	43.4	40.9	39.0
Road – Completion Stage								
Compressor	77.2	30	60.2	54.1	48.1	44.6	42.1	40.2
Paver	77.2	30	59.7	53.6	47.6	44.1	41.6	39.7
Roller	80.0	15	59.4	53.4	47.4	43.9	41.4	39.4
Tractor	84.0	30	66.5	60.4	54.4	50.9	48.4	46.5
Concrete Mixer Truck	78.8	30	61.3	55.2	49.2	45.7	43.2	41.3
Tunnel Mouth								
Jackhammer	88.9	50	73.6	67.6	61.5	58.0	55.0	53.6
Tunnel								
Blasting	94.0	1	61.7	55.7	49.6	46.1	43.6	41.7
Bridge								
Boring Jack Power Unit	83.0	20	63.7	57.7	51.7	48.1	45.6	43.7

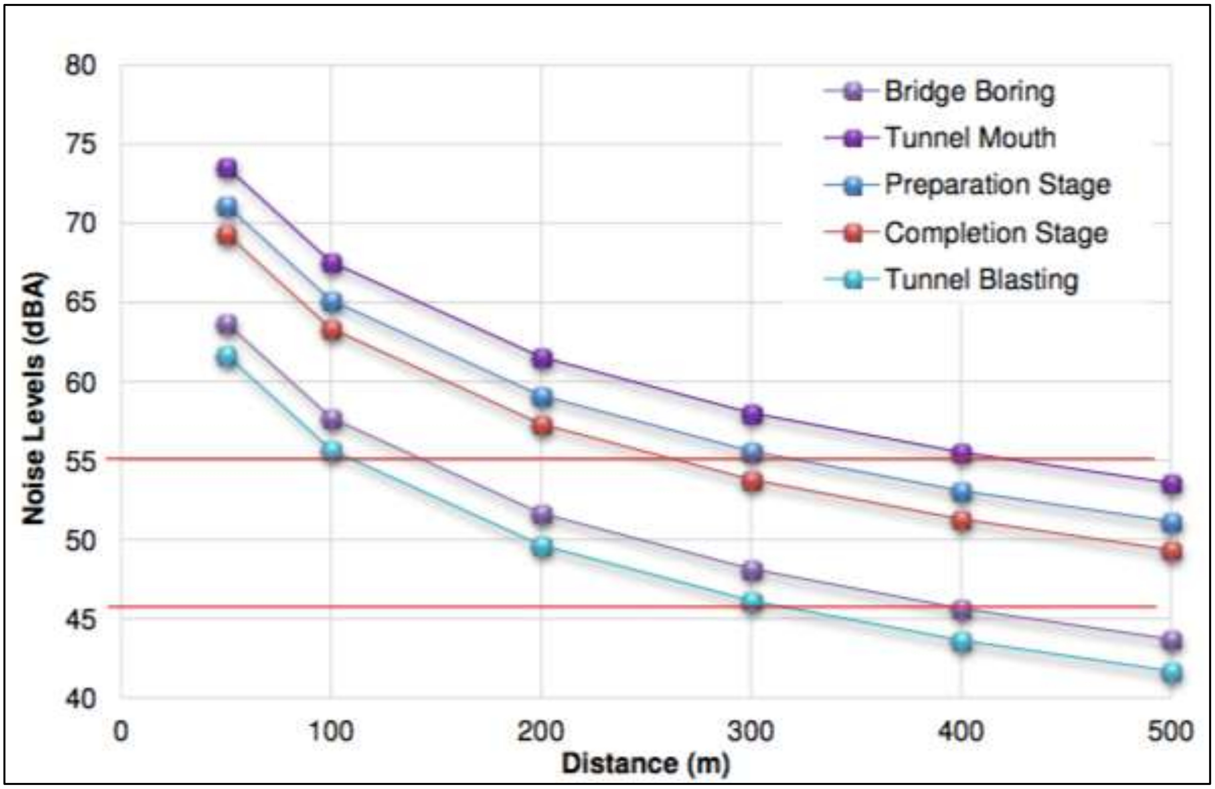
814. For a more detailed impact assessment, the construction noise was calculated at distances starting from 50 m to 500 m to see the extent of spreading of noise and separately for surface, bridge and tunnel. The modeling results for construction noise are shown in Figure 139**.** Following assumptions were made during calculation:

(i) It was assumed that the equipment working simultaneously in preparation stage are; dozer, excavator, grader, road roller, rock drill and dumpers whereas in completion stage the equipment are; compressor, paver, road roller, tractor and concrete mixers. Blasting will not be used for excavation at the tunnel mouth and portal.

(ii) Boring is used for bridges whereas the jack hammer is used for tunnel mouth.

(iii) The estimated shielding was taken as 2 dBA. Shielding is the reduction in noise due to addition of mitigation measures like barriers and dirt mound.

Figure 139: Construction Noise



815. It can be seen that all the construction activities detailed above cannot take place at nighttime (22:00pm to 7:00am) except the boring which is meeting the nighttime limit at 400 m distance.

816. The overall construction noise at a distance of 100 m exceeds the prescribed 55/45 dB(A) limit. However, the resultant noise levels at the receptors when the construction work is carried out at a distance of the 500 m from the receptor could be in the range 45- 55 dB(A). As a worst case, when the baseline noise level is over 60 dB(A) like in some locations close to the existing road, there the increase may be still less than 3 dB(A) and thus barely noticeable. Note that the above statement is valid if there is a continuous non-fluctuating noise source. As the noise levels of construction equipment vary considerably, the community can easily notice the variation.

Pre-construction Noise Management & Mitigation

817. Correct siting of construction camps and ancillary facilities will reduce the potential for elevated noise levels to affect sensitive receptors. Locating these facilities more than 500 meters from residential or sensitive receptors should mean that the noise generated by these facilities will be lower than IFC daytime and night-time guideline limits at this distance. Locating these facilities more than 1km downwind of sensitive receptors will further limit potential noise impacts.

818. Prior to the start of construction, and as part of his SEMP, the Contractor will develop a noise management plan that will include the mitigation measures outlined below for the construction phase.

Construction Phase Noise Mitigation

819. During the construction phase the Contractor will be responsible for the following:

(i) Time and Activity Constraints, i.e., operations will be scheduled to coincide with periods when people would least likely be affected; work hours and work days will be limited to less noise-sensitive times. Hours-of-work will be approved by the Engineer having due regard for possible noise disturbance to the local residents or other activities. Construction activities will be strictly prohibited between 10 PM and 7 AM in the residential areas. When operating close to sensitive areas (within 250 meters) such as medical facilities, the Contractor's hours of working shall be limited to 8 AM to 6 PM;

(ii) Use temporary noise barriers while working in sensitive locations in case accidence of allowable limits is expected. Placing the barrier close to the source proves to be effective.

(iii) Give notice as early as possible to sensitive receptors for periods of noisier works such as excavation. Describe the activities and how long they are expected to take. Keep affected neighbours informed of progress.

(iv) Within normal working hours, where it is reasonable to do so:
    (a) schedule noisy activities for less sensitive times.
    (b) provide periods of respite from noisier works (for example, periodic breaks from jackhammer noise).

(v) The weekend/evening periods are important for community rest and recreation and provide respite when noisy work has been conducted throughout the week. Accordingly, work should not usually be scheduled during these times.

(vi) All mechanical plant is to be silenced by the best practical means using current technology. Mechanical plant, including noise-suppression devices, should be maintained to the manufacturer's specifications. Internal combustion engines are to be fitted with a suitable muffler in good repair.

(vii) Maintenance tools, machines and equipment so that they are in good conditions. When some wrong is found, they must be fixed immediately in order to reduce noise from the equipment.

(viii) Fit all pneumatic tools with an effective silencer on their air exhaust port.

(ix) Install less noisy movement/reversing warning systems for equipment and vehicles that will operate for extended periods, during sensitive times or in close proximity to sensitive sites. Occupational health and safety requirements for use of warning systems must be followed.

(x) Turn off plant when not being used.

(xi) All vehicular movements to and from the site to only occur during the scheduled normal working hours, unless approval has been granted by the Engineer.

(xii) Keep good conditions of trucks that use to transport construction materials so they cause no loud noise and control the truck speed, to be not exceeded 40 km/hr when driving through communities, and not exceeded 80 km/hr when driving on highways.

(xiii) Where possible, no truck associated with the work should be left standing with its engine operating in a street adjacent to a residential area.

(xiv) Provision of noise protection kits such as ear plug, earmuff, for workers who are working in the area with noise level is higher than 85 dB(A). It is designated as a regulation that workers must wear protection kits in case of working in a noisy area.

Operational Phase Noise Impacts

G.8.8.1Environmental Noise Model

820. To assess the impacts of operational noise within the Project area a noise model has been prepared.

821. To assess the impacts of operational noise within the Project area a noise model has been prepared.

822. The Environmental noise model is based on a specific set of conditions for which the noise is being estimated, it will be a fixed representation or 'snapshot' of a physical environment of interest; in practice the physical environment of the area of interest is constantly and randomly changing; the model intend to represent the most typical or frequently occurring conditions as reconstructed by the input data.

823. Modeling takes into consideration both worse scenario and the average conditions, the latter being a good representation in case of pretty constant traffic conditions. The key conditions for the development of a good noise model are:

(i) Knowledge of the noise source, or sources, for which associated environmental noise levels are of interest.

(ii) The physical environment through which noise will transmit from the noise source(s) to the location or targets/region of interest. This includes the ground terrain, the built environment, and atmospheric conditions (e.g. wind, temperature, humidity).

(iii) An approximation of the way in which sound will travel from the noise source(s) via the physical environment, to the receiver location or region of interest (building surface).

824. In complex scenarios, the environmental noise model is repetitiously calculated for the distribution of sound source (by using ray – tracing modeling), from the traffic to the receiver location. The total sound level at each position is then calculated by summing the contribution of each source and transmission path. The road will be considered as a linear source of noise, composed by a number of vehicles considered as single sources moving along a line. Application of these calculations to each point on a uniformly distributed grid enables a noise contour map to be developed to depict regions of equal estimated noise level and depict trends in the spatial pattern of the sound field:

825. Information considered in the development of the model **-** Table 86 shows the requirements for specifying a noisy environment:

Table 86: Factors in Acoustic Mapping

Stage	Minimum	Other elements to be considered
The noise sources to be investigated	Number of sound sources; Total sound power output of each source; Directional characteristics of each source; Height of each source; Frequency characteristics of each source	Time variations of emissions for example, a worst-case assessment would imply the use of the highest possible value irrespective of how frequently it may occur, whilst an assessment which related to 'typical' conditions could necessitate the use of an averaged value or some typically recurring upper value. (**In our case, impulsive noise from the source should be excluded)**

Stage	Minimum	Other elements to be considered
The physical environment through which noise will transmit to the receivers	Separating distances between all relevant noise sources and receivers Reflecting/ obstructing structures; amount and type of vegetation Height(s) of receiver(s) (Obtained from Maps or field survey of buildings)	Ground terrain profile characteristics of the ground cover Meteorological conditions relevant to the intentions of the including wind direction and speed, temperature, and humidity, (**not so relevant in our case due to the short distances from the source).**

826. To estimate the way in which noise will travel from the noise sources to the receivers, a range of sound propagation methodologies may be employed. Methods vary widely in their complexity and the scope of applications for which they can offer meaningful predictions.

827. In our model a standard hemi-spherical spreading is considered; this method accounts for the reduction in sound intensity as a sound wave front spreads over a larger area, with the consequence of increasing the area of the spherical surface where the energy (sound pressure wave) is distributed.

828. To calculate the propagation the algorithm takes into account:
- (i) The absorption associated with the propagation of noise through the atmosphere ***(very low due to the short distance)***
- (ii) The change in noise level that occurs as a result of interactions between the sound wave travelling directly to the receiver and those reflected from the ground, buildings and accounting for influence of the ground cover type ***(calculated from the 3D model of soil and buildings obtained by field survey).***
- (iii) The attenuation offered by obstacles that fully or partly obstruct line of sight between a source and a receiver location ***(poor vegetation will not determine any attenuation).***
- (iv) The influence of atmospheric conditions that can change the direction of an advancing sound wave front by refracting the wave at points where there are significant changes in wind speed and/or temperature (not considered due to the short distance).
- (v) The influence of reflecting surfaces which re-direct an advancing sound wave front (for the second row of buildings reflection/shielding will be the main factor of attenuation).

F.8.8.2 Variability

829. The noise sources considered in the model exhibit very large variability in space and time and during the construction phase also the background noise from the nearby existing road has to be considered. The following table gives examples of variations considered in the developed model.

Table 87: Examples of Components Variations

Component	Examples of component variations
Source	Background noise: Changing traffic sound e.g. hourly, daily, and seasonal changes in the general traffic flow volume and composition, as well short term (wet or dry) and long

Component	Examples of component variations
	term (road surface degradation) changes in road conditions.
Transmission	Position dependent sound propagation, e.g. varying separation distances due to sound source movement, varying degrees of sound path screening according to source and receiver location, and localized regions affected by reflections (not of capital importance in tour case due to linear modelization of traffic)

F.8.8.3 Algorithms for Outdoor Sound Propagation

830. The ability of mathematical algorithms to accurately represent sound propagation has been the focus of considerable researches, particularly given the role of noise prediction as an integral assessment tool in the fulfillment of the European Noise Directive (i.e. EU Directive 2002/49/EC, which requires member states to produce noise maps and action plans for urban areas and major transport infrastructures, including roads, railways and airports). As mentioned, the applied software fully complies with that and it is updated to the latest EU directives and norms. In particular the used Software SOUND PLAN VER. 7.2 considers the guidelines ISO 3891 e ISO 9613; the sound pressure has been calculated in accordance to the procedures stated in the model “Nouvelle Metode du Presion du Bruit - Routes 2008” and the following norms:

(i) Industrial Noise
- (a) ISO 9613 incl. VBUI (International, EC-Interim)
- (b) CONCAWE (International)
- (c) VDI 2714, VDI 2720 (Germany)
- (d) DIN 18005 (Germany)
- (e) ÖAL Richtlinie Nr. 28 (Austria)
- (f) BS 5228 (United Kingdom)
- (g) Nordic General Prediction Method (Scandinavia)
- (h) NORD 2000 (Scandinavia)
- (i) Ljud från vindkraftverk (Sweden)
- (j) Harmonoise, P2P calculation model (International)
- (k) NMPB08 - Industry (France)
- (l) CNOSSOS-EU (2014)

(ii) Road Noise
- a. NMPB-Routes-96 (France, EC-Interim)
- b. RLS-90, VBUS (Germany)
- c. DIN 18005 (Germany)
- d. RVS 04.02.11 (Austria)
- e. STL 86 (Switzerland)
- f. SonRoad (Switzerland)
- g. CRTN (United Kingdom)
- h. TemaNord 1996:525 (Scandinavia)
- i. Czech Method (Czech Republic)
- j. NMPB-Routes-08 (France)
- k. TNM (USA)
- l. CNOSSOS-EU (2014) Industrial Noise

F.8.8.4 Standards, regulations and guidance notes

831. The following standards, regulations and guidance notes have been considered as part of the model:

- (i) ISO 9613-2, Acoustics — Attenuation of sound during propagation outdoors Part 2: General method of calculation.
- (ii) BS 4142, Method for rating industrial noise affecting mixed residential and industrial areas.
- (iii) BS 5228-2, Noise and vibration control on construction and open sites — Part 2:Guide to noise and vibration control legislation for construction and demolition including road construction and maintenance.
- (iv) BS 7445, Description and measurement of environmental noise.
- (v) IPPC H3 Horizontal Noise Guidance. Part 1 'Regulation and Permitting' and Part 2 'Noise Assessment and Control'.
- (vi) Calculation of Road Traffic Noise 1988, Department of Transport, Welsh Office.
- (vii) Calculation of Railway Noise 1995. Department of Transport.
- (viii) The CAA Aircraft Noise Contour Model: ANCON Version 1. DORA Report 9120, Civil Aviation Authority 1992.
- (ix) PPG 24 Planning Policy Guidance: Planning and Noise. Department of the Environment 1994. TAN11 (Wales); PAN56 (Scotland).
- (x) BS 9142: 2006 Assessment methods for environmental noise — Guide, 2003/01534 12 July 2006.

F.8.8.5 Simulation parameters

832. The modeling of the noise emissions and noise propagation from the new road takes into account that there are many houses very close to road side in certain sectors and others where urbanization is almost absent. The morphology, characterized by hills, and the presence of the river valley and riverbed plays a very important role mostly because this determine the distribution and type of vegetation which is acting as noise barrier and the absence of obstacles for the propagation across the valley.

833. Modelling of noise level was performed using data up to 2037 traffic flow as provided by the ADB with a difference between day and night of 70% for light vehicles and 30% for trucks.

Table 88: Daily average vehicles/day (working day) (2018 – 2037)

Year	Car	Minibus+van	Bus+MGV	HGV+TT	AADT
2018	9,482	2,188	1,458	1,459	14,589
2019	10,029	2,314	1,525	1,575	15,443
2020	10,606	2,448	1,595	1,700	16,348
2021	11,217	2,589	1,668	1,834	17,308
2022	11,778	2,718	1,748	1,986	18,230
2023	12,367	2,854	1,832	2,299	19,352
2024	12,985	2,997	1,920	2,489	20,391
2025	13,635	3,147	2,013	2,695	21,489
2026	14,316	3,304	2,111	2,917	22,648
2027	14,889	3,436	2,193	3,092	23,610
2028	15,484	3,574	2,278	3,277	24,614
2029	16,104	3,717	2,367	3,474	25,662

2030	16,748	3,865	2,460	3,682	26,756
2031	17,230	4,004	2,547	3,842	27,624
2032	17,727	4,149	2,638	4,008	28,520
2033	18,237	4,298	2,731	4,181	29,447
2034	18,762	4,453	2,829	4,361	30,405
2035	19,303	4,613	2,930	4,550	31,395
2036	19,859	4,779	3,034	4,746	32,418
2037	20,431	4,951	3,143	4,951	33,476

834. These traffic fluxes are for ultra-conservative scenario in which full load of the road in year 2037 will occur (peak hour at day and maximum expected load at night) and also for the present day vehicle levels. In reality, it can be said with high probability that vehicle levels in Georgia will change by 2037 with the consequence of having lower emissions than predicted in the project design documents and used in this modelling. This will result from:

- (i) Technological improvement (new models, hybrids, electric cars have and will have less and less noise emissions and the share of these vehicles in the whole vehicle cars will be significant);
- (ii) Full amortization of the old vehicles; and
- (iii) Possibly also from national regulations to limit the use of old vehicles producing excessive air pollution (the same categories of vehicles happen to be responsible for high noise emissions too).

F.8.8.6 Numeric model

835. The forecast of noise emissions or new urban road has been performed using SOUND PLAN VER. 7.2 ray tracing software. Noise sound pressure results on receiving point are based on method BNPM (Basic Noise Prediction Method) and on German regulation BNPM, which is based on DIN 18005.

F.8.8.7 Receptors to be investigated

836. In order to investigate noise levels in operation field and close to buildings, many receiving points have been ideally set in correspondence of building facades, at proper distance and height according to Georgian and international standard regulations. The model can evaluate not only general noise level in the area but also noise levels close to buildings, in position suggested by international regulations about residential buildings. Due to the absence of tall buildings, maximum height is four floors, and their distance from the source, there is no need to make a multi level computation at different heights.

F.8.8.8 Traffic forecasts

837. Currently last 5 year statistic data is available from Roads Department of Georgia for the main roads; data includes seasonal measurements during the year, specifically in April, July and October from these measurements AADT is derived.

838. According to German regulation BNPM, the vehicle fluxes must be divided in light and heavy means; accordingly the reported data has been divided assigning the class of light vehicles to cars and minibuses, the class of heavy vehicles to buses tracks and trailers. The traffic flux per day at 2017 is shown in Table 89.

Table 89: Traffic Flux Per Day, 2017

Year	Car	Mini Buses<15, PickUPs	Buses & Trucks	Trailers & > 3 axles	Total
2017	13,335	3,448	2,410	1,116	20,310

839. This data has been collected in a period of 8 hours in the day reference period, so the average hour flux can be considered 2,540 vehicles per hour. Due to unstable patterns it was considered more reasonable to calculate Compound Annual Growth Rate (CAGR) to apply first year growth rate separately for Passenger and Freight Vehicles based on last few year traffic history. The compound annual growth rate is calculated by taking the root ^{nth} of the total percentage growth rate, where "n" is the number of years in the period being considered.

840. For the reasons above described, in our model as future traffic flux the traffic forecast values at 20 years from now data was the input data; in other words the traffic values after a period of about 18 years after road construction. The future vehicle flux used in calculations is 47,064 total vehicles.

841. To investigate the worst traffic condition for noise levels, this flux, according to BNPM method, has been evenly spread on road lanes, the average per day has been divided in a period of 8 hours, obtaining the above average flux per hour, 5,883 vehicles/hour with about 16% of heavy vehicles; speed has been set to 80 Km/h.

842. As far as regards the night reference time, considering the absence of any directly measured data and lacking of a study as detailed as daytime one, a vehicles flux of 70% of the daytime for cars and 30% for buses trucks and trailers has been chosen (see Table 90). The assumption is based on experience in European countries, and corrected by direct observation of traffic reduction during night time in the investigation area.

Table 90: Night Traffic

Year	Car (70%)	Mini Buses<15, PickUP (30%)s	Buses & Trucks(30%)	Trailers & >3 axle (30%)s	Total
2017	9334,5	1034,4	723	334,8	11426,7
2018	9801,4	1086,3	756,3	350,1	11994,1
2019	10329,9	1144,8	793,5	367,5	12635,7
2020	10945,2	1212,9	837	387,6	13382,7
2021	11664,1	1292,7	887,4	410,7	14254,9
2022	12427,1	1377,3	940,5	435,6	15180,5
2023	13098,4	1451,4	987	456,9	15993,7
2024	13805,4	1530	1035,9	479,7	16851
2025	14385	1594,2	1075,8	498	17553
2026	14989,8	1661,1	1117,2	517,2	18285,3
2027	15619,1	1731	1160,4	537,3	19047,8
2028	16220,4	1797,6	1203	556,8	19777,8
2029	16844,8	1866,6	1247,1	577,5	20536
2030	17400,6	1928,4	1286,4	595,5	21210,9
2031	17975,3	1992	1326,9	614,4	21908,6

Year	Car (70%)	Mini Buses<15, PickUP (30%)s	Buses & Trucks(30%)	Trailers & >3 axle (30%)s	Total
2032	18568,2	2057,7	1368,9	633,6	22628,4
2033	19180,7	2125,5	1411,8	653,7	23371,7
2034	19814,2	2195,7	1456,5	674,1	24140,5
2035	20468	2268,3	1502,1	695,4	24933,8
2036	21143,5	2343	1549,5	717,3	25753,3
2037	21840,7	2420,4	1598,4	740,1	26599,6

G.8.8.9 Modeling Results

843. A noise model of the existing road was prepared using the current traffic levels on the project road (see discussion in **Section F.4.5 Noise and Vibration** and **Appendix P – Baseline Noise Model Iterations).** This model represents the ambient noise levels on the existing road.

844. All receptors that are slated for expropriation were removed from the modelled list of potential receptors as they will not be affected by noise (a total of 23 will be expropriated out of a total of 87 identified receptors in the Project corridor). **Appendix J** provides the locations of the properties to be expropriated within the Project corridor. This leaves a total of 64 noise receptors within the Project corridor.

845. The next step in the analysis is to determine if the proposed Project will increase noise levels above IFC daytime and nighttime guideline limits (45 dBA and 55 dBA respectively) or more than 3 dB above the ambient noise levels at each receptor where guideline limits are exceeded. The following table indicates the ambient conditions (the baseline) then the results of the modelled new road, in year 1, 10 and 15 of operation. In all cases where the IFC guidelines limits for noise are met, the cells are highlighted in blue. The table also shows, in green, where difference in noise levels between the ambient and the modelled new road in year 15, and where compliance with IFC Guideline limits is achieved, i.e. within 3dB of the ambient.

Table 91: Results of Baseline and Predicted Noise Model

Receiver	Ambient		New Road Yr1		New Road Yr10		New Road Yr 15	
L2	48	45	53	45	54	46	55	47
L5	50	47	62	54	64	55	64	56
L9	65	62	62	54	64	56	65	56
L10	54	51	62	50	64	52	65	52
L11	37	34	59	48	56	44	62	51
L12	59	56	58	49	59	51	60	56
L13	58	55	59	51	61	53	61	52
L14	56	53	59	51	61	52	62	53
L15	51	47	54	47	56	49	56	49
L17	64	61	55	47	57	48	57	48
L18	61	57	58	50	60	51	60	51
L19	55	52	58	50	60	52	61	52
L20	55	52	59	51	61	52	61	52
L21	54	51	59	51	61	53	62	53
L22	60	57	58	52	60	53	61	54
L23	66	63	62	54	64	55	65	56
L24	62	58	61	53	63	54	63	55
L28	70	66	61	53	63	55	65	56

Receiver	Ambient		New Road Yr1		New Road Yr10		New Road Yr 15	
L29	64	61	60	52	62	53	63	54
L30	66	63	60	51	62	53	62	54
R1	51	48	51	42	52	44	54	45
R2	59	55	63	55	65	57	66	57
R3	57	54	63	54	64	56	66	57
R4	55	52	62	53	63	55	64	55
R5	53	50	60	51	61	53	62	54
R10	41	38	47	39	49	41	49	41
R11	65	61	61	53	63	55	64	55
R12	59	55	60	52	62	54	63	54
R13	57	54	64	55	65	57	66	58
R14	49	45	59	51	61	53	62	53
R15	55	52	64	56	66	57	67	58
R17	39	35	47	38	48	40	48	40
R18	44	41	44	36	46	37	45	37
R19	34	30	41	33	43	35	43	34
R20	40	37	44	36	46	38	47	38
R21	48	45	53	45	55	46	55	46
R22	43	39	54	48	55	49	56	49
R23	59	55	67	59	69	61	70	61
R24	60	56	67	59	69	61	71	62
R25	54	51	62	54	64	56	66	57
R26	56	53	63	54	65	56	66	57
R27	59	55	64	55	66	57	67	58
R28	56	53	62	53	64	55	65	56
R29	57	53	63	54	64	56	66	57
R30	57	53	65	57	67	59	69	60
R31	52	49	61	53	63	55	64	55
R32	54	51	62	54	64	55	64	56
R36	66	62	58	50	60	51	61	52
R37	67	64	59	51	61	52	61	53
R38	64	61	57	49	59	50	59	51
R39	67	63	59	50	60	52	61	53
R40	66	62	59	51	61	52	61	53
R41	66	63	58	50	60	52	61	52
R42	65	62	58	50	60	51	61	52
R43	64	61	59	51	61	53	62	53
R44	58	55	64	55	65	57	67	58
R45	58	54	61	53	63	54	64	55
R46	53	49	59	50	60	52	61	52
R47	59	56	59	50	60	52	61	52
R48	57	53	52	44	54	46	55	46
R49	65	62	56	48	58	49	58	49
R50	52	49	61	53	63	55	64	55
R51	52	48	58	50	60	52	61	52
R52	51	47	60	51	61	53	62	53
Total IFC Compliant	24	10	37	54	33	49	31	47

846. The results show that as time progresses more and more receptors are exposed to noise levels above IFC Guideline Limits, specifically during the daytime period. By year 15 almost 50% of receptors will be subject to noise levels above IFC Guideline limits.

847. Noise barriers of alternative heights (between 4 and 6m), located on the edge of the highway, were then added to the noise model at specific locations to determine the noise attenuation with the noise barriers. The following table shows the results (excluding the receptors within 3dBA of the modeled ambient and those already below IFC day time and night time noise limits at year 15 without any required mitigation). Again, blue cells represent levels that are within 3dBA of the ambient noise levels and green cells indicate levels that are below IFC guidelines for daytime and nighttime noise (45 and 55 DBA).

Table 92: Results With Noise Barrier Mitigation

Receiver	Ambient		New Road Yr1		New Road Yr10		New Road Yr 15	
L5	50	47	50	39	52	41	53	42
L10	54	51	54	44	56	45	57	46
L11	37	34	51	41	53	43	54	44
L14	56	53	49	39	51	40	52	41
L15	51	47	51	42	53	44	54	45
L19	55	52	58	49	60	51	60	52
L20	55	52	58	50	60	51	61	52
L21	54	51	59	51	61	52	62	53
R2	59	55	62	53	64	55	65	56
R3	57	54	60	51	62	53	63	54
R4	55	52	59	50	61	52	62	53
R5	53	50	57	48	59	50	60	51
R12	59	55	51	41	53	43	54	44
R13	57	54	58	49	60	51	62	52
R14	49	45	59	51	61	52	61	53
R15	55	52	61	52	63	53	64	54
R22	43	39	51	43	53	44	55	45
R23	59	55	58	48	60	49	61	50
R24	60	56	58	47	59	49	61	50
R25	54	51	53	43	55	44	56	45
R26	56	53	51	40	53	42	54	43
R27	59	55	51	40	53	41	54	42
R28	56	53	49	39	51	40	52	41
R29	57	53	50	39	52	40	53	41
R30	57	53	51	40	53	41	54	42
R31	52	49	54	45	56	46	58	47
R32	54	51	56	46	58	48	59	49
R44	58	55	55	45	57	46	58	47
R45	58	54	51	41	53	42	54	43
R46	53	49	51	42	53	43	54	44
R50	52	49	55	46	57	48	59	49
R51	52	48	51	41	53	42	54	43
R52	51	47	51	41	53	43	54	44
Total IFC Non compliant	17	30	3	1	12	1	13	1

848. The table above indicates that 20 of the 33 receptors will be within the IFC limits if the proposed noise barriers are added to the new road. This leaves 13 receptors above the limits, mainly as a result of exceedances of daytime noise limits.

Conclusions & Mitigation / Management Measures

849. The noise model identified 87 potential noise receptors within the Project corridor. 23 of the 87 receptors have been identified for expropriation in the Project area, leaving 64 potential receptors.

850. Using the predictive and baseline models 31 of the 64 receptors were found to be within IFC noise limits (within 3dBA of the modeled ambient and/or 45 dBA / 55 dBA) by year 15 without any mitigation measures leaving 33 receptors above IFC guideline limits.

851. A noise barrier of varying heights was then introduced to the predictive model (the locations of the barriers can be found in **Appendix T**). A number of barriers were effective at reducing the noise levels to a level below IFC daytime and night time limits or within the IFC 3dBA above ambient guideline for 20 receptors. The recommended noise barriers are identified in the table below.

Table 93: Proposed Noise Barriers

Barrier No.	Length (m)	Height (m)
B2	130	4
B6	380	4
B7	490	4
B8	250	6
B11	770	4.5
B13	550	4
B16	1,100	4
B19	330	4
Total	**4,000**	

852. 13 receptors (mapped and are included in **Appendix T**) will still be negatively impacted by higher noise levels even with the installation of these noise barriers. Given the number of variables in the model, the timescale for this scenario, and potential changes in vehicle fleet composition (to electric vehicles with lower engine noise levels) it is considered highly possible that noise levels could well be within the IFC guideline limits by this time.

853. The following table lists these remaining receptors and by how much they exceed the IFC guideline limits in Year 15.

Table 94: Remaining Affected Receptors

#	Receptor	Level above IFC daytime / night time limit and / or 3 dBA above modelled ambient.	
		DAY	NIGHT
		dB(A)	dB(A)
1	L19	5	-
2	L20	6	-

#	Receptor	Level above IFC daytime / night time limit and / or 3 dBA above modelled ambient.	
		DAY	NIGHT
		dB(A)	dB(A)
3	L21	7	-
4	R2	6	-
5	R3	6	-
6	R4	7	-
7	R5	5	-
8	R13	5	-
9	R14	6	8
10	R15	9	-
11	R31	3	-
12	R32	4	-
13	R50	4	-

854. A range of potential mitigation measures were assessed for these remaining 13 receptors, they included:

- Speed Limits – a detailed assessment was undertaken to look at the effect of speed reduction and noise. To meet IFC noise standards the assessment showed that speeds needed to be reduced from 80km/h to 60km/h in most instances and also from 80km/h to 50km/h in several other instances. This option was ruled out by the RD as it had significant negative impacts on the economic benefits of the road.
- Noise Proof Windows – Installing noise proof windows at the affected receptor (Noise Protection Class 1) can reduce noise levels by 25-29 decibels inside the property. Noise Protection Class 2-5 can have an even greater nose reduction.[25] However, this does not meet IFC requirements for noise measured at the façade of the affected property.
- Low Noise Asphalt – The DD team indicated that the low noise asphalt performance will deteriorate over a 3-4 year period and would require regular maintenance to be effective. As such this measure could not guarantee continued compliance through the Project lifecycle.
- Monitoring and Expropriation – For residences where noise is predicted to be exceeded. Monitoring will be carried out at the Property during operation up to year 15. Should measured noise be shown to exceed IFC limits at the property during this period, the owner of the house will be given the option to relocate after selling their house to the RD. Their property will then be included in the LARP or other similar instrument (post project).

871. Given the above, the mitigation measure proposed for the remaining 13 receptors is the monitoring and expropriation option. The RD will be responsible for monitoring and then consulting with the remaining 13 receptors to determine what option is preferable to the individual receptors and as to whether any property level mitigation is possible (i.e. improvement of property boundary walls). This activity shall be completed during operation and will be particularly relevant for L21, R14 and

[25] Based on German Standard DIN 4109.

R15 receptors which are predicted to go out of compliance in year 1 of operation. Should a property require resettlement, a corrective action plan will be prepared for the Project LARP or similar instrument to take into account any properties that may choose expropriation.

855. Planning Zones and Noise – It is possible that the population of the villages through which the Project road passes will expand in the future as growth in Georgia continues. If the population of the villages does increase homes could be constructed in areas where noise levels will increase above IFC standards for daytime and nightime noise as a result of increased traffic on the new road. WHO indicate that noise levels above 55 dBA for the daytime and 45 dBA for the nightime can lead to negative health impacts [26] and as such constructing residential properties in areas with high noise levels could have a detrimental impact on people's wellbeing.

856. It is therefore considered prudent for the GoG to develop planning restrictions for residential buildings and other sensitive receptors where elevated noise currently exists, or is anticipated due to traffic noise.

857. The noise model has identified areas where noise levels are likely to be above the 45 / 55 dBA limits in 2037, but the model does not show the year that the limits will be reached. Discussions have been held with the RD regarding the issue of planning restrictions based on road noise, however, the RD do not have any experience of implementing such measures on other road Projects and no mechanism exists within the GoG planning framework to implement such measures.

858. Other countries, such as the UK have prepared guidelines which direct the planning process. Specifically, the UKs Planning Policy Guideline Note 24 – Planning and Noise, provides noise exposure categories for new dwellings. Four categories are provided in the guidelines:

- Category A - Noise need not be considered as a determining factor in granting planning permission, although the noise level at the high end of the category should not be regarded as a desirable level. Nightime noise not exceeding 45 dBA, daytime noise not exceeding 55 dBA.
- Category B - Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection against noise. Nightime noise between 45-57 dBA, daytime noise between 55-63 dBA.
- Category C - Planning permission should not normally be granted. Where it is considered that permission should be given, for example because there are no alternative quieter sites available, conditions should be imposed to ensure a commensurate level of protection against noise. Nightime noise between 57-66 dBA, daytime noise between 63-72 dBA.
- Category D - Planning permission should normally be refused. Nightime noise greater that 72 dBA, daytime noise greater than 66 dBA.

859. As an example, if in the future a development of houses was planned close to the Project road in Khunevi it is possible that the development would fall within Category B. This would mean that the RD would need to consider potential noise mitigation measures on the road in this location or that planning restrictions would be placed on the development, e.g. ensuring that non-sensitive land uses, such as garages, are placed closer to the noise source to act as a noise barrier.

860. Similar planning guidelines could be prepared for Georgia and would help limit potential future health impacts arising from road Projects across the country. It is therefore recommended that the RD coordinates with the MRDI to establish a set of planning guidelines for noise that can be applied during the operational phase of the Project.

[26] Guidelines for Community Noise, WHO.

Residual Impact Significance
<u>Construction Phase</u> – ***MINOR*** *Despite the fact that comprehensive mitigation measures have been set to manage construction noise there may still be instances where construction works may result in unanticipated elevated noise levels. However, these will only be temporary and localized. Good oversight from the Contractors HSE team and the Engineers environmental manager should limit the impact of these types of incidents.* *<u>Operational Phase</u>* – ***MEDIUM*** Residual impacts will be negligible for all of the identified receptors if the noise barriers are constructed. For the remaining 13 receptors monitoring will be conducted during operation and where IFC noise limits are exceeded, the property owners will be expropriated. However, some property owners may choose to remain in their homes. These properties may be subject to elevated noise levels above IFC limits in the future, and for these receptors residual impacts will remain throughout the lifecycle of the Project. It is noted that the number of potentially affected receptors is only a very small percentage of the overall population within the Project area.

G.9 Induced and Cumulative Impacts

861. As noted above, induced impacts are not anticipated to be significant in this 12km section of road. The cumulative impacts of the Project relate mainly to the combined effect of F2, F3 and F4 which will be constructed more or less simultaneously. It is also noted that construction will soon begin on Section F1 (Rikoti Tunnel to Khevi) and has already started on Section F0 (before Rikoti Tunnel).

862. The key cumulative impacts identified are:

(i) Construction Traffic – Most construction vehicles will be operating within their specific section (and even the Contractors individual ‘Lot’), however, there will also be numerous daily vehicle movements across all three sections for the delivery of materials and the movement of spoil material to Kutaisi bypass. These combined vehicle movements will have impacts to noise and air quality along the road, in addition to the potential safety aspects that come with the movement of as many as 1,000 construction vehicles per day along the combined F2, F3 and F4 section. This is especially significant around Zestaphoni as vehicles delivering spoil to Kutaisi from the project areas will need to pass directly through the town on the existing road, which is already overloaded during the summer period and during peak hours in the morning and evening.

(ii) Construction Camps – There are, potentially six construction ‘Lots’ for the all three sections. This means that there could be six different contractors as well as at least three supervision engineers. Each one will need their own construction camps and offices. As noted above, the valley is rather constrained in terms of land availability and six construction camps could place a strain on the local population and the ecology of the area.

863. The mitigation measures proposed are as follows:

(i) Construction Traffic – The RD shall coordinate with the Contractors and supervision engineers of all Lots to ensure that traffic management plans are aligned and to coordinate traffic movements through urban areas, specifically Zestaphoni. Ideally, the RD should consider one supervision engineer in order to help coordinate Contractors activities.

(ii) Construction Camps – Efforts should be made by the RD to coordinate with all Contractors to ensure that facilities and camps are located along the alignment in such a way to minimize impacts to local communities and biodiversity. That means, for example, avoiding placing multiple camps close to villages and sharing of resources, such as asphalt plants and concrete batching plants.

Residual Impact Significance

<u>*Construction Phase*</u> – ***MINOR***

Successful coordination of the Contractors traffic management plans and siting of construction camps should mitigate the cumulative impacts. However, strong oversight from the RD and their environmental specialists to ensure that the coordination between Contractors is achieved.

<u>*Operational Phase*</u> – ***None anticipated***

G.10 Compliance Impacts

864. In addition to the impacts associated with the construction and operation phases of the project several compliance impacts have also been identified as follows:

(i) Lack of Environmental Clauses in Contracts – The EIA is an environmental statement prepared by the RD. While it is prepared by the EIA consultant the EIA defines the commitment by the GoG through the proponent and its contractors and consultants, to implement the mitigation and monitoring actions listed in the EIA. For the measures proposed in the EIA's EMP to be taken seriously, they must become legally binding through inclusion as environmental clauses in the loan agreement between the GoG and ADB as well as the specifications in the contract-bid documents. This will be achieved by integrating the EMP into the contract specifications as a clause and using the EMP to prepare the SEMP defining specific steps to be taken by the contractors and the government during the project construction phase. References to the EMP will be made in the loan agreement between the GoG and ADB. It will be the Engineers responsibility to review the environmental mitigation and monitoring activities undertaken by the Contractor, with payments made only after verification that each work component has been completed as prescribed.

(ii) Lack of Construction Compliance Inspection Services and Environmental Training – While the EMP and the environmental covenants can be very clear and specific, if there is no one knowledgeable to undertake compliance monitoring, inspection and regular reporting, little of the EMP will be implemented or completed. The Engineer, through his National Environmental Specialist (NES) and International Environmental Specialist (IES), will ensure that compliance inspections are undertaken on a regular basis. In addition, the Engineers IES will also provide training to the Contractor and his Environmental Officer in the correct implementation of the SEMPs prior to the commencement of works.

(iii) Lack of Permits / Approvals – The Contractor must obtain a number of permits and licenses in order to comply with national environmental regulations. Any delay in obtaining these approvals, for example the EIA for the spoil disposal area, could delay the works schedule.

H. Environmental Management Plans and Institutional Requirements

H.1 Introduction

865. The EMP herewith provides the overall Project environmental management framework. It provides summary information of the types of impacts, which are described in detail in **Section F**. It also provides detailed information about the required mitigation and monitoring measures, their implementation arrangements reporting requirements. In addition, the approximate costs of the EMP are outlined.

H.2 Environmental Management Plan

866. Table 95, Table 96 and Table 97 provides the environmental mitigation and observational monitoring for the Project during the pre-construction, construction and operational phases of the Project respectively.

H.3 Instrumental Monitoring Plan

867. Regular monitoring of air quality, water quality and noise levels against Georgian and IFC standards shall be carried out throughout the construction and commissioning periods. The party responsible for monitoring will be the Engineer who will report the results monthly to the RD. The reports shall clearly indicate the monitoring dates, times, locations, weather conditions, types of equipment used and calibration information.

868. Table 98 provides the monitoring actions required during the construction phase of the Project.

Table 95: Environmental Management Plan - Detailed Design / Pre-construction Phase

Subject	Potential Impact / Issue	Mitigation Measure	Responsibilities	Monitoring
Air Quality	Construction impacts	Preparation of an Air Quality Plan (AQP) which shall include the locations of haul routes and the items specified under **Section G.5.1** of this EIA.	Contractor to prepare AQP	Engineer to review and approve AQP.
	Air quality impacts from stationary sources	• Locations for concrete batching plants require approval from the Engineer and MoEPA and all necessary permits. • All of the above facilities will also have the appropriate GoG permits and licenses. • No batching plant shall be located within 500 meters of any urban area or sensitive receptor.	Contractor to select sites.	Engineer and MoEPA to approve sites.
Climate Change	Impacts to Bridges and Surface Water Management Structures	Ensure the items outlined in **Table G-14: Climate Change Recommendations and Responses** are included in the "Recommendation for the management of the highway" document.	Detailed Design Consultant	N/A
Soils	Loss of Agricultural Soils	Before the commencement of the construction works of the Project at any road, the RD must prepare the Land Acquisition and Resettlement Plan (the LARP), obtain the approval of ADB and then implement the plan and acquire the land.	• RD to prepare the LARP. • RD to implement the Plan.	ADB to approve the LARP.
	Soil Erosion	Measures to control erosion will be outlined in the Contractors Clearance, Re-vegetation and Restoration Management Plan.	Contractor to prepare plan.	Engineer to review and approve plan.
	Spills and Leaks of Liquids	Develop a spills response plan, including a spill log for all spills over 1 liter.	Contractor to prepare plan.	Engineer to review and approve plan.
Hydrology	Bridge Construction	Preparation of a Bridge Construction Plan prior to the starting of works at any bridge construction site. The Plan shall include items relating to the construction schedule, construction techniques, work areas, equipment use, siting of hazardous liquids and waste materials, provision of coffer dams, fish spawning periods, results of any other fauna surveys, e.g. for otters, procedures for fueling of vehicles, sediment management, methods to reduce turbidity, OHS measures, etc. The Plan shall also contain a specific Spill	Contractor to prepare the Plan.	Engineer to review and approve plan.

Subject	Potential Impact / Issue	Mitigation Measure	Responsibilities	Monitoring
		Response Procedure relating to the management and clear up of spills in these areas.		
		• All new bridges shall be designed for the life expectancy of 100 years. • A design discharge of 100 years return period is considered for bridges. • Bridge designs will ensure that drainage from bridge decks over 50 meters does not discharge directly to the watercourses beneath the bridges. • The bridge run-off waters shall lead to an interceptor tank, or filter pond adjacent to the bridge in order to trap oil and grease run-off and prevent pollution of surface water courses. • The bridges shall be designed with dry paths under the bridge on either side of the streams to facilitate movements of people, livestock and wildlife. • The bridge design and layout must be aesthetically pleasing and in harmony with the existing environment.	Detailed Design Consultant	Engineer to review design documents prior to the start of construction.
		Confirm the fish spawning period in relation to the bridge construction works to ensure that all works are undertaken in periods least likely to affect the fish spawning period. Figure 85: Active Spawning Periods indicates this period is May to July.	• Contractor to consult with MoEPA regarding fish spawning periods. • Contractor to inform Engineer of any periods of construction restriction based on the consultations with MoEPA.	N/A
	Culverts	A design discharge of 50 years return period is considered for culverts.	DD Consultants	Engineer to review design documents prior to the start of construction.
	Drainage	Include the use of oil separators within the road drainage system to capture any spills of oil / fuel	DD Consultants	N/A

Subject	Potential Impact / Issue	Mitigation Measure	Responsibilities	Monitoring
		and also to filter hydrocarbon run-off from the road in general.		
	Tunneling	Contractor shall develop a ground water management plan for each tunnel under which shall be submitted for approval by the Engineer at least four weeks prior to the start of tunnelling works.	Contractor to prepare plan.	Engineer to review and approve plan.
	Siting of facilities	• No construction camp, permanent or temporary, shall be located within 500 meters of any river, or irrigation channel (not including drainage channels) including the Dzirula, Rikotula and Dumala rivers. • Contractor to prepare Camp Management Plan including the hydrology management measures outlined in **Section G.7.4** of this EIA.	• Contractor to select sites. • Contractor to prepare plans.	• Engineer and MoEPA to approve sites. • Engineer to approve plans prior to the start of construction.
Flora & Fauna	Land clearance	• The Contractor shall prepare a Clearance, Re-vegetation and Restoration Management Plan for prior approval by the Engineer. The Clearance Plan shall be followed strictly by the contractor. Areas to be cleared should be minimized as much as possible. • As part of this plan prepare a Biodiversity Action Plan (BAP) for the restoration of habitat that will be cleared prior to the start of construction. The plan shall be prepared by qualified biodiversity specialists. A template for the BAP is provided by **Appendix S**. • The plan shall include restoration of the existing site, re-planting of the spoil disposal site and re-planting at any other locations requested by MoEPA. • The total area to be restored / re-planted shall be 33 hectares as per Table 69: Habitat to be Restored, Reinstated or Replanted. • 120,000 seedlings (2-3 y/o), 20,000 seedlings (5-6 y/o) and 200 GEO Red-list seedlings (5-6 y/o) shall be replanted to achieve no net loss	• Contractor to prepare and implement Plan. • Biodiversity specialists to prepare habitat restoration plan. • Contractor to consult with MoEPA regarding habitat restoration locations. • Contractor to survey trees for vulnerable species.	• Engineer to review and approve plan.

Subject	Potential Impact / Issue	Mitigation Measure	Responsibilities	Monitoring
		of habitat. • Prior to the commencement of works the Contractor shall stake the boundary of the entire site, including intersections and areas under bridges. The Contractor will then undertake a survey of all trees within 5 meters of the boundary of the staked site and identify if any Georgian red-list species are located within this zone. This survey will form part of the Contractors Clearance, Re-vegetation and Restoration Management Plan. • All temporary construction facilities should be located on already heavily disturbed ground where secondary forest growth has not yet become well-established.		
	Tree cutting	The LARP shall contain the compensation methods and payments for loss of trees on private land.	• RD to prepare the LARP. • RD to implement the Plan.	ADB to approve the LARP.
	State Forest Fund	Prior to cutting trees in the identified State Forest Fund areas, it is required to obtain permit (Decree of the Government of Georgia on the "exclusion of certain areas from the State Forest Fund"), also known as 'delisting' the trees from the State Forest Fund and for compensation payments to be made.	• RD to obtain permit and submit to Engineer for review. • RD to make compensation payments.	Engineer to review permit.
	Impacts to Protected Areas	No haul route will pass through a protected area.	Contractor to implement mitigation.	Engineer to approve Traffic Management Plans.
Fauna	Impacts to Otter habitat	Prior to the start of construction in river beds, or close to river embankments (within 10 meters), the Contractor shall undertake a site survey (using a local ecologist) to ensure that there are no otter holts in these areas. If holts are found in these areas the Contractor will prepare a method statement for the management of these areas	• Contractor to perform site surveys with qualified specialists. • Contractor to prepare method statements for any affected areas.	Engineer to review and approve method statements.

Subject	Potential Impact / Issue	Mitigation Measure	Responsibilities	Monitoring
		which will be sent to the Engineer for review and approval.		
	General impacts to fauna	Prior to the clearing of vegetation at any site (and prior to works in in existing tunnels and at bridge sites) the Contractor will undertake site surveys of the area to be cleared using national biodiversity specialists.	Contractor to undertake site surveys using qualified specialists.	N/A
Land Use	Loss of land and Property	Before the commencement of the construction works of the Project at any road, the RD must prepare the Land Acquisition and Resettlement Plan (the LARP), obtain the approval of ADB and then implement the plan and acquire the land. The LARP, by way of a corrective action plan, will include any of the potential 14 properties that may choose expropriation due to high noise levels.	• RD to prepare the LARP and any required corrective action plan. • RD to implement the Plan / corrective action plan.	ADB to approve the LARP / corrective action plan.
Transportation and Utilities	Damage to roads	Prior to the commencement of works a road condition survey will be undertaken to record the condition of access roads to asphalt plants, camps, etc.	• Engineer to complete road condition survey. • Contractor to review and agree to the findings of the road condition survey.	N/A
	Traffic management	Preparation of a traffic management plan as part of the SEMP. Special attention should be given in the TMP to the Public School of Verkvichchala, Public school of village Vashlevi and the Khunevi School, including speed restrictions for construction traffic outside the schools (50 kph). Drivers operating in these areas will be given specific instruction and toolbox training sessions reminding them not to exceed this speed limit in these areas. In addition, School Safety Sessions will be completed by the Contractors H&S team and community liaison on 6-month basis throughout construction and an initial session prior to start of works to provide road safety awareness to children. During these	Contractor to prepare plan.	Engineer to review and approve plan.

Subject	Potential Impact / Issue	Mitigation Measure	Responsibilities	Monitoring
		sessions the school children shall also be provided with reflective badges to fit to clothing or school bags.		
Construction Camps	Selection of Construction Camp Site	• Screening of camp site location to determine significant environmental and social impacts during site selection. • Preparation of a Construction Camp Site Plan. • Preparation of a Spills Response Plan. • Construction camps shall not be located within one kilometer of an urban area and at least 50 meters from any surface water course and not within 2 kilometers of a protected area. • Coordinate all construction camp activities with neighboring land uses.	Contractor to screen site and provide screening report to the Engineer and RD.	• Engineer and RD to approve camp locations. • Engineer to review & approve Plans.
Occupational Health and Safety	Worker Health and Safety	• Prepare an Occupational Health and Safety Plan (OHS Plan), including the items specified by **Section G.8.3** of this EIA. A template for an OHS plan is provided by **Appendix R**. • Ensure that sub-contractors are provided with copies of the SEMP and that they adhere to the content of the SEMP.	• Contractor to prepare OHS Plan. • Contractor to provide copies of the SEMP to sub-contractors prior to their access to the site.	Engineer to review and approve OHS Plan.
	Traffic Safety	Submit a Traffic Management Plan (TMP) to local traffic authorities prior to mobilization.	Contractor to prepare TMP.	Engineer to approve TMP.
Emergency Response	Fires, explosions, earthquake, etc.	Preparation of an Emergency Response Plan (ERP).	Contractor to prepare ERP.	Engineer to review and approve ERP.
Waste Management	Management of waste materials	• Preparation of a waste management plan, including measures to re-use and recycle wastes and measures to dispose of hazardous waste. • Preparation of a construction camp management plan to manage liquid wastes.	Contractor to prepare Plans.	Engineer to review and approve Plans.
	Tunnel and Embankment Spoil	• Assessment of the spoil disposal locations using the format specified in **Appendix O**. • Agreements with MoEPA and Municipality for the spoil locations.	• Contractor to prepare spoil assessment. • Contractor to coordinate with MoEPA and	• MoEPA to approve EIA. • RD and Engineer to review and

Subject	Potential Impact / Issue	Mitigation Measure	Responsibilities	Monitoring
		• Preparation of an EIA for the spoil disposal site. • Preparation of a Spoil Re-use and Disposal Plan according to **Section G.7.3**.	Municipality • Contractor to prepare EIA. • Contractor to prepare plan.	approve the plan.
PCR	Chance Finds	The Contractor shall prepare a chance find procedure in line with the requirements of the GoG. **Appendix E** provides a sample procedure.	Contractor to prepare Plans.	Engineer to review and approve Plans.
Noise	Noise Barriers	Include areas for the installation of the identified noise barriers in the Project detailed design.	Detailed Design Consultant	N/A
Vibration	Construction vibration	The Contractor will develop a detailed Tunnel Blasting Plan (TBP) as part of the overall construction schedule. The plan shall include surveys of potentially affected properties provided by the Engineer. The surveys will cover the following aspects: • Overall condition of the structures, both exterior and interior. • Documentation of defects observed in the structure using digital imagery along with notes, measurements and sketches. • Documentation of pre-existing cracks using digital imagery along with notes, measurements and sketches. Where cracks are identified in a building tape shall put across them so that if the crack widens the tape will snap. The tape can be stamped and a date put on so it cannot be tampered with. • The findings of the survey shall be agreed upon by the property owner who shall be in attendance during the survey and will sign official documentation agreeing to the findings of the survey.	• Contractor to prepare Plans • Engineer to undertake surveys.	Engineer to review and approve Plans.
SEMP Requirement	Preparation of SEMP	Prepare SEMP.	Contractor to prepare SEMP.	Engineer to review and approve SEMP.

Subject	Potential Impact / Issue	Mitigation Measure	Responsibilities	Monitoring
	Incorporation of Items into Bid Documents	A specific environmental and social section shall be included within the main Bid Documents indicating that the Contractor shall be responsible for conforming with the requirements of this EMP.	RD to ensure EMP is included within Bid Documents.	N/A
Project Awareness	Stakeholder Awareness	Prior to start of site works residents, business representatives in the project area, local authorities and other stakeholders, including NGOs, who are likely to be affected by the project or are interested in the project) shall be informed on the construction schedule and activities, potential environmental impacts and mitigation measures through public meetings at each affected community.	RD to undertake public meetings.	N/A
	GRM	Prior to start of site works, the Contractor shall: • Communicate the GRM to communities in the project impact zone. • Set-up and publicize a 24-hour hotline for complaints. • Ensure that names and contact numbers of representatives of GRCE and the Contractor are placed on the notice boards outside the construction site.	Contractor	N/A

Table 96: Environmental Management Plan - Construction Phase

Subject	Potential Impact / Issue	Mitigation Measure	Responsibilities	Monitoring	Monitoring Responsibility & Schedule
Air Quality	Open burning of waste materials	No burning of debris or other materials will occur at any camp or construction site.	Contractor to implement mitigation.	Engineers NES	Daily site inspections, throughout construction period.
	Rock-crushing plant	• Rock crushing plant equipment shall be fitted with water sprinklers that will run continuously while the plant is operational. • If the sprinklers stop working, the plant shall also cease operation until the sprinklers are functioning.	• Contractor to implement mitigation. • Engineer to routinely monitor	Engineers NES	Daily site inspections, throughout construction period.

Subject	Potential Impact / Issue	Mitigation Measure	Responsibilities	Monitoring	Monitoring Responsibility & Schedule
		• Water run-off from the sprinkler system shall not discharge directly to surface water courses without first passing through a silt trap or any other suitable device to prevent siltation of surface waters.	Contractors activities.		
	Exhaust emissions from the operation of construction machinery	• No furnaces, boilers or other similar plant or equipment using any fuel that may produce air pollutants will be installed without prior written consent of the Engineer. • Construction equipment will be maintained to a good standard and fitted with pollution control devices regularly monitored by the Contractor and Engineer.	• Contractor to implement mitigation. • Engineer to routinely monitor Contractors activities.	Engineers NES	Daily site inspections, throughout construction period.
	Emissions from Construction vehicles.	• Emissions from on-road and off-road vehicles should comply with national or regional programs. In the absence of these, the following should be considered: • Regardless of the size or type of vehicle, owners / operators should implement the manufacturer recommended engine maintenance programs. • Drivers should be instructed on a routine basis by the Contractors EM on the benefits of driving practices that reduced both the risk of accidents and fuel consumption, including measured acceleration and driving within safe speed limits. • Implement a regular vehicle maintenance and repair program.	• Contractor to implement mitigation. • Engineer to routinely monitor Contractors activities including vehicle maintenance records.	Engineers NES	• Daily site inspections, throughout construction period. • Annual inspection of vehicle maintenance records.
	Fugitive emissions.	• Conveyor belts (e.g. at batching plants and rock crushing plants) shall be fitted with wind-boards, and conveyor transfer points and hopper discharge areas shall be enclosed to minimize dust emission. • All trucks used for transporting materials to and from the site will be covered with canvas tarpaulins. • Carry out watering for dust control at least 3 times a day: in the morning, at noon, and in the afternoon during dry weather with temperatures of over 25C, or in windy weather. Avoid overwatering as this may make the surrounding muddy. • Earthwork operation to be suspended when the wind speed exceeds 20 km/h in areas within 500 m of any community.	• Contractor to implement mitigation. • Engineer to routinely monitor Contractors activities.	Engineers NES	Daily site inspections, throughout construction period.
Soils Erosion and Soil Contamination	Contamination of Soils	• All fuel and chemical storage will be sited on an impervious base within a bund and secured by fencing. • The storage area will be located away from any watercourse or wetlands.	• Contractor to implement mitigation.	Engineers NES	Daily site inspections, throughout

Subject	Potential Impact / Issue	Mitigation Measure	Responsibilities	Monitoring	Monitoring Responsibility & Schedule
		• The base and bund walls will be impermeable and of sufficient capacity to contain 110% of the volume of tank (or one tank if more than one tank is located in the bund). • The construction camp maintenance yard will be constructed on impervious hardstanding with adequate drainage to collect spills (including oil interceptor tanks), there will be no vehicle maintenance activities on open ground. • Filling and refueling will be strictly controlled and subject to formal procedures. • Drip pans will be placed under all filling and fueling areas. Waste oils will be stored and disposed of by a licensed contractor. • All valves and trigger guns will be resistant to unauthorized interference and vandalism and be turned off and securely locked when not in use. • The contents of any tank or drum will be clearly marked. Measures will be taken to ensure that no contaminated discharges enter any soils. • No bitumen drums or containers, full or used, will be stored on open ground. They will only be stored on impervious hardstanding. • Areas using bitumen will be constructed on impervious hardstanding to prevent seepage of oils into the soils. • No bitumen drums or containers, full or used, will be stored on open ground. They will only be stored on impervious hard standing. • Areas using bitumen will be constructed on impervious hard standing to prevent seepage of oils into the soils.	• Engineer to review and approve bunding prior to the start of construction. • Engineer to review and approve vehicle fueling area prior to the start of construction.		construction period.
	Loss of topsoil	• Locate topsoil stockpiles outside drainage lines and protect stockpiles from erosion. • Construct diversion channels and silt fences around the topsoil stockpiles to prevent erosion and loss of topsoil. • Rip ground surface prior to the spreading of topsoil. • Remove unwanted materials from topsoil such as roots of trees, rubble and waste etc. • Specifically regarding soil compaction, the Contractor will confine operation of heavy equipment within the RoW, as much as possible, to avoid soil compaction and damage to privately owned land.	Contractor to implement mitigation.	Engineers NES	Daily site inspections, throughout construction period.

Subject	Potential Impact / Issue	Mitigation Measure	Responsibilities	Monitoring	Monitoring Responsibility & Schedule
		• If in case private lands are disturbed, the contractor should promptly inform the owner and agree on the ways to remedy the situation.			
	Soil Erosion	• Material that is less susceptible to erosion will be selected for placement around bridges and culverts. • Re-vegetation of exposed areas including; (i) selection of fast growing and grazing resistant species of local flora; (ii) immediate re-vegetation of all slopes and embankments if not covered with gabion baskets; (iii) placement of fiber mats to encourage vegetation growth. • The Engineer and the Contractor will both be responsible for ensuring that embankments are monitored continuously during construction for signs of erosion.	Contractor to implement mitigation.	Engineers NES	Daily site inspections, throughout construction period.
Hydrology	Ground and surface water pollution.	• Implementation of the specific mitigation measures outlined under **Construction Camps**, below and **Soil Contamination** above. • Provide portable toilet facilities for workers at road work sites.	Contractor to implement mitigation.	Engineers NES	Daily site inspections, throughout construction period.
	Groundwater depletion	• Routine monitoring of groundwater levels in groundwater wells in the Project area will be undertaken on a weekly basis by the Contractor within the vicinity of each tunnel he is excavating, in line with his groundwater management plan. The monitoring shall continue for a two month period after the tunnel is sealed. If drawdown levels in wells are significant the Contractor will provide a temporary source of potable water to the affected persons until the groundwater levels are recharged. • Monitoring shall continue for a two month period after the completion of the tunnels. If the wells fail to re-charge, new boreholes will be constructed for affected persons.	Contractor to implement mitigation	Engineers NES	Weekly review of groundwater monitoring reports.
	Bridges	The Contractor will: • Provide spill kits in worksites around rivers. • Ensure no vehicle refueling occurs within 50 meters of any surface water course. • Divert the water flow near the bridge piers. • Provide coffer dams, silt fences, sediment barriers or other devices to prevent migration of silt during construction within streams. • Perform dewatering and cleaning of cofferdams to prevent siltation by pumping from cofferdams to a settling basin or a containment unit.	Contractor to consult with MoEPA and provide copies of letters confirming construction periods to the Engineer.	Engineers NES	Routine monitoring of bridge works to ensure they are in compliance with MoEPA guidelines.

Subject	Potential Impact / Issue	Mitigation Measure	Responsibilities	Monitoring	Monitoring Responsibility & Schedule
		• Carry out bridge construction works without interrupting the traffic on the existing road with the provision of suitable diversions. • Ensure no waste materials are dumped in the river, including re-enforced concrete debris. • Place generators more than 20 meters from the river. • Ensure that no concrete waste from concrete mixers is dumped in the river. • Provide areas where concrete mixers can wash out leftover concrete without polluting the environment. This may be in the form of a lined settling pond at each bridge site. Drivers will be informed of these locations and the requirements to use these settling ponds on a routine basis by the Engineer. Dried waste from the settling ponds can be used as backfill for culverts, etc. • Carefully collect all polystyrene (from expansion joints) so that it does not litter the local environment. • Ensure that no hazardous liquids are placed within 10 meters of the river. • Provide portable toilets at bridge construction sites to prevent defecation by workers into the river. • Ensure that workers are provided with correct PPE including harnesses. • During piling works ensure that pumped water is filtered through a silt trap before being discharged to the river. • In addition, the Contractor, through his Environmental Manager, will be responsible for consulting with MoEPA to establish the fish spawning period in relation to the bridge construction works to ensure that all works are undertaken in periods least likely to affect the fish spawning period.			
	Drainage and Flooding	• During the construction phase the Contractor will be required to construct, maintain, remove and reinstate as necessary temporary drainage works and take all other precautions necessary for the avoidance of damage to properties and land by flooding and silt washed down from the works. • Arrange with the village representatives those works which might interfere with the flow of irrigation waters to be carried out at such times as will cause the least disturbance to irrigation operations.	Contractor to implement mitigation.	Engineers NES	Monitor drainage channels on a weekly basis.

Subject	Potential Impact / Issue	Mitigation Measure	Responsibilities	Monitoring	Monitoring Responsibility & Schedule
		• Should any operation being performed by the Contractor interrupt existing irrigation facilities, the Contractors will restore the irrigation appurtenances to their original working conditions within 24 hours of being notified of the interruption. • The Contractor will also be responsible for ensuring that no construction materials or construction waste block existing drainage channels within the Project corridor.			
	Dewatering of tunnels	The Contractor will pass all drainage water from the tunnel through a settlement tank. Weekly monitoring of the water quality from the tank will be undertaken by the Contractor to assess for any pollution. If the drainage water meets drinking water standards it can be considered for re-use in any potentially depleted wells during the construction phase.	• Contractor to implement mitigation. • Engineer to review and approve settlement tank locations and designs.	Engineers NES	• Review of weekly water monitoring results. • Weekly inspection of settlement tanks.
	Water Supply & Discharge	Only legally permitted water resources shall be used for technical water supply, including rivers. All permits and licenses for water supply and discharge will be obtained prior to use.	• Contractor to implement mitigation. • Engineer to review all water extraction / discharge permits.	Engineers NES	• Weekly inspections, throughout construction period. • Annual review of permits.
Flora	Tree cutting	• Trees cleared from private land plots will be compensated in accordance with the Land Acquisition and Resettlement Plan (LARP). • Tree cutting shall not occur during bird nesting seasons (End of March - May)	GoG to implement the LARP.	According to the LARP	According to the LARP
	State Forest Fund	• The Contractor will be provided with plans indicating the areas of State Forest Fund. • Tree-cutting works in the State Forest Fund areas shall be implemented under the supervision of specialists of the National Forestry Agency. • Contractor to remove the trees to a location specified by the National Forest Agency.	• RD to provide plans to Contractor. • Contractor to undertake tree cutting. • Contractor to remove trees.	National Forestry Agency	None

Subject	Potential Impact / Issue	Mitigation Measure	Responsibilities	Monitoring	Monitoring Responsibility & Schedule
	Habitat Restoration	• Follow the action plan for habitat restoration prepared prior to construction. • Plant maintenance will be carried out for at least two years. • Monthly monitoring of the re-planted areas and report on the success rate of the re-planted trees, which should be above 80%. • If the success rate falls below 80% re-plant on a 1:1 basis to compensate for losses.	• Contractor to implement action plan • Contractor to purchase, plant and maintain the seedlings. • Contractor to plant additional seedlings if success rate not met.	• Engineer to monitor success rate (NFA to determine success rate criteria).	Monthly monitoring of success rate.
	Protection of Vulnerable Species	The Contractor will place protective wood fencing around the any Georgian red-list species identified within 5 meters of the site boundary in the pre-construction survey in order to protect the tree during construction works, including its root zones.	Contractor to implement mitigation.	Engineers NES	Daily site inspections, throughout construction period.
	Vegetation clearance	• No chemicals shall be used to clear vegetation.	Contractor to implement mitigation.	Engineers NES	Daily site inspections, throughout construction period.
Fauna	Otters	• Implement method statements for otter protection. • If live otters are encountered Contractor is to cease work and contact the ecologist who will then liaise with the appropriate regulatory officers to discuss the encounter and how best to proceed from that point. • Ensure the measures outlined in Table 70 are followed.	Contractor to implement mitigation.	Engineers NES	Review of method statements. Daily inspections of Contractors works at the bridge sites.
	Other IUCN / GRL species	• Ensure the measures outlined in Table 70 are followed.	Contractor to implement mitigation.	Engineers NES	Daily site inspections, throughout construction period.
	Bats, Birds and Other non special status fauna.	• Ensure mitigation measures outlined in **Section G.6.1 Flora and Fauna** are followed If bats and other fauna are found during pre-construction site surveys. • Ensure the measures outlined in Table 71 are followed.	Contractor to implement mitigation.	Engineers NES	Daily site inspections, throughout construction period.

Subject	Potential Impact / Issue	Mitigation Measure	Responsibilities	Monitoring	Monitoring Responsibility & Schedule
	Poaching	• Poaching of wildlife shall be strictly prohibited. • The Contractor will be responsible for providing training sessions to his workers relating to environmental protection (including the ban on poaching).	Contractor to implement mitigation.	N/A	N/A
Waste Management and Spoil	Recycling and re-use	• Where possible, surplus materials will be reused or recycled. • Used oil and grease shall be removed from site and sold to an approved used oil recycling company.	Contractor to implement mitigation.	Engineers NES	Monthly review of waste manifests to determine if wastes are being recycled.
	General Spoil Management	• Follow the Spoil Disposal Plan prepared for the Project, including restoration of the site according to the plan. • Under no circumstances shall the Contractor dump excess materials on private lands. • Excess spoil shall not be dumped or pushed into any river at any location. • Spoil re-use and disposal haul routes shall be included within the traffic management plan. • The Contractor will be responsible for upgrading and maintenance of any locals roads used for the transport of spoil materials. • Transport of spoil material from tunnels on local roads shall be prohibited between 10pm and 6am. • Routine spraying of haul routes during dry periods.	Contractor to implement mitigation.	Engineers NES	Daily site inspections, throughout construction period.
	Inert Solid & Liquid waste	• Provide refuse containers at each worksite. • Maintain all construction sites in a cleaner, tidy and safe condition. • Waste storage containers shall be covered, tip-proof, weatherproof and scavenger proof. • Train and instruct all personnel in waste management practices and procedures. • Collect and transport non-hazardous wastes to all approved disposal sites. • Keep copies of waste manifests on site. • Keep a record of waste on-site and waste removed.	• Contractor to implement mitigation and conduct training. • Engineer to approve any waste disposal site.	Engineers NES	Daily site inspections, throughout construction period. Regular review of Contractors training sessions.
	Asphalt and Concrete	• Waste asphalt will be recycled where possible for base material and shoulder material. • Unused or rejected tar or bituminous products shall be returned to the supplier's production plant.	• Contractor to implement any recommendations for re-use of asphalt.	Engineers NES	Daily site inspections, throughout construction period.

Subject	Potential Impact / Issue	Mitigation Measure	Responsibilities	Monitoring	Monitoring Responsibility & Schedule
		• Waste concrete shall be crushed and re-used as fill material, or base material where possible. • Under no circumstances should concrete mixers be washed out onto open ground at construction sites, such as bridges.	• Contractor to implement mitigation.		
	Hazardous Waste	• Storage of hazardous waste shall be in specific secure locations as identified by the waste management plan. • Hazardous liquids must be stored within impermeable bunds (the bund should be able to contain at least 110% of the volume of the largest storage tank within the bund). • Collect and temporarily store used hazardous waste separately in specialized containers and place in safe and fire-free areas with impermeable floors roofs, at a safe distance from fire sources and according to the requirements of their MSDS. • Training and suitable PPE will be provided to all personnel handling hazardous waste. • Disposal of waste materials shall be undertaken by a licensed waste management company. Keep copies of the companies licenses on record as well as the agreements with the company. • Keep records of the types and volumes of waste removed from the site on a weekly basis. • Keep copies of waste manifests.	• Contractor to implement mitigation. • Engineer to approve any waste disposal site. • Engineer to review waste manifests.	Engineers NES	Daily site inspections, throughout construction period. Monthly review of waste manifests.
Transport and Utilities	Transportation	The Contractor will: • Provide information to the public about the scope and schedule of construction activities and expected disruptions and access restrictions at least 24 hours before the disruptions; • Allow for adequate traffic flow around construction areas via diversions or temporary access roads; • If temporary access roads are to be constructed with a gravel surface they shall be routinely watered by the Contractor during dry weather to reduce dust impacts; and • Provide adequate traffic signs, appropriate lighting, well-designed traffic safety signs, barriers and flag persons for traffic control. • Access roads for batching plants, etc, will be maintained during the construction phase and rehabilitated at the end of construction.	Contractor to implement mitigation.	Engineers NES	Weekly inspections, throughout construction period.
	Utilities	• All utilities in the Project area shall be kept operational, particularly during the winter months.	Contractor to implement mitigation.	Engineers NES	Weekly inspections,

Subject	Potential Impact / Issue	Mitigation Measure	Responsibilities	Monitoring	Monitoring Responsibility & Schedule
		• The Contractor will be responsible for liaising with the relevant utilities operators to ensure all utilities remain operational. • Should utilities need relocating in a different location the Contractor will consult with the relevant utilities and local community to ensure that there is no change in supply as a result of these changes.			throughout construction period.
Asphalt Plants	Emissions & Noise	• Asphalt plants will be located downwind of urban areas and not within one kilometer of any urban area. • Adequate PPE will be provided to staff working in areas of high noise and emissions. • Storage and Use of Hazardous Materials (including bitumen): • Ensure all hazardous materials are stored (including within suitable sized bunds for liquids), handled and disposed of according to their Material Safety Data Sheet (MSDS). • Copies of MSDS will be kept on site with all hazardous materials. • The Contractor will keep a log of the type and volume of all hazardous wastes on site. • The Contractor will keep a plan of site indicating where all hazardous materials are stored.	Contractor to implement mitigation.	Engineers NES	Daily site inspections, throughout construction period. Monthly review of hazardous waste log.
	Vehicle Movement	The Contractor will include the asphalt plant in his Traffic Management Plan, including haul routes from the plant.	Contractor to implement mitigation.	Engineers NES	Daily site inspections, throughout construction period.
	Health and Safety	• To prevent bitumen burns it will be compulsory for the workers handling hot bitumen to wear full-body protection. • All transportation, handling and storage of bitumen will be handled safely by experienced personnel. • The dust from the manufacturing process may pose respiratory hazards, hence protective air mask will be provided to the operators for the loading and unloading of aggregates. • Ear-muffs will be provided those working on the plant. • First Aid kit will be available on site for the workers in case of emergency. • The Material and Data Sheet (MSDS) for each chemical product will be made accessible onsite and displayed.	Contractor to implement mitigation.	Engineers NES	Daily site inspections, throughout construction period.

Subject	Potential Impact / Issue	Mitigation Measure	Responsibilities	Monitoring	Monitoring Responsibility & Schedule
Construction Camps	Pollution and Emissions	• The Contractor will ensure that all of the following conditions are met: • Rain-water run-off arising on the site will be collected, removed from the site via a suitable and properly designed temporary drainage system and disposed of at a location and in a manner that will cause neither pollution nor nuisance. The drainage system will be fitted with oil and grease interceptors. • There will be no direct discharge of sanitary or wash water to surface water. • In the absence of functioning sewerage and sewage treatment facilities it is recommended that the Contractor provides his own on-site wastewater treatment facilities. For sites servicing a small number of employees (less than 150), septic tanks may be used. For larger sites, liquid wastes will as a minimum receive primary treatment in anaerobic tank or pond preceded by a bar screen to remove large solid objects (e.g. sticks, rags). • There will be no direct discharge of untreated sanitary or oily wastewater to surface water bodies. • Licensed contractors will be required to collect and disposal of liquid waste from the septic tanks on regular basis. • Disposal of materials such as, but not limited to, lubricating oil and onto the ground or water bodies will be prohibited. • Liquid material storage containment areas will not drain directly to surface water. • Waste water from vehicle washing bays will be free of pollutants if the wash bay has been constructed correctly. • Lubricating and fuel oil spills will be cleaned up immediately and spill cleanup materials will be maintained at the storage area. • Construction and work sites will be equipped with sanitary latrines that do not pollute surface waters and are connected to septic tanks, or waste water treatment facilities. • Discharge of sediment-laden construction water directly into surface watercourses will be forbidden. Sediment laden construction water will be discharged into settling lagoons or tanks prior to final discharge. • Washing out concrete trucks at construction sites will be prohibited unless specific concrete washout areas are	Contractor to implement mitigation.	Engineers NES	Daily site inspections, throughout construction period.

Subject	Potential Impact / Issue	Mitigation Measure	Responsibilities	Monitoring	Monitoring Responsibility & Schedule
		provided for this purpose at the construction site (e.g. a bridge site). The washouts will be impermeable and emptied when 75% full. • Spill cleanup equipment will be maintained on site (including at the site maintenance yard and vehicle fueling areas). The following conditions to avoid adverse impacts due to improper fuel and chemical storage: • Fueling operations will occur only within containment areas. • All fuel and chemical storage (if any) will be sited on an impervious base within a bund and secured by fencing. The storage area will be located away from any watercourse or wetlands. The base and bund walls will be impermeable and of sufficient capacity to contain 110% of the volume of tanks. • Filling and refueling will be strictly controlled and subject to formal procedures and will take place within areas surrounded by bunds to contain spills / leaks of potentially contaminating liquids. • All valves and trigger guns will be resistant to unauthorized interference and vandalism and be turned off and securely locked when not in use. • The contents of any tank or drum will be clearly marked. Measures will be taken to ensure that no contaminated discharges enter any drain or watercourses. • Disposal of lubricating oil and other potentially hazardous liquids onto the ground or water bodies will be prohibited. • Should any accidental spills occur immediate cleanup will be undertaken and all cleanup materials stored in a secure area for disposal to a site authorized to dispose of hazardous waste. • If determined warranted by the Engineer, the Contractor will provide a wash pit or a wheel washing and/or vehicle cleaning facility at the exits from the sites. • If so requested, the Contractor will ensure that all vehicles are properly cleaned (bodies and tires are free of sand and mud) prior to leaving the site areas. • The Contractor will provide necessary cleaning facilities on site and ensure that no water or debris from such cleaning operations is deposited off-site. • The Contractor will be responsible to maintain and cleanup campsites and respect the rights of local landowners.			

Subject	Potential Impact / Issue	Mitigation Measure	Responsibilities	Monitoring	Monitoring Responsibility & Schedule
Concrete Batching Plants	Pollution and Emissions from Concrete Batching Plants	• To limit impacts from dust, the following conditions will apply: – Batching plants will be located downwind of urban areas and not within one kilometer of any urban area. – The entire batching area traversed by vehicles – including driveways leading into and out of the area – will be paved with a hard, impervious material. – Sand and aggregates will be delivered in a dampened state, using covered trucks. If the materials have dried out during transit they will be re-wetted before being dumped into the storage bunker. – Sand and aggregates will be stored in a hopper or bunker which shields the materials from winds. The bunker should enclose the stockpile on three sides. The walls should extend one metre above the height of the maximum quantity of raw material kept on site, and extend two metres beyond the front of the stockpile. – The hopper or bunker will be fitted with water sprays which keep the stored material damp at all times. Monitor the water content of the stockpile to ensure it is maintained in a damp condition. – Overhead storage bins will be totally enclosed. The swivel chute area and transfer point from the conveyor will also be enclosed. – Rubber curtain seals may be needed to protect the opening of the overhead bin from winds. – Conveyor belts which are exposed to the wind and used for raw material transfer will be effectively enclosed, to ensure dust is not blown off the conveyor during transit. Conveyor transfer points and hopper discharge areas will be fully enclosed. – Conveyor belts will be fitted with belt cleaners on the return side of the belt. – Weigh hoppers at front end loader plants will be roofed and have weigh hoppers shrouded on three sides, to protect the contents from the wind. The raw materials transferred by the front end loader	Contractor to implement mitigation.	Engineers NES	Daily site inspections, throughout construction period.

Subject	Potential Impact / Issue	Mitigation Measure	Responsibilities	Monitoring	Monitoring Responsibility & Schedule
		should be damp, as they are taken from a dampened stockpile. – Store cement in sealed, dust-tight storage silos. All hatches, inspection points and duct work will be dust-tight. – Silos will be equipped with a high-level sensor alarm and an automatic delivery shut-down switch to prevent overfilling. – Cement dust emissions from the silo during filling operations must be minimised. The minimum acceptable performance is obtained using a fabric filter dust collector. – Totally enclose the cement weigh hopper, to ensure that dust cannot escape to the atmosphere. – An inspection of all dust control components will be performed routinely – for example, at least weekly. • All contaminated storm water and process wastewater will be collected and retained on site. • All sources of wastewater will be paved and bunded. The specific areas that will be paved and bunded include; the agitator washout area, the truck washing area, the concrete batching area, and any other area that may generate storm water contaminated with cement dust or residues. • Contaminated storm water and process wastewater will be captured and recycled by a system with the following specifications: – The system's storage capacity must be sufficient to store the runoff from the bunded areas generated by 20 mm of rain. – Water captured by the bunds will be diverted to a collection pit and then pumped to a storage tank for recycling. – An outlet (overflow drain) in the bund, one metre upstream of the collection pit, will divert excess rainwater from the bunded area when the pit fills due to heavy rain (more than 20 mm of rain over 24 hours). – Collection pits should contain a sloping sludge interceptor, to separate water and sediments. The			

Subject	Potential Impact / Issue	Mitigation Measure	Responsibilities	Monitoring	Monitoring Responsibility & Schedule
		sloping surface enables easy removal of sludge and sediments. – Wastewater will be pumped from the collection pit to a recycling tank. The pit will have a primary pump triggered by a float switch and a backup pump which automatically activates if the primary fails. – Wastewater stored in the recycling tank needs to be reused at the earliest possible opportunity.			
Community Health and Safety	Blasting	Blasting will be conducted using standard mining industry practices and procedures to ensure safety of personnel and equipment. This includes establishing a safety zone around the blast area, say to a distance of 500 m (actual distance will be established by the Contractor and approved by the Engineer based on the safety standards) and evacuating it.	Contractor to implement mitigation.	Engineers NES	Daily site inspections, throughout construction period.
		School Safety Sessions will be completed by the Contractors H&S team and community liaison on 6-month basis throughout construction and an initial session prior to start of works to provide road safety awareness to children. During these sessions the school children shall also be provided with reflective badges to fit to clothing or school bags.			
	HIV / AIDS	• Subcontract with an Approved Service Provider to provide an HIV Awareness Program to the Contractor's Personnel and the Local Community. • Repeat the HIV Awareness Program at intervals not exceeding four months	• Contractor to implement mitigation. • Service Provider to implement training. • Engineer to review program.	Engineers NES	Annual review of awareness program activities.
	Code of Conduct	The Contractor shall develop an induction program, including a Code of Conduct, for all workers directly related to the Project. A copy of the Code of Conduct is to be presented to all workers and signed by each worker.	Contractor to implement mitigation.	Engineers NES	Routine assessment of workers staff to determine if the code of conduct has been presented.
	Monthly Meetings	The Contractor will be responsible for holding monthly community meetings within the Project area throughout the construction period.	Contractor to implement mitigation.	Engineers NES	Engineers NES to attend all community meetings.

Subject	Potential Impact / Issue	Mitigation Measure	Responsibilities	Monitoring	Monitoring Responsibility & Schedule
Occupational Health and Safety	Worker Health & safety	• Initial Safety Induction Course: All workmen will be required to attend a safety induction course before they are allowed access to the Site. • Develop a Safety Training Program including training to recognize and respond to workplace chemical hazards. • Keep a log of both training records and safety incidents including near misses. • Safety Meetings conducted on a monthly basis. • Regularly inspect, test and maintain all safety equipment. • Equipment, which is damaged, dirty, incorrectly positioned or not in working order, shall be repaired or replaced immediately. • All construction plant and equipment used on or around the Site shall be fitted with appropriate safety devices. • A fully equipped first aid base shall be provided at the Construction Camp and Asphalt Plant. • Coordinate with local public health officials and shall reach a documented understanding with regard to the use of hospitals and other community facilities. • Workers will be provided (before they commence works) with of appropriate PPE suitable for electrical work such as safety boots, helmets, gloves, protective clothes, goggles, and ear protection at no cost to the workers. • Provide portable toilet facilities for workers at road work sites. • Provide fencing on all areas of excavation greater than 2 m deep. Install warning signs.	• Contractor to implement mitigation. • Engineer to review and approve training program.	Engineers NES	Daily site inspections, throughout construction period. Periodic attendance of training sessions to determine quality and numbers in attendance.
	Sub-contractor H&S	• All sub-contractors will be supplied with copies of the SEMP. Provisions to be incorporated into all sub-contracts to ensure the compliance with the SEMP. All sub-contractors will be required to appoint a safety representative who shall be available on the Site.	• Contractor to provide SEMP. • Sub-contractors to ensure compliance with SEMP	Engineers NES	Routinely monitor sub-contractors activities.
	Noise	Zones with noise level above 80 dBA must be marked with safety signs and appropriate PPE must be worn by workers.	Contractor to implement mitigation.	Engineers NES	Daily site inspections and monitoring (with smartphone technology) throughout

Subject	Potential Impact / Issue	Mitigation Measure	Responsibilities	Monitoring	Monitoring Responsibility & Schedule
					construction period.
PCR	Impacts to Cemetery	During the construction phase the northern boundary of the cemetery (KM8.6) shall be fenced off to ensure that there is no encroachment into this area by construction workers or equipment.	Contractor to implement mitigation.	Engineers NES	Weekly site inspections of the fencing.
	Church	During the construction phase works shall be schedule that no works occur within 250 meters of the Church on Sundays, or during religious holidays.	Contractor to implement mitigation.	Engineers NES	Weekly site inspections of the fencing.
	Impacts to Historical and archeological areas	In the event of any chance finds during the construction works procedures shall apply that are governed by GoG legislation and guidelines and as outlined in the Contractors Chance Find Procedure.	Contractor to implement mitigation.	Engineers NES	Daily site inspections throughout construction period.
Noise	Construction noise	• During the construction phase the Contractor will be responsible for the following: – Time and Activity Constraints, i.e., operations will be scheduled to coincide with periods when people would least likely be affected; work hours and work days will be limited to less noise-sensitive times. Hours-of-work will be approved by the Engineer having due regard for possible noise disturbance to the local residents or other activities. Construction activities will be strictly prohibited between 10 PM and 6 AM in the residential areas. When operating close to sensitive areas (within 250 meters) such as residential, nursery, or medical facilities, the Contractor's hours of working shall be limited to 8 AM to 6 PM. – Use temporary noise barriers while working in sensitive locations in case accidence of allowable limits is expected. Placing the barrier close to the source proves to be effective. – Give notice as early as possible to sensitive receptors for periods of noisier works such as excavation. Describe the activities and how long they are expected to take. Keep affected neighbours informed of progress. – Within normal working hours, where it is reasonable to do so: – schedule noisy activities for less sensitive times.	Contractor to implement mitigation.	Engineers NES	Daily site inspections throughout construction period.

Subject	Potential Impact / Issue	Mitigation Measure	Responsibilities	Monitoring	Monitoring Responsibility & Schedule
		– provide periods of respite from noisier works (for example, periodic breaks from jackhammer noise). – The weekend/evening periods are important for community rest and recreation and provide respite when noisy work has been conducted throughout the week. Accordingly, work should not usually be scheduled during these times. – All mechanical plant is to be silenced by the best practical means using current technology. Mechanical plant, including noise-suppression devices, should be maintained to the manufacturer's specifications. Internal combustion engines are to be fitted with a suitable muffler in good repair. – Maintenance tools, machines and equipment so that they are in good conditions. When some wrong is found, they must be fixed immediately in order to reduce noise from the equipment. – Fit all pneumatic tools with an effective silencer on their air exhaust port. – Install less noisy movement/reversing warning systems for equipment and vehicles that will operate for extended periods, during sensitive times or in close proximity to sensitive sites. Occupational health and safety requirements for use of warning systems must be followed. – Turn off plant when not being used. – All vehicular movements to and from the site to only occur during the scheduled normal working hours, unless approval has been granted by the Engineer. – Keep good conditions of trucks that use to transport construction materials so they cause no loud noise and control the truck speed, to be not exceeded 40 km/hr when driving through communities, and not exceeded 80 km/hr when driving on highways. – Where possible, no truck associated with the work should be left standing with its engine operating in a street adjacent to a residential area.			

Subject	Potential Impact / Issue	Mitigation Measure	Responsibilities	Monitoring	Monitoring Responsibility & Schedule
		– Provision of noise protection kits such as ear plug, earmuff, for workers who are working in the area with noise level is higher than 85 dB(A). It is designated as a regulation that workers must wear protection kits in case of working in a noisy area.			
	Noise barriers	Construction of the noise barriers specified in **Error! Reference source not found.** and according to any modifications made prior to construction.	Contractor to implement mitigation.	Engineers NES	Routine inspection of the noise barrier works.
	Planning Guidelines	Initiate dialogue with MRDI and other relevant government departments to develop planning guidelines for noise.	RD / MRDI	Engineer	Six monthly meetings with RD to determine status of dialogue and guidelines.
Vibration	Tunneling Vibration	The Contractor shall follow the procedures outlined in **Section F.8.7** of the EIA.	Contractor and Engineer to implement mitigation.	N/A	N/A
	Blasting	• No blasting will be carried out within 100 m of the portal of the tunnel. • Blasting will be scheduled during the day only. • Local communities will be informed of blasting timetable in advance and will be provided adequate notice of when blasts are required outside of the planned schedule.	Contractor and Engineer to implement mitigation.	Engineers NES	Routine inspections of blasting activities.
Land Use	Expropriation	Implement the LARP corrective action plan if any properties chose expropriation to mitigate noise impacts	RD to implement the plan	N/A	N/A

Table 97: Environmental Management Plan – Operational Phase

Subject	Potential Impact / Issue	Mitigation / Monitoring Measure	Responsibilities
Hydrology	Drainage issues	Monitor drainage along the road to ensure that it does result in increased run-off and flooding.	RD
	Groundwater depletion	If groundwater fails to re-charge to pre-construction levels alternative water supply will be provided to the affected parties.	Contractor during DFL period
Tree re-planting	Tree maintenance	If tree maintenance and habitat restoration extends beyond the construction and DFL period the RD shall engage an operator to continue maintenance of the trees / habitat area to complete the two-year maintenance period.	RD to contract a suitable operator.
Tunnels	Air quality	• Ensure continued maintenance of tunnel ventilation system.	RD

Subject	Potential Impact / Issue	Mitigation / Monitoring Measure	Responsibilities
Fauna	Impacts to animals	• Register and analyze road kills. Develop additional mitigation measures if found to be necessary. • During maintenance works strictly comply with wildlife/vegetation impact mitigation measures set for construction stage. • Prohibit poaching (ensure that tunnel operator staff is aware of the ban).	RD
Road Maintenance	Pollution of water	• Perform maintenance paving of the road sections and bridge decks only in dry weather to prevent runoff contamination. • Use staging techniques to reduce the spread of paving materials during the repair of potholes and worn pavement. These can include covering storm drain inlets and manholes during paving operations, using erosion and sediment controls to decrease runoff from repair sites, and using drip pans, absorbent materials and other pollution prevention materials to limit leaks of paving materials and fluids from paving machines. • Comply with mitigation measures defined for water protection during construction. • Remove all waste, material, machinery and tool from the area after completion of works. • Reinstate disturbed areas – if the case.	RD
	Asphalt	If low noise asphalt is used routine maintenance of the surface will be required in order to achieve continued performance of the surface.	RD
Waste Management	Pollution of the environment	• Install waste collection bins in technical buildings area. • Use garbage bins fitted with lids to avoid scattering around and attraction of scavengers. • Segregate hazardous, non-hazardous and reusable waste streams. • Manage and dispose hazardous waste according to the type and the class of hazard. Note: for hazardous waste removal licensed company must be contracted. • Until removal (temporarily) waste must be stored within secure facilities with weatherproof flooring and roofing. • Dispose garbage according to agreement with licensed waste management contractors.	RD
Climate Change	GHGs	• Measure and report annual GHG emissions.	RD
Noise	Elevated noise affecting 13 receptors	• Monitor noise for the operation of the road up to year 15 of operation, focusing on locations where noise is predicted to exceed IFC standards. • Where noise levels are exceeded, work with the Property owner to explore any options for noise mitigation at the property and where not possible offer expropriation. • For Properties where expropriation is required a CAP will be prepared for the LARP, or similar.	RD

Table 98: Pre-Construction / Construction Phase Instrumental Monitoring

Issue	Monitoring	Locations	Schedule	Responsibilities	Reporting
Air Quality	Establish routine ambient air quality monitoring throughout the construction period. Baseline	At the 6 locations of	Monitoring to be undertaken monthly	The Engineer shall hire certified laboratory to	The certified laboratory shall provide the results to

Issue	Monitoring	Locations	Schedule	Responsibilities	Reporting
	monitoring shall be undertaken once ***before*** the start of the Construction work to provide robust data in addition to that provided in this report. The following parameters shall be monitored in line with IFC / EU averaging periods: • Particulate Matter (PM_{10} & $PM_{2.5}$). • Nitrogen Oxide (NO_X) • Sulphur Dioxide (SO_2)	ambient air quality monitoring in this EIA, or others as required.	during construction period (36 months)	perform the monitoring activities.	the Engineer within three days of the monitoring activity.
Noise	Ensure that routine noise monitoring is undertaken throughout the construction period. Parameters to be monitored include: Laeq 1h (dBA)	At 13 locations of noise monitoring in this EIA, or others as required.	Monitoring to be undertaken monthly both daytime and night-time measurements during construction period (36 months)	The Engineer shall hire certified laboratory to perform the monitoring activities.	The certified laboratory shall provide the results to the Engineer within three days of the monitoring activity.
Vibration	Vibration sensors for PPV monitoring.	At each tunnel location	Throughout tunnel blasting period.	Contractor to purchase, install and monitor vibration.	Weekly reporting of vibration results to the Engineer.
Surface Water Quality	Establish routine water quality monitoring throughout the construction period. The following parameters shall be monitored: pH; Suspended Solids; BOD5; COD; Coliforms; Nitrate (NO3); Phosphate (PO4); Oil and Grease	50 meters upstream from bridge sites crossing rivers (12 locations) during construction; 50 meters downstream of the bridge site.	Monitoring to be undertaken bi-weekly during bridge construction works	The Engineer shall hire certified laboratory to perform the monitoring activities.	The certified laboratory shall provide the results to the Engineer within seven days of the monitoring activity.
Tunnel water	Monitoring of water from tunnel dewatering settlement tanks. Parameters will include all required to meet Georgian drinking water standards.	At all settlement tanks.	Weekly	The Engineer shall hire certified laboratory to perform the monitoring activities.	The certified laboratory shall provide the results to the Engineer within 5 days of the monitoring activity.
Ground water	Monitoring of groundwater levels.	Selection of ten sites	Weekly	The Engineer shall hire certified laboratory to	Weekly reporting to the Engineer.

Issue	Monitoring	Locations	Schedule	Responsibilities	Reporting
				perform the monitoring activities.	

H.4 EMP Costs

869. Most costs associated with the environmental recommendations of the EMP are a normal part of preparing the bid and contract documents and ensuring that proper environmental provisions are incorporated therein. The installation of septic systems at construction camps, for example, is an environmental necessity, but not generally considered an "environmental cost". Table 99 lists the proposed mitigation measures and indicates where they would be "included in the project budget" as part of a bid document and where additional costs are a likely "environmental cost" beyond what would normally be included in a project budget.

Table 99: EMP Costs

Activity	Item	Number of Units / Unit cost /US$	Cost estimate / US$	Responsibility
Pre-construction				
SEMP	SEMP and associated plans	Included in Project Construction costs	-	Contractor
Approval of Camp locations	Approval	Included in Project Construction costs	-	RD / Engineer
Incorporation of Environmental Items into Bid Documents	Item in Bid Document	Included in Detailed Design Budget.	-	RD
Obtain permits	Permits	Included in Project Construction costs	-	Contractor
Spoil disposal location	Assessment	1/ 5,000	5,000	
	National EIA	1 / 20,000	20,000	Contractor
SFF	Compensation	Approx. 16,000	16,000	RD
Noise	Expropriation	Maximum 14 / Budget according to LARP	See LARP for costs	RD
Total Pre-construction costs				**$41,000**
Construction				
Standard site management	Septic Tanks	Included in Project Construction costs	-	Contractor
Additional environmental measures	Spill Kits	20 / US$200	4,000	Contractor
	Bunds for fuel and oil storage	Included in Project Construction costs	-	Contractor
	Waste containers	Included in Project Construction costs	-	Contractor
	Waste Storage areas	Included in Project Construction costs	-	Contractor
	Waste collection and disposal	Included in Project Construction costs	-	Contractor
	Storage areas for hazardous materials	Included in Project Construction costs	-	Contractor
	Sprinklers for rock crushing plant	Included in Project Construction costs	-	Contractor
	Drainage (including oil and grease interceptors)	Included in Project Construction costs	-	Contractor

Activity	Item	Number of Units / Unit cost /US$	Cost estimate / US$	Responsibility
	Vehicle washing bay	Included in Project Construction costs	-	Contractor
	Fire safety	Included in Project Construction costs	-	Contractor
	PPE	Included in Project Construction costs	-	Contractor
	Impervious hardstanding (for maintenance yards, bitumen storage, etc)	Included in Project Construction costs	-	Contractor
	First aid facilities	Included in Project Construction costs	-	Contractor
	Animal Crossings	Included in Project Construction costs	-	Contractor
	Fencing around PCR	1 / $1,000	$2,000	
	Water bowsers	Included in Project Construction costs	-	Contractor
	Water sprinklers (rock crushing plant)	Included in Project Construction costs	-	Contractor
	Dust control measures (rock crushing and batching plants)	Included in Project Construction costs	-	Contractor
	Tarpaulins	Included in Project Construction costs	-	Contractor
SFF Tree Cutting and tree removal	Labour	Included in Project Construction costs	-	Contractor
Fencing around red-list species (over 8cm in diameter)	Fencing	Approximately 200 / $50	10,000	Contractor
Habitat Restoration	Seedlings (5-6 y/o)	12,000 / $5	60,000	Contractor
	Seedlings (2-3 y/o)	120,000 / $1.5	180,000	Contractor
	Seedlings (GEORed-list)	200 / $10	2,000	Contractor
Tree / Vegetation maintenance	Labour and water	Included in Project Construction costs	-	Contractor
Embankment vegetation and soil erosion measures	Vegetation, Labor and maintenance	Included in Project Budget	-	Contractor
Noise	Noise Barriers[27]	4,000 m / $1,352 m	5,408,000	Contractor
	Noise Barrier foundations	1,480 m / $200 m	296,000	Contractor
Training & Awareness Programs	Safety Training	Included in Project Budget	-	Contractor
	HIV/AIDS Training	4 / US$1,000	4,000	Independent Contractor

[27] Cost estimate is provided by **Appendix H**.

Activity	Item	Number of Units / Unit cost /US$	Cost estimate / US$	Responsibility
	Toolbox Training	Included in Project Budget	-	Contractor
	Construction orientation meetings	Included in Project Budget	-	Contractor
	Periodic meetings with stakeholders	Included in Project Budget	-	Contractor
Clean-up of construction sites.	Labor, waste disposal	Included in Project Budget	-	Contractor
Environmental Staff	EO	36 / US$ 2,000	72,000	Contractor
	H&S Specialist x 12 (based on 600 workers)	432 / US$ 2,000	864,000	Contractor
	H&S Specialist	36 / US$ 1,500	54,000	Engineer
	IES	6 / US$ 20,000	120,000	Engineer
	NES	36 / US$ 1,500	54,000	Engineer
	RD Environmental Officer	36 / US$ 2,000	72,000	RD
	RD Health and Safety Officer	36 / US$ 2,000	72,000	RD
Total Construction Costs				US$ 7,274,000
Total Cost				**US$ 7,315,000**

Table 100: Construction Phase Instrumental Monitoring Costs

Activity / Item	Frequency / Responsibility	Unit Cost	Cost /USD
Air Quality Monitoring	Monthly (6 locations) / Engineer to hire certified laboratory.	200 per site	43,200
Noise Monitoring	Monthly (13 sites) / Engineer to hire certified laboratory.	200 per site	93,600
Surface Water Quality Monitoring	Bi-Weekly during construction period at the bridge sites crossing rivers (12 locations) / Engineer to hire certified laboratory.*	200 per site	172,800
Groundwater levels	Weekly during construction period of each of the 11 tunnels / Engineer to hire certified laboratory.*	20 per site	7,920
Tunnel dewatering	Bi-Weekly during construction period of each of the 11 tunnels / Engineer to hire certified laboratory.	200 per site	39,600
Vibration Monitoring	Continuous during tunneling in the vicinity of tunnels where receptors have been identified. One sensor for each cluster of house within the risk zones. At least 5 sensors within 100 m and 5 beyond. 10 sensors in total / Contractor	800	8,000
Total			**365,120**

*assume 9 months construction period.

H.5 Specific EMP (SEMP)

870. The SEMP is the documents that the Contractor shall prepare outlining how he intends to implement the EMP and ensure that all of the mitigation and monitoring is completed according to the implementation arrangements specified in this EMP and the EIA as a whole.

871. The SEMP will describe the precise location of the required mitigation / monitoring, the persons responsible for the mitigation / monitoring, the schedule and reporting methodology. The SEMP will also include the following plans:

- (i) Topic Specific Plans:
  - (a) Waste Management Plan.
  - (b) Spoil Disposal Plan for Arrangement of Spoil Disposal Area.
  - (c) Re-cultivation Plan.
  - (d) Traffic Management Plan.
  - (e) Occupational Health and Safety Plan.
  - (f) Emergency Response Plan.
  - (g) Air Quality Plan.
  - (h) Spill Response Plan.
  - (i) Vibration Monitoring Plan.
  - (j) Clearance, Re-vegetation and Restoration Management Plan.
  - (k) Groundwater Management Plan.
  - (l) Tunnel Blasting Plan.
  - (m) Noise Management Plan.
  - (n) Biodiversity Action Plan.
- (ii) Site Specific Plans:
  - (a) Construction Camp Plan.
  - (b) Asphalt Plant Plan.
  - (c) Rock Crushing Plant Plan.
  - (d) Concrete Batching Plant Plan.
  - (e) Bridge Construction Plan (for each bridge construction site)

872. The SEMP will be submitted to the Engineer and RD for approval at least 10 days before taking possession of any work site. No access to the site will be allowed until the SEMPs are approved by the Engineer and RD. New topic specific or site specific EMPs may also need to be developed by the Contractor during the construction phase. These new plans will also need to be approved by the Engineer and the RD.

H.6 Bid Documents

873. The Bid Documents for the potential Contractor will contain two sections relating to environmental issues, firstly a basic clause indicating that the Contractor will be responsible for following the requirements of the EMP and that he should prepare his own SEMP for the Project. Secondly, the EMP shall be repeated in its entirety as an Annex to the Bid Documents so as the bidder is aware of his environmental requirements under the Project and help him put environmental costs to his proposal.

H.7 Contract Documents

874. The Contract Documents will follow a broadly similar pattern to the Bid Documents. It is not considered necessary to repeat the mitigation measures verbatim in a list of environmental contract provisions, rather the Contract will specify that the Contractor is responsible for implementation of the EMP via his SEMP. Again, the EMP will be included as an Annex to the Contract so the Contractor will be liable for any non-conformance with the EMP, and thereby this EIA.

H.8 Contractor Requirements

875. As stated above, the Contractor will be responsible for the preparation of the SEMP. The SEMP will need to be fully compliant with the EMP and this EIA as a whole and will need to be prepared within 30 days of Contract award and approved 10 days prior to access to the site.

876. During construction the Contractor must retain the expertise of an Environmental Officer (EO) to implement and continually update the SEMP and to oversee and report on the operation throughout the contract period. The EO should be full-time member of staff on the Contractors roster and should be on site at least five days per week.

877. The required qualifications of the EO are as follows:

- Degree in environmental sciences and related expertise.
- Fluent in Georgian and English.
- Experience of at least one construction project of a similar size and scale.

878. The EO will be responsible for the preparation of weekly environmental checklists and an environmental section of the Contractor’s monthly progress reports that shall be submitted to the Engineer for review. The Engineer shall provide a template of the checklist to the Contractor.

879. The monthly reports, which will include the weekly environmental checklists, shall contain sections relating to:

(i) General Progress of the Project.
(ii) Environmental Incidents; e.g. spills of liquids, accidents, etc.
(iii) Progress of any environmental initiatives, e.g. energy savings, recycling, etc.
(iv) Records of any environmental monitoring, both observational and instrumental.
(v) Conclusions and Recommendations.

880. The EO shall provide daily toolbox training at the construction camp and also at construction sites. The EO shall keep a record of all monthly training and toolbox training undertaken. The Contractor shall also hire qualified Health and Safety Specialists for the Project duration. According to Georgian Law at least 1 H&S specialist is required for every 50 workers. The H&S specialists shall have at least five years on-site experience of similar sized infrastructure Projects.

H.9 Engineer Requirements

881. As noted in the mitigation plans below, the Engineer is tasked with specific responsibility to review designs and ensure safeguard compliance of civil works – with particular emphasis on the monitoring of implementation of EMP through the Contractors SEMP and related aspects of the project. The Engineer will also be responsible for reviewing and approving the monthly reports prepared by the Contractor, especially the first monthly report, to ensure that it contains all of the required reporting elements, such as instrumental monitoring results. The Engineer will also be responsible for regular review and attendance of the Contractors environmental, health and safety training.

882. The Engineer is also responsible for engaging external services from a certified laboratory for instrumental monitoring of air quality, noise and water during the construction phase.

883. The Engineer should retain the use of Environmental Specialist, both national (NES) and international (IES), to ensure that the Contractor is compliant with his environmental obligations. Terms of reference for both specialists is provided below.

Engineers National Environmental Specialist

884. Scope of Services: He/she will (i) review all documents and reports regarding the integration of environmental including contractor's environmental action plan, (ii) supervise the contractors' compliance to EMP, and (iii) prepare monthly compliance reports.

885. Qualification: Degree in environmental sciences or equivalent. Preferably five years' experience in conducting environmental impact assessments and implementation of environment mitigation plans and/or monitoring implementation of environmental mitigation measures during implementation of projects including highway projects funded by developing partners.

886. Time Period – The NES shall be employed permanently over the duration of the construction period.

Engineers International Environmental Specialist

887. Scope of Services: The IES will prepare a detailed action plan including environmental monitoring checklists to be completed by the NES. He/she will conduct environmental training and briefings to provide environmental awareness on ADB and the government environmental safeguards policies, requirements and standard operating procedures in conformity with the government's regulations and international practice for project and RD Safeguards staff; ensure baseline monitoring and reporting of Contractor's compliance with contractual environmental mitigation measures during the construction phase.

888. Qualification: Degree or diploma in environmental sciences or equivalent. Preferably fifteen years' experience in conducting environmental impact assessments and implementation of environment mitigation plans and/or monitoring implementation of environmental mitigation measures and health and safety plans during implementation of projects including road projects funded by developing partners, including twelve years' international experience. Working knowledge of Georgia is preferred.

889. Time Period: The IES shall be engaged on a part-time basis for a period of five months spread over the duration of the construction period (two months per year). The specific on-site inputs will be determined by the Engineers Team Leader and the RD.

890. The Engineer shall also retain a national health and safety specialist for the duration of the Contract. The specialist will be responsible for the day to day monitoring of health and safety aspects of the Contractors works as well as keeping a log of safety statistics.

H.10 RD PIU Requirements

891. A review of the capacity of the RD was undertake as part of this EIA. The review indicates that the existing RD has the expertise to adequately manage the Contractors environmental performance. However, given the size and scope of the Project and the combined projects of sections F1, F2, F3 and F4 it is recommended that a dedicated Environmental and Social Officer be hired to manage E-60 projects. In addition, it is recommended that a dedicated Health and Safety Officer also be hired by the RD to provide similar oversight of E-60 activities.

892. It is also recommended that the PIU coordinate with the Contractors of all lots along the E-60 through Monthly Contractors Meetings to discuss issues such as spoil disposal, access roads, shared use of resources, etc.

H.11 EMP Implementation Summary

893. The following Table summarizes the various institutional responsibilities for the implementation of the environmental management plan at various stages of the Project Road rehabilitation.

Table 101: EMP Implementation

Project Stage	Responsible Institution	Responsibilities
Detailed Design	RD with the Detailed Design Consultant and EIA Team.	• Incorporate EMP mitigation measures into engineering design.
	RD	• Ensure EMP is incorporated into the works Contracts.
	RD	• Review Contractors proposals to ensure that they are aware of the EMP requirements and that line items for environmental management as per the EMP are included in the BOQ.
Pre-construction	Contractor	• Prepare SEMP
	Contractor	• Prepares EIA for spoil disposal site.
	Contractor	• Identification of construction camp sites. • Approvals / Licenses for construction camp sites.
	Engineer, ADB and PMU	• Review and approve SEMP
	Contractor and Engineer	• Site Induction
Construction	Contractor (through its EM)	• Daily monitoring of environmental issues • Preparation of weekly environmental checklists • Preparation of Monthly environmental reports • Preparing Corrective action plans
	PMU	• Routine site visits to monitor Contractors performance.
	Engineer	• Weekly monitoring of the Contractors compliance with EMP / SEMP by the NES. • Issuing the Contractor with Non-compliance Notices • Monthly reporting to RD of Contractors performance based on the review of Contractors weekly checklists and weekly site visits. • Quarterly Environmental Reports prepared by the IES and submitted to PMU and ADB.

I. Public Consultation, Information Disclosure & Grievance Mechanism

I.1 Public Consultations

894. According to the ADB Safeguard Policy Statement (2009):
"*The borrower/client will carry out meaningful consultation with affected people and other concerned stakeholders, including civil society, and facilitate their informed participation. Meaningful consultation is a process that:*
(i) Begins early in the project preparation stage and is carried out on an ongoing basis throughout the project cycle;
(ii) Provides timely disclosure of relevant and adequate information that is understandable and readily accessible to affected people;
(iii) Is undertaken in an atmosphere free of intimidation or coercion;
(iv) Is gender inclusive and responsive, and tailored to the needs of disadvantaged and vulnerable groups; and
(v) Enables the incorporation of all relevant views of affected people and other stakeholders into decision making, such as project design, mitigation measures, the sharing of development benefits and opportunities, and implementation issues.

895. Consultation will be carried out in a manner commensurate with the impacts on affected communities. The consultation process and its results are to be documented and reflected in the environmental assessment report."

896. ADB SPS (2009) states that "For environment category A projects, such consultations will necessarily include consultations at the early stage of EIA field work and when the draft EIA report is available during project preparation, and before project appraisal by ADB." Accordingly two rounds of consultations were undertaken, initially at an early stage of the Project in June 2017 and on a draft EIA before project appraisal by ADB in February 2018.

897. In addition, further consultations will be undertaken as part of the LARP process.

I.1.1 Scoping Consultations

898. Scoping consultations were held in June, 2017 in Boriti. The consultations were arranged by the RD. Information about the date, time and venue of the meeting was published in a newspaper. Communication with local municipal authorities was also undertaken to inform them of the meeting. Participants in the consultations were given an overview of the proposed project and then asked what they thought may be the significant issues that would require detailed study as part of an EIA. A copy of the presentation made can be found as **Appendix A**. The following provides an overview of the consultations (names of all attendees can be found in **Appendix B**).

Table 102: Boriti Scoping Consultation

Date: 7th June, 2017 **Location:** Boriti **Panel Members:** Mr. Nick Skinner – International Environmental Specialist Mr. Giansante Bonin – Team Leader Ms. Maka Stamateli – National Environmental Specialist Ms Lika Bubashvili – Environmental Specialist, Roads Department of Georgia Mr. Gia Sopadze – Head of Environmental Division, Roads Department of Georgia

List of Participants: 25 Participants (see **Appendix B** for list)			
#	**Question / Comment**	**Answer**	**EIA Status**
1	When the works commence we will need to be informed in advance of where exactly the works will occur.	We will prepare procedures as part of the EIA to ensure that the Contractor provides adequate advance warning of construction works in specific areas.	Addressed under section **F.7.1 - Transportation Facilities & Utilities.**
2	When will construction of the road start?	Within the next 12 months.	N/A
3	How will you dispose of spoil material from tunnels?	At the moment we are unsure about the exact locations for spoil disposal. However, we will ensure that all locations are approved by the relevant authorities and that no unauthorized disposal of spoil will occur.	Addressed under section **F.7.3 – Waste Management**.
4	Roadside businesses should be protected from construction impacts, e.g. dust, restricted access.	The EIA will have specific mitigation measures to ensure these types of impacts do not significantly impact upon roadside businesses.	Addressed as part of section **F.5.1 – Air Quality** and **F.7.1 - Transportation Facilities & Utilities.**
5	Cattle underpasses should be considered.	This is an issue that we need to consider during the design.	No specific requirement for cattle underpasses due to the fact that the Project comprises mainly tunnels and bridges so cattle can move either beneath the bridges or over the tunnels.
6	Will all three construction lots be undertaken at the same time, or will they be phased? This could cause a lot of traffic disruption.	They will be phased, but at some point construction will be on-going in all three lots. Traffic management plans will be prepared by Contractors to limit traffic related impacts.	Addressed under section **F.7.1 - Transportation Facilities & Utilities.**
7	Will access to properties be disrupted during construction?	There will be temporary impacts to access during the construction phase. The Contractors will be required to coordinate all of his activities with locals to ensure minimal disruption.	Addressed under section **F.7.1 - Transportation Facilities & Utilities.**
8	There are periods of very high flow in the river, this should be carefully considered during the detailed design to ensure that flooding does not occur.	During detailed design hydrological studies will be undertaken to ensure that all bridges, culverts, etc are designed and constructed to the correct specification.	Addressed under section **F.5.5 – Hydrology**.
9	I am a bee-keeper and am concerned about the potential impacts to my business.	The road is unlikely to have significant impacts on the bee-keeping industry in the region. However, if there are specific issues during the construction phase that affect your business they can be raised through the grievance redress mechanism. In addition, routine dampening of construction routes to reduce the	Addressed under section **H.3 – Grievance Mechanism**.

		impacts of dust will be undertaken.	

Figure 140: Scoping Consultation in Boriti, 7th June, 2017

I.1.2 Public Consultations

899. A second round of consultations were held in Kharagauli in February 2018. Participants in the consultations were presented with the initial findings of the Georgian version of the EIA (see **Appendix C** for the presentation). The following provides an overview of the consultations (names of all attendees can be found in **Appendix D**).

Table 103: Boriti Public Consultation

Date: 22nd February, 2018 **Location:** Kharagauli Administrative Building **Chairman of the meeting**: Gia Sopadze, Head of division for Resettlement and Environmental Protection, Roads Department of Georgia **Secretary of the meeting**: Maia Stamateli, environmental specialist, Gamma Consulting Ltd **Attendees:** Representatives of Roads Department of Georgia, representative of Kharagauli administration, local residents, Representatives of Gamma Consulting Ltd, representative of the Ministry of Environment Protection and Agriculture, representative of Georgian Greens (See **Appendix C**)			
#	**Question / Comment**	**Answer**	**EIA Status**
1	Population is asking for a map of alignment to know where the new road will be	Gia Sopadze promised to provide pdf version of the map to local authorities for reference.	Project map is provided as part of the EIA which will be disclosed.
2	Will project have impact on ground water	Tunneling may have impact on ground water. To avoid impact of possible water level change on water users, the monitoring of water level in the areas	Addressed as part of **F.7.6 – Tunnels**.

		where population relies of wells will be carried out.	
3	Construction of the road may block surface runoff, what measures are considered to avoid that	The road design considered surface runoff. Drainage system and culverts are designed with consideration of the relief	**Project Description, Section 2**, provides a summary of the drainage system and culverts.
4	There are cultural heritage sites in the area. Is there any risk of impact on them during construction and operation of the new road	The road bypasses cultural heritage sites. There is no risk of impact on aboveground monuments. Archaeological conclusion for submission to cultural heritage protection authorities is being prepared. The chance find procedure is available. Construction company identified through tender will be responsible to implement the mentioned procedure in case of any chance find.	Addressed under Section **F.8.5 – PCR**.
5	Since the new road will create a barrier for free movement of the residents it is vital to arrange passages to allow passing from one side of the highway to another	The project alignment includes bridges, tunnels. In Tbilisi Argveta direction 18 bridges and 9 tunnels, whereas in Argveta-Tbilisi direction 16 bridges and 11 tunnels will be built. Two interchanges are planned one - in the area of Sakasria village, at the left side of the river and another in the end of the Lot F2 in Boriti area. Existing road will remain in place.	Explained throughout the report that the new road will not present a barrier to the free movement of residents.
6	Will impact on trees be high?	Taxation will provide exact information on the type of species and number of the trees to be cut for the needs of the project. Impact on vegetation adjacent to the RoW will be mitigated by a range of measures suggested by the team. This includes: keeping to the boundaries of the worksites and RoW, fencing of the sensitive areas to avoid accidental damage during works, briefing of the staff in environmental HS measures and requirements.	Addressed under section **F.6.1 – Flora**.
7	Is there a risk that blasting works affect properties	Prior to blasting works properties located in potential impact zone will be checked. The status – recorded. Inspection will also help to determine blasting method and dosage. Type, ‘size’ of the charge, selection of time between detonations, design (e.g. closer hole spacing, smaller diameter holes), presplitting blasting, perimeter blasting and millisecond blasting technique can be used in sensitive locations to minimize blasting effect.	Addressed under section **F.8.6 – Noise and Vibration**
8	What will happen on case of damage of existing infrastructure by heavy machinery	Damage to existing road infrastructure will be repaired after completion of works in the area. The same approach will apply to any third party property (in case the claim is justified).	Addressed under Section **F.7.1 – Transportation and Utilities**.

9	Will other secondary roads be rehabilitated	The project does not envisage rehabilitation of secondary roads unless they are damaged because of the project activities.	N/A
10	Spoil disposal issue is crucial for the area. What will happen with material removed from the tunnels	The issue is very important. The EIA states the need for careful selection of the site for spoil disposal. Location of the site and spoil disposal will be done based on the spoil management plan. The latter will be agreed with local administration and environmental authorities.	Addressed under section **F.7.3 – Waste Management**.

I.2 Planned Information Disclosure

900. It is anticipated that in compliance with ADB's SPS (2009) the document will be provided for disclosure on the ADB website and the RD Website (in local language).

901. The RD PMU will be responsible to notify and inform the public of construction operations prior to construction works, publish an emergency response plan disclosing his intentions to deal with accidents and emergencies, including environmental/public health emergencies associated with hazardous material spills and similar events, etc.

I.3 Grievance Mechanism

I.3.1 Introduction

902. Grievance redress mechanisms (GRMs) are institutions, instruments, methods, and processes by which a resolution to a grievance is sought and provided. GRM is seen by ADB as a pre-litigation mechanism for conciliation of disagreements and addressing concerns of project affected persons (PAPs) at early stages of dispute. GRM is aimed on smooth and creative resolution of disputes, minimizing time and resources waste and reputational risk to the project. The experience gained in ADB and other donor funded projects demonstrates that the efficient GRM enables to avoid time-consuming and complex legal procedures in majority cases of claims.

903. The GRM is an integral part of the ADB Accountability Mechanism (AM) that complements the problem solving (OSPF) and compliance review (CRP) functions of the ADB AM Policy 2012.

904. The GRM should be established and operated in compliance with the Georgian Regulations and ADB Policy requirements.

905. According to the ADB requirements, the GRM should be arranged to address the resettlement related issues (SPS 2009 – Safeguard Requirements 2: Involuntary Resettlement, Requirement 7. Grievance Redress Mechanism) and the environmental concerns of the affected communities and other stakeholders (SPS 2009 - Safeguard Requirements 1: Environment, Requirement 5. Grievance Redress Mechanism).

I.3.2 Georgian Regulations

906. The Administrative Code of Georgia is the legal document defining the rules and procedures for the grievance review and resolution.

907. According to the law, the Administrative body receiving officially lodged claims is obliged to review the claims and engage the claimant in the grievance review and resolution process, and issue final decision in that regard.

908. Clause 181. defines the content and the grievance submission forms. In particular, the grievance package should include: a) Name of the administrative body to whom the complaints are addressed; b) Name, address and contact details of the claimant; c) Name of the administrative body, who's decisions or administrative acts are the subject of complain; d) Name of the administrative act or decision, which is subject of complain; e) Content of the claim; f) The context and facts, based on which the complaint is substantiated; g) list of attachments

909. Clauses 194 and 198 define the rules and procedures ensuring participation of the claimants in the grievance review process.

910. According to the clause 202, the decision issued by the Administrative Body in relation with the reviewed claim has a status of individual administrative legal act.

911. The standard period given for the issuance of the decision in relation with the grievance is 1 month.

I.3.3 ADB Policy (SPS, 2009) Requirements

912. The borrower/client will establish a mechanism to receive and facilitate the resolution of affected persons' concerns and grievances about physical and economic displacement and other project impacts, paying particular attention to the impacts on vulnerable groups.

913. The grievance redress mechanism should be scaled to the risks and adverse impacts of the project.

914. It should address affected persons' concerns and complaints promptly, using an understandable and transparent process that is gender responsive, culturally appropriate, and readily accessible to the affected persons at no costs and without retribution.

915. The mechanism should not impede access to the country's judicial or administrative remedies. The borrower/client will inform affected persons about the mechanism.

I.3.4 Grievance Redress Process

916. At the LARP/EIA preparation stage, during the consultation meetings and negotiations the PAPs shall be fully informed of the grievance redress mechanism, its functions, procedures, contact persons and rules of making complaints.

917. Grievance resolution is viewed as a two-stage process, first involving local resources for the grievance resolution and only in case of failure engaging top management and entire capacity of the central offices of RD/PIUs.

918. Grievance redress procedures of Stage 1 represent an informal tool of dispute resolution allowing the PAPs and the project implementation team to resolve the disagreement without any formal procedures, procrastination and impediments. Such informal grievance redress mechanism helps to solve most of the complaints without formal procedures (i.e. without using the procedures specified in the Administrative Code or litigation). This mechanism enables unimpeded implementation of the Project and timely satisfaction of complaints.

919. Care will always be taken to prevent grievances rather than going through official procedures of Stage 2. The achievement of this goal can be ensured through careful planning and preparation of EIA and LARP, active participation of PAPs, effective consultations, proper communication and coordination among local communities, IAs and local authorities.

920. In case of failure of the grievance resolution attempts at the stage 1, the process of grievance review and resolution enters Stage 2. Stage 2 is a process formalized in accordance with the Administrative Code of Georgia. The claimant submits official claim in a written form to the RD and the RD as an administrative body is conducting the grievance review and response process following requirements of the law, regarding time frames, involvement of claimant, etc. The stage 2 process may require involvement of different departments and specialists of the RD, its consultants, local authorities and other stakeholders.

921. If the grievance is not resolved at the stage 2, the claimant has right and possibility to apply to court and the GRM helps the claimant to prepare application package. The claimant also has the possibility to make a complaint to the ADB directly at this stage.

I.3.5 Grievance Redress Mechanism

922. The GRM consists of temporary, project-specific units established at the municipal level in project affected municipality and regular system established at the RD level:

(i) ***Grievance Redress Committee (GRCE)*** established at municipal level as a project-specific instrument, which is functional only for the period of the project implementation.

(ii) ***Grievance Redress Commission (GRCN)*** is formed as permanently functional informal structure within the RD to ensure grievance review, resolution and record.

I.3.6 Grievance Redress Commission for Stage 1

923. A Grievance Redress Committee (GRCE) is an informal, project-specific grievance redress mechanism, established to administer the grievances at Stage 1. This informal body will be established at community level in both the affected Municipality. The representative of Zestafoni Municipality will be a Chairman of the GRCE. The RD representative(s) of Environmental and Resettlement Unit in GRCE shall coordinate the GRCE formation. The Contact Person will then be responsible for the coordination of GRC activities and organizing meetings. In addition, GRCE shall comprise representative of Shorapani (Secretary), representatives of PAPs, women PAPs (if any), and appropriate local NGOs to allow voices of the affected communities to be heard and ensure a participatory decision-making process.

924. GRCEs will be established at the community level (office of the official Representative of Zestafoni Municipality). The establishment of GRCE will be formalized by the protocol of the first meeting, as a part of binding agreement of the Government and ADB. For the GRCE following composition is proposed. There shall be at least one female member of the GRCE.

Table 104: GRCE Composition

1	Representative(s) of Environmental and Resettlement Safeguards Unit of RD	Member
2	Representatives of Kharagauli Municipality	Chairman
3	Representative of Boriti	Member

4	Representative of PAPs	Member
5	Representative of NGO	Member
6	Representative of Contractor	Member
7	Environmental and Resettlement Specialists of Engineer	Member

925. The representative(s) of the Environmental and Resettlement Unit of RD shall coordinate the work of the Committee and at the same time they will be the contact person for collecting the grievances and handling grievance log. The local authorities at the municipal level (Kharagauli), Contractor, Engineer, as well as PAPs (through informal meetings) will be informed about the contact person.

926. The PAPs should be informed about the available GRM. This shall be achieved through the public consultation process and routine community meetings throughout the construction phase.

I.3.7 Grievance Redress Commission for Stage 2

927. Grievance Redress Commission (GRCN) is formed by the order of the Head of the RD as a permanently functional informal structure, engaging personnel of RD from all departments having regard to the environmental and LARP issues and complaint resolution. This includes top management, Environmental and Social Safeguards Units, Legal Departments, PR department and other relevant departments (depending on specific structure of the RD). The GRCN is involved at the Stage 2 of grievance resolution process. The Order shall also state that if necessary representative of local authorities, NGOs, auditors, representatives of PAPs and any other persons or entities can be engaged in a work of GRCN. For the GRCN the following composition is proposed below. There shall be at least one female member of the GRCE.

Table 105: GRCN Composition

1	RD Management	Member
2	Head of Environmental and Social Safeguards Unit at RD	Member
3	Legal Department of RD	Member
4	PR Department of RD	Member

I.3.8 Grievance Redress Procedures

Stage 1 – informal review of the AP's complaint (whether written or oral)

928. **Grievance Collection and registration.** The representative(s) of the Environmental and Resettlement Unit of the RD is the person responsible for collecting the grievances received from different entry points and for recording them. Through the consultations conducted at the early stages of the project development and throughout construction, the PAPs will be informed that grievances should be addressed directly to the Contact Person. However, it is expected that some portion of grievances will be addressed to the local authorities at the Municipal level, to the Contractor and Engineer. All these stakeholders will arrange entry points and recording systems for grievances and will readdress the grievances to the Contact Person. Further, the Contact Person will register the grievances and will coordinate the grievance resolution process, engaging the required members of GRCE.

Step 1: Informal negotiations

929. The Representative of the RD will review the grievance, and based on that will:

(i) Define the list;
(ii) Agree with the claimant the date and site for the informal meeting;
(iii) Conduct meetings, site visits and negotiations with the PAP with participation of relevant members of the GRCE; and
(iv) Will document all site-visits, meetings and discussions with the involved parties (minutes of meetings, photos, etc.)

930. 910. In case of amicable resolution of the dispute, a Protocol of Agreement (Protocol 1: Action Plan) will be prepared by the RD describing agreed actions, dates, other conditions. The protocol will be signed by the claimant and Contact Person. The Action Plan should define:
(i) Clear timeline for each action; and
(ii) Parties responsible for undertaking and completing each action, budget.

931. 911. After implementation of the agreed action another protocol is prepared by the RD (Protocol of Grievance Closure), which confirms the fact that the parties have finally resolved the dispute. The protocol will be signed by RD as a representative of GRCE and by the claimant.

Step 2.: Formal Review of the Grievance by GRCE:

932. If informal negotiations conducted as step 1 of the stage 1 process fails to resolve the issue, the official procedure of the grievance review by the GRCE is triggered.

933. The Contact Person of Environmental and Resettlement Safeguards Unit of RD assists the claimant to prepare the official written claim addressed to the GRCE and supplements this by his information notes.

934. The written claim will contain the following information:
- Name and contact details of the claimant;
- Date of submitting claim;
- The brief description of the essence of claim; and
- Documents prepared (photos, maps, other documents) confirming the information presented in a claim.

935. The RD and all members of the GRCE regarding the need of execution of the formal GRCE procedure. The RD will agree the date of formal meeting with the chairman and Secretary of the GRCE and inform the claimant and all members of the GRCE regarding the meeting site and date. The meeting should be held not later than two weeks after the notification issued by the RD. The RD will distribute the claim supplementary documents among the GRCE members.

936. The GRCE will engage all required specialists in reviewing the claim and, in case of need, will invite them on a planned meeting. During 1 week after the meeting the GRCE will issue its Conclusion and the Contact Person will inform the claimant about the decision.

937. In case of amicable resolution of the dispute, a Protocol of Agreement is prepared by the RD describing agreed actions, dates, other conditions. The protocol is signed by the claimant and Chairman of the GRCE.

938. After implementation of the agreed action the Protocol of Grievance Closure is prepared by the RD. The protocol will be signed by the Chairman of GRCE and by the claimant.

939. If informal negotiations conducted as stage 1 process fails to resolve the issue, the grievance resolution by GRCE at the local level is considered as not sufficient and the claim resolution process by GRCN at the central level is triggered.

940. The RD assists the claimant to prepare the official written claim addressed to the GRCE and supplements this by his information notes.

941. The written claim will contain following information:

- Name and contact details of the claimant;
- Date of submitting claim;
- The brief description of the essence of claim; and
- Documents prepared (photos, maps, other documents) confirming the information presented in a claim.

Stage 2 – Official Review of the Grievances by GRCN

942. The Stage 2 process is triggered by notice from the RD sent to the GRCN with the attached claim and the supplementary package of documents prepared with the assistance of the RD.

943. The notice sent by the RD contains brief description of the grievance review and resolution attempts made at the Stage 1, including explanation of the reasons of disagreement and attachments (minutes of meetings, protocols, photos etc.).

944. Upon receiving the grievance and supplementary documents, the secretary of the GRCN will register the claim in a grievance log and initiate the formal grievance review and resolution process in accordance with the requirements of the Administrative Code. The GRCN members will discuss the issue and engage relevant departments and specialists of the RD, in order to find solutions for the grievance resolution. In case of need the specialists from other governmental institutions or expert groups could be also engaged.

945. Not later than two weeks from receiving the claim, the GRCN will conduct a formal hearing participation of the claimant at a date fixed by the GRCN member secretary. On the date of hearing, the aggrieved PAP will appear before the GRCN at the RD office for consideration of grievance. The member secretary will note down the statements of the complainant and document all details of the claim, proposed solutions and final agreement.

946. In case of amicable resolution of the dispute, a Protocol of Agreement (protocol 1) is prepared by the Secretary of GRCN, describing agreed actions, deadlines and other conditions. The protocol is signed by the claimant and Chairman of the GRCN.

947. After implementation of the agreed action the Protocol of Grievance Closure is prepared by the Secretary of GRCN. The protocol will be signed by the Chairman of GRCE and by the claimant.

948. If the RD decision fails to satisfy the aggrieved PAPs, they can pursue further action by submitting their case to the appropriate court of law (Rayon Court). GRCN (secretary) will help the claimant to prepare the documents for submission to the Rayon (municipal) court.

949. A brief description of all stages of Grievance Resolution Process are given in the below.

Table 106: Grievance Resolution Process

Steps	Action Level	Process
Stage 1 (GRCE Level)	Step 1: Informal negotiations with PAPs	The complaint is informally reviewed by the GRCE Contact Person – Representative of Environmental and Resettlement Unit of RD, which takes all necessary measures to resolve the dispute amicably. At this stage, RD Contact Person engages in discussions with PAP

Steps	Action Level	Process
		only those members of the GRCE, who have direct relation to the issue.
	Step 2: Formal negotiations with PAPs GRCE level resolution of grievance	If the oral grievance is not solved during the negotiations, the GRCE will assist the aggrieved PAPs to formally lodge the grievances to the GRCE. The aggrieved PAPs shall submit their complaints to the GRCE within 1 week after completion of the negotiations at the village level or later, as he wishes. The aggrieved PAP shall produce documents supporting his/her claim. The GRCE RD Contact Person will review the complaint and prepare a Case File for GRCE hearing and resolution. A formal hearing will be held with the GRCE at a date fixed by the GRCE RD Contact Person. On the date of hearing, the aggrieved PAP will appear before the GRCE at the Municipality office for consideration of grievance. The member secretary will note down the statements of the complainant and document all details of the claim. The decisions from majority of the members will be considered final from the GRCE at Stage 1 and will be issued by the RD Contact Person and signed by other members of the GRCE. The case record will be updated and the decision will be communicated to the complainant PAP. After implementation of the agreed action the Protocol of Grievance Closure is prepared by the RD Contact Person. The protocol will be signed by the Chairman of GRCE and by the claimant.
Stage 2	Step 3 Decision from central RD GRCN	If any aggrieved PAP is unsatisfied with the GRCE decision, the next option will be to lodge grievances to the RD at the national level. GRCE should assist the plaintiff in lodging an official complaint to GRCN (the plaintiff should be informed of his/her rights and obligations, rules and procedures of making a complaint, format of complaint, terms of complaint submission, etc.). The aggrieved PAP shall produce documents supporting his/her claim, in accordance with the legal requirements (Administrative Code of Georgia). The GRCN of the RD shall review the complaint in compliance with the procedures specified in the Administrative Code of Georgia. If needed, a formal hearing will be held with the GRCN at a date fixed by the GRCN member secretary. On the date of hearing, the aggrieved PAP will appear before the GRCN at the RD office for consideration of grievance. The Contact person will note down the statements of the complainant and document all details of the claim. The plaintiff shall be informed of the decision.

Steps	Action Level	Process
Stage 3	Step 4 Court decision	If the RD decision fails to satisfy the aggrieved PAPs, they can pursue further action by submitting their case to the appropriate court of law (Rayon Court). The aggrieved PAP can take a legal action not only about the amount of compensation but also any other issues, e.g. occupation of their land by the contractor without their consent, damage or loss of their property, restrictions on the use of land/assets, etc.

I.3.9 Grievance Log

950. The Grievance Logs will be developed at GRCE level.

Grievance Log in GRCE

951. The GRCE Grievance Logs will be developed and maintained at the Municipal level.

952. The Grievance Logs will be developed and managed by the RD representative at site. The logs will be kept on Excel files and shared copies will be available at the RD and at site in the Engineers office. The records in Grievance logs include the following information:

- Name and contact details of the claimant;
- Date of receiving claim;
- Form of claim – (oral or written);
- To whom the claim has been addressed initially (entry point);
- The brief description of the essence of claim;
- The stages, dates and participants of negotiations with the PAP with GRCE (stage 1);
- Minutes of meetings;
- Final decision of the GRCE (in case of the dispute is resolved, the decision is about closure of the issue. In case if the dispute remains unresolved, the decision is about passing to the stage 2 of the grievance redress process);
- Date of decision of GRCE; and
- Documents prepared by PAP with the help of GRCE for passing to GRCN.

953. The copies of the records/documents may be also kept in the municipal office.

I.3.10 Communication

954. Prior to start of site works, the Contractor shall:

- Communicate the GRM to communities in the project impact zone.
- Set-up and publicize a 24-hour hotline for complaints.
- Ensure that names and contact numbers of representatives of GRCE and the Contractor are placed on the notice boards outside the construction site.

ADB Accountability Mechanism Policy, 2012

955. In addition to the GRM, the ADB has also developed its Accountability Mechanism (AM) Policy. The AM provides a forum where people adversely affected by ADB-assisted projects can voice and seek solutions to their problems and report alleged noncompliance with ADB's operational policies and procedures. It consists of two separate but complementary functions: problem solving function and compliance review function. The objective of the Accountability

Mechanism Policy 2012 is to be accountable to people for ADB-assisted projects as a last resort mechanism.

I.3.11 Disclosure of the Grievance Process

956. The complaints resolution process was presented formally during the public consultations. The grievance redress mechanism will also be presented during routine community meetings in the Project area during the construction phase of the Project.

J. Conclusions and Recommendations

J.1 Conclusions

957. This EIA has established that, with the exception of the residual impacts mentioned below, there are no significant environmental issues that cannot be either totally prevented or adequately mitigated to levels acceptable to the GoG and international standards for Project activities.

958. The identified residual impacts during the Construction Phase include:

- Fauna - Site clearance will impact upon fauna in the Project corridor, including, for instance Otters. Residual impacts will be **MINOR/MEDIUM.** Further surveys of fauna prior to the start of construction to identify potentially affected species and action plans to manage these issues will help reduce the residual impacts.

- Aquatic Flora and Fauna – A number of bridge piers will be constructed within the Dzirula and Rikotula rivers. In addition, bridge abutments will also encroach into the river in some locations. Even though mitigation measures outlined above will help reduce the significance of the impact, residual impacts will be **MODERATE** as aquatic flora and fauna are disturbed by the Project works.

- Habitat - The clearing of a large portion of natural habitat will have significant impacts to biodiversity in the area. The restoration and re-planting programs should go a long way to mitigating these impacts, but in some locations, such as river banks, residual impacts will remain, and impacts will be **MODERATE TO MAJOR**. In addition, short term fragmentation of habitat maybe caused by access roads and other temporary construction facilities. In addition, the Clearance, Re-vegetation and Restoration Management Plan and its Biodiversity Action Plan will help manage potential impacts to habitat.

- Land Use - No residual impacts are anticipated if the LARP is implemented correctly. However, there will still be disruption to the local community during the LARP implementation process. A GRM has been prepared to manage complaints received during this process. Residual impacts will be **MINOR/MODERATE.**

- Waste Management - In general, if the mitigation measures suggested are implemented residual impacts will be minor. However, restoration of any spoil disposal area will take a number of years and as such the residual impacts for the spoil disposal areas are considered **MINOR/MODERATE**.

- Noise and Vibration – Despite the fact that comprehensive mitigation measures have been set to manage construction noise and vibration there may still be instances where construction works may result in unanticipated elevated levels of noise and vibration. However, these will only be temporary and localized. Good oversight from the Contractors HSE team and the Engineers environmental manager should limit the impact of these types of incidents. Residual impacts will be **MINOR**.

959. The identified residual impacts during the Operational Phase include:

- Surface Water Drainage - It is noted that the Project requires interceptor tanks for bridge run-off and this should also be considered for the road drainage network in general, if not **LOW/MEDIUM** residual impacts will occur during the operational phase as polluted road water run-off drains directly into surface water courses.

- Greenhouse Gases - Residual impacts from the generation of GHGs will remain throughout the lifecycle of the Project. This is an unavoidable consequence of the Project, but as noted in other sections of this report, the growth of the electric car market and more fuel efficient cars may, in the future lead to a decrease in the emissions generated on the Project road. Residual impacts will be **LOW/MEDIUM.**

- Employment - After the Project construction phase many local workers may be without employment. However, the Project will have provided them, in many instances, with additional skills and experience to work on similar projects in other locations. Local businesses supplying the Contractors and their staff may also see a fall in trade, this is an unavoidable consequence of the Project. Residual impacts will be **LOW/MEDIUM.**

- Habitat - In the short term the residual impacts will be **MEDIUM/HIGH** as the habitat is cleared. It will take a number of years for the habitat to be restored and for re-planted areas to develop into something similar to the habitats they are replacing. However, in the longer term, the significance of the impacts will reduce as these areas mature.

- Aquatic Flora and Fauna – The actual area in the river to be lost from bridge piers or retaining walls will be minimal compared to the wider aquatic habitat available in the Dzirula River, well below 1% of the habitat available. While habitat loss will cause local impacts to aquatic flora /fauna as rivers are dynamic systems it is expected that the river will make a full recovery following construction. Residual impacts will be **LOW/MEDIUM.**

- Visual Impacts - Cut slopes, embankments, concrete bridges and tunnels will have an impact on the landscape within the valley throughout the Project lifecycle. The mitigation measures outlined above may go someway to enhancing the aesthetic value of the Project especially as vegetation grows back around construction zones, and in all likelihood any negative opinion of the new road in terms of visual impact will decrease over time as people get used to the altered landscape. Residual impacts will be **LOW/MEDIUM.**

- Noise - Residual impacts will be negligible for all of the identified receptors if the noise barriers are constructed. For the remaining 13 receptors monitoring will be conducted during operation and where IFC noise limits are exceeded, the property owners will be expropriated. However, some property owners may choose to remain in their homes. These properties may be subject to elevated noise levels above IFC limits in the future, and for these receptors residual impacts will remain throughout the lifecycle of the Project. It is noted that the number of potentially affected receptors is only a very small percentage of the overall population within the Project area. Residual impacts will be **MEDIUM**.

960. The total estimate costs of the environmental mitigation and management to be funded by ADB has been calculated at approximately US$7,680,120, or approximately 2.5% of the total project cost of $330m. This figure does not include costs of resettlement of people affected by noise (which will be included in the Project LARP).

J.2 Recommendations

961. The EMP, its mitigation and monitoring programs, contained herewith will be included within the Bidding documents for project works for all Project components. The Bid documents state that the Contractor will be responsible for the implementation of the requirements of the EMP through his own SEMP which will adopt all of the conditions of the EMP and add site specific elements that are not currently known, such as the Contractors camp locations. This

ensures that all potential bidders are aware of the environmental requirements of the Project and its associated environmental costs.

962. The EMP and all its requirements will then be added to the Contractors Contract, thereby making implementation of the EMP a legal requirement according to the Contract. He will then prepare his SEMP which will be approved and monitored by the Engineer. Should the Engineer note any non-conformance with the SEMP (and the EMP) the Contractor can be held liable for breach of the contractual obligations of the EMP. To ensure compliance with the SEMP the Contractor should employ an Environmental Manager to monitor and report Project activities throughout the Project Construction phase.