

Environmental Impact Assessment

Updated Final – May 2019

Environmental Impact Assessment of Section F4 of the Khevi-
Ubisa-Shoropani-Argveta Road (E60 Highway)
Republic of Georgia.

Table of Contents

Executive Summary	9
1. Introduction.....	9
2. Project Background	9
3. Project Description	10
4. Alternatives.....	11
5. Description of the Environment.....	12
6. Impact Identification.....	15
7. Mitigation Actions	21
8. Monitoring Actions	28
9. Consultations.....	29
10. Conclusions.....	29
11. Implementation	31
 A. Introduction.....	 32
A.1 General.....	32
A.2 Overview	32
A.3 Purpose of the EIA report	33
A.4 Category of Project.....	33
A.5 Scope of the EIA.....	33
A.5.1 Scoping Consultations	34
A.5.2 ADB Requirements	34
A.5.3 Best Practice.....	35
A.5.4 Structure of the Report.....	35
 B. Project Description	 37
B.1 Section Layout.....	37
B.2 Type and Location of project.....	37
B.3 Environmental Setting.....	37
B.4 Road Standards and Profiles	47
B.5 Bridges	50
B.6 Tunnels.....	52
B.7 Retaining Walls.....	54
B.8 Interchanges.....	54
B.9 Culverts and Underpasses.....	55
B.10 Overpasses	56
B.11 Construction Process.....	56
B.12 Source of Materials	60
B.13 Camps and Storage Areas.....	61
B.14 Road Safety.....	62
B.15 Traffic Projections	62
 C. Alternatives	 64
C.1 General.....	64
C.2 The No Action Alternative	64
C.3 Alternative Road Corridors.....	64
C.4 Alternative Transport Modes	64
C.5 Alternative Alignments	64
C.6 Alternative Transport Modes	74
C.7 Alternative Pavement Types	75
 D. Environmental Laws, Standards and Regulations	 76

D.1	Overview.....	76
D.2	General.....	76
D.3	Environmental & Social Legislation of Georgia	76
D.4	Action Plans and Strategies.....	86
D.5	Administrative Framework	89
D.6	Environmental Regulations and Standards	91
D.7	National Technical Regulations Relevant to the Project.....	97
D.8	Environmental Permitting Procedures.....	98
D.9	Licenses, Permits, and Approvals.....	102
D.10	Construction Permits.....	104
D.11	State Forest Fund	104
D.12	International Conventions and Agreements.....	105
D.13	Asian Development Bank Safeguard Policies 2009.....	107
D.14	Comparison of ADB, EBRD and National Requirements.....	110
E.	Baseline Data Collection Methodology	113
E.1	General.....	113
E.2	Detailed Methodology	113
E.2.1	Geology	113
E.2.2	Topography.....	113
E.2.3	Soils.....	114
E.2.4	Climate and Climate Change	114
E.2.5	Air Quality	114
E.2.6	Hydrology	114
E.2.7	Natural Hazards.....	115
E.2.8	Biodiversity	115
E.2.9	Protected Areas and IBAs.....	117
E.2.10	Socio-economic conditions	117
E.2.11	Infrastructure.....	118
E.2.12	Land Use	118
E.2.13	Waste Management.....	118
E.2.14	Health and Educational Facilities	118
E.2.15	Cultural Resources	118
E.2.16	Noise and Vibration.....	118
E.3	EIA Project Area.....	119
F.	120	
	Description of the Environment.....	120
F.1	Physical Resources	120
F.1.1	Air quality	120
F.1.2	Climate	125
F.1.3	Topography.....	128
F.1.4	Natural Hazards.....	131
F.1.5	Hydrology	133
F.1.6	Geology & Soils	138
F.1.7	Geomorphology	144
F.2	Biodiversity	145
F.2.1	Habitat	146
F.2.2	Fauna	154
F.2.3	Avi Fauna	163
F.2.4	Fish.....	166
F.2.5	Protected Areas	170
F.3	Economic Development.....	172
F.3.1	Industries & Agriculture.....	172

F.3.2	Infrastructure and Transportation facilities.....	174
F.3.3	Tourism and Recreation.....	175
F.4	Social and Cultural Resources.....	175
F.4.1	Socio-economic conditions	175
F.4.2	Community Health & Education	176
F.4.3	Economy and Employment	179
F.4.4	Waste Management.....	179
F.4.5	Physical and Cultural Resources	180
F.4.6	Noise & Vibration	182
G.	Environmental Impacts and Mitigation Measures	187
G.1	Introduction.....	187
G.2	Impact Assessment Methodology	187
G.2.1	Identification of Significant Environmental Aspects	187
G.2.2	Impact Significance Rating.....	190
G.3	Mitigation, Management and Good Practice Measures.....	193
G.4	Screening of Impacts	193
G.5	Physical Resources	203
G.5.1	Air quality.....	203
G.5.2	Climate Change	221
G.5.3	Soils.....	223
G.5.4	Hydrology	227
G.5.5	Natural Hazards	232
G.6	Biodiversity	233
G.6.1	Flora and Fauna	233
G.6.2	Forests and Protected Areas	241
G.7	Economic Development.....	242
G.7.1	Transportation Facilities & Utilities	242
G.7.2	Land use.....	244
G.7.3	Waste Management.....	244
G.7.4	Construction Camps & Batching Plants.....	248
G.7.5	Tunnels.....	254
G.8	Social and Cultural Aspects.....	256
G.8.1	Employment Creation, Skills Enhancement and Local Business Opportunities 256	
G.8.2	Community Health and Safety.....	257
G.8.3	Workers' Rights & Occupational Health and Safety.....	260
G.8.4	Emergency Response Planning	263
G.8.5	Physical and Cultural Resources	263
G.8.6	Visual Impact	264
G.8.7	Vibration	265
G.8.8	Noise	271
G.9	Induced and Cumulative Impacts.....	316
G.10	Compliance Impacts	318
H.	Environmental Management Plans and Institutional Requirements	319
H.1	Introduction.....	319
H.2	Environmental Management Plan.....	319
H.3	Instrumental Monitoring Plan	319
H.4	EMP Costs	353
H.5	Specific EMP (SEMP).....	356
H.6	Bid Documents	356
H.7	Contract Documents.....	356
H.8	Contractor Requirements.....	357

H.9	Engineer Requirements	357
H.10	RD PIU Requirements	359
H.11	EMP Implementation Summary	359
I.	Public Consultation, Information Disclosure & Grievance Mechanism	361
I.1	Public Consultations	361
I.1.1	Scoping Consultations	361
I.1.2	Public Consultations	363
I.2	Planned Information Disclosure	364
I.3	Grievance Mechanism	365
I.3.1	Introduction	365
I.3.2	Georgian Regulations	365
I.3.3	ADB Policy (SPS, 2009) Requirements	366
I.3.4	Grievance Redress Process	366
I.3.5	Grievance Redress Mechanism	367
I.3.6	Grievance Redress Commission for Stage 1	367
I.3.7	Grievance Redress Commission for Stage 2	368
I.3.8	Grievance Redress Procedures	368
I.3.9	Grievance Log	372
I.3.10	Communication	373
I.4.11	Disclosure of the Grievance Process	373
J.	Conclusions and Recommendations	374
J.1	Conclusions	374
J.2	Recommendations	376

Appendices

Appendix A	List of Consultation Attendees, June 2017
Appendix B	Consultation Presentation, June 2017
Appendix C	List of Consultation Attendees, November 2017
Appendix D	Consultation Presentation, November 2017
Appendix E	Chance Find Procedure
Appendix F	State Forest Fund
Appendix G	Noise Barrier Cost Estimate
Appendix H	Vibration Analysis
Appendix I	Noise Monitoring Results

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
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
EWB	East West Highway
EWIPs	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 _{eq}	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 ₂ e	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
µg/m ³	Micrograms per cubic meter

Currency Exchange Rates as of 22nd May, 2019:

1 US\$ = 2.77 (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:
 - (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).
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, 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 has been completed and selection of the construction Contractor is on-going. Detailed design of sections F2, F3 and F4 is now on-going and this report forms the EIA for detailed design phase of section F4 which will be followed by sections F3 and 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 **Figure 1**). Section F4 forms the Shorapani – Argveta 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) - 14.778 km;
- Left lane (**AT** – meaning Argveta – Tbilisi direction) - 14.726 km.

Figure 1: Road Location Map



8. 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.

9. The main technical parameters adopted in the detailed design are as follows:

- Design speed - 100 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^[SEP]

- 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. Five long span bridges and one short span bridge will be constructed during the project works. The total length of the five bridges is 4,912 meters, the longest of which is 941 meters. The bridges are grouped into the following main typologies:
- Steel-concrete bridges - bridges 1,2,4: maximum span length up to 60 m for bridges 1 and 2 and up to 72 meters for bridges 4-AT and 4-TA.
 - Precast concrete bridges – bridges 3 and 5: maximum span up to 34m.
11. Six tunnels will be constructed with double tubes with length from 399 m to 1166 m.
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. Reinforced concrete retaining walls are required at the beginning of the project section from:
- KM 0.00 to KM 0.25
 - KM 8.63 to KM 8.71
 - KM 8.84 to KM 8.94
13. There are four interchanges planned in F4 Section.
14. The following types of culverts will be constructed:
- Underpasses for rural roads, which are construction 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 cross the project road. Construction of cast in situ reinforced concrete structures of closed contours cross sections 4.0x2.5 m - 4 units is envisaged in the design.
 - Culverts, for which cast in situ reinforced concrete culverts cross section 2.0x2.5 m - 17 units, 4.0x2.5m - 2 units is envisaged in the design to provide water discharge from ravines and canals.
15. Eight underpasses will be constructed using reinforced concrete culverts. One overpass will be constructed at km 11+854 with a length of 40 meters.
16. 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

17. 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.

18. 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.
19. As noted above, the Project forms part of a program upgrading the E-60. The Khevi – Argveta section of the E-60 (including section F4) 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.
20. 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.
21. 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.

5. Description of the Environment

22. Within the Project area the main sources of air emissions are from transport, including vehicles on the existing Project road, and large scale industrial facilities including the Georgian American Alloys (GAA) manganese processing plant which is located almost adjacent to the southern boundary of the Project road between KM 11 and KM 12. Air quality monitoring was carried out at nine different locations during August 2017 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, IFC standards. The most noticeable factor was the higher levels of PM recorded at the first four monitoring stations which are adjacent to the existing road. This suggests that these levels PM₁₀ and PM_{2.5} are attributable to vehicle movements on the existing road.
23. Annual precipitation in Zestaphoni is around 1,200 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 5 °C in the winter months to around 25 °C in the summer. The dominant wind direction is from the east. However, strong winds from the west are also experienced quite frequently.
24. No site-specific data has been found relating to climate change. However, given the general overview for Georgia it can be assumed that there will be an increase in average annual temperatures of between 1 and 1.5 °C over the next 30 years and that precipitation will decrease. The number of hot days may increase, and as such, consideration of suitable pavement types shall be given.

25. The Project area is located to the west of the Likhi Range which connects the Greater and Lesser Caucasus Mountains. The Project corridor is set within a landscape of mountains, rolling hills and valley plain. The existing road is located within the bottom of the river valley and as such elevation only varies between 200 and 170 meters above sea level.
26. Within the Project area a few areas prone to landslides have been identified. Generally, the landslides do not affect the project alignment, except for the mass movements identified above around KM 0.6 affecting TUN 4.0.01-TA/AT and its eastern and western portals. 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).
27. Two main rivers can be found within the Project area, the Kvirila and the Dzirula. The confluence of the two rivers is in Shorapani adjacent to the Project road at Km 5.0. Other small tributaries within the area include the Borimela River (which the Project road crosses at KM 3.5), and the Ajamura and Samanishvilisghele rivers, both of which located on the south bank of the Kvirila river more than 1.3 km from the Project road. To assess the status of water quality in the Project area, including the Kvirila and Dzirula rivers, monitoring of surface water was undertaken in September 2017. The results of the monitoring exercise show that both the Dzirula and Kvirila rivers meet the national Maximum Allowable Concentrations (MACs) for surface water quality, although the levels of manganese in the Kvirila sample was above the recommended standards for drinking water, this is due to the presence upstream of manganese mining operations.
28. The soils in the Project area are very productive and range of crops are grown in the region which is well known for its wine production. However, hazardous wastes generated by the GAA, Chiatura manganese enrichment plant, and many small-size smelters operating in various settlements of Imereti are sources of soil pollution in the region. To assess the status of soil quality in the Project area, specifically around the Georgian American Alloys Plant (GAA) plant, soil samples were taken and analyzed. The results of the sampling show that all parameters are within the current Georgian limits with the exception of Arsenic and Lead. However, these limits are considered outdated, stemming from old regulations developed during Soviet times. Assessing the results against EU limits (Italy and the UK), the results of all parameters sampled are well within the limits for residential areas. In addition, the results are also well within the proposed Georgian maximum allowable concentrations recently developed by the MoEPA which should come into force in 2018. Most importantly, all parameters are also below the proposed Georgian preventive limits of risk elements in agricultural soil, which is an important factor considering that much of the spoil material may be disposed of at the Kutaisi bypass which borders on an area of agricultural land. Additional analysis of PAHs shows that both samples meet the Dutch target levels meaning that the soil is considered a sustainable soil quality and will have negligible risk to the ecosystem.
29. The project corridor crosses forest areas, agricultural land plots, hilly forest slopes, residential areas and riparian ecosystems. 17.3 hectares (ha) of the municipality of Zestaphoni is covered by forest and shrubbery. Due to human pressures natural vegetation has been taken over by agricultural crops and other human development. In these areas arable lands and pastures have developed. Some of the animal species typical for the area have moved to other areas in away from human activity. Over the time the fauna of the region has changed significantly. 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.

30. A study of flora within the Project area showed that the corridor could be split broadly into six sections, most of which were classified as a mix of 'high' and 'low' status. The low status areas were mainly classified in this way due to the absence of any unique flora in these areas and the generally degraded nature of the landscape due to human interference. The 'high' status areas were classified as such primarily due to the presence of a number of tree species found on the Georgian Red List.
31. According to available information there are two species (Caucasian squirrel and Eurasian otter) considered as vulnerable in Georgia (Georgian Red List) that may be found within the Project area. As part of a fauna survey the bridge locations were checked with particular care and no otters were noted. During the survey trees within the RoW of the new alignment (with exclusion of the areas where tunnels are planned) have been checked. Neither burrows, nor squirrels have been registered in the survey area. The review of the habitat along the alignment indicates that it is not optimum for existence of the Caucasian squirrel.
32. The nearest protected area to the Project road is the Ajameti Managed Reserve, which is located approximately 5 kilometers south west of the end point of the road (km14.7). The nearest Important Bird Area (IBA) to the Project road is the Adjara-Imereti Ridge more than twenty kilometers south of the Project road.
33. Viticulture is the main economic activity in the municipality of Zestaphoni providing 80% of agricultural output. Its development is supported by favorable soil-climatic conditions. GAA is the largest company in Zestaphoni. GAA produced over 187,000 metric tons of silico-manganese in 2012, however the mining and production of the manganese is not without its environmental problems, including impacts to air quality and impacts to the water quality of the Kvirila River. The Project road passes almost adjacent to the north of the plant for around 2 kilometers between KM 9.7 and KM 11.8.
34. Agricultural land plots cover 7,027 ha of the municipality or 46% of the whole territory. 5,159 ha out of the above-mentioned area are arable lands. Other than grapes, melon and maize are predominant crops grown in the region and have been noted within the Project corridor, specifically from KM 7.0 onwards.
35. Zestaphoni is not considered an important or significant area for tourism and recreation. A recent study of foreign visitors to Imereti region indicated that less than 2% of the visitors visited Zestaphoni for recreation or vacation.
36. The road network in the Project area is dominated by the existing E-60 which links Tbilisi with Batumi. Numerous local roads feed onto the E-60 in Zestaphoni, and these roads vary in condition from good to very poor. The main railway line from Tbilisi to Batumi runs broadly parallel with the Project road until it reaches Zestaphoni. In fact, in the first section of the road, between KM 0.0 and KM 6.0 the railway line and the road are only separated by a couple of hundred meters, with the road running south of the railway line. At one location, the new road alignment passes within 20 meters of the railway line (KM 2.5) and eventually passes over the railway line at KM 6.3 as the road heads northwest to start its bypass around Zestaphoni.
37. The Project road is located within Zestaphoni Municipality, which covers a total area of 423 square kilometers and includes the towns of Zestaphoni and Shorapani as well as numerous small villages. The following settlements have been identified within the Project area.
 - Kveda Tseva (KM 0)
 - Shorapani (KM 4.0 – 6.0)

- Zestaphoni (KM 6.0 – 11.0)
 - Kveda Sakara (KM 11.0 – 12.0)
 - Argveta (KM 13.0 – 15.0)
38. 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.
39. Data provided by the Road Department of the Ministry of Regional Development and Infrastructure (RD), shows that during the period 2012 – 2016 there were 2,713 collisions, 471 persons killed and 4,913 persons injured spread over the E-60 corridor. Focusing the analysis on the Khevi – Argveta section, 351 collisions occurred, 78 persons were killed and 648 persons were injured. Finally, along the F4 section 130 collisions occurred, with 30 persons killed and 218 persons injured.
40. The social survey undertaken as part of this Project found that the average wage of the population in the target villages is 650 GEL. The majority (70%) of those surveyed state that the main source of income is wage, 20% of the surveyed families said that main source is pension / allowance, only 5 % said that it is self-employment.
41. Previously there was a landfill site in Zestaphoni adjacent to Kvaliti village. The area of the site was 2.2 hectares and received 15,000 m³/year of waste. However, the Solid Waste Management Company of Georgia closed the Zestaphoni municipal landfill in 2016 due to the fact that it was overloaded. No other landfill has been observed in Zestaphoni.
42. Within the Project area a number of physical cultural resources (PCR) have been identified including the Shorapani Fortress. None of the identified PCR, including the Shorapani Fortress is within close proximity of the Project road itself, with the exception of a cemetery and a small natural spring located to the north of the GAA.
43. Noise and vibration within the Project corridor can be discussed in two parts, firstly the parts of the corridor that broadly follow the existing alignment, and secondly the part of the corridor that bypass to the north of Zestaphoni more than 500 meters north of the existing road. Noise levels within the first part 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. In the second part of the corridor the alignment traverses a predominantly rural / residential landscape with the exception being the portion of the alignment that passes just to the north of the GAA facility. 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 results show that noise levels close to the existing road are elevated above IFC daytime and nighttime standards. However, as the Project corridor enters the rural bypass around the north of Zestaphoni noise levels get lower and are within IFC guideline limits for daytime and nighttime noise.

6. Impact Identification

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

Design / Preconstruction Phase

45. 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.
46. 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. Soil samples taken to the north of the GAA plant have indicated that this area does not comprise levels of soil contamination above Dutch Intervention Levels or Italian standards for residential areas. Arsenic and Lead were identified in the samples above the current national limits, but within proposed new national limits and other international limits (UK and Italy). However, only two soil samples were taken in this location and it is possible that soil contamination could still exist in the area north of the GAA. The Project road runs parallel to the GAA plant for approximately 1.3 kilometers, but the potential for any additional pollution is considered to be confined to a smaller area, around 500 meters in length, and is focused around large two piles of waste material sited on the northern boundary of the GAA. In this portion of the Project road the road level will be raised on an embankment. An average of 50 cm of topsoil will be stripped from an area more than 40 meters wide over this 500 meter section, that equates to around 10,000 m³ of top soil to be removed. Although the two soil samples taken as part of this EIA did not show significant levels of contamination it is considered prudent to undertake additional sampling of these soils to determine if any additional actions for soil monitoring and disposal would be needed during the construction phase.
47. Natural Hazards - Generally, landslides in the Project area do not affect the project alignment, except for the mass movements identified above around KM 0.6 affecting TUN 4.0.01-TA/AT and its eastern and western portals. The impacts from the landslides are not expected to be significant enough to warrant major mitigation measures as part of the detailed design. However, minor mitigation measures e.g. safety nets have been included in the design. 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.
48. 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 to the north of Zestaphoni and the fact that large portions of the road run beneath ground reduces the level of resettlement and compensation that would otherwise be expected if the existing alignment was being upgraded.
49. 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.
50. 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

51. 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.

52. 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.
53. 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 Kvirila rivers. The required amounts, potentially 200 m³ per day (0.002 m³/s) are insignificant given the flow rates of these major rivers.
54. 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).
55. 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.
56. Flora & 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 7,232 trees have been identified in State Forest Fund areas. Of these, 204 are Georgian Red-listed species greater than 8cm in diameter and 411 are Georgian Red-listed species less 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.
57. Fauna - Impacts during the construction phase may occur, including; a) As a result of vegetation cover removal and earthworks habitats (nests, holes) may be lost. Tree and vegetation cutting will also affect the food base, b) Small-sized animals may fall in trenches and pits and may be injured, c) During the movement of construction vehicles and construction equipment, collision with animals may be [SEP]expected, d) Emission of noise, dust and combustion products, as well as human intensive activities will cause [SEP]animal disturbance and migration to other places, e) Unsystematic spread of waste, improper management of waste (change in environmental quality [SEP]indicators) will cause a further deterioration of the living conditions of terrestrial and aquatic animals, f) Night lighting systems at construction camps may cause disturbance of animals and disorientation of [SEP]birds, g) There may be the cases of poaching by staff, h) Temporary impacts on fish may occur due to sedimentation and water turbidity in the immediate vicinity of the construction work area, and the potential for minor introduction of pollutants from construction operations; and i) Bridge works could impact upon the habitat of otters.

58. Protected Areas - The nearest protected area to the Project road is the Ajameti Managed Reserve, which is located approximately 5 kilometers south west of the end point of the road and is unlikely to be impacted by Project works.
59. 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. The new alignment also crosses above and adjacent to the existing railway line at a number of locations. The bridge works above the railway line at KM 13.1 may cause specific issues due to its close proximity to railway.
60. 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.
61. 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.
62. Tunnel & Embankment Spoil Material - A large volume of spoil material will be generated from the tunneling works. Estimates provided by the Projects Tunnel experts indicate that as around 1,027,200 m³ of spoil material will be generated from the tunneling. Another 1,184,100 m³ of cut will be generated from excavation works on slopes, etc. Where practical the spoil will be re-used as embankment material at the Project site (for example on the embankments behind Zestaphoni). Estimates indicate that approximately 1,519,800 m³ can be re-used as embankment material, which would leave approximately 691,500 m³ as static balance. Assuming that most of the embankments associated with the Project are located in the bypass area to the north of Zestaphoni, the average journey distance to transport the spoil material from tunnels to the embankment areas may be around 8 kilometers. To transport material to the embankment areas approximately 250,000 truck journeys will be required, or an average of 277 a day over the 30 month construction period. Disposal of the static balance would require an area of 82,980 m² with a height of 10 meters if they were to be disposed of in one spoil disposal location. Preliminary investigations with the RD indicate that the spoil material could be re-used as embankment material at the Kutaisi Bypass where material is required to construct a further two lanes of the bypass. A field visit to the Kutaisi area did not indicate any sensitive land uses in this area which has already been acquired by the RD for the future construction works in this area. Disposal of spoil material in this location will require close coordination between the contractors of both projects and the RD. To transport this volume of material to Kutaisi Bypass over 115,250 truck journeys will be required, or an average of 128 per day over the 30 month construction period. The distance to the Kutaisi site is around 35.5 kilometers.
63. 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.

64. 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.
65. 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.
66. 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.
67. 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 embankments around Zestaphoni may also have an aesthetic impact.
68. 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 with the exception of one cemetery identified approximately 50 meters south of tunnel TUN 4.0.06-AT/TA and a small natural spring located to the north of the GAA.
69. 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.
70. Vibration - Vibration from the construction activities is a cause for 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. It is likely that construction works will impact upon structures within the Project area, potentially causing cosmetic damage and in extreme cases possibly structural damage.
71. Cumulative Impacts – Cumulative impacts during the construction phase include:
- (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.

- (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.

Operational Phase

- 72. **Climate Change** - The transport sector is vulnerable to changes in climate variables, expected changes in the frequency and intensity of extreme weather events, and increased sea level. The following are a few examples of the potential effects; a) Changes in temperature—both a gradual increase in temperature and an increase in extreme temperatures—are likely to impact road pavements (for example, heat-induced heaving and buckling of joints), b) Changes in temperature will also impact the behaviour of permafrost and thus the infrastructure lying on permafrost, c) Changes in precipitation and water levels will impact road foundations, d) Extreme weather events such as stronger and/or more frequent storms will affect the capacity of drainage and overflow systems to deal with stronger or faster velocity of water flows, e) Stronger or faster velocity of water flows will also impact bridge foundations, f) Increased wind loads and storm strengths will impact long span bridges, especially suspension and cable-stayed bridges, g) High levels of precipitation may threaten embankment stability and h) Increase in scouring of roads, bridges, and support structures.
- 73. **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.
- 74. **Noise** – A noise model developed for the EIA shows that there are many receptors, 115, where IFC guideline limits for daytime and nighttime noise would be exceeded in 2033 given the predicted increase in traffic over this period. The model also shows that noise abatement, in the form of a 4-meter-high solid noise barriers would reduce the number of affected receptors to just 24.
- 75. **Vibration** - Highway traffic is not likely to have any measurable impact on the structures or on comfort.
- 76. **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); SO₂; carbon dioxide (CO₂); 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 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. If a similar traffic flow should transit via the existing road, the emissions would be almost 20% higher. 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.

77. 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.
78. 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. 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.
79. 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.
80. 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 Actions

81. The summary mitigation measures for the potential impacts identified above for the Project Road include:

Design / Preconstruction Phase

82. Specific Environmental Management Plan – To ensure that all of the potential mitigation measures are applied during the construction phase, the Contractor shall be responsible in the pre-construction phase for the preparation of his Specific Environmental Management Plans (SEMP). The SEMPs shall include the following plans:

- (i) 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.
- (ii) 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)
83. 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 SEMP is 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.
84. 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.
85. 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).
86. Air Quality - To adequately manage air quality impacts the Contractor will be responsible for the preparation of an Air Quality Plan.
87. Climate Change - Most climate change impacts are projected to occur slowly over a long period of time and as such providing mitigation measure for topics such climate change impacts on pavement design need to be taken over time and cannot be determined in a study like this. Notwithstanding the above a number of simple measures can be taken to ensure that in the short term that extreme precipitation events do not result in significant impacts to the Project, they include; a) Increase ditch and culvert capacity, b) Maintain positive cross slope to facilitate flow of water from surface, c) Increase resistance to rutting, d) Reduce splashing/spray through porous surface mixtures, e) More frequent use of elevated pavement section, f) Improve visibility and pavement marking demarcation, and g) Ensure that all embankments are seeded to help increase stability.
88. Contaminated Soils – An additional four samples will be taken prior to the start of construction by the Engineer. If the results show that the monitored parameters are within the proposed national limits and the Dutch target values no further soil sampling will be considered necessary. Should the results of the monitoring indicate any elevated levels of contamination further testing of the excavated soils in this area will be required during the construction phase by the Contractor. The procedure for any construction phase testing is as follows:
- a) The Contractor shall identify a temporary storage area for excavated material.
 - b) The Contractor shall strip the topsoil in batches of 2,500 m² and store the mixed material in the temporary storage area (the stockpile).

- c) The Contractor shall then divide the stockpile into quadrants of 250m³.
 - d) The Engineer will hire a certified laboratory to take a soil sample from each of the quadrants for further chemical analysis.
 - e) If the results show that all of the samples are within the proposed national limits and the Dutch target values the material can be removed from the stockpile area and disposed of as non-hazardous material.
 - f) If any of the ten samples show elevated levels of contamination the material from the respective contaminated quadrants will be disposed of as hazardous waste. Any other non-contaminated quadrants may be disposed of as non-hazardous waste.
89. Alternatively, the Contractor may wish to explore alternative methods to treat the contaminated waste so that it can be disposed of as non-hazardous waste. If the Contractor chooses this option, he will be responsible for the preparation of a Contaminated Spoil Treatment Plan that will outline the procedures and methods for treating the waste spoil.
90. 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.
91. 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.
92. 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.
93. Cutting of Trees – Cutting of trees can be addressed under two headings:
- (i) Private Land – Compensation shall be paid to all affected tree owners as per the Project LARP.
 - (ii) 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 be 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.

94. 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.
95. 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.
96. 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.
97. Spoil Disposal – The responsibility for identifying the final disposal areas for tunnel and embankment spoil material lies with the Contractor. Initial consultations with the RD indicate that the remaining static balance of 691,500 m³ could be re-used at the Kutaisi Bypass. However, Spoil material from F4 will be generated at different times and in different volumes throughout the construction phase. At this stage of the Project the construction schedule for F4 is not known and as such it is not possible to draw up plans for the disposal of spoil material at the Kutaisi bypass. If the Contractors for F4 and Kutaisi bypass can, in coordination with RD, agree to re-use the materials F4 Contractor will be responsible for preparing a Spoil Disposal and Re-use Plan specifically for the Kutaisi bypass site.
98. If there is no agreement between the Contractors of F4 and the Kutaisi Bypass regarding the re-use of the materials the Contractor will be responsible for the preparation of a separate Spoil Disposal Plan for Arrangement of Spoil Disposal Area and a Re-cultivation Plan for a separate site which will be indicated and provided by the RD. 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. The 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 SEMP. No spoil storage will be allowed until the RD and the Engineer have approved the plan.
99. 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 Engineer within the vicinity of each tunnel he is excavating.

100. 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.
101. 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.
102. 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.
103. 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 surveys undertaken. The TBP will also include a vibration monitoring plan to monitoring vibration levels and frequency around the blasting sites.

Construction Phase

104. 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.
105. 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.
106. 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.
107. 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.

108. Flora – it is recommended that re-planting of the 615 red-list species is undertaken as an additional compensation measure. The Contractor should coordinate with the National Forest Agency to identify a site, or sites, within the Project area where these trees can be re-planted. Plant maintenance will be carried out for at least two years. The Contractor will be responsible for the maintenance. 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.
109. Fauna - 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 burrows in these areas. If burrows 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. Poaching of wildlife shall be strictly prohibited.
110. Protected Areas - No construction activities, including camps, haul routes, etc. will be allowed within, or through protected areas, or reserves.
111. Infrastructure - To mitigate the potential impacts the Contractor will submit a Traffic Management Plan to local traffic authorities prior to mobilization and include the plan as part of his SEMP. The Contractor will also 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. To prevent potential environmental, health and safety issues arising whilst working in the area above the railway line at KM 6.3 and at Bridge BR 4.0.1.AT/TA, the Contractor will be responsible for the preparation of an Environmental, Health and Safety Method Statement for working in these areas.
112. Utilities - During construction all utilities in the Project area shall be kept operational, particularly during the winter months.
113. 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.
114. Asphalt Plants, Concrete Batching Plants and Construction Camps – The EMP provides a range of detailed mitigation and management measures for these facilities. All of these measures are based on international best practice.
115. Bridge Construction – A range of measures are provided in the EIA to prevent impacts occurring at bridge construction sites, 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 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.

116. Tunnels - Routine monitoring of the groundwater levels in well in the Project area will be undertaken on a weekly basis by the Contractor within the vicinity of each tunnel he is excavating. 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. 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 will be constructed for the affected persons.
117. 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.
118. 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.
119. 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.
120. Physical and Cultural Resources - The cemetery identified close to the Project road is unlikely to be impacted by construction works, however, it is required that during the construction phase the northern boundary of the cemetery be fenced off to ensure that there is no encroachment into this area by construction workers or equipment. A short section of noise barrier is recommended around KM 10.1 if it is not to be included as part of general noise mitigation measures. During the construction works the spring shall be fenced on the northern side to prevent construction works impacting upon the spring. In the event of any chance finds during the construction works procedures shall apply that are governed by GoG legislation and guidelines.
121. Noise & Vibration – 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. Specific measures have been proposed

in this EIA to manage vibration issues during the construction phase, they include building surveys, consultations, real time monitoring, choice of tunneling techniques and defining damage risk zones.

Operational Phase

122. Noise – The noise models prepared indicate that noise barriers, in certain locations and of certain heights, will reduce noise levels to comply with IFC standards. These noise barriers should be constructed as part of the Project. However, 24 receptors have been identified that will still be subjected to noise levels above IFC standards during the operational phase. A range of potential mitigation measures were assessed for these remaining 24 receptors, they included speed limits, noise proof windows and low noise asphalt. However, none of these options are viable for the Project. However, two other options have been determined as viable for the Project, expropriation of the affected property, or signing of a waiver. The RD will be responsible for consulting with the remaining 24 receptors to determine what option is preferable to the individual receptors. This activity shall be completed before construction commences and the results of the consultations shall be presented to the ADB for final review and approval.
123. Induced Impacts – Although the EMP contains provisions controlling direct impacts of land takings for both the road and ancillary functions (asphalt plants, construction camps, etc.), control of the induced impacts is largely beyond the scope of the Project.
124. 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.
125. 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

126. 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:
127. 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.
128. 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.
129. 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

130. Two rounds of stakeholder consultations were undertaken in Zestaphoni. 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.

131. 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.

10. Conclusions

132. 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.

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

Construction Phase

134. The identified residual impacts during the Construction Phase include:

- **Terrestrial Fauna** - 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. Residual Impacts will be **MINOR / MODERATE**.
- **Aquatic Flora and Fauna** - A number of bridge piers will be constructed within the Dzirula 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 are disturbed by the Project works. Residual Impacts will be **MODERATE**.
- **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 and Spoil Disposal** - 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. Residual Impacts will be **MINOR / MODERATE**.

- **Vibration** - 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. Residual Impacts will be **MINOR / MODERATE**.
- **Noise** - 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. Residual Impacts will be **MINOR / MODERATE**.

Operational Phase

- **Climate Change** - 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**.
- **Soils** - The erosion protection measures outlined above will prevent impacts occurring into the operational phase of the Project. However, although the measures outlined above will mitigate short term impacts, in the long term a solution for the disposal of contaminated soils must be found otherwise residual impacts will be medium. Residual Impacts will be **MEDIUM**.
- **Hydrology** - 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. Residual Impacts will be **LOW/MEDIUM**.
- **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**.
- **Employment and Local Businesses** - 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**.
- **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. Residual Impacts will be **LOW/MEDIUM**.

- **Noise** - According to the noise model residual impacts to a number of receptors will remain even after the construction of the noise barriers listed above. Further assessment of the impacts to these receptors will be on-going during the operational stage of the Project to confirm the findings of the model and if additional noise abatement measures are required, including for example; Fencing around individual properties, construction of earth embankments around groups of properties, installation of sound proof windows in properties and expropriation. Residual Impacts will be **MEDIUM**.

11. Implementation

135. 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.
136. 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 camp site.
137. 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.
138. 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

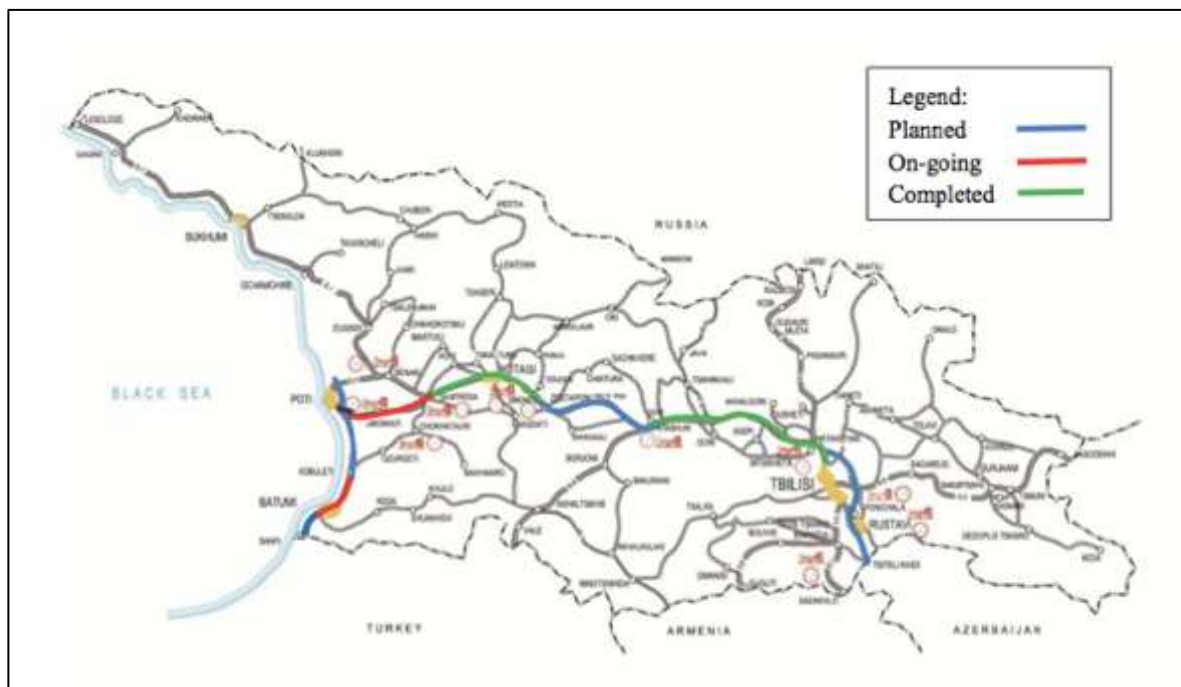
A.1 General

139. 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

140. 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. In anticipation of admission of Georgia to the Central Asia Regional Economic Cooperation (CAREC) program in 2016, 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



141. In light of the traffic growth on EWH, the high percentage of truck traffic, and the difficult terrain and resulting geometric profiles, 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.

142. 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.

Table 1: Chumateleti – Argveta Road Sections

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

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

A.3 Purpose of the EIA report

144. 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 F4 of the new Khevi-Ubisa-Shorapani-Argveta section of the E60 Highway, or more simply, the “Project”.

145. 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.

146. 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

147. 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

148. 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

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.”

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. The following section provides further details of each of these aspects.

A.5.1 Scoping Consultations

149. Scoping consultations were held in June 2017 in Zestaphoni. 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:

- In previous road projects in the region there were bad experiences with disposal of spoil material, especially from tunnels. Locations were selected, but there was too much spoil material and as such locals were paid to allow spoil material to be dumped on their land. This issue needs to be carefully managed.
- Landslides are a problem in this region, the project must carefully manage this issue.
- For every tree cut, at least three must be replanted as part of the project.
- Access to properties and land needs to be maintained during both phases.
- Will the Contractors repair access roads after construction works are completed?
- There are lots of cultural heritage sites along the corridor. They need to be protected.

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

A.5.2 ADB Requirements

151. 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

152. 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

153. 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.

154. **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.

155. **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

156. 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

157. The Project is a road construction project located in Imereti Region of central Georgia. The Project road comprises Section F4 (Shorapani – Argveta) of the Khevi-Ubisa-Shorapani-Argveta Road (E-60).
158. The alignment passes hilly-mountainous relief from KM 0.0 to KM 1.3, on the left side of the existing road both as exposed road and through two tunnels. The alignment runs in the gorge of the river Dzirula from KM 1.3 to KM 3.0, crosses the river Dzirula several times. The alignment runs on the left side of the existing road, crosses the river Borimela, enters the tunnel and joins the existing road in Shorapani from KM 3.0 to KM 4.3. The alignment follows the existing road from KM 4.3 to KM 5.6. Widening of the road takes place at the expense of cutting into the slope on the left, then the alignment turns to the right, crosses the river Kvirila and the railway twice, then the alignment turns northward of Zestaphoni through three tunnels. From KM 9.6 to the end of the route design road bypasses Zestaphoni, joins the interchange under construction at km KM 14.7 at the village Argveta located on Zestaphoni-Kutaisi motorway.
159. The length of Project road is:
- Right lane **(TA)**² - 14.778 km;
 - Left lane **(AT)** - 14.726 km.
160. **Figure 3** indicates the location of the Project within the context of Georgia and **Figure 4** illustrates the location in a local context. **Figure 5** to **Figure 14** provide a set of twelve detailed maps of the site including locations of tunnels and bridges.

B.3 Environmental Setting

163. **Figure 15** provides an overview of the F4 Section environmental setting.

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

Figure 3: Road Location Map

Figure 4: Project Road

Figure 5: Project Road (KM0 – 0.6)

Figure 6: Project Road (KM0.4 – 2.1)

Figure 7: Project Road (KM2.1 – 3.7)

Figure 8: Project Road – KM3.7 – 5.5

Figure 9: Project Road (KM5.5 – 7.0)

Figure 10: Project Road (KM7.0 – 8.7)

Figure 11: Project Road (KM8.7 – 10.3)

Figure 12: Project Road (KM10.0-11.6)

Figure 13: Project Road – KM11.5 – 13.0

Figure 14: Project Road – KM13.0 – 14.7

Figure 15: F4 Environmental Setting



KM0 - The F4 section starts on the south bank of the Dzirula river, approximately 8km east of Zestaphoni and opposite the settlement of Kveda Tseva. The south bank of the river is dominated by forest. However, the start of section F4 almost immediately disappears into a set of two tunnels thereby limiting impacts to vegetation. The road emerges from the tunnel to broadly follow the alignment of the existing road just to its south. The road will pass just behind the restaurant pictured opposite, one of very few properties in this portion of the road. The road then crosses back and forth across the Dzirula river before coming to a proposed interchange on the outskirts of Shorapani. The photo above is taken looking east.



KM4.3 - After the interchange the road enters a tunnel emerging on the south side of the Dzirula river opposite the 'center' of Shorapani. A number of residential properties and apartment blocks are located in this area as well as a school. The photo above is taken from a small pedestrian bridge crossing the Dzirula looking west. The new road will be constructed on the existing road, with further cut into the slopes on the left side of the road required.



KM4.4 - The existing road follows the Dzirula river and the new road will follow almost the same alignment, or just to the south. Some small stalls selling items for tourists can be noted (see photo opposite). Few residential properties will be affected by construction works, although noise may be an issue during the construction and operational phases of the project here. The photo above is taken looking east towards the tunnel portal – TUN 4.0.03-TA/AT (tunnel shown in green on the plan).



KM6.0 - The road continues west towards Zestaphoni. In this area a few residential buildings can be observed as well as some light industrial and commercial properties. At this point the Kvirila river joins with the Dzirula River. The alignment will then cross the Kvirila river and enter directly into a long tunnel (TUN 4.0.04-AT/TA) bypassing the north east of Zestaphoni. The photo above is taken looking north east from across the Kvirila at the location where the new road will split from the existing pavement.



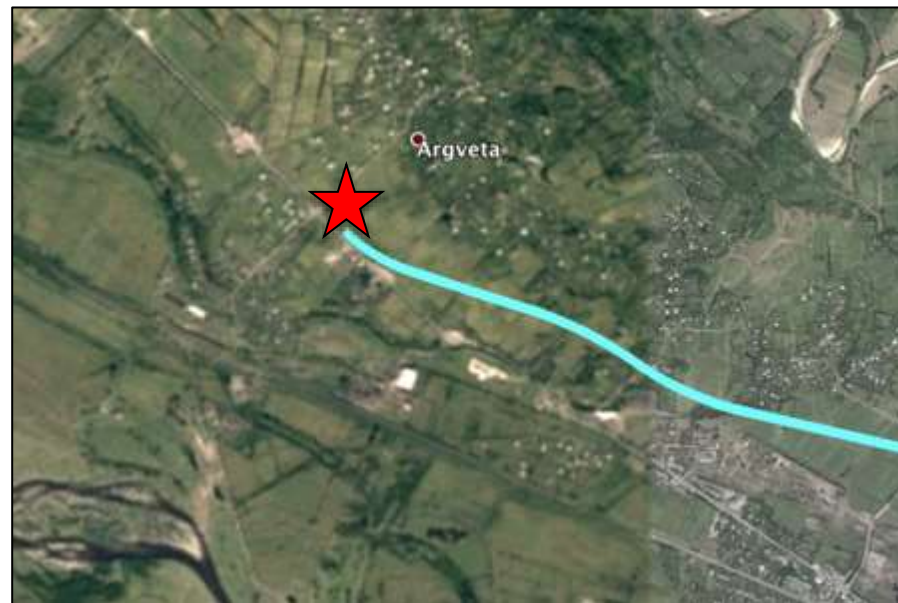
KM6.3 - The alignment will then cross the Kvirila river and enter directly into a long tunnel (TUN 4.0.04-AT/TA) bypassing the north east of Zestaphoni. The photo above is taken looking south east across the river in the direction of the bridge, almost adjacent to the proposed tunnel portal.



KM9.3 - After exiting the tunnel the road traverses a mix of woodland, agricultural land and pastureland avoiding impacts to residential properties. The road then passes through a small residential area to the north of Zestaphoni. A bridge is planned in this location (BRI 4.1.05-TA/AT)



KM11.5 - The road continues west through agricultural land (mostly corn) on the north side of the GAA manganese processing plant. The road may encroach on the GAA property and as such soil samples have been taken in this area to assess if there is any soil contamination from the plant. The road crosses existing local roads and comes very close to a small medical clinic. Low and medium voltage transmission lines and residential gas pipelines are also located in this area. The photo above is taken looking south towards the GAA plant.



KM14.7 - The Project road ends at the junction with the new road (Argveta – Kutaisi) which is currently under construction. The topography of the road is flat in this portion which traverses agricultural land. The existing alignment is located approximately 50 meters to the south of the new road. The photo above is taken looking east from the end point of the road.

B.4 Road Standards and Profiles

161. 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:

- Design speed - 100 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^[1]_{SEP};
- 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.

162. A minimum radius of horizontal curve 400 m for the design speed 100 km/h is adopted based on Austrian standards 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

163. 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.

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

- 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;
- 1.00m verge on the outmost of the external shoulders, where external safety barrier may be located according to needs;
- 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).

167. 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 16: Cross Section on Embankment and Cuts

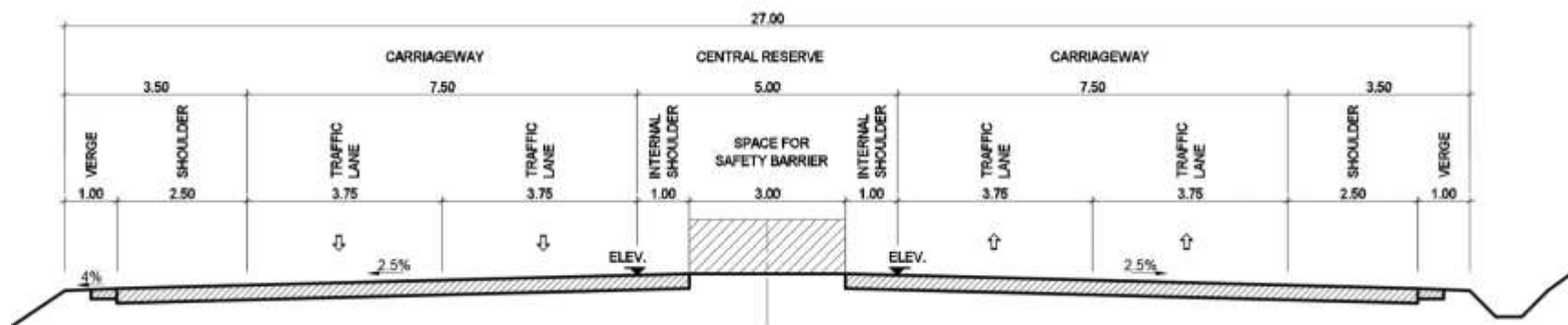


Figure 17: Cross Section on Bridges

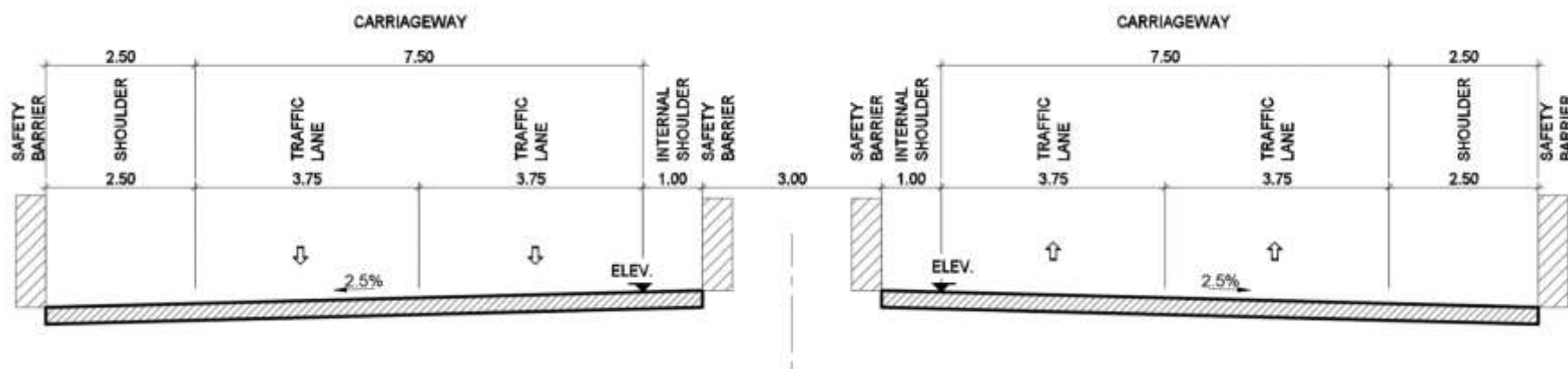
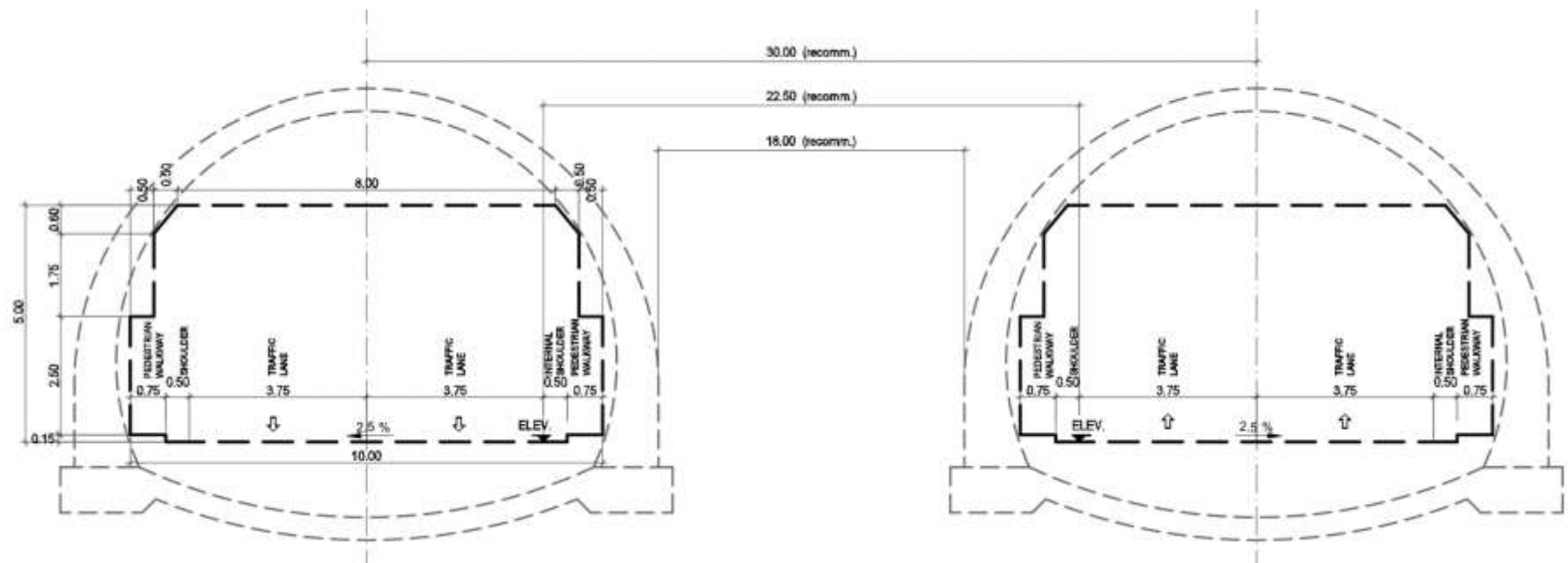


Figure 18: Cross Section in Tunnels



165. **Cross Section on Bridges** - This is a functional cross section, so the structural part is not shown. 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.

166. **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

167. Five long span bridges and one short span bridge will be constructed during the project works (throughout the report we will refer to five bridges, although from a technical perspective there are ten bridges as the AT lane and TA lane on each 'bridge' are not joined, but are standalone structures). **Table 2** below provides summary details of the bridges and their locations.

Table 2: Bridges

Bridge #	Chainage Start (m)	Chainage finish (m)	Watercourse Type / Name	Bridge length (m)
BRI 4.1.01-AT	1,256	1,846	Dzirula River	589
BRI 4.1.01-TA	1,250	1,890	Dzirula River	640
BRI 4.1.02-AT	2,039	2,980	Dzirula River	941
BRI 4.1.02-TA	2,050	2,930	Dzirula River	880
BRI 4.1.03-AT	3,230	3,485	Borimela River	255
BRI 4.1.03-TA	3,210	3,470	Borimela River	260
BRI 4.1.04-AT	5,862	6,317	Kvirila River	455
BRI 4.1.04-TA	5,853	6,273	Kvirila River	420
BRI 4.1.05-AT	9,044	9,240	None	196
BRI 4.1.05-TA	9,018	9,214	None	196
BRI 4.1.06-AT	7,061	7,101	None	40
BRI 4.1.06-TA	7,031	7,071	none	40
TOTAL				4,912

168. The bridges are grouped into the following main typologies:

- Steel-concrete bridges - bridges 1,2,4: maximum span length up to 60 m for bridges 1 and 2 and up to 72 meters for bridges 4-AT and 4-TA.
- Precast concrete bridges – bridges 3 and 5: maximum span up to 34m

169. The following presents a short description of each bridge:

- Bridges 1-TA and 1-AT – Bridges are composed of spans with length 42, 48, 54 and 60 meters. Structural scheme is a continuous deck.
- Bridges 2-TA and 2-AT – Bridges are composed of spans with length 42, 48, 54 and 60 meters. Structural scheme is a continuous deck.

- Bridges 3-TA and 3-AT – Bridges are composed of spans with maximal length 34 meters.
 - Bridges 4-TA and 4-AT – Bridges are composed of spans with lengths 48, 54, 60 and 72 meters.
 - Bridges 5-TA and 5-AT – Bridges are composed of spans with maximal length 34 meters.
170. Both bridge types have their advantages and disadvantages as follows:
- Precast 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.
 - 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.
171. There are two types of pier geometry in elevation, as follows:

Figure 19: For steel-concrete bridges – type 1

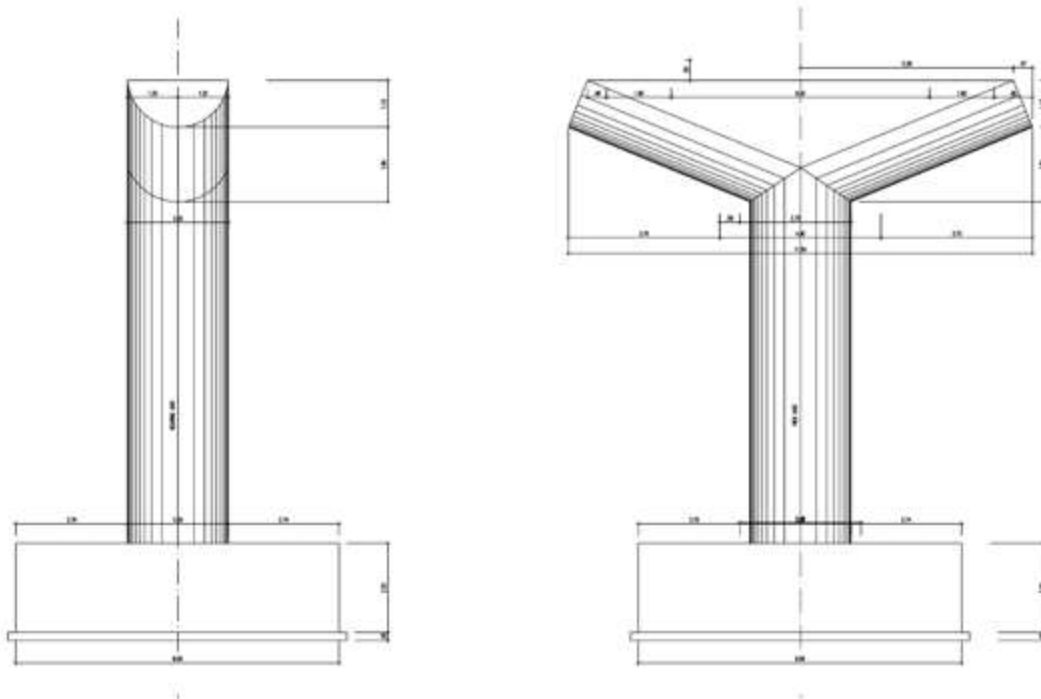
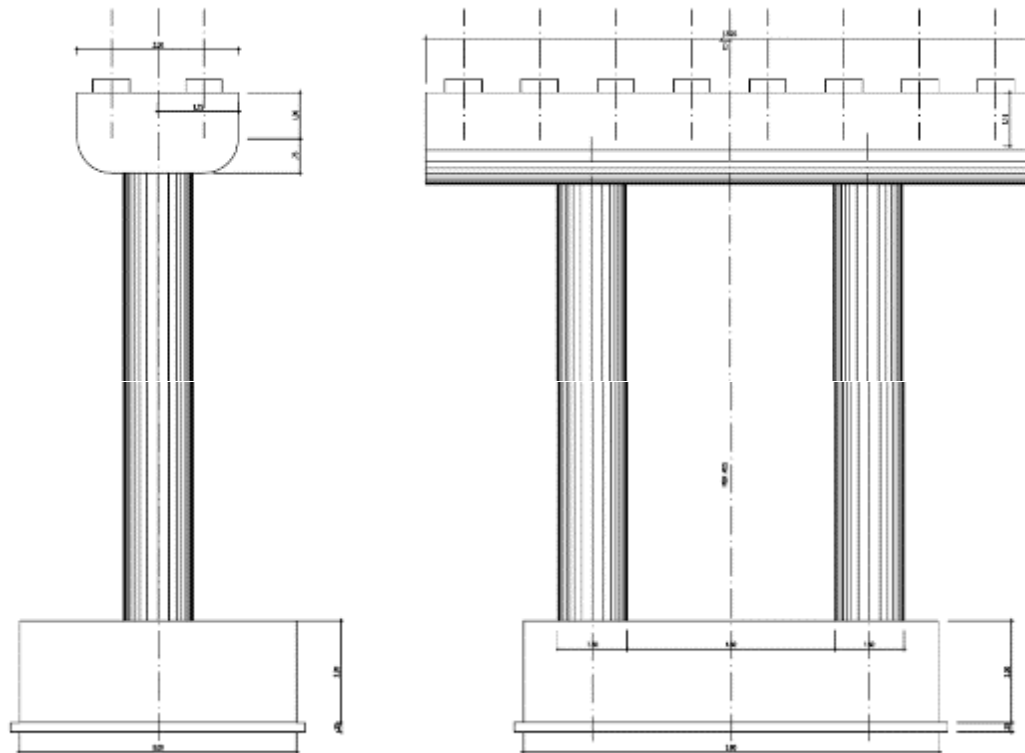
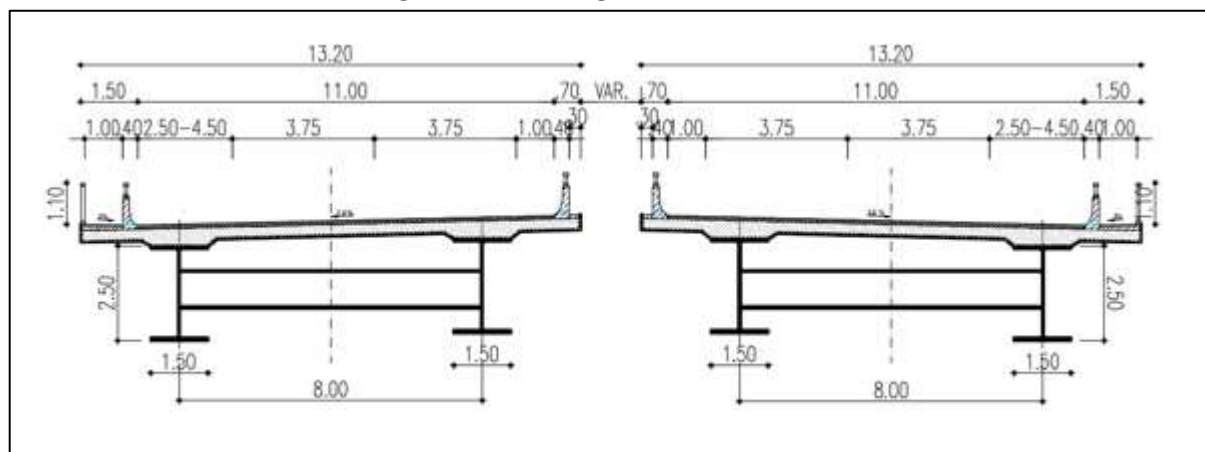


Figure 20: For pre-stressed precast PSC beams bridges – type 2



172. The bridge decks will be two main beams connected by a trasversal beam and with the slab cast on a steel plate, more or less as is shown in **Figure 21** below.

Figure 21: Bridge Cross Section



173. For foundation of substructures, installation of piles will be done through boring using cast-in-place bored pile with reinforced concrete was adopted due to local field condition, environment effect, and supply of materials. This construction method has minor noise and vibration impacts compared to precast driving methods.

B.6 Tunnels

174. In Section F4 six tunnels will be constructed with double tubes with length from 399 m to 1166 m. In this Section, the ground thickness over the tunnel are generally limited and crossed clusters rock shown poor mechanical characteristics.

Table 3: Tunnels in Section F4

Tunnel #	Length (m)	Chainage		Maximum Overburden	Lithology
		Start (m)	End (m)		
TUN 4.0.01-AT	560	165	725	59.85	Medium sound rock
TUN 4.0.01-TA	399	226	625	63.97	
TUN 4.0.02-AT	510	725	1,235	141.49	Medium sound rock
TUN 4.0.02-TA	445	725	1,220	149.23	
TUN 4.0.03-AT	1,165	3,472	4,637	83.51	Medium sound rock
TUN 4.0.03-TA	804	3,490	4,294	86.06	
TUN 4.0.04-AT	715	6,330	7,045	76.76	From moderately weak to medium sound rock
TUN 4.0.04-TA	723	6,300	7,023	74.83	
TUN 4.0.05-AT	1,193	7,137	8,330	59.74	From moderately weak to medium sound rock
TUN 4.0.05-TA	1,152	7,107	8,259	58.81	
TUN 4.0.06-AT	450	9,277	9,727	-	From moderately weak to medium sound rock
TUN 4.0.06-TA	444	9,265	9,709	-	

Table 4: 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	10.00 m

175. Ventilation - The primary ventilation for the tunnels having length >1000m (TUN 4005 TA/AT and TUN 4003 AT) 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.

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.

176. 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).

177. 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.

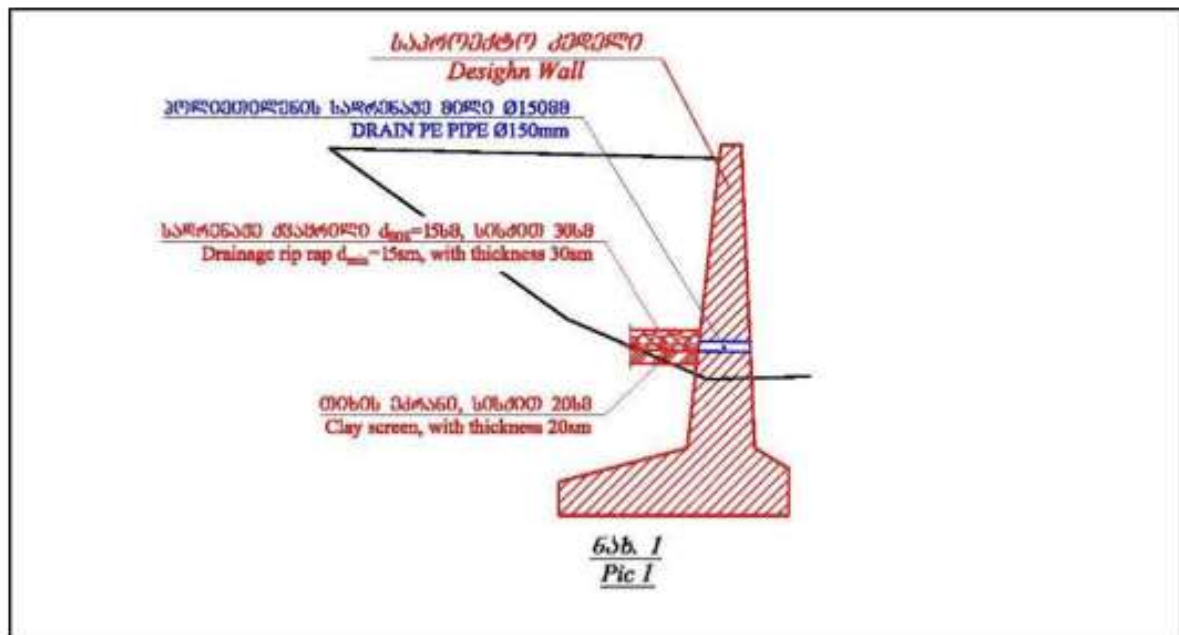
B.7 Retaining Walls

178. 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 are required at the beginning of the project section from:

- KM 0.00 to KM 0.25
- KM 8.63 to KM 8.71
- KM 8.84 to KM 8.94

179. A reinforced concrete support structure wall is required at Shorapani, on the section of the road from KM 4.36 to KM 4.43.

Figure 22: Typical Retaining Wall



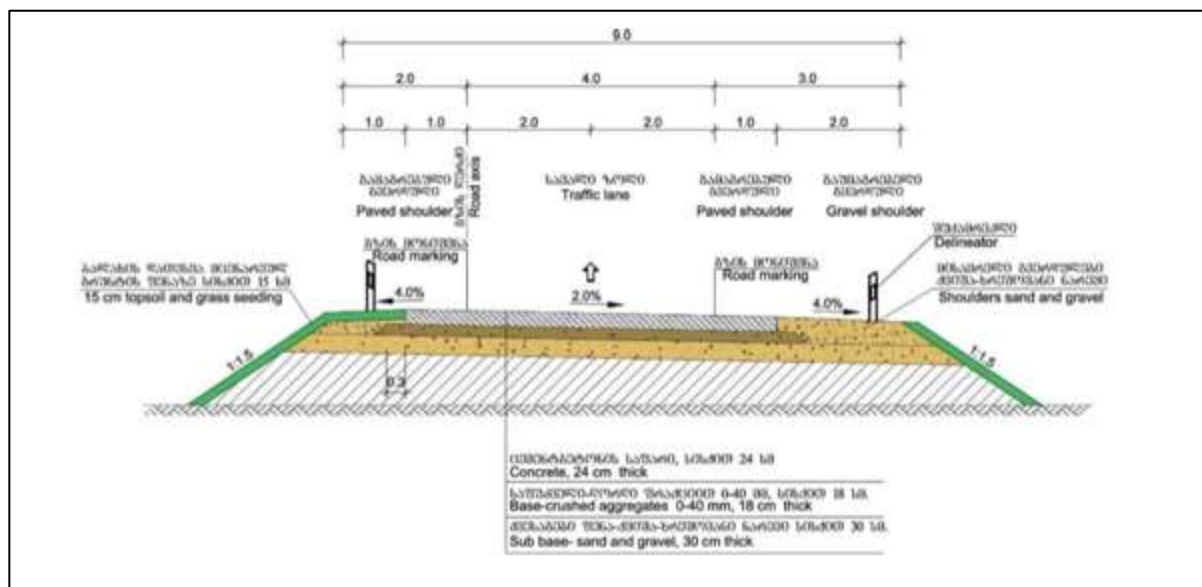
Note: Drain Pipe 150mm / Drainage Rip-rap thickness 30cm / Clay Screen thickness 20cm

B.8 Interchanges

182. There are four interchanges planned in F4 Section. Figure 7, Figure 9, Figure 13 and Figure 14 provide plans of the Project road including all interchanges.

180. The pavement structure for interchanges includes:
- Pavement - cement-concrete, thickness 24 cm.
 - Base course - crushed aggregates 0-40 mm, thickness 20 cm.
 - Sub-base - sand and gravel mix, thickness 30 cm.

Figure 23: Road Pavement Structure for Interchanges



B.9 Culverts and Underpasses

181. Culverts, cattle passes and 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 Project road passes inhabited areas, arable lands, pastures and other rural territory. Thus box section underpasses shall be constructed to pass cattle, pedestrians and vehicles and ensure uninterrupted crossing of the Project road.
182. The following types of culverts will be constructed:
- Underpasses for rural roads, which are construction 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 cross the project road. Construction of cast in situ reinforced concrete structures of closed contours cross sections 4.0x2.5 m - 4 units is envisaged in the design.
 - Culverts, for which cast in situ reinforced concrete culverts cross section 2.0x2.5 m - 17 units, 4.0x2.5m - 2 units is envisaged in the design to provide water discharge from ravines and canals.
183. Eight underpasses will be constructed using reinforced concrete culverts. The table below indicates their locations.

Table 5: F4 Underpasses

#	Chainage (m)
UND 4.3.01-AT	10,293
UND 4.3.01-TA	10,269
UND 4.3.02-AT	12,770
UND 4.3.02-TA	12,749

#	Chainage (m)
UND 4.3.03-AT	13,222
UND 4.3.03-TA	13,200
UND 4.3.04-AT	13,636
UND 4.3.04-TA	13,614

B.10 Overpasses

184. One overpass will be constructed at km 11+854 with a length of 40 meters.

B.11 Construction Process

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

- **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.
- **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.
- **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:
 - Clearing and grubbing.
 - Removal and disposal of traffic signs, sign posts and their foundations.
 - Demolition, removal and disposal of existing bridges including foundations, abutments, piers, retaining walls, riverbank and waterway protection works.
 - Demolition, removal and disposal of existing culverts, inlet and outlet structures, headwalls, concrete drains, channel lining, and erosion protection works.
 - Removal of and any other natural or artificial objects within the RoW.
 - Removal and disposal of all vegetation and debris within the designated limits of the Right-of-Way.
- **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
 - water mains
 - overhead electric supply lines
 - gas pipelines
 - underground telephone cables
 - sewer mains
- **Construction Activities**– The main construction phase aspects are described in detail below.

B.11.1 Bridges

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

- Foundations.
- Substructure including bridge bearings.
- Superstructure, including construction of expansion and deformation joints and footpaths.

- Deck pavement including hydro isolation, drainage, hand railing, and conduits for services.
- Approach slabs.
- Slope treatments in front and around the abutments.
- Construction and maintenance of traffic detours.
- 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.
- All necessary and incidental items required for a complete bridge.
- All new and widened bridges will be designed for the life expectancy of 100 years.
- Oil and grease interceptor tanks.

B.11.2 Tunnels

187. The actual development of the tunnel design follows the principles of ADECO RS³ method and is summarized in the following table.

Table 6: ADECO Tunneling 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. 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.11.3 Culverts

188. 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:

^{3 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.

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

B.11.4 Other Drainage Structures

189. 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.11.5 Earthworks

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

- Removal of topsoil.
- Construction of embankments.
- Construction of subgrade.
- Excavation and removal of the existing pavement materials and the existing road embankment.
- Removal and replacement of unsuitable materials.
- Structural excavation.
- Excavation for the construction of side drainage and cross-drainage works.
- Excavation for the removal and relocation of the existing utilities.
- 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.
- Preparation of beddings and filters for all structural, cross drainage, side drains or pavement works.
- Excavation, filling or backfilling necessary for the execution of any other incidental works.

191. The following table indicates the approximate earthworks and pavement quantities for the Project Road.

Table 7: Estimated Earthworks for Section F4

Description	Unit	Quantity
Stripping of topsoil	M ³	132,420
Road bed excavation and excavation in cut	M ³	1,250,000
Embankment Construction for roads and associated works up to bridge pay lines	M ³	1,600,000
Subgrade Preparation	M ³	320,00
Preparation of the underlying granular pavement layer	M ³	100,000
Dismantling of existing concrete structures	M ³	2,500
Removal and transportation of existing bituminous pavement	M ³	30,500
Structural excavation for culverts, headwalls & wingwalls	M ³	50,000

Description	Unit	Quantity
and retaining walls		
Granular backfill to culverts, headwalls, wingwalls and bedding for culverts	M ³	35,000

B.11.6 Pavement

192. 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.
193. The following shall apply to the motorway, concrete pavement structure, construction category I:
- 28 cm Concrete;^[1]_{SEP}
 - 30 cm Crushed Aggregate Course;
 - 27 cm Granular Base Course;^[1]_{SEP}
 - 85 cm Total Pavement Construction.
194. The following shall apply to slip roads and minor roads, asphalt pavement structure, construction category III:
- 4cm Asphalt Wearing Course;
 - 4cm Asphalt Binding Course;
 - 14 cm Asphalt Bearing Course;
 - 58 cm Granular Base Course;
 - 80 cm Total Pavement Construction.
195. 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.
196. 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.
197. 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.11.7 Removal of Asphalt

198. The Contractor shall remove the existing bituminous pavement layers 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, after which it will be re-used for shoulder material.

B.11.8 Construction Equipment

The following table provides indicative lists of the key equipment required in the construction phase (not including tunneling equipment).

Table 8: Key Equipment Section F4

#	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 m ³ /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 (>150m ³ /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 (>6m ³)	6

B.11.8 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. 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.12 Source of Materials

B.12.1 Borrow Material

200. Where practical cut will be balanced with fill. An assessment of the volumes of cut and fill are provided in **Section F.8.3** which discusses the management of spoil material. No additional quarries or borrow pits will be needed under this Project.

B.12.2 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 80 km east of the Project area), other sources of cement may also be found closer to the site.

203. The Contractor will be responsible for ensuring the concrete batching facilities and asphalt plant comply with the conditions outlined in **Section F.8.5**. The Contractor will source concrete and asphalt from existing batching plants or from his own dedicated plant. **Section F.7.4** provides explicit conditions for operating batching plants and asphalt plants and the conditions for sourcing concrete and asphalt from existing plants.

B.12.3 Technical and Potable water

204. Approximately 200 m³ of technical water will be needed per day during the construction phase and around 15 m³ 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 bottles. 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.13 Camps and Storage Areas

B.13.1 Construction Camps

205. 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 final locations of the camps will be selected by the Contractor after the approval from the RD and the Engineer.

206. 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.

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

- Safe and reliable water supply.
- Hygienic sanitary facilities and sewerage system.
- Treatment facilities for sewerage of toilet and domestic wastes
- Storm water drainage facilities.
- Sickbay and first aid facilities.

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

B.13.2 Storage Areas

209. 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 m² 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.14 Road Safety

210. The following elements are provided for traffic control and security on road:

- Road signs and indicators;
- Fences;
- Signal posts;
- Traffic markings;
- Lighting;
- Traffic lights;
- U-turns;
- Ground for short time stops for vehicles;
- Sidewalks;
- Bus stops.

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

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

212. Some of these advantages could be partially offset by the higher speeds that may lead to accidents, which will be possible after the road improvements.

B.15 Traffic Projections

213. Traffic forecasts for Dzirula and Argveta are presented below by **Figure 24** and **Figure 24**. The figures indicate that traffic volumes are set to more than double over the next 30 years between Dzirula and Argveta.

Figure 24: Forecasted Traffic, Dzirula, 2017 - 2037

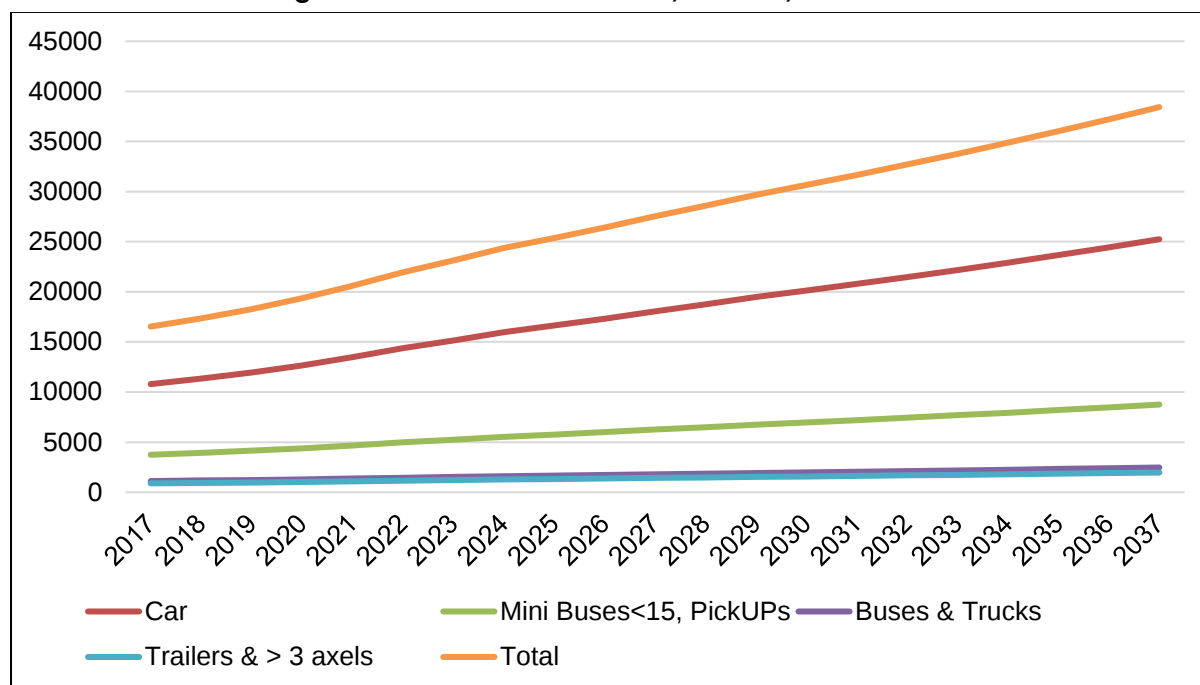
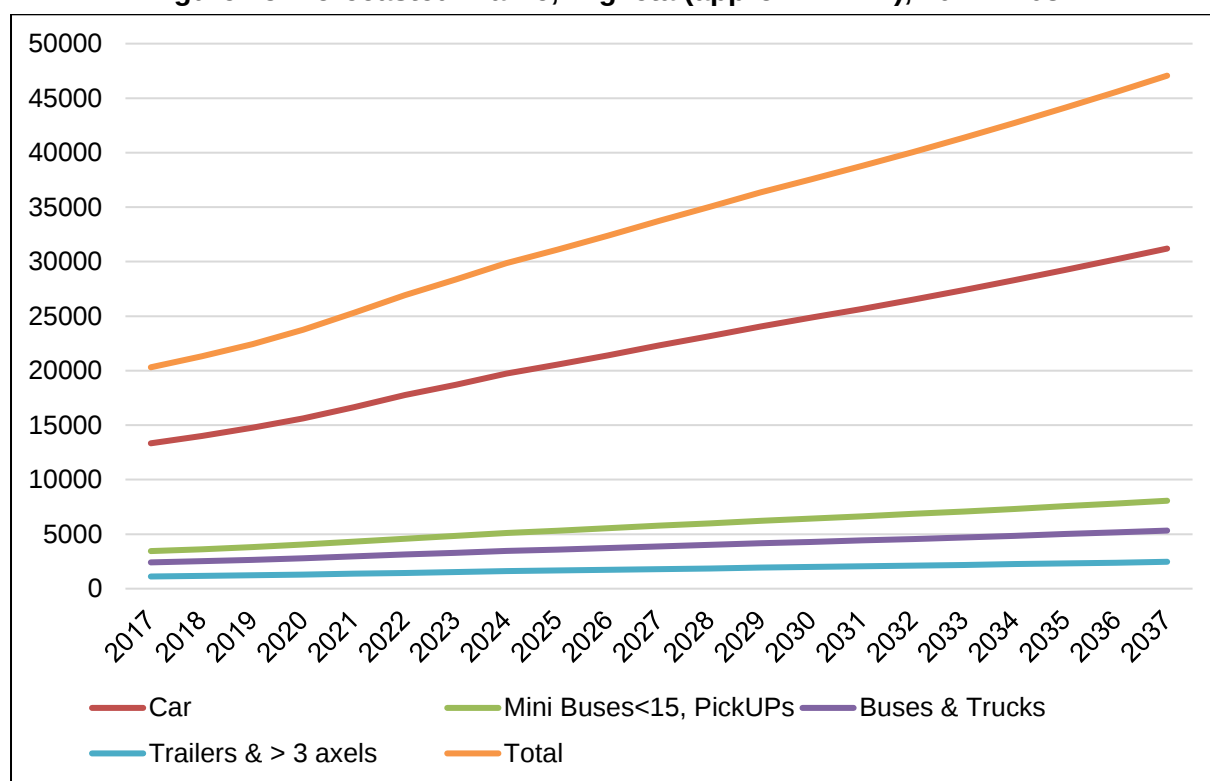


Figure 25: Forecasted Traffic, Argveta (approx. KM 14), 2017 - 2037



C. Alternatives

C.1 General

214. 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

215. 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

216. 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 Transport Modes

217. As noted above, the Project forms part of a program upgrading the E-60. The Khevi – Argveta section of the E-60 (including section F4) 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.

C.5 Alternative Alignments

Feasibility Study

218. 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

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

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 26** to **Figure 30**.

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
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.

219. 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

220. 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

Section F4 of the Khevi-Ubisa-Shorapani-Argveta Road (E60 Highway)
Environmental Impact Assessment

ANALYSIS	Optimized BLUE LINE			Optimized GREEN LINE			Revised YELLOW LINE		
	POINTS	WEIGHT	SCORE	POINTS	WEIGHT	SCORE	POINTS	WEIGHT	SCORE
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		

Figure 26: Alternative Alignment 2BC-1



Figure 27: Alternative Alignment 2BC-2



Figure 28: Alternative Alignment 2BC-3

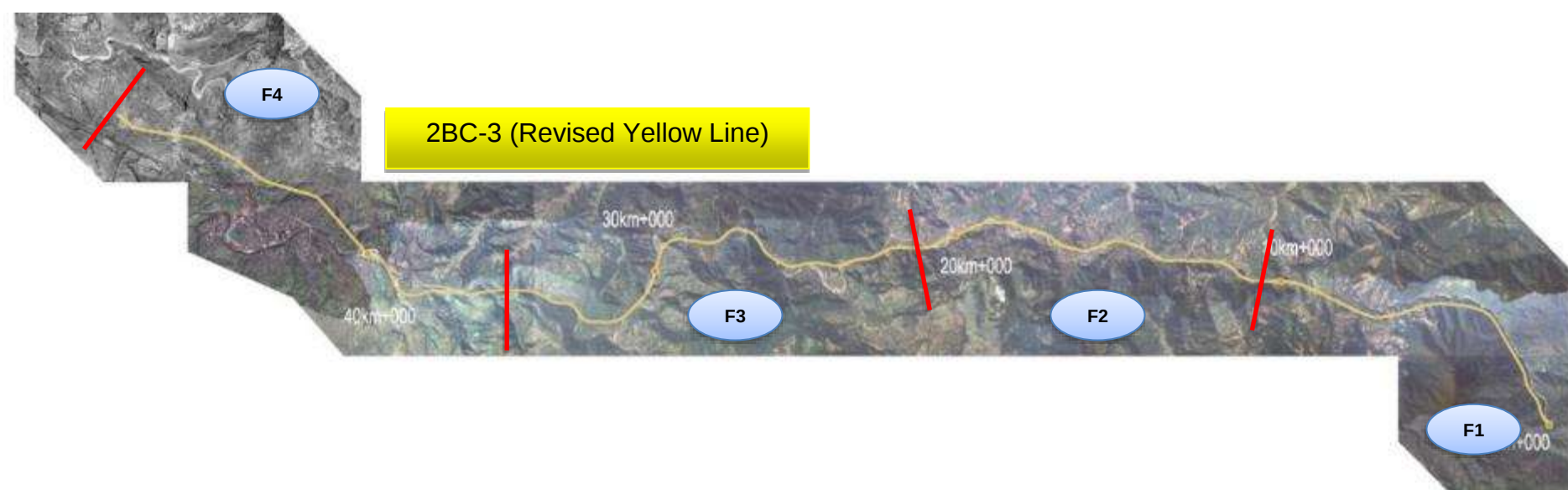


Figure 29: Alternative Alignment 2BC-4

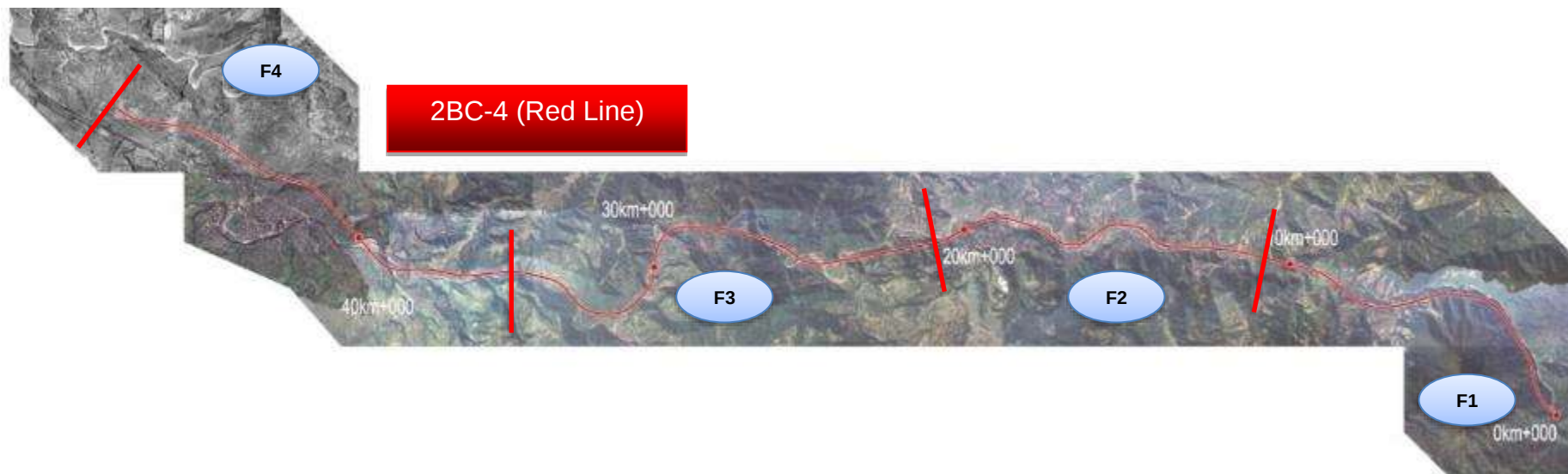


Figure 30: Alternative Alignment 2BC-5



Detailed Design

221. 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. The following figures indicate where alternatives have been adopted in the final alignment.

	At Tunnel 2 the tunnel will now exit to the north of the FS alignment (in red) and cross back and forth over the Dzirula river via Bridge 1. The aim of this change was to reduce the amount of cut material that would be required in the southern slope and limit impacts to the existing road.
	Bridge 2 has been adopted based on the same principles as Bridge 1 above, reducing cut and also straightening the alignment thereby avoiding impacts to the existing road.
The alignment in this location is moved a little further south, this is based on engineering requirements rather than any specific environmental or social aspect.	
To the north of Zestaphoni the road alignment shifts south slightly, this may have a moderate impact upon residential properties in terms of noise, but not in resettlement. However, the small settlement in the upper left-hand side of the photo will now under passed by a tunnel (Tunnel 6), thereby reducing resettlement impacts in this area.	
	The section to the north of the Alloy works has been moved slightly to the north to avoid passing through a large slagheap located within the works boundary. This slagheap probably contains high levels of pollutants and as such moving around this area reduces the need for disposal of hazardous waste.

C.6 Alternative Transport Modes

222. 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) 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.

C.7 Alternative Pavement Types

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

- 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.
- 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.
- 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.
- 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.
- 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.

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

D. Environmental Laws, Standards and Regulations

D.1 Overview

224. 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 and EBRD safeguard policies / performance requirements.

D.2 General

225. 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.

226. 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 & Social Legislation of Georgia

227. A list of Georgia's environmental legislation as it pertains to the proposed project is given in Table 11.

Table 11: 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 licenses and permits	23/12/2017	300.310.000.05.001.001.914

Year	Law / Regulation	Consolidated version -Last revision	Code
2003	Law of Georgia on conservation of soil and restoration-amelioration of soil fertility	07/12/2017	370.010.000.05.001.001.274
2014	Waste code	07/12/2017	360160000.05.001.017608
2017	Environmental Assessment Code	07/12/2017	360160000.05.001.018492

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

229. **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).

230. **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 list 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.

231. **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.

232. **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).

233. 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.

234. 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 tons of non-hazardous waste or 1000 tons 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.

235. **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, considering 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.

236. **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.

- 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 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.

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.

- 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.
- 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:
 - 10 meters – in the case of a river up to 25 kilometers long,
 - 20 meters – in the case of a river up to 50 kilometers long,
 - 30 meters – in the case of a river up to 75 kilometers long,
 - 50 meters – in the case of a river over 75 kilometers long.
- 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 atomization, 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.

237. **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, considering 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.

238. **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.
239. **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.
240. **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.
241. **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.
242. **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.

243. **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.
244. **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.
245. **The Georgian Red List and Red Book** – The Red List of Georgia was adopted in 2006 based on work conducted by the Commission of Georgian Scientific Academy working in Endangered Species and updated in 2014. It now includes some 56 plant and 139 animal species, including 33 mammals, 35 birds, 11 reptiles, 2 amphibians, and 11 fish (including all sturgeon). Of these, 20 plant and 43 animal species are categorized as critically endangered (CR) or endangered (EN)⁷, and 4 mammals may be extinct.
246. The “Red Book” of critically endangered species includes information on the status, habitat, home range, quantity, reproduction areas and conditions, protection measures and risk factors for species listed in the Red List. In terms of plants, some 275 species of vascular plants are considered endemic to Georgia, of which approximately 60% (152 species) are considered endangered, although there is insufficient information from them all to be included in the Red List⁸. Further details on Red List species within the Project area are included within **Section F**.
247. Laws and regulations related to social aspects and land ownership applicable to the project are presented in Table 12.

Table 12: 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
2005	Law of Georgia on Spatial Development and Basis for City-building	25/07/2017	330.090.000.05.001.001.845
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	Labor Code	04/05/2017	270000000.04.001.016012
2015	Law on Development of High-mountain Areas	05/07/2018	010110020.05.001.017881

248. Brief summaries of the listed documents are given below.
249. **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.

⁷ 44 vertebrate species are also included in the IUCN Red List as CR, EN or VU – see later

⁸ <https://www.cbd.int/doc/world/ge/ge-nr-05-en.pdf>

250. **Labor 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.
251. **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.
252. **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.
253. **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.
254. **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.
255. **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.
256. **Law on Labor Safety** defined general requirements and preventive measures related to safety on worksites; avoidance of existing and potential hazards, accidents/incidents and professional diseases; training, awareness raising, communication and consultations with equal involvement/participation of employees. The law regulates rights, obligations and responsibilities of state institutions, employers, employees and employees' representatives in providing safe and healthy environment. The law applies to dangerous, hazardous, heavy and works with/in dangerous working conditions. The list of high risk works is defined by the government in consultations with social partnership.
257. **Law on cultural heritage** sets out procedures for protection of cultural heritage and permitting arrangements for archaeological investigations.
258. **Law on Spatial Development and Basis for City-building** regulates the spatial development and the process of city-building, including the development of the accommodations, settlements and infrastructure regarding the requirements of the cultural heritage and environmental policies. In this field, the law defines the rights and obligations of the state authorities, physical and legal entities, principles of spatial development and city-building, its priorities, goals and tasks, as well as the form and the role of the spatial-territorial planning and planning documents in terms of the development of the territorial development of Georgia.

259. **Law on Development of High-mountain Areas.** The policy implemented by the State towards high mountainous regions is part of the regional development policy of the country and is aimed at ensuring the equal socio-economic development of the entire territory of Georgia and at solving the social and economic problems of persons living in high mountainous regions. The aim of this Law is to determine the benefits of encouraging the social and economic progress of high mountainous regions as guaranteed by the Constitution of Georgia; such benefits ensure the well-being of persons living in high mountainous regions, raise living standards, promote employment and improve social and economic conditions. Regardless of their altitudes, the status of high mountainous settlement has been granted to settlements located within the following historic and geographic areas: Khevi, Mtiuleti, Pankisi Gorge, mountainous Adjara, Gudamakari Valley, Pshav-Khevsureti, Tusheti, Upper Svaneti, Kvemo Svaneti (lower Svaneti), Lechkhumi and Racha.
260. The State shall ensure the establishment of the following social benefits in high mountainous settlements:
- a monthly bonus to the state pension being at least 20% of the state pension set for permanent residents of high mountainous settlements who have reached the retirement age and receive the monthly state pension as a social benefit, according to the amount of the state pension defined by the law of Georgia on the state budget of Georgia for the relevant year. The procedures and conditions for issuing the said supplement shall be determined by ordinance of the Government of Georgia. The permanent residents of high mountainous settlements who are the recipients of the social package determined by the Government of Georgia shall receive the monthly supplement in the amount of 20% of the social package provided to them.
 - medical personnel employed at medical institutions, which are under State management and where the State is an equity partner, located in high mountainous settlements, whose work is paid from the state budget, shall receive a monthly bonus in accordance with rules determined by ordinance of the Government of Georgia: b.a) doctors shall receive a bonus in the amount of the state pension; b.b) for nurses – in the amount of the pension;
 - the implementation of relevant measures during the winter period (from 15 October of the relevant year through to 15 April of the following year) in order to facilitate the provision of heating for permanent residents of high mountainous settlements;
 - compensation of 50% of monthly charges for electricity consumed by users (residential customers) in high mountainous settlements, but not more than the charge for 100 kWh of consumed electricity;
 - a contribution of monthly cash assistance, in accordance with procedures determined by ordinance of the Government of Georgia, being at least GEL 100 throughout the period of one year after the entry into force of this Law, for the birth of the first child and the second child, where one of the parents of the child is a permanent resident of a high mountainous settlement, and for the third child and every following child, a contribution of monthly cash assistance of at least GEL 200 throughout the period of 2 years after the entry into force of this Law;
 - the provision of a bonus being not less than 35% of the basic remuneration of a teacher in accordance with procedures established by the Ministry of Education and Science of Georgia to a teacher in a legal entity under public law -an institution of general education located in a high mountainous settlement and established by the Ministry of Education and Science of Georgia; the payment of a bonus being not less than 35% of the remuneration of teachers in accordance with procedures established by the Ministry of Education and Science of Georgia to a teacher in an institution of vocational education located in a high mountainous settlement and established by the Ministry of Education and Science of Georgia. In order to provide financial assistance to coaches employed in the sports sector and to promote the development of sports in

- high mountainous settlements, the government of Georgia shall develop and approve a relevant state program.
- the provision of an increased number of vouchers to the pupils of public schools, multi-sectoral public schools, and to students of institutions of vocational education located in high mountainous settlements. The terms and conditions for issuing the said vouchers shall be determined by ordinance of the Government of Georgia.
 - the provision of a bonus of not less than 50% of the remuneration of a teacher in accordance with the procedures and conditions established by the Ministry of Education and Science of Georgia, or the head of the administrative body implementing this program, to a teacher who is a participant of a relevant program as defined by the Ministry of Education and Science of Georgia and/or the administrative body within under its authority, and who is employed within this program at an institution of general education located in a high mountainous settlement. The bonus provided for by this sub-paragraph shall not be given to a person entitled to the benefit provided for by paragraph 2(f).
261. According to the law, a natural person shall be granted the status of permanent resident of a high mountainous settlement if he/she meets the following criteria: a) he/she must be a citizen of Georgia; b) he/she must be registered in a high mountainous settlement; c) he/she must actually live in a high mountainous settlement for an aggregate 9 months or more than 9 months during each calendar year.
262. Permanent residents of high mountainous settlements shall enjoy tax privileges established by the Tax Code of Georgia in relation to income tax and property tax. Business entities which, in accordance with the legislation of Georgia, have been granted the status of high mountainous settlement enterprise shall be exempt from taxes under the terms and rules defined by the Tax Code of Georgia. The administrative body with power to grant to business entities the status of high mountainous settlement enterprise, and the terms and conditions of granting, terminating and suspending the status of high mountainous settlement enterprise, shall be determined by the rules for granting, terminating and suspending the status of high mountainous settlement enterprise, which shall be approved by ordinance of the Government of Georgia.
263. **The Constitutional Agreement between the State of Georgia and the Apostolic Autocephalous Orthodox Church** (2002) regulates the relationship between the state and the Church. Its provisions (art. 7, 8 and 9) have a major impact on the management of cultural heritage in the country. By this agreement all the religious buildings and related structures on the territory of the country, in use or without function, standing or in ruins, together with their parcels and also all the immovable ecclesiastic treasures protected in museums and archives are handed down in the ownership of the Church of Georgia (art.7 and 8). The MoCMP must agree with the Church of Georgia in the process of adopting protection zones, rules and methodologies, planning and approving rehabilitation projects or scientific research of movable and immovable religious monuments. Together with the state, the Church is responsible for maintenance and care of the monuments in its ownership (art.7 and 9). The property of the Church is exempt from the state taxes (art. 5). According to the Concordat the church is the owner of the majority of immovable listed properties in the country, most of which, at the same time, are living heritage sites, with the religious function being restored and enhanced after the fall of Soviet regime. Because of this special circumstance, the specific rules for maintenance and exploitation of these properties need to be elaborated.

D.4 Action Plans and Strategies

D.4.1 National Biodiversity Strategy and Action Plan

264. The Georgian National Biodiversity Strategy and Action Plan (NBSAP) was adopted in 2005 and updated in 2014. It sets out the goals, objectives and policies for the protection and conservation of biodiversity in Georgia. The initial NBSAP included nine strategic goals to help ensure that Georgia “will be a country where biological diversity is sustained and rehabilitated within a political, social and economic context that favors the wise use of natural resources and adequate benefit sharing” by aiming to:
- Develop a protected areas system to ensure conservation and sustainable use of biological resources.
 - Maintain and restore Georgia's habitats, species and genetic diversity through ex-situ and inter-situ conservation measures, and sustainable use of biological resources.
 - Conserve Georgian agrobiodiversity through ensuring its sustainable use and by promoting of ex-situ and in-situ conservation measures.
 - Promote sustainable hunting and fishing through adequate planning, restoration and protection of key biological resource.
 - Develop a biodiversity monitoring system and an active and integrated biodiversity database to ensure sustainable use and conservation of biological resources.
 - Protect both the human population and biodiversity from potential threats from genetically modified organisms (biotechnology), through strengthening the law and increasing public involvement in decision making.
 - Raise public awareness of biodiversity issues and to encourage public participation in the decision-making process.
 - Ensure appropriate financial and economic programs are in place in order to support effective conservation of biodiversity, and to ensure the delivery of the BSAP.
 - Further improve national legislation (and associated institutions) relating to biodiversity conservation, through the creation of new, and elaboration of existing laws and regulations, and through ensuring harmonization to international legal responsibilities.
265. The first 10-year period did not see all of these fully implemented but did see a number of key achievements including:
- Development of the system of protected areas.
 - Preparation of the National Red List of Georgia based on international criteria and categories.
 - Development of conservation management plans for endangered species and groups of species and launching of their implementation.
 - Initiation of the national biodiversity monitoring system.
 - Ex-situ and/or on-farm conservation of several endemic and endangered plant species and crops.
 - Launching of the Georgian biodiversity clearing house mechanism.
266. The 2014 update to the NBSAP (for the period of 2014-2020) has adopted a more holistic, cross-cutting and ecosystem-based approach and also goes further in terms of formulating a comprehensive policy and defining national priorities. It envisions that by 2030 Georgia “*will be a country with population living in harmony with nature, biodiversity will be commonly valued, biological resources – conserved and wisely used. This will provide natural continuity of ecosystem processes, healthy environment and benefits essential for all people*”.
267. It includes a situational analysis, strategic approaches and actions in five new areas including Inland water ecosystems, Forest ecosystems, Natural grasslands and Cross-

cutting issues and governance. It also seeks to strengthen cross-sectorial cooperation and partnerships amongst key stakeholders⁹ (including ministries, private sector, NGOs, Universities and media) and includes 21 national goals for protection of biodiversity, which are in line with key strategic targets of the Convention on Biodiversity and Aichi Targets¹⁰. These include actions to:

- Address the underlying causes of biodiversity loss through integration of biodiversity issues into governmental activities and public life.
- Reduce the direct pressures on biodiversity and promote sustainable use of biological resources.
- Improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity.
- Enhance the benefits to all from biodiversity and ecosystem services.
- Enhance implementation of biodiversity strategy through participatory planning, knowledge management and capacity building.

268. A primary goal of the NBSAP to help support national obligations under the EU Association Agreement and facilitate harmonization with EU environmental policy. It is especially important in promoting legislative changes, protection of global and European significance habitats and species and establishment of the “Emerald Network”, and enhancement of the country’s involvement in the regional process of sustainable forestry, such as “European forests” and reconciliation of the Georgian forestry policy, legislation and standards with EU requirements

D.4.2 Related Plans

269. In addition to the NBSAP there are a number of other key National Plans of relevance to biodiversity and conservation as outlined below.

Table 13: Other National Plans

Document	Relevance
National Environmental Action Plan (NEAP 2012)	Outlines overall approach to environmental protection. Includes specific chapters on both biodiversity and protected areas and forests and forestry. The NBSAP includes detailed actions for achieving NEAP goals and objectives such as: • Rehabilitation, protection and conservation of viable populations and habitats of selected endangered species; • Improvement of effectiveness of hunting and fishery management to ensure sustainable use of fauna resources; • Development of an effective protected areas network; • Improvement of the effectiveness of the Protected Areas management through the capacity building of its administration and introduction of financial sustainability mechanisms; • Creation of proper data bases for biodiversity conservation and sustainable management of biological resources by developing the relevant national biomonitoring system; • Development of background for establishment of a sustainable forestry system; • Mitigation of unsustainable and illegal forest use (logging); • Mitigation of eutrophication.
National	Aimed at establishment of a system of sustainable forest management to ensure:

⁹ The process was coordinated by a supervision committee under the direction of MoEPA with representation from organisations including WWF (Caucasus Program Office), IUCN (Caucasus Cooperation Centre) and National NGOs such as NACRES, and GreenAlternative as well as Ilia State University:

¹⁰ <https://www.cbd.int/doc/world/ge/ge-nr-05-en.pdf>

Document	Relevance
Forest Strategy	• protection of biological diversity; • effective use of the economic potential of forests considering their ecological value; • public participation in forest management related issues; • fair distribution of derived benefits; • Priority is to be given to meeting the needs of the local population, and everybody's principally free access to forest resources. Restoration of degraded forests and afforestation are also identified as priority areas.
Rural – Agricultural Development Strategy (2015-2020)	Promotes long term agricultural development but includes preservation of biodiversity as a key aim, as well as strengthening cooperation with MoEPA and associated agencies of neighboring countries. Relevant activities include: • Introduction of “good agricultural practices”, which will promote mitigation of environmental pollution through optimal application of chemical fertilizers and substances; • Refinement of agrarian ecosystem and natural grassland management systems; • Introduction of the system for biofarm establishment, encouragement, sustainable management and certification. • Special emphasis is placed on preservation of agrarian biodiversity and endemic species and it includes actions around: • creation of an effectively manageable genetic bank; • detailed inventory and restoration of local species and forms; • informing farmers and other stakeholders of agrarian biodiversity and endemic species.
Kazbegi Development Strategy (2016-2020)	Developed by Kazbegi Local Action Group (LAG Kazbegi). This Strategy has been developed within the frames of the Project “Kazbegi Local Action Group”. The Project is implemented by the international NGO “People in Need” (PIN), within the European Neighborhood Program for Agriculture and Rural Development (ENPARD). The Project is being implemented together with the partners of “People in Need”: Biological Farming Association “Elkana” and the National Network of Local Action Groups (NNLAG) of the Czech Republic. The Project envisages introduction of LEADER¹¹ methodology in Kazbegi municipality, in order to facilitate rural development.
Dusheti municipality socio economic development plan	The plan was elaborated through active cooperation with local authorizes. The plan contains detailed information on socio-economic state and development prospects of the municipality.
Road Safety Strategy (2016). ¹²	The strategy sets out the key directions recommended by international organizations and global experts for successful and sustainable long-term road safety management in Georgia. The need for the strategy has been conditioned by rising level of registered motor vehicle and necessity to allow Georgia to achieve substantially improved results and sustained success in its road safety activity. The strategy describes national capacity building and shared responsibility for road safety in the state. Developed through capacity review and in consultation with the key governmental partners and road safety stakeholders, the Strategy sets a new long-term vision and goal for road safety in Georgia, stresses benefits of long-term investment in road safety, mentions measures and targets to address the key road safety problems.

D.5 Administrative Framework

¹¹ "Liaison Entre Actions de Développement de l'Économie Rurale", which means "Links between the rural economy and development actions"

¹² National Centre for Disease Control, Georgia, 2016
(<http://www.ncdc.ge/Handlers/GetFile.ashx?ID=6164d012-744c-4077-bdc8-7943b43fe1f7>)

270. **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.
271. 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 out 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.
272. **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. licensing activity). The MoESD is a responsible institution for developing and administrating Local Market Information System (LMIS). The LMIS information providers include: Ministry of Economy and Sustainable Development of Georgia, Enterprise Georgia, Georgia's Innovation and Technology Agency, National Agency of State Property, National Statistics Office of Georgia, Ministry of Education and Science of Georgia, Education Management Information System, National Center for Educational Quality Enhancement, Ministry of Environment Protection and Agriculture of Georgia, Agricultural Projects' Management Agency and Ministry of Labor, Health and Social Affairs of Georgia.
273. **Ministry of Regional Development and Infrastructure and the Roads Department** – The Roads Department (RD) of the Ministry of Regional Development and Infrastructure (MRDI) 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.
274. **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.

275. 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.
276. **Ministry of Labor, Health and Social Affairs (MoLHSA)**, together with other ministries, institutions and social partnerships defines the state policy on labor safety; supports awareness raising and training sessions, develops proposals and recommendations related on labor safety programs. MoLHSA is represented in Trilateral Commission of Social Partnership together with the Ministry of Justice (MoJ), MoESD, MoRDI and Ministry of Education and Sport (MoES). MoLHSA defines the scope, qualification requirements, condition and rules for accreditation of labor safety officers; elaborates incident evidence gathering and keeping procedures as well as reporting rules and terms; together with Social Partnership acts and mediator in collective labor disputes, monitors implementation of OHS conventions, recommendations and agreements, develops reports on the subject, ensures cooperation with ILO and other international and governmental institutions, carried out labor market studies and analysis.
277. **Service for the Protection of Labor Safety Regulations** under the MoLHSA monitors and implements supervision over compliance with the labor safety rules, investigates incidents and professional deceases cases and registration.
278. **Trilateral Commission of Social Partnership (TCSP)**. Parties to the Partnership are the government of Georgia, employers’ associations and employees’ associations. The term of office of the TCSP members is 1 year. Each member has 6 members in the commission. Objective of the TCSP is improvement of labor safety through supporting dialogue between the GoG, employers and employees.

D.6 Environmental Regulations and Standards

279. 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.6.1 Ambient Air Quality Standards

280. Maximum permissible concentrations (MPC) for air born pollutants are set by Technical regulations – Ambient air quality standards (approved by GoG decree 383, dates 27July, 2018, see Table 14. This project will also ensure compliance with IFC guideline values ¹³ (not interim targets) and EU air quality standards as these values are, in some instances, more stringent than the national standards, the most stringent standards are highlighted in green and will be applied.

Table 14: Ambient Air Quality Standards

Parameter	Averaging Period	National limits (µg/m ³)	IFC/WHO (µg/m ³)	EU (µg/m ³) / Permitted Exceedences Per Year
Sulfur Dioxide	24 hour	125	20	125 / 24

1. ¹³ The IFC guidelines are based on World Health Organization (WHO). Air Quality Guidelines Global Update, 2005.

Parameter	Averaging Period	National limits (µg/m³)	IFC/WHO (µg/m³)	EU (µg/m³) / Permitted Exceedences Per Year
(SO ₂)	1 hour	350		350 / 3
	10 mins		500	
Nitrogen Dioxide (NO ₂)	1 hour	200	200	200 / 18
	1 year	40	40	40 / n/a
PM _{2.5}	1 hour		25	
	1 year	25	10	25 / n/a
PM ₁₀	1 hour		50	
	24 hours	50		50 / 35
	1 year	40	20	40 / n/a
Carbon Monoxide (CO)	Maximum daily 8 hour mean			1000 / n/a

D.6.2 Surface Water Quality Standards

281. Water 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 15: Water quality requirements by water use category

	Water use category			
	Household water use	Recreational water use ¹⁴	Fisheries	
			Highest first	and Second
	Increase not higher than 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 color	
	20cm	10cm	-	
Odor, taste	Water must not have odor and taste of higher than 1 unit intensity		Water must not result in unusual odor 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 (<i>Acipenseridae</i> , <i>Coregonidae</i>) maximum allowable temperatures in summer and winter are 20C and 5C respectively, for other water bodies 28C (in summer), 8C (in	

¹⁴ According to the Technical regulations for protection of surface water from pollution three categories of water use are set:

- სასმელ-სამეურნეო (хозяйственно-питьевое, literally drinking- domestic) which is generally translated as household water use. This category refers to water bodies for drinking and domestic water use
 - სამეურნეო-საყოფაცხოვრებო (хозяйственно-бытовое, domestic) which is generally translated as domestic water use. This category includes surface water bodies used for recreation
 - water for fisheries (which is split in two - a) highest, first and b_ second category)
- According to these clasification household water includes water for drinking.

	Water use category			
	Household water use	Recreational water use ¹⁴	Fisheries	
			Highest first	and Second
			winter)	
pH	Must be in 6.5-8.5 interval			
Water mineralization	<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.	

282. In addition to the above, the IFC provides guidelines values for effluent discharge to water courses. The following table provides these values with which the Project shall comply, for example relating to water discharge from construction camps.

Table 16: Indicative Values for Treated Sanitary Sewage Discharges

283. Pollutant	284. Unit	285. Guideline Value
286. pH	287. pH	288. 6-9
289. BOD	290. Mg/l	291. 30
292. COD	293. Mg/l	294. 125
295. Total Nitrogen	296. Mg/l	297. 10
298. Total Phosphorus	299. Mg/l	300. 2
301. Oil and Grease	302. Mg/l	303. 10
304. Total Suspended Solids	305. Mg/l	306. 50
307. Total Coliform Bacteria	308. MPN ^A / 100 ml	309. 400

310. A – MPN = Most Probable Number

D.6.3 Groundwater Quality Standards

311. 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
Odor	Unit	2
Taste	Unit	2
Color	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
Sulphates	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
Total; 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.6.4 Noise Standards

312. 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.
313. 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} 08:00 – 19:00, Day	Evening 19:00-23:00	23:00 – 08:00 L _{night} , Night
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, l halls	50	50	50
Theatre/concert halls and sacred premises	30	30	30
Sport halls and pools	55	55	55
Small offices (≤100m ³) – working rooms and premises	40	40	40

Purpose/use of area and premises	Allowable limits (dBA)		
	L _{day}		23:00 – 08:00
	08:00 – 19:00, Day	Evening 19:00-23:00	L _{night} , Night
without office equipment			
Small offices (≤100m ³) – 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 less 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

314. 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.6.5 Vibration Standards

315. The Georgian Standards for vibration are designed for human comfort. These are shown in Table 21. Note that no Georgian 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

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
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.

316. The German Standard DIN 4150-3 – Vibration in Buildings – Part 3: Effects on structures provides short term and long-term limits¹⁵ for vibration at the foundation for various structures (see Table 22). This standard is considered international best practice and will be followed as part of the Project.

Table 22: Guideline Values for Vibration Velocity to be Used When Evaluating the Effects of Short-term and Long-term Vibration on Structures

Group	Type of structure	Guideline Values for Velocity (mm/s)				
		Short-term				Long-term
		At foundation			Uppermost Floor	Uppermost Floor
		Less than 10 Hz	10 Hz to 50 Hz	50 to 100 Hz	All frequencies	All frequencies
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design	20	20 to 40	40 to 50	40	10
2	Residential dwellings and buildings of similar design and/or use	317.5 318. (105 dB) ¹⁶	5 to 15	15 to 20	15	5 (105 dB)
3	Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Lines 1 or 2 and have intrinsic value (e.g. buildings that are under a preservation order)	319.3 320. (100.5 dB)	2 to 8	8 to 10	8	2.5 (99.0 dB)

Source: DIN 4150-3, Structural Vibration, Part 3: Effect of vibration on structures

321. DIN 4150-3 notes that “experience has shown that if these values are complied with, damage that reduces the serviceability of the building will not occur. If damage

2. ¹⁵ short-term vibrations are defined as those that do not occur often enough to cause structural fatigue and do not produce resonance in the structure being evaluated and long-term vibrations are all the other types of vibration.

¹⁶ The formula for conversion from mm/s to dB can be found in **Appendix V – Vibration Assessment**

nevertheless occurs, it is to be assumed that other causes are responsible. Exceeding the value in the table does not necessarily lead to damage”.

D.6.6 Soil Quality

322. 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 Labor, 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			
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.7 National Technical Regulations Relevant to the Project

323. 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.)

324. 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 modernization, 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 considered 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.8 Environmental Permitting Procedures

325. Environmental permitting procedure is defined in the Environmental Assessment Code. According to the national regulations (Environmental Assessment Code), the main stages of EIA include:

- scoping procedure;
- preparation of an EIA report by the proponent or consultant;
- public participation;
- assessment of information (EIA report, if necessary- additional information, information obtained during public participation and consultations with competent administrative bodies) by the Ministry;
- expert examination of information/reports;
- implementation of a transboundary environmental impact assessment procedure – if necessary;
- issuance of environmental decision or making decision refusing implementation of the project.

326. The application procedure for obtaining authorization from environmental authorities required for implementation of the planned development, including Environmental and Social Impact Assessment coordination, timeframes for information disclosure and public review for this project follows Procedure described below:

Table 24. Procedure Applicable to the Project – Scoping

Step	Action	Comment	Timeframe
1	Scoping application and scoping report (hard copy and digital) is developed and submitted to the Ministry	A scoping report shall include: • a brief description of the planned activity, especially general information on: • location of the planned activity, with indication of GIS coordinates (along with the shp file); • physical characteristics of the planned activity (capacity, scale, production process, the amount of products to be manufactured); • any alternatives to the planned activity, and the place of its implementation; • general information on the potential environmental impact and its types	Day 0

Step	Action	Comment	Timeframe
		which will be examined in the EIA process, including: • information on the potential impact (if any) in protected areas; • information on the potential transboundary impact (if any); • information on the potential impact of the implementation of the planned activity on human health, the social environment, cultural property and other objects of cultural heritage; 3. information on basic/exploratory research to be carried out and on the methods necessary to prepare an EIA report; 4. plan for deposit processing (including a Recultivation project) drafted in accordance with the requirements established by the legislation of Georgia, where relevant; 5. general information on the measures which will be taken into account for preventing, reducing and/or mitigating significant adverse effects on the environment.	
2	The Ministry posts scoping application and the scoping report on its official website and on the notice board of the executive body and/or representative body of a respective municipality, and upon request, makes printed or electronic copies available	The Ministry shall be responsible for organizing and holding public reviews. Accordingly, it shall ensure the reimbursement of the costs associated with organizing public reviews, including the publication of information on holding public reviews. Public reviews shall be led, and the minutes of public reviews shall be drafted, by a representative of the Ministry.	Within 3 days after a scoping application has been registered
3	The Ministry organizes a public review of the scoping report. Information on the public review shall be published in advance	The meeting shall be held in the building of the appropriate administrative body located closest to the location of the planned activity or in the territory adjacent to the building; or if it is planned to carry out the activity within the administrative boundaries of a self-governing city, public reviews shall be held in the building of the appropriate administrative body determined by the Ministry or in the territory adjacent to the building. Public reviews shall be open and any member of the public.	• not later than 10 days before the public review • Not earlier than the 10th day and not later than the 15th day after the placement of the scoping application
4	Feedback from stakeholders		Within 15 days after the placement of the screening application
5	The Ministry reviews the scoping application and the scoping report and issues a scoping opinion	When issuing the scoping opinion, the Ministry shall ensure a review of the opinions and comments submitted by the stakeholders and, if there are	Not earlier than the 26 th day and not later than 30 th day after the scoping application

Step	Action	Comment	Timeframe
		appropriate grounds, take them into account. The scoping opinion shall determine a list of studies required and information to be obtained and examined for preparing an EIA report. When issuing scoping opinions, the guideline document on Environmental Impact Assessment may be used.	has been registered
6	The Ministry posts scoping opinion and/or the decision refusing the carrying out of the activity placed on its official website and on the notice board of the executive body and/or representative body of a respective municipality, and upon request, shall make printed copies available		Within 5 days after completion of the scoping procedure

Note: If the project is expected to have transboundary impact relevant clauses of the Code must apply.

327. The scoping opinion issued by the Ministry shall be mandatory for a person carrying out activities in the preparation of an EIA report.

Table 25. Procedure Applicable to the Project – EIA

Step	Action	Comment	Timeframe
1	Written application is submitted by developer the Ministry.	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 above mentioned 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

Step	Action	Comment	Timeframe
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 will be available as well as indication about the opportunity of accessing the paper copies of these documents during the public hearing.	No less than 20 days prior to organizing the public hearing
8	Public hearing	The Ministry is responsible for organizing and conducting the public hearing. It is chaired and protocolled 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 25 th day and no later than 30 th 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		no less than 51 and no more than 55 days after registration of the application

Step	Action	Comment	Timeframe
	project		
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

328. If, within 2 years after the scoping opinion has been approved, the proponent fails to obtain an environmental decision in accordance with the procedures provided for by the Environmental Assessment Code, the individual administrative act of the Minister approving the scoping opinion shall be declared as invalid.

D.9 Licenses, Permits, and Approvals

329. 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 Licenses 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	Project design approval Construction Permit	MoESD	Law on Licenses and Permits; Government Resolution N57 "On Terms and Conditions of issuance of Construction Permit"	RD
Construction activities	Environmental Decision	MoEPA	Law on Environmental Protection Environmental Assessment Code	RD
Construction activities	Cultural Heritage Clearance	National Agency of Cultural Heritage (NEA)	Law "On Cultural Heritage" Law on Licenses and Permits; Government Resolution N57 "On Terms and Conditions of issuance of Construction Permit"	RD
Construction activities	Geological-engineering conclusion	NEA	Government Resolution N57 "On Terms and Conditions of issuance of Construction Permit"; Order N7 of the Minister of Environment Protection Law on Licenses and Permits	RD
Construction				
Tree felling in state forest lands for	Forest use agreement	MoEPA	Law No.2124 on Forestry Code of Georgia; Resolution No.242 of Government of Georgia on	Contractor

ROW and permanent facilities			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	
Tree felling in state forest lands for Temporary Facilities	Forest Use Agreement	MoEPA- NEA	Resolution No.242 of Government of Georgia on Approval of Rules for Forest Use (last revision 02/02/2018); Order N10/61 of the Chairman of State Department of Forestry" On Approval of the Special Cutting and its Rule" - Resolution #132 of the government of Georgia (consolidated version 16/05/2015) On Approval of Regulations on the Rules and Conditions of Issuing Forest Use Licenses Order #10/61 of the Head of the State Department of Forestry of Georgia	Contractor
Construction or upgrade of access roads	Approval of construction or upgrade activities	MoRDI; 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 "On Road Transport"; Law "On Road Traffic"	Contractor
Spoil disposal	Spoil disposal approval – Environmental Decision	MoEPA	Law "On Subsoils", May 8, 2012 Environmental Assessment Code. 2017	Contractor
Running own quarry (in case contractor decides to) *	License for abstraction of inert material.	MoESD	Georgia on Licenses and Permits aw on Fees for the use of natural resources	Contractor
Running asphalt plant**	Environmental Decision	MoEPA	Environmental Assessment Code. 2017	Contractor
Import of explosives	Permit to import explosives	Ministry of Internal Affairs	Tax Code of Georgia; Decree of the Government of Georgia N420; Law "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	MoESD	Tax Code of Georgia; Decree of the Government of Georgia N420; Law "On Control of Technical Hazard"; Order N 1-1/2502 of the Minister of Economy and Sustainable Development	Contractor
Right on land	Project's registered rights to land	MoESD, Court	Law on procedures for expropriation of property for pressing social needs (Document code:	RD

			020.060.040.05.001.000.670, last revision: 06/09/2013)	
		National Agency of Public Registry of Ministry of Justice	Civil Code (Document code: 040.000.000.05.001.000.223, last revision 23/12/2017)	
	Approval of the topsoil storage	Local administration, land owners	Law on subsoil (last revision 07/12/2017. Document code:380.000.000.05.001.000.140)	

Note: Purchase of material from already existing licensed quarries is preferable. In this case a copy of the license and agreement with the quarry operator must be provided. If contractor already has permit for operation of the asphalt unit – a copy of permit (Environmental decision) must be provided.

330. If waste water is to be discharge into the surface water body, the Contractor will be obliged to calculate the limits of discharge into the waterbody. The limits are to be approved by the MoEPA. The quality of waste water should ensure compliance of recipient surface water quality (in the section located in 1km upstream the point of use) with the limits set in the Annex 1 and 2 to the Technical regulation for protection of water from pollution. To protect the surface water quality, for each point of discharge maximum permissible discharge limits must be defined separately. The document (limits of discharge) must set the discharge limits to ensure compliance of recipient water body with the quality standard.

331. For sewage the following parameters are generally considered – suspended solids, BOD, COD, total N and total P, pH, coliforms.

332. For other ('industrial') discharge the list of parameters generally includes – suspended solids, BOD, TPH, pH. The set of components depends on the type of potential pollutants.

D.10 Construction Permits

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

334. 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.

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

- Geological conclusions to be issued by National Environmental Agency;
- Cultural heritage clearance to be issued by National Agency of Cultural Heritage;
- Environmental Decision issued by MoEPA;
- Project design approval to be issued by MoESD; and
- Project's registered rights to land.

D.11 State Forest Fund

336. According to The Resolution No.242 of Government of Georgia on Approval of Rules for Forest Use, Article 27₁ 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.12 International Conventions and Agreements

337. 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 Water birds	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
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,	Entry into force	1996

Date	Title	Status in Georgia	Date
	(and its London, Copenhagen, Montreal and Beijing Amendments 2000 and 2011)	force	
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
Labor issues			
1930	Forced Labor Convention	Entry into force	1993
1936	Holidays with Pay Convention	Entry into force	1993
1949	Freedom of Association and Protection of the Right to Organize Convention	Entry into force	1999
1948	Right to Organize 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 Labor 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 force	1997
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	Labor 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 Labor Convention	Entry into force	2002

D.12.1 Regional Cooperation

338. Georgia has worked with its neighboring countries to create an “Ecoregion Conservation Plan for the Caucasus” (2006, updated 2012), in line with the Aichi biodiversity goals. This identifies 56 regional hot-spots and 60 regional corridors to be prioritized for conservation¹⁷ and also proposed specific actions to be taken with regards to establishment of a protected area network, enhancement of transboundary connectivity, restoration of degraded ecosystems, harmonization of policies and legislation, coordination of scientific researches and monitoring activities, environmental education and raising awareness. A “Regional Biodiversity Council” facilitates coordination of activities at the Ecoregion level.
339. In addition, the Transboundary Joint Secretariat in South Caucasus (TJS) assists Environmental Ministries/Protected Area Management Structures of Georgia, Azerbaijan and Armenia in strengthening regional cooperation and development and harmonization of the nature conservation sector. The TJS was founded in 2007, under the Ecoregional program “Sustainable Management of Biodiversity, South Caucasus”, and contributes to development of tools for sustainable funding of policy and strategic documents and protected areas.

D.13 Asian Development Bank Safeguard Policies 2009

340. 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.¹⁸

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

¹⁷ http://d2ouvy59p0dg6k.cloudfront.net/downloads/ecp_2012.pdf

¹⁸ ADB. 2009. Safeguard Policy Statement, Manila

- proposed mitigation measures, environmental monitoring and 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 Appendix A – 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. **(The project is not expected to trigger Critical Habitat for any of the site designations in the area or habitats present along the proposed project route. It is also not expected to trigger critical habitat criteria for any of the notable species that have the potential to be present within the Project area).**
- (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. **(The EIA herewith has identified all physical cultural heritage within the Project area and prepared mitigation measures to avoid damaging or destroying them. 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.

- 341. 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 underscore 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.
- 342. 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. **(A LARP is currently being prepared for the Project according to the requirements of ADB)**

Safeguard Requirements 3: Indigenous Peoples.

- 343. 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. **(The Project does not involve impacts to Indigenous Peoples and therefore no further actions relating to this safeguard are required).**

D.14 Comparison of ADB, EBRD and National Requirements

344. 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 and Social Policy and Regulations	ADB's SPS (2009) sets out the policy objectives, scope and triggers, and principles for three key safeguard requirement areas: • Environmental safeguards, • Involuntary resettlement safeguards, and • Indigenous people's safeguards	Environmental assessment and permitting procedure in Georgia are set out in the Environmental Assessment Code.	The Project shall comply with Lender's and national requirements.
Screening	Project screening and categorization at the earliest stage of project Four categories are defined Category A, B, C, FI. Rapid Environmental Assessment (REA) Checklist is used for categorization.	Project screening is done at early stage of the project. Environmental Assessment Code provides list of A and B category activities. For category B project need of EIA is defined based on the scoping procedure by MoEPA.	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	For Category A projects EIA (that includes EMP describing mitigation and monitoring issues) is obligatory. For Category B projects – initial environmental examination (IEE) is required to determine whether or not significant environmental impacts warranting an EIA are likely. If an EIA is not needed, the IEE is regarded as the final environmental assessment report. Guidelines and the outline of an EIA report are provided in SPS (2009).	EIA report is required for Annex 1 listed projects. For Annex 2 project need of EIA is decided based on the scoping procedure. The content of the EIA report is structured so to cover requirements indicated in the Environmental Assessment Code. The EMP is a part of the EIA document.	The EIA and EMP reports will follow the table of contents proposed by ADB SPS (2009). The report for obtaining Environmental Decision from the MoEPA will consider national regulatory requirements
Public Consultations and public meetings	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	Publication of information in national and regional mass-media. Arrange two public meetings – one at the scoping stage, another not later than at 55 th date from submission of the draft EIA report to MoEPA. All	Consultations will be carried out with the stakeholders, directly and in-directly affected people, NGOs throughout the

Aspect	ADB	GoG	Harmonized Framework
	understood by decision makers and taken into account. Continue consultations with stakeholders throughout project implementation as necessary to address environmental assessment- related issues. Minimum two consultations are required. Presence of ADB representative at official meetings with stakeholders is obligatory.	stakeholders are invited for the meetings. One two one meetings and consultations with stakeholders during EIA process. Consultation not later than 60 days from the date of publication.	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 scoping document is available for public review for 45 days before public consultations.	Draft EIA report (English and Georgian) will be published in ADB, EBRD 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

345. 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.
346. 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.
347. 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.
348. 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

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

E.2.1 Geology

350. 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.

351. Sources of Data:
- (i) Detailed Design Consultant.

E.2.2 Topography

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

353. Sources of Data:
- (i) Detailed Design Consultant – Site plans and profiles.

- (ii) Google Earth.

E.2.3 Soils

354. 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.
355. Sources of Data:
- (i) Detailed Design Consultant.
 - (ii) Feasibility Study for E-60 Highway Section from Zemo Osiaurui 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

356. 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.
357. 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

358. 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. NO₂, SO₂, CO, PM₁₀, PM_{2.5} 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).
359. Site visits were also undertaken to assess if there were any other point sources of air pollution within the Project corridor.
360. 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

361. Methodology for collection of baseline data – Maps and locations of surface water courses were reviewed and discussions with the Detailed Design Consultant undertaken.
362. 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.
363. 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.
364. 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.
365. In addition to the samples for offsite analysis, parameters such as temperature, dissolved oxygen, pH, important for fish wellbeing were measured on the spot.
366. Sources of Baseline 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.2.7 Natural Hazards

367. Methodology for collection of baseline data – 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

368. Methodology for collection of baseline data – 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).

369. **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)
370. 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.
371. 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.
372. **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.
373. 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.
374. 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.
375. The species composition of birds was determined by voice if it was not possible to observe them visually.
376. 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.)

377. 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.

378. **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 perythtone 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).

379. 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.

380. Sources of Baseline Data:

- (i) See **Appendix M**.

E.2.9 Protected Areas and IBAs

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

382. 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

383. 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.

384. 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

385. 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

386. 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

387. 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

388. 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.

389. 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

390. 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.

391. 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

392. 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.

393. Additional ambient noise monitoring was undertaken at 5 locations in order to calibrate the updated noise model. The results of the monitoring can be found in **Appendix I**.

394. Sources and Reference Documents:

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

E.3 EIA Project Area

395. 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 receptors¹⁹ that are most likely to be impacted by the Project's development activities.

3. ¹⁹ 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

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

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

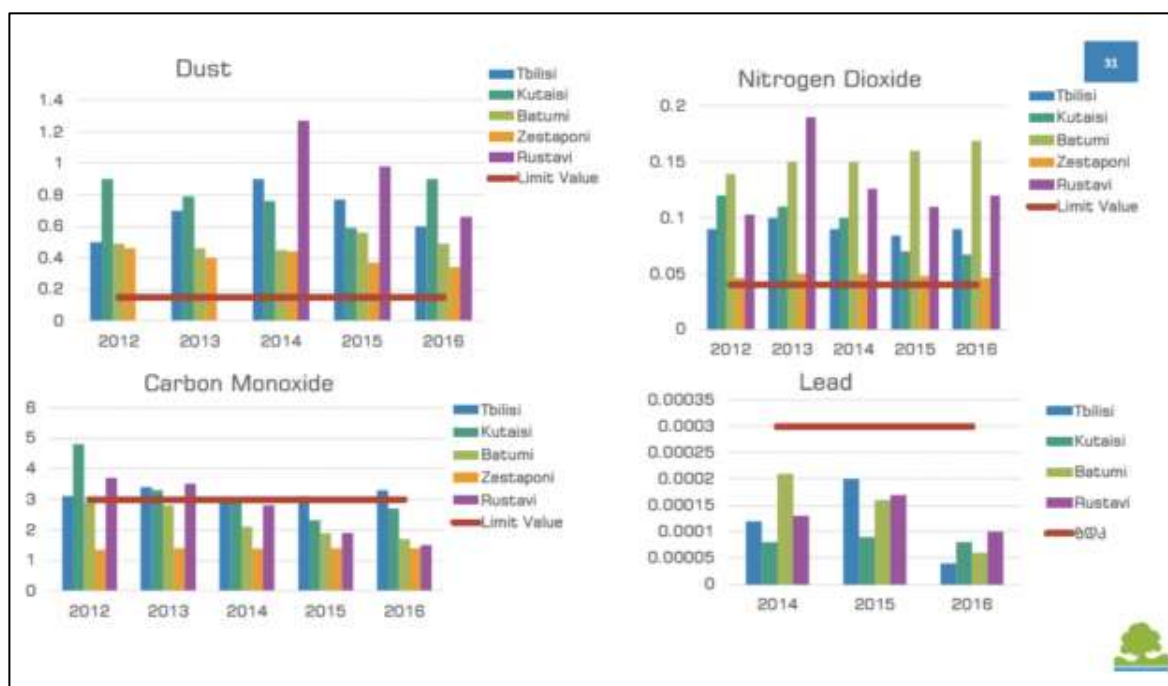
F.1 Physical Resources

F.1.1 Air quality

Regional Context

397. The National Environmental Agency has recently published air quality statistics for five cities in Georgia. Of particular relevance to the Project is the data from Zestaphoni. **Figure 31** indicates that in general Zestaphoni is the least polluted city of those monitored. However, ambient levels of dust and NO₂ currently exceed the national limits in Zestaphoni but levels of CO and Lead are well below the limits.

Figure 31: Ambient Air Quality Data



Site Observations

398. Within the Project area the main sources of air emissions are from transport, including vehicles on the existing E-60, and large-scale industrial facilities including the GAA manganese processing plant which is located almost adjacent to the southern boundary of the Project road between KM 11 and KM 12.

399. The main environmental issue concerning the GAA involves the lack of modern and efficient filters to reduce and control air emissions, in particular manganese dioxide emissions. **Figure 32** illustrates high levels of emissions from GAA smoke stacks during a site visit in July 2017. An emissions reduction program is being implemented by the plant in order to meet the existing environmental regulations. However, according to the UN Environmental Performance Review ambient air quality monitoring in Zestaphoni indicated that manganese concentration in air exceeded the MAC. Concentrations were 2.5 to 4-fold higher than the MAC, varying from 4.04 µg/m³ MnO₂ at 500 m distance from the plant to 2.5 µg/m³ MnO₂ at 300 m distance from the plant. Manganese concentrations in dust collected in residential houses or in the hospital at Zestaphoni are characterized by higher levels compared with the Tbilisi control sample.

400. In addition, it is assumed that some rural households cook with wood burning stoves and they may also use wood for household heating. This can also generate emissions to air although they are not anticipated to be significant given the fact that the population within the Project corridor is quite limited.

Figure 32: Visible Air Emissions from GAA Plant, 2017 (taken from boundary of the Project road around KM 11.1)

Sensitive Receptors

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

Baseline Ambient Air Quality

402. Air quality monitoring was carried out at nine different locations during August, 2017 to characterize the current air quality within the Study Area.

403. 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:

- Total Suspended Particulates (TSP), or Dust;
- Carbon Monoxide (CO);
- Nitrogen Dioxide (NO₂);
- Sulfur Dioxide (SO₂); and
- Particulate Matter (PM₁₀ and PM_{2.5})

404. A description of sampling locations and the rationale of selection is given in **Table 29**. The locations of the sampling points are indicated by **Figure 33**. The ambient air quality data was compared against applicable IFC and Georgian Standards.

Table 29: Ambient Air Quality Monitoring Locations

Sample ID	Coordinates	Approximate Location	Rationale for Site Selection
AQ01	42 ° 05'31.75"N / 43° 07'47.68"E	KM0.0	Start of F4, opposite a small cluster of residential properties.
AQ02	42 ° 05'42.77"N / 43° 06'23.19"E	KM2.2	Adjacent to a roadside restaurant. Site of embankment cutting.

AQ03	42 ° 05'31.72"N / 43° 04'53.87"E	KM4.3	Shorapani residential area, location of a school and exit of Tunnel 3.
AQ04	42 ° 05'58.49"N / 43° 04'26.10"E	KM5.5	Adjacent to residential properties.
AQ05	42 ° 06'14.75"N / 43° 03'51.79"E	KM6.3	At the portal to Tunnel 4.
N06	42 ° 06'56.22"N / 43° 02'57.23"E	KM8.3	Close to the portal to Tunnel 5 adjacent to residential properties.
AQ07	42 ° 07'02.90"N / 43° 02'08.61"E	KM9.5	Residential area at the portal to Tunnel 6 and at the end of Bridge 4.
AQ08	42 ° 07'36.01"N / 43° 01'11.19"E	KM11.0	North of the GAA facility and south of a residential cluster.
AQ09	42 ° 07'54.20"N / 42° 59'41.87"E	KM13.4	Adjacent to a small cluster of residential properties.

Figure 33: Ambient Air Quality Monitoring Locations

405. The results of the ambient air quality monitoring are provided in **Table 30**. The results, which provide a 'snapshot' of the air quality in the Project area on this particular day of the year show that in all instances the parameters monitored were below national, and where applicable, IFC standards with the exception of sampling locations NVA-1 and NVA-2 adjacent to the existing road. The most noticeable factor was the higher levels of PM recorded at the first four monitoring stations which are adjacent to the existing road. This suggests that these levels PM₁₀ and PM_{2.5} are attributable to vehicle movements on the existing road.
406. 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.
407. 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.

Table 30: Ambient Air Quality Monitoring Results

#	Time	Wind speed, m/s	Wind direction	CO, µg/m3	NO ₂ , µg/m3	SO ₂ , µg/m3	PM ₁₀ , µg/m3	PM _{2.5} , µg/m3	TSP, µg/m3	Comment
NVA-1										
1	12:30 -13:50	1.3	W	<1000	376	<500	28	26	<100	Edge of the E-60 highway
2	19:30-19:50	1.4	W	<1000	<200	<500	91	61	200	
3	01:30 -01:50	1.0	W	<1000	<200	<500	18	15	<100	
4	06:55–07:15	1.0	W	<1000	<200	<500	10	9	<100	
NVA-2										
1	13:00-13:20	2.0	SW	<1000	550	<500	48	32	120	14.9m from the centerline of E-60 highway
2	18:50-19:10	1.6	SW	<1000	376	<500	72	39	170	
3	01:00 -01:20	1.0	SW	<1000	<200	<500	18	15	<100	
4	06:50-07:10	1.0	SW	<1000	<200	<500	10	9	<100	
NVA-3										
1	10:30 -10:50	2,0	SW	<1000	<200	<500	12	9	<100	Next to internal road in Shorapani
2	18:20-18:40	1.6	SW	<1000	<200	<500	29	21	<100	
3	00:30-00:50	1.2	SW	<1000	<200	<500	10	7	<100	
4	06:20 -06:40	1.0	SW	<1000	<200	<500	5	4	<100	
NVA-4										
1	12:00-12:20	2.0	W	<1000	<200	<500	36	24	110	15.2m from the centerline of E-60 highway
2	17:50-18:10	1.2	W	<1000	<200	<500	35	25	120	
3	24:00-24:20	1.1	W	<1000	<200	<500	11	8	<100	
4	05:50-06:10	1.0	W	<1000	<200	<500	<1.0	<1.0	<100	
NVA-5										
1	10:00 -10:20	1.6	NW	<1000	<200	<500	5	4	<100	Next to the local road
2	17:20-17:40	1.2	NW	<1000	<200	<500	25	16	<100	
3	23:30-23:50	1.1	NW	<1000	<200	<500	<1.0	<1.0	<100	
4	05:20-06:40	1.0	NW	<1000	<200	<500	<1.0	<1.0	<100	
NVA-6										
1	09:10-09:30	1.0	SW	<1000	<200	<500	<1.0	<1.0	<100	87.5m from the centerline of Gomi-Sachkhere-Chiatura-Zestaphoni road, in about 30m from the street - Zestaphoni
2	16:40-17:00	1.0	SW	<1000	<200	<500	16	11	<100	
3	23:10-23:30	1.2	SW	<1000	<200	<500	<1.0	<1.0	<100	

Section F4 of the Khevi-Ubisa-Shorapani-Argveta Road (E60 Highway)
Environmental Impact Assessment

#	Time	Wind speed, m/s	Wind direction	CO, µg/m3	NO ₂ , µg/m3	SO ₂ , µg/m3	PM ₁₀ , µg/m3	PM _{2.5} , µg/m3	TSP, µg/m3	Comment
4	04:10-04:30	1.0	SW	<1000	<200	<500	<1.0	<1.0	<100	
NVA-7										
1	08:30-08:50	1.5	NW	<1000	<200	<500	9	6	<100	Next to existing internal road – Kvemo Sakara
2	16:10-16:30	1.1	NW	<1000	<200	<500	16	12	<100	
3	22:50-23:10	1.0	NW	<1000	<200	<500	<1.0	<1.0	<100	
4	04:10-04:30	1.1	NW	<1000	<200	<500	<1.0	<1.0	<100	
NVA-8										
1	07:30-07:50	2.2	S	<1000	<200	<500	12	8	<100	Next to existing internal road – Kvemo Sakara
2	15:30-15:50	1.1	S	<1000	<200	<500	26	19	<100	
3	22:30-22:50	1.1	S	<1000	<200	<500	<1.0	<1.0	<100	
4	03:30-03:50	1.3	S	<1000	<200	<500	<1.0	<1.0	<100	
NVA-9										
1	07:00-07:20	2.0	SW	<1000	<200	<500	17	15	<100	Next to existing internal road – Argveta
2	15:00-15:20	1.1	SW	<1000	<200	<500	21	10	<100	
3	22:10-22:30	1.0	SW	<1000	<200	<500	16	10	<100	
4	03:00-03:20	1.2	SW	<1000	<200	<500	<1.0	<1.0	<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	Comment
1	National limit – max. permissible one time (volley) concentration (MPC), µg/m ³		24 h	3000	40	50	n/a	n/a	150	One time (volley) maximum permissible concentration is the maximum concentration of hazardous substance determined in 20-30 minute interval based on one-time (volley) concentrations (ref. Technical Regulation – On approval of technical regulations for calculating threshold limit values of emission of harmful substances into the ambient air”, approved by governmental decree #408, Document code: 300160070.10.003.017622). The measured values are in line with 30min aver.period values – see text in red.
			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	

F.1.2 Climate

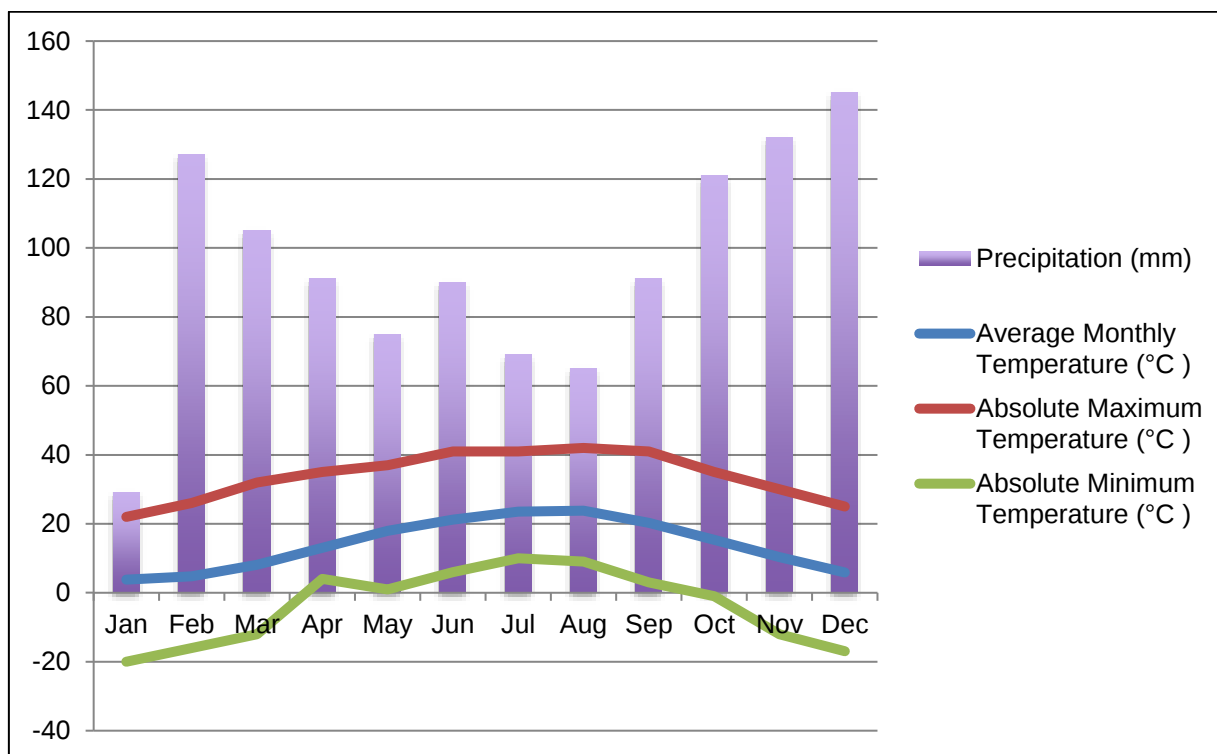
408. Due to the peculiar geographical position of Georgia between the Black and Caspian seas and the presence of powerful natural climatologic in the North of the Main Caucasus Range, and also owing to the large range of elevations above sea level, the climate of Georgia varies quite widely for a small country. Climates of all types, ranging from subtropical, characteristic of the coastal zone of the Black sea, to the Arctic, prevailing in the most mountainous region of the Caucasus range can be found.

409. 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.

Precipitation & Temperature

410. Annual precipitation in Zestaphoni is around 1,200 mm. Rainfall is highest in the Winter, Autumn and Spring, although rainfall can still be observed during the hotter summer months (see **Figure 34**)

Figure 34: Temperature and Precipitation (mm), Zestaphoni

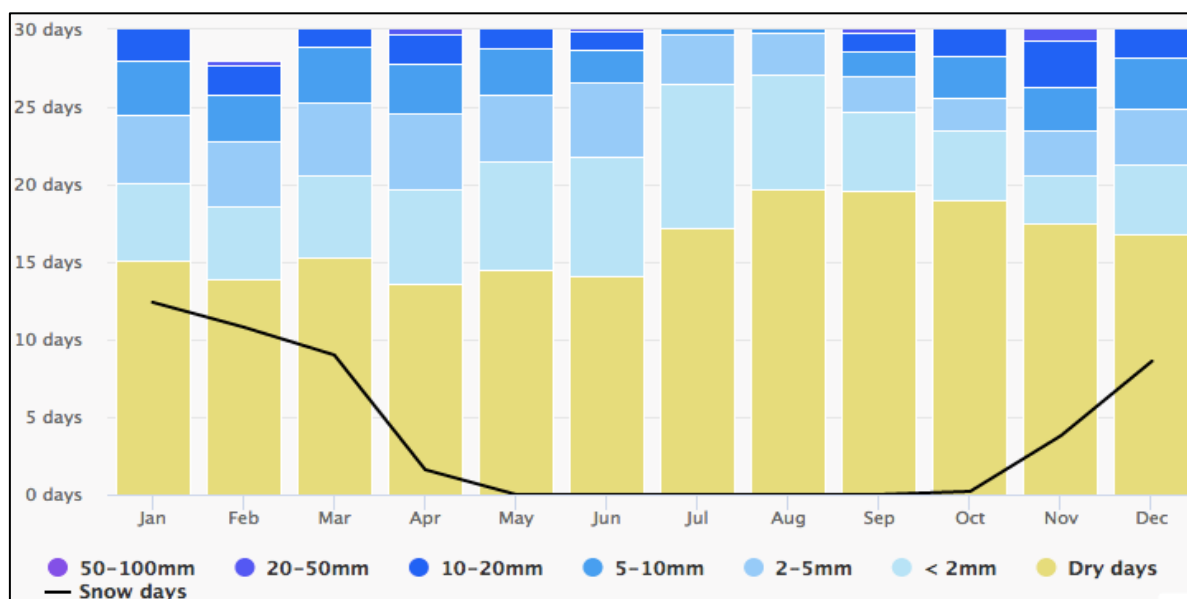


411. >0.2 mm/day are considered sufficient to effectively suppress wind-blown dust emissions^{20 21}. **Figure 35** details the number of days showing >0.2 mm/day rainfall. On average each year, around ten such days occur between November and June and rarely in the months of July to August.

4. ²⁰ IFC (2007). Environmental, Health and Safety Guidelines. General EHS Guidelines: Environmental. Air Emissions and Ambient Air. April 2007.

5. ²¹ 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.*

Figure 35: Precipitation Levels (mm), Zestaphoni



412. Snow cover is not formed every year, as winter precipitation often falls as rain. The average duration of snow cover is an average of 6-20 days. Snowstorm in the mountains to the north of Zestaphoni are possible from November to April. The average total duration of snowstorms per year is 8 hours. Average per year number of days with Blizzard is three, maximum – ten. Most often blizzards occur in the winter months, in which the average duration of snowstorms per day snowstorm is 2.7 hours.

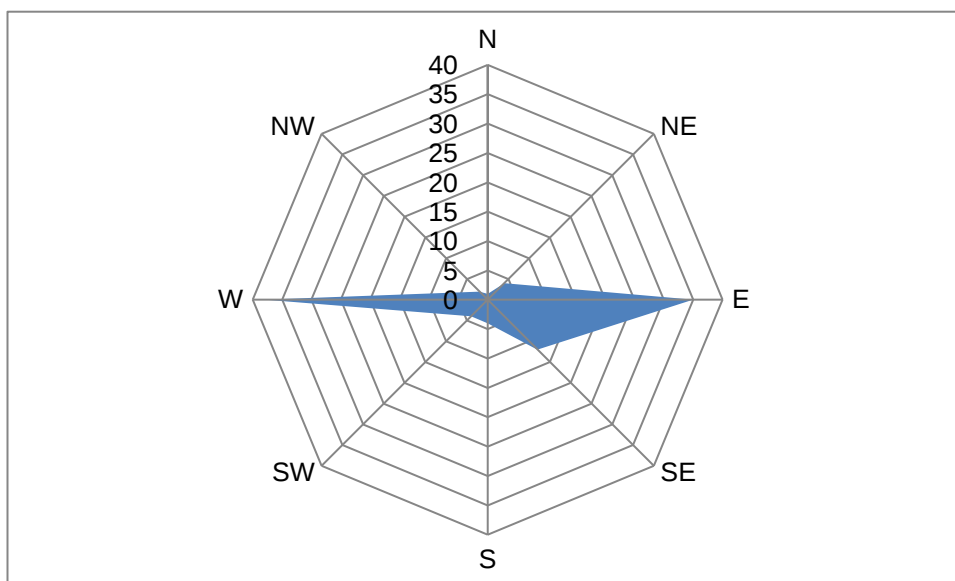
413. 310. Thunderstorms occur in all months of the year. The maximum number of days with thunderstorms refers to June (6 days), and the average duration of thunderstorms in the afternoon with thunderstorm is 1.5 hours and the maximum continuous – 12.3 hours.

414. **Figure 34** illustrates the monthly temperature for Zestaphoni which ranges on average, from 5 °C in the winter months to around 25 °C in the summer. Absolute maximum and minimum temperatures show that it is possible for the temperatures to reach as low as 20 °C and more than 40 °C in the summer.

Prevailing Winds

415. Wind strength, direction and frequency is shown in **Figure 36**. 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 36: Wind Rose, Zestaphoni



F.1.2.3 Climate Change

General

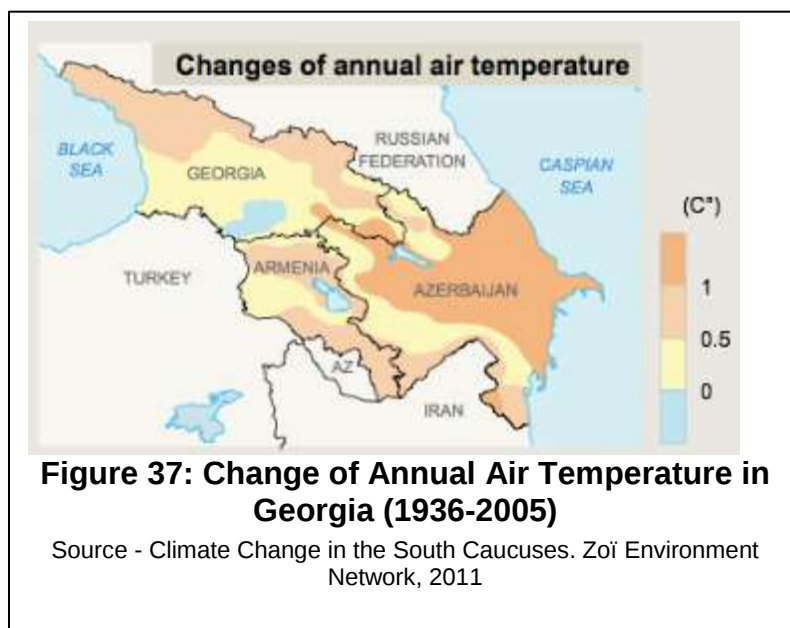
416. Georgia is a mountainous country with diverse physical geography and climates, has a history of natural disasters, making the nation particularly susceptible to global environmental changes.

417. Climate trends observed since the 1960s include:

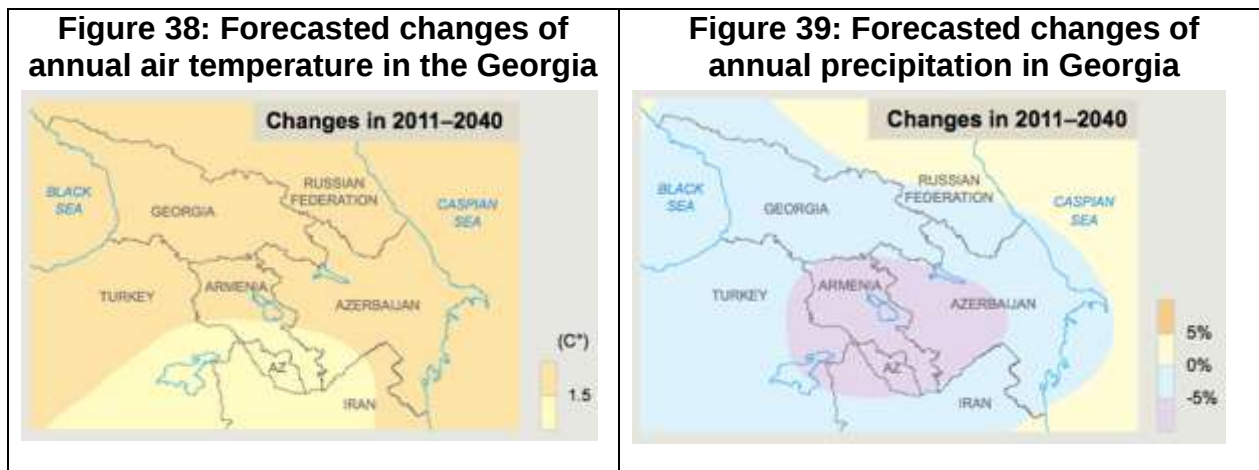
- Increased temperatures in the west by 0.3°C, and by 0.4°–0.5°C in the east (see **Figure 37**).
- Increase in the number of hot days, particularly in the lowlands. Number of dangerously hot days in Tbilisi increased 14 days (1986–2010).
- Increased precipitation in the west (the mountain areas of Svaneti and Adjara. Both saw increases of 14%); decreased precipitation along the Likhi Ridge and to the east.
- Decrease in glacier mass by 30 %.
- Increased number of extreme events such as extreme precipitation, which cause landslides, mudflows and droughts; as well as more frequent floods in the west.

418. Projected climate changes include:

- Increased average annual temperatures by 0.8°–1.4°C by 2050 and 2.2°–3.8°C toward 2100; greatest increase in northwest mountains.



- Precipitation data less certain, but general increase expected up to 2050, and potential decreases of up to 24 % by 2100 (However, other data provided seems to indicate that there will be a general decrease in precipitation, see Figure 39).
- Increase in the number of hot days (which may double in some mountain areas) and more frequent heat waves June – August.²²
- Decrease in both days and nights with frost.
- Complete loss of Georgia's 637 glaciers projected by 2160 due to higher temperatures.



Source - Climate Change in the South Caucasus. Zoï Environment Network, 2011

419. No site specific data has been found relating to climate change. However, given the general overview above it can be assumed that there will be an increase in average annual temperatures of between 1 and 1.5 °C over the next 30 years and that precipitation will decrease. The number of hot days may increase, and as such, consideration of suitable pavement types shall be given.

Greenhouse Gases (GHGs)

420. 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 MtCO₂e) of Georgia's total emissions. Land-use change and forestry (LUCF) was the second most significant sector. Of the 7.5 MtCO₂e % of emissions from the energy sector approximately 2 of the 7.5 MtCO₂e 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.²³ In 2013 emissions data compiled by the World Resources Institute (WRI) indicated that Georgia produced around 14 MtCO₂e or 0.0003% of global GHG emissions. 2 MtCO₂e represents 0.00004% of global GHG emissions.

F.1.3 Topography

421. The Project area is located to the west of the Likhi Range which connects the Greater and Lesser Caucas Mountains. The Project corridor is set within a landscape of mountains, rolling hills and valley plain (see **Figure 42** for a Topographical Map of the Project area). The existing road is located within the bottom of the river valley and as such elevation only

²² Climate Risk Profile – Georgia. USAID, 2015

²³ Greenhouse Gas Emissions in Georgia. USAID, July, 2016

varies between 200 and 170 meters above sea level. **Figure 40** and **Figure 41** illustrate the mountainous / rolling landscape in the first and middle portion of the road.

Figure 40: Topography of the Road Corridor (existing road can be observed to the left of the valley)

Figure 41: Topography looking over Shorapani towards Zestaphoni

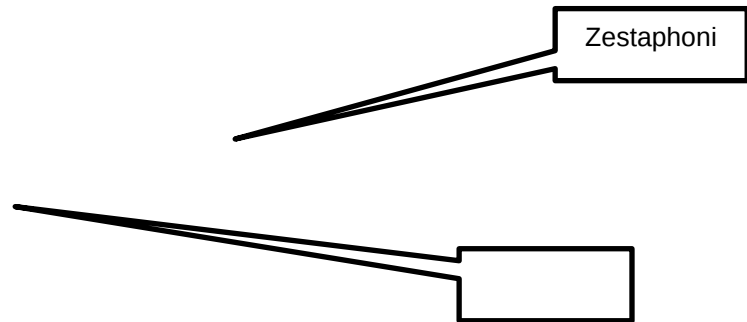
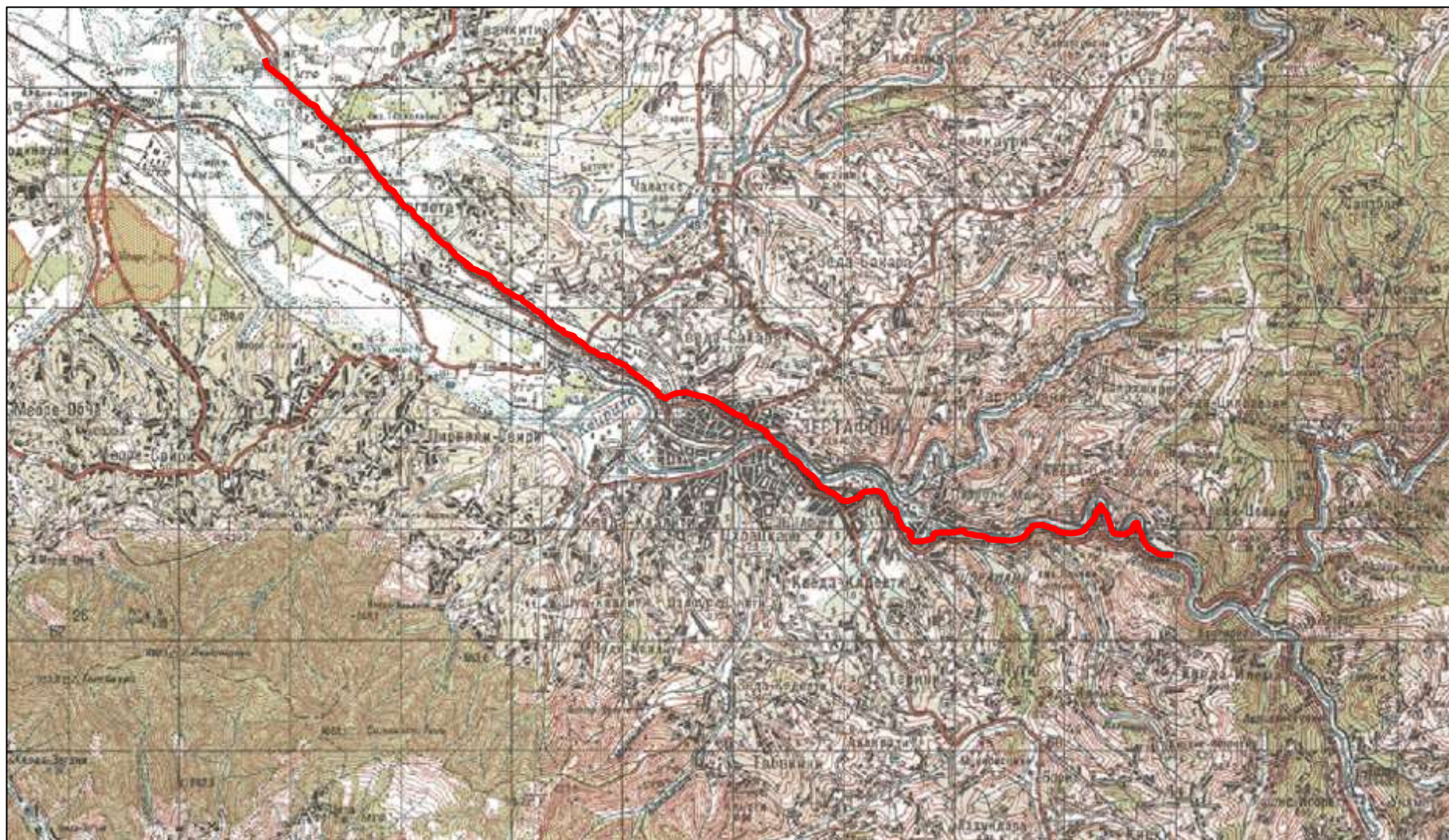


Figure 42: Topography of the Project Area with Existing Road



F.1.4 Natural Hazards

Regional Context

422. 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.

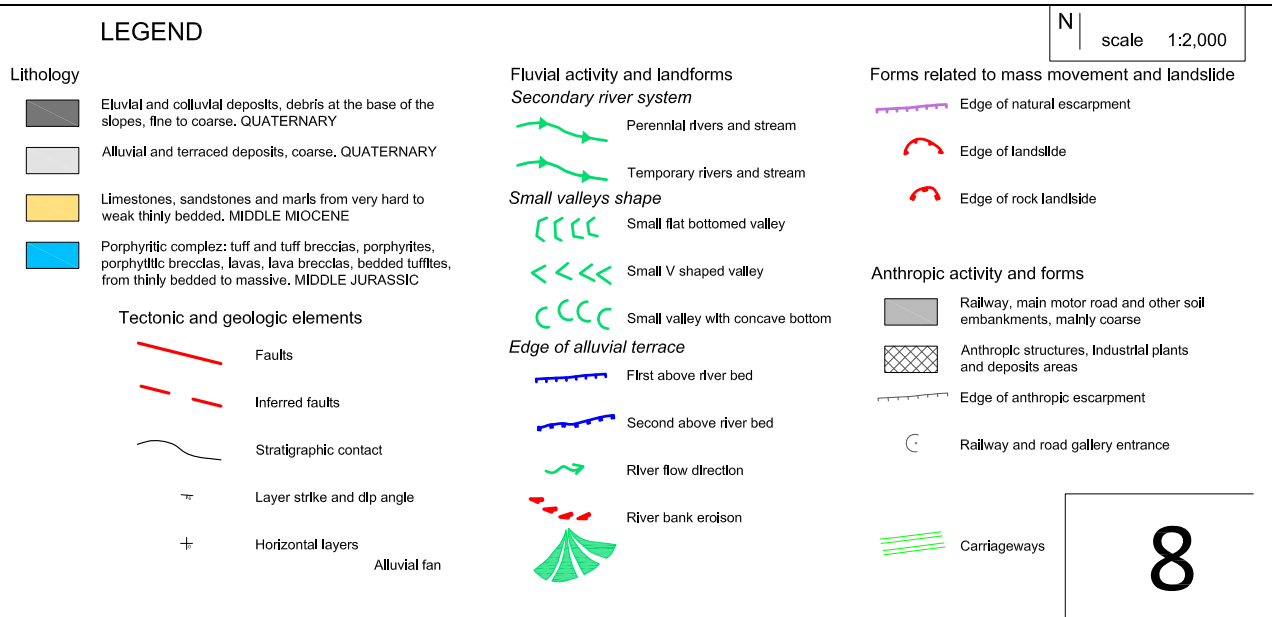
423. Almost all morphological-climatic zones in Georgia, starting with the sea coastline up to the high altitude mountain alpine-nival zone, have experienced damage to different extents. Over 50,000 landslides of different sizes and over 3,000 mudflow-transforming watercourses (rivers, canyons) have 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.

Landslides

424. Within the Project area a few areas prone to landslides have been identified. **Figure 43** provides the locations of the landslides.

Figure 43: Landslide Locations Within the Project Area

	KM 0.6 – Located above a tunnel.
	KM 2.8 – This landslide area is located above the existing road which the new alignment bypasses to the north.
	KM 3.1 – Located above a cut slope on a steep embankment.
	Between KM 4.8 and 5.2 – located immediately above the new alignment.
	KM 8.7 – located immediate to the north of the new alignment.

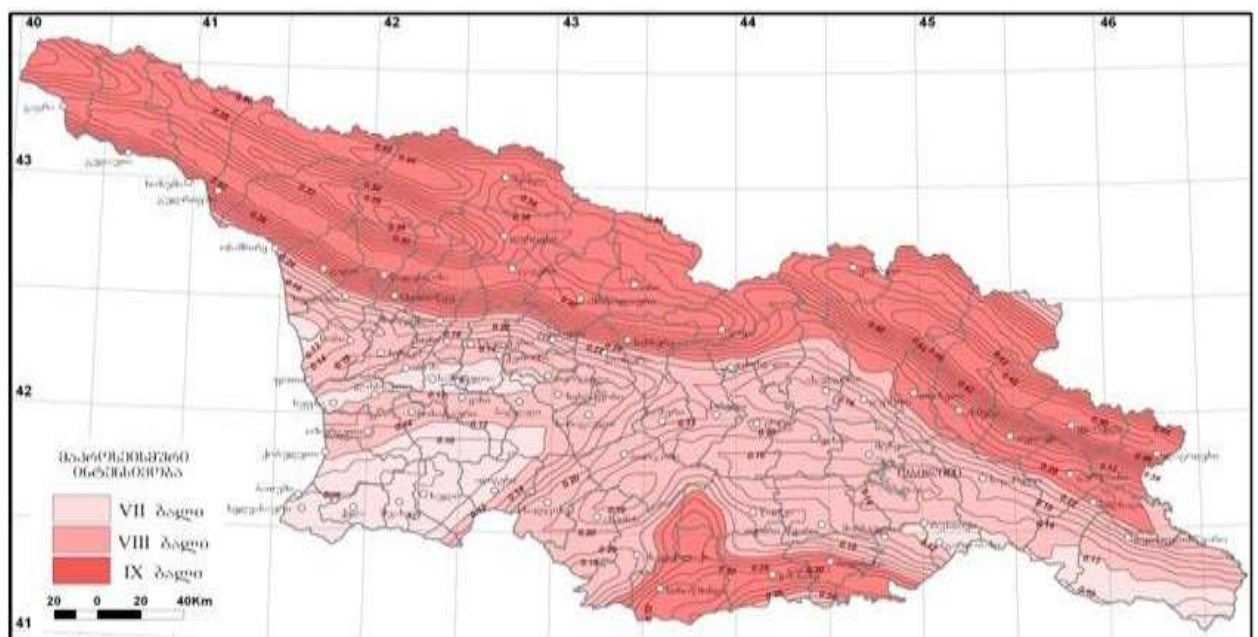


425. Generally, the landslides do not affect the project alignment, except for the mass movements identified above around KM 0.6 affecting TUN 4.0.01-TA/VAT and its eastern and western portals.

Seismicity

426. 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) with the dimensionless coefficient of seismicity (A) equaling 0.16 (village Khevi) under the same document. **Figure 44** illustrates the seismic conditions in Georgia.

Figure 44: Seismicity Map of Georgia (MSK Scale)



F.1.5 Hydrology

F.1.5.1 Surface Water

Regional Context

427. 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 45** illustrates the division on the Caspian and Black Sea basins.



Figure 45: Rioni Sub-basin

428. 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 km², which is approximately 20% of the whole Georgian territory.

Local Context

429. Two main rivers can be found within the Project area, the Kvirila and the Dzirula. The confluence of the two rivers is in Shorapani adjacent to the Project road at Km 5.0, see **Figure 46**.

430. **Kvirila** - The river Kvirila heads from Ertso basin on the southern slope of Racha Ridge. It flows out of Ertso Lake at 1,711 m altitude and into Vartsikhe water reservoir. Before the water reservoir was created, it flowed into the river Rioni from its left bank. The length of the river is 140 km, its total fall is 1628 m, its mean slope is 11,6‰, the area of the rivers basin is 3,598 km² and the mean height of the basin is 790m. The river comprises 2,906 tributaries of different ranges with the total length of 5,254 km.

431. The upper part of the basin is located on the southern slope of Racha ridge and western slope of the Likhi range, its middle course is located over Kartli-Imereti crystal massif, while the lower reaches flow across Kolkheti Plain. The upper part of the basin is characterized by deep gorges and gullies typical to the mountainous region. There are milder relief forms spread over the crystal massif, and the river flows out across Kolkheti Plain past Zestaphoni.

432. The upper part of the Kvirila basin is structured with the Upper and Middle Jurassic limestones, marls, sandstones, porphyries and slates. The Upper and Middle Miocene clays, marls, sandstones and conglomerates dominate in the middle part. The Upper and Middle Jurassic rocks are spread in the environs of Zestaphoni, and there are Cretaceous limestones, marls and sandstones spread over the same location and past it. The part of the middle course of the basin and surface of its lower course is mostly covered with the

Quaternary deposits, which are partially presented by alluvial and fluvio-glacial deposits. Alluvial and alluvial-proluvial deposits are also in bulk. The humus calcareous soils are spread over Racha ridge. A great part of the basin is occupied by brown forest soils, and zheltosol dominate on Kolkheti Plain. The percentage of forest land in the basin is over 50%.

Figure 46: Dzirula and Kvirila Rivers

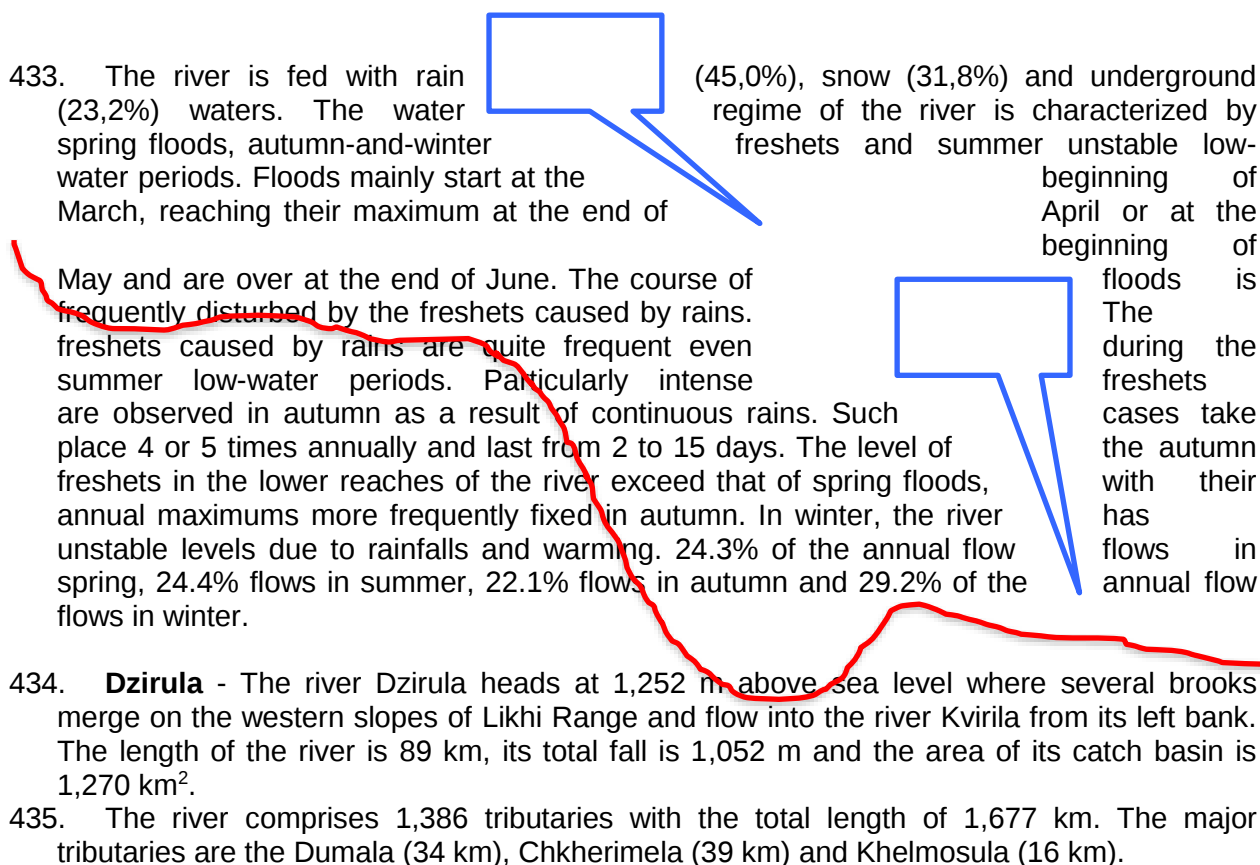


Figure 47: Dzirula River, KM 4.4, June 2017

436. 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 river basin is well developed in the lower zone due to the confluence with the river Chkherimela. 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.
437. 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.
438. 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.

439. 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.

440. Other small tributaries within the are include the Borimela River (which the Project road crosses at KM 3.5), and the Ajamura and Samanishvilisghele rivers, both of which located on the south bank of the Kvirila river more than 1.3 km from the Project road.

Table 31: Average monthly discharges of the Kvirila and Dzirula Rivers

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
Kvirila	Zestaphoni	2490	45.3	70.6	10.4	12.6	83.0	55.7	35.3	26.5	23.6	39.2	45.6	53.7

Table 32: Peak Discharges of the Kvirila and Dzirula Rivers

River	Station	Catchment (km ²)	Reoccurrence □ Year					
			1000	100	50	20	10	5
Dzirula	Tseva	1190	965	670	575	455	380	315
Kvirila	Zestaphoni	2490	2130	1430	1245	1000	850	695

Surface Water Quality

441. Water quality monitoring has been undertaken previously on the Kvirila river due to the presence of mining activities near the town of Chiatura which is approximately 28 kilometers north east of Zestaphoni. One of the world's richest manganese (Mn) deposits and largest Mn mining areas lies in the foothills of the Caucasus Mountains, near the city of Chiatura. The monitoring revealed that the Kvirila River is contaminated with Mn and Fe. Total Mn levels were almost 15 times the MAC downstream of the discharge from the Central Keeping Facility (CKF, which is the main ore processing facility). Concentrations of total Mn were 2–12 times the MAC in Darkveti, Shuqruti, and Rgani streams, and total Fe values were 8–55 times the MAC in these tributaries. The primary sources of Mn and Fe in the Kvirila River are the untreated industrial wastewater discharged from the CKF, tailings and waste rock associated with the Mn ore disposed of on the Kvirila River floodplain, and the main tributaries (primarily Darkveti and Shuqruti streams). The monitoring report concluded that use of the Kvirila River before and after the CKF, for drinking, economic, cultural, and household purposes should be prohibited. Based on Mn concentrations, these areas are extremely highly polluted water, according to Georgian regulations.²⁴

²⁴ Effects of Manganese Mining on Water Quality in the Caucasus Mountains, Republic of Georgia. Caruso, et al. Mine Water Environ. 2011

442. To further assess the status of water quality in the Project area, including the Kvirila and Dzirula rivers monitoring was undertaken in September, 2017. A total of two surface water samples were collected and analyzed to determine the baseline water quality levels. **Table 33** describes the sample locations and rationale for their selection. The sampling locations are mapped in **Figure 48**.

Table 33: Surface Water Quality Monitoring Locations

Sample ID	Coordinates	Rationale for Site Selection
SW01	42 ° 05'37.36"N / 43° 06'09.45"E	At location of Bridge BRI 4.1.01-AT/TA, Dzirula River
SW02	42 ° 06'12.29"N / 43° 03'57.67"E	At location of Bridge BRI 4.1.04-AT/TA, Kvirila River

Figure 48: Surface Water Monitoring Locations

443. The results of the water quality monitoring are presented in **Table 34** below show that both the Dzirula and Kvirila rivers meet the national MACs for surface water quality at the sampling locations, although the levels of manganese in the Kvirila sample was above the recommended standards for drinking water. This reflects the findings of the study on manganese in the Kvirila river mentioned above.

Table 34: Surface Water Quality Monitoring Results

#	Parameter	Units	SW-1 (Dzirula)	SW-2 (Kvirila)	Method/standard	National, maximum allowable concentration
1	pH	-	8.2	8.1	ISO 10523-08	6.5-8.5
2	Electrical conductivity (EC)	S/m	0.027	0.0248	ISO 7888-85	n/a
3	Turbidity	FTU	3.87	176	ISO 7027-99	n/a
4	BOD ₅	mg/IO ₂	2.7	1.7	ISO 5815-03	6
5	COD	mg/IO ₂	<15	<15	ISO 6060-89	30
6	Dissolved oxygen (DO)	mg/l	9	7.6	ISO 5815-03	≥4
7	Total suspended solids (TSS)	mg/l	26	96	ISO 11923-97	increase by no more than 0.75
8	Oil and grease	mg/l	<5.0	<5.0	EPA 413,1-97	n/a
9	Total Phosphorus	mg/l	<0.1	0.1	ISO 6878-04	2
10	Total Nitrogen	mg/l	0.25	0.3	GOST 18826-73	n/a
11	Total Ammonium	mg/l	<0.1	<0.1	GOST 4192-82	0.5 mg/l NH ₄
12	TPH	mg/l	<0.04	<0.04	EPA 48,1-97	0.3
13	Total residual chlorine	mg/l	<0.05	<0.05	GOST 18190-72	n/a
14	Total Zinc	mg/l	<0.003	<0.003	ISO 8288-A-86	1
15	Dissolved Copper	mg/l	<0.003	<0.003	ISO 8288-A-86	1
1	Manganese	mg/l	<0.02	0.28	EPA 3005 A-92	1

#	Parameter	Units	SW-1 (Dzirula)	SW-2 (Kvirila)	Method/standard	National, maximum allowable concentration
6						
1 7	Total Coliform Bacteria	100ml	680	800	ISO 9308-1:2014	≤10 000

444. No fisheries are known to exist within the Project area, although recreational fishing was observed during surveys performed by the LCF.

445. No fisheries are known to exist within the Project area, although recreational fishing was observed during surveys performed by the LCF.

F.1.5.2 Groundwater Water

Local Context

446. 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 and groves, groundwater is very shallow depths (0.3m). Aquifers are mainly fed from rivers and precipitation.

447. 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.²⁵

Groundwater Quality

448. A total of two groundwater samples were collected from two wells to assess the baseline groundwater quality in the Project area. Sampling was originally intended close to Shorapani, but the monitoring team had difficulties accessing this location and as such sampled at two locations close to the GAA plant instead. **Table 35** provides a summary of the results.

Table 35: Groundwater Quality Monitoring Locations

Sample ID	Coordinates	Rationale for Site Selection
GW1	42 ° 07'11.23"N / 43° 01'40.06"E	Behind GAA Site
GW2	42 ° 07'36.52"N / 43° 01'06.14"E	Behind GAA Site

345. Results – The results of the groundwater monitoring indicate all parameters in sample location GWS-1 meet the national MACs and where applicable, WHO standards. GWS-2 however exhibited high hardness, total dissolved solids, calcium, manganese and sulfates.

Table 36: Groundwater Quality Monitoring Results

#	Parameter	Units	GWS-1	GWS-2	Method/standard	National limit, maximum allowable concentration	WHO, guidance values, mg/l
1	pH	-	7.35	7	ISO 10523-08	6.5-8.5	n/a

²⁵ Second Regional Development Project, Imereti Regional Development Program, Imereti Tourism Development Strategy. Strategic Environmental, Cultural, Historical and Social Assessment. World Bank, 2014

#	Parameter	Units	GWS-1	GWS-2	Method/standard	National limit, maximum allowable concentration	WHO, guidance values, mg/l
2	Dissolved oxygen (DO)	mg/l	7.1	5	ISO 5815-03	n/a	n/a
3	Electrical conductivity (EC)	S/m	0.0478	0.178	ISO 7888-85	n/a	n/a
4	Alkalinity	mg-eq/l	<0.2	<0.2	Gost 23268.3-78	n/a	n/a
5	Hardness	mg-eq/l	5.38	22.5	Gost 23268.5-78	7-10	n/a
6	Total suspended solids (TSS)	mg/l	<2.0	<2.0	ISO 11923-97	n/a	n/a
7	Total dissolved solids	mg/l	466	1946.7	Calculated	1000-1500	n/a
8	Arsenic, As	mg/l	<0.005	<0.005	Gost 4152-89	<0.01	0.01
9	Chlorides	mg/l	17	41.1	Gost 23268,17-78	<250	n/a
10	Iron, Fe	mg/l	<0.02	<0.02	EPA 3005 A-92	<0.3	n/a
11	Nitrates	mg/l	8.91	8.86	Gost 18823-73	<50	50
12	Sodium, Na	mg/l	17.1	125.4	ISO 9964-3-93	<200	n/a
13	Potassium, K	mg/l	1.05	3.08	ISO 9964-3-93	n/a	n/a
14	Calcium, Ca	mg/l	80	245	Gost 23268,5-78	<140	n/a
15	Magnesium, Mg	mg/l	16.8	124	Gost 23268,5-78	<85	n/a
16	Lead, Pb	mg/l	<0.01	<0.01	ISO 8288-A-86	<0.01	0.01
17	Sulfates	mg/l	36	960	Gost 23268,3-78	<250	n/a
18	Manganese, Mn	mg/l	<0.02	<0.02	EPA 3005 A-92	<0.4	0.4*

F.1.6 Geology & Soils

F.1.6.1 Geology

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

1. Effusive volcanic rocks covering the crystalline basement (not exposed in Lot F4), dated Middle Jurassic. They are represented by the porphyritic complex including the following geological formations:
 - a. J2b2 (A) - Tuff and tuff breccias, from moderately hard to hard. Mainly massive.
 - b. J2b2 (B) - Irregular succession of porphyrites, porphyritic breccias, lava breccias, bedded tuffites, tuff and tuff breccias; mainly hard. From thinly bedded to massive.
2. Sedimentary rocks covering the volcanic units, dated Middle Miocene and represented by the following geological formations:
 - a. N1² (m) - Marls.
 - b. N1² - Limestones and sandstones. From very hard to weak, thinly bedded.
3. Quaternary soils, covering both the volcanic and the sedimentary rocky units, represented by:
 - a. eQ - Eluvial cover deposits on the upper plains. Coarse and/or fine.
 - b. cdQ - Colluvial deposits in the valley floors and debris at the slope bases. Coarse and/or fine.
 - c. aQ - Recent alluvial and terraced deposits. Coarse.
 - d. aaQ - Current alluvial deposits. Coarse.

450. From a geo-lithological point of view, along the alignment, three main homogeneous sections can be identified, depending on similar lithological conditions (**Table 37**, below):
- From km 0+000 to 6+350 – outcropping formations are represented by volcanic rocks of the porphyritic complex, including both the mainly effusive rocks of the J2b2 (B) formation and the mainly pyroclastic rocks of the J2b2 (A) formation. The contact between this two geological units is generally a stratigraphic contact, being tuffs above lavas. In some cases, important faults cause tectonic contacts between them. In this section, tunnels are expected to be excavated in J2b2 (B) formation; bridges are expected to have their abutments and piers on quaternary deposits (aQ, aaQ and mQ with a variable thick) covering the J2b2 (B) formation; cuts are expected to be mainly in the porphyritic complex, sometime affecting the thin covering quaternary deposits.
 - From km 6+350 to ~ 10+200 – outcropping formations are mainly represented by carbonate sandstones of N1² formation, overlaying with a stratigraphic limit the J2b2 (A) formation, exposed in the major valleys. Covering quaternary deposits are widespread in this area. Several faults are observed. In this section, tunnels are expected to be excavated in the porphyritic complex (both J2b2 (A) and (B) formations) and in the N1² formation; one bridge crosses a colluvial deposit overlaying the N1² formation; one cut is expected to be excavated in the N1² formation.
 - From km ~ 10+200 to 14+726 – in this area, colluvial and alluvial deposits (cdQ and aQ) outnumber the not-outcropping rocky formations.

Table 37: Lithology – Rikoti - Argveta

Bridges	from km	to km	length	lithology
T-TA-1	260,00	590,00	330	Irregular succession of porphyrites, porphyritic breccias, lava breccias, bedded tuffites, tuff and tuff breccias; mainly hard. From thinly bedded to massive
T-TA-2	830,00	1200,00	370	Irregular succession of porphyrites, porphyritic breccias, lava breccias, bedded tuffites, tuff and tuff breccias; mainly hard. From thinly bedded to massive
T-TA-3	3510,00	4270,00	760	Irregular succession of porphyrites, porphyritic breccias, lava breccias, bedded tuffites, tuff and tuff breccias; mainly hard. From thinly bedded to massive
T-TA-4	6320,00	6622,00	302	Tuff and tuff breccias, from moderately hard to hard. Mainly massive
	6622,00	6759,00	137	Irregular succession of porphyrites, porphyritic breccias, lava breccias, bedded tuffites, tuff and tuff breccias; mainly hard. From thinly bedded to massive
	6759,00	7020,00	261	Tuff and tuff breccias, from moderately hard to hard. Mainly massive
T-TA-5	7130,00	7496,00	366	Tuff and tuff breccias, from moderately hard to hard. Mainly massive
	7496,00	8250,00	754	Limestones and sandstones from very hard to weak, thinly bedded
T-TA-6	9280,00	9640,00	360	Limestones and sandstones from very hard to weak, thinly bedded

T-AT-1	200,00	610,00	410	Irregular succession of porphyrites, porphyritic breccias, lava breccias, bedded tuffites, tuff and tuff breccias; mainly hard. From thinly bedded to massive
T-AT-2	770,00	1220,00	450	Irregular succession of porphyrites, porphyritic breccias, lava breccias, bedded tuffites, tuff and tuff breccias; mainly hard. From thinly bedded to massive
T-AT-3	3490,00	4600,00	1110	Irregular succession of porphyrites, porphyritic breccias, lava breccias, bedded tuffites, tuff and tuff breccias; mainly hard. From thinly bedded to massive
T-AT-4	6345,00	6639,00	294	Tuff and tuff breccias, from moderately hard to hard. Mainly massive
	6639,00	6776,00	137	Irregular succession of porphyrites, porphyritic breccias, lava breccias, bedded tuffites, tuff and tuff breccias; mainly hard. From thinly bedded to massive
	6776,00	7030,00	254	Tuff and tuff breccias, from moderately hard to hard. Mainly massive
T-AT-5	7145,00	7504,00	359	Tuff and tuff breccias, from moderately hard to hard. Mainly massive
	7504,00	8300,00	796	Limestones and sandstones from very hard to weak, thinly bedded
T-AT-6	9290,00	9720,00	430	Limestones and sandstones from very hard to weak, thinly bedded

F.1.6.2 Soils

451. The soils in the Project area are very productive and range of crops are grown in the region which is well known for is wine production. Soil temperatures from Zestaphoni and topsoil thicknesses along the road alignment are shown in **Table 38** and **Table 39**.

Table 38: Soil Temperature

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Monthly Temperature (°C)	2	3	8	15	21	26	29	28	22	15	9	4

Table 39: Topsoil Thickness in the Project Corridor

Chainage (km)	Topsoil Thickness (m)
10+100 – 10+450	0.50
10+450 – 10+820	0.70
10+820 – 11+240	0.40
11+240 – 11+620	0.30
11+620 – 12+400	0.40
12+400 – 12+625	0.20
12+625 – 12+990	0,20
12+990 – 13+445	0.35
13+445 – 13+835	0.30
13+835 - 14+080	0.25
14+080 - 14+730	0.60

452. Hazardous wastes generated by the GAA, Chiatura manganese enrichment plant, and many small-size smelters operating in various settlements of Imereti have been identified as potential sources of soil pollution in the region.²⁶
453. To assess the status of soil quality in the Project area soil sampling and analysis was undertaken in September, 2017. A total of two soil samples were collected and analyzed to determine the existing soil quality.
454. **Table 40** describes the sample locations and rationale for their selection. The sampling locations are mapped in **Figure 49**.

Table 40: Soil Monitoring Locations

Sample ID	Coordinates	Rationale for Site Selection
GW_S-1	42 ° 05'36.08"N / 43° 04'52.36"E	Behind the GAA Factory
GW_S-2	42 ° 07'36.52"N / 43° 01'06.14"E	Behind the GAA Factory

Figure 49: Soil Monitoring Locations

²⁶ Integrated Natural Resources Management in Watersheds of Georgia Program. USAID, 2011

Table 41: Soil Sampling Results

#	Parameter	Units	GWS-1	GWS-2	Method/standard	National limit, maximum allowable concentration	Proposed National Limit, MAC	Proposed National Preventive limits of risk elements in agricultural soil	Italian Standard For Residential Areas	UK Soil Guidelines for Residential Areas ²⁷
1	Copper, Cu (mobile)	mg/kg	1.35	2.30	GOST P50683-1994	3-132	60-100	60	120	
2	Zinc, Zn (mobile)	mg/kg	<0.5	3.6	GOST P50686-1994	23-220	130-200	120	150	
3	Nickel, Ni (mobile)	mg/kg	1.0	0.25	GOST P50683-1994	4-80	60-80	50	120	
4	Chromium, Cr (mobile)	mg/kg	<0.5	<0.5	GOST P50683-1994	6	100-200	90	150	
5	Lead, Pb (total)	mg/kg	41.5	47.0	ISO 14869-.1-2001	32-130	100-140	60	100	
6	Arsenic, As (total)	mg/kg	14.4	16.2	GOST 4152-89	2-10	30	20	20	32
7	Cadmium, Cd(total)	mg/kg	<2.0	<2.0	ISO 14869-.1-2001	2	0.5 – 1.0	0.5	2	
8	Polychlorinated biphenyl PCB	mg/kg	<7.0	<7.0	EPA 8082 A-2007	60	10	-	5	
9	Asbestos		nd	nd	NIOSH 9002 -1989	3-132	-	-	100 (next law)	

²⁷<http://webarchive.nationalarchives.gov.uk/20140328153727/http://www.environment-agency.gov.uk/static/documents/Research/SCHO0409BPVY-e-e.pdf>

Table 42: US EPA 16 PAHs Results

Parameter	Unit	GWS- 1	GWS- 2	Proposed Georgian Standard, MAC	Canadian SQG, residential	Dutch Target Value ²⁸	Dutch Intervention Values ²⁹	Italian Standard for Soils in Residential Areas	Italian Standard for Soils in Industrial / Commercial Areas
Naphthalene	ug/kgdm	1.51	2.15	100	600				
Acenaphthylene	ug/kgdm	<0.5	1.98						
Acenaphthene	ug/kgdm	1.11	4.42						
Fluorene	ug/kgdm	1.20	3.29						
Phenanthrene	ug/kgdm	11.30	28.08	100	100				
Anthracene	ug/kgdm	2.16	5.81	10					
Fluoranthene	ug/kgdm	29.40	93.3	100					
Pyrene	ug/kgdm	20.50	72.2		100			5,000	50,000
Benzo(a)anthracene	ug/kgdm	15.30	51.9	1,000	100			500	10,000
Chrysene	ug/kgdm	17.70	53.08	10				5,000	50,000
Benzo(b)fluoranthene	ug/kgdm	35.80	382		100			500	10,000
Benzo(k)fluoranthene	ug/kgdm	12.20	133		100			500	10,000
Benzo(a)pyrene	ug/kgdm	26.20	270	100				100	10,000
Indeno(123cd)pyrene	ug/kgdm	11.70	207		100			100	5,000
Benzo(ghi)perylene	ug/kgdm	10.80	179					100	10,000
Dibenzo(ah)anthracene	ug/kgdm	2.44	41.6		100			100	10,000
Sum – 16 PAH	ug/kgdm	200	1,530						
Sum – 16 PAH	mg/kgdm	0.20	1.53						
Sum – 10 PAH	ug/kgdm	138.27	1,023.32			1,000	4,000		
Sum - 10 PAH	mg/kgdm	0.14	1	1		1	40		

* Parameters highlighted in green used for Dutch Sum 10 PAH Values.

²⁸ The target values indicate the level at which there is a sustainable soil quality. In terms of curative policy this means that the target values indicate the level that has to be achieved to fully recover the functional properties of the soil for humans and plant and animal life. Besides this the target values give an indication of the benchmark for environmental quality in the long term on the assumption of negligible risks to the ecosystem.

²⁹ The soil remediation intervention values indicate when the functional properties of the soil for humans, plant and animal life, is seriously impaired or threatened. They are representative of the level of contamination above which there is a serious case of soil contamination.

* (PAH tests by ultrasonic extraction and GC/MS-SIM detection)

Table 43: Mercury report

Sample origination	Hg, mg/kgdm	Georgian regulations, mg/kg
GWS- 1	0.024	2.1 * (MPC with consideration of the background)
GWS- 2	0.089	

* Qualitative norms of the status of environment – Hygiene assessment of soil in residential areas, guidelines 2.1.7.003-02

** (Hg measured by Varian SpectraAA 220FS with Vapour Generation Accessory VGA-77 on the basis of SOP AEL 2003 (ISO17025 accredited) complied with EPA245.1 Standard Method.)

455. The results of the general soil sampling show that all parameters are within the current Georgian limits with the exception of Arsenic and Lead. However, as noted in **Section D.5.6**, these limits are considered outdated, stemming from old regulations developed during the Soviet times.

456. Assessing the results against EU limits (Italy and the UK), we can see that the results of all parameters sampled, including arsenic and lead, are well within the limits for residential areas, which are significantly lower than the ones for industrial areas, which should be the reference in this case. This, it should be said, is a direct effect of the precise choice, made by the Design Team, to move the alignment far from two piles of waste material sited on the northern boundary of the GAA, an area considered as hazardous. In addition, the results are also well within the recently proposed maximum allowable concentrations that have been developed by the MoEPA. Discussions with the UNEP indicate that these proposed limits will come into force some time in 2018. The UNEP stated that the purpose of the new limits is to harmonize them with the requirements of the Product Safety and Free Movement Code and Georgia's obligations undertaken under the Association Agreement with the European Union. Most importantly, all parameters are also below the proposed national Preventive limits of risk elements in agricultural soil, which is an important factor considering that much of the spoil material may be disposed of at the Kutaisi bypass which borders on an area of agricultural land.

457. Analysis of the PAHs shows that both samples meet the Dutch target levels meaning that the soil is considered a sustainable soil quality and will have negligible risk to the ecosystem. Levels of mercury were recoded below Georgian limits.

F.1.7 Geomorphology

458. From a morphological point of view three geomorphological structures can be recognized in the Project area:

- Zemo Imereti Highland (Plateau);
- Kolkheti piedmont undulated zone; and
- Kolkheti Lowland (alluvial plain).

459. A detailed description of the alignment of the project road in terms of geomorphology is given below.

- **KM 0.0 – 1.5.** On this segment, the river Dzirula has a sharply meandering channel and the valley acquires a narrow canyon-like shape. The valley floor width varies from 40 m to 80 m. Compared with the right slope, the left one is steeper. Slope grades varies from 27° to 43°. The valley slopes are dissected with lateral inflows and small erosion gullies. The right slope is characterized by edges of both natural and anthropic escarpment, mainly related to the old and actual railway lines. Left slope is forested and not at all stable above the road profile: important natural escarpments are reported, and landslides have been detected between km 0+450, and km 0+750, affecting the western portal of TUN 4.0.01-TA and eastern portals of TUN 4.0.02 TA/AT.
- **KM 1.5 – 2.3.** On this segment the river Dzirula valley is narrow and V-shaped. The river runs in the narrow channel the width of which is 40 - 60 m. Above-flood-plain terraces

are registered fragmentally. On both sides of the valley, slopes have equal grade and are dissected with lateral erosion gullies. The slope grade varies from 16° to 37°. Also in this section, right slopes are characterized by anthropic escarpment, while the left forested steep slopes exhibit natural escarpments, but appear to be stable.

- **KM 2.3 – 3.5.** On this segment, from south-eastern direction, the river Dzirula is joined by the river Borimela which is its left tributary. It is deeply cut into the V-shaped canyon-like narrow valley. The river Dzirula valley slopes are steep and dissected with lateral erosion gullies. The slope grades vary from 15° to 41°. Above-flood-plain terraces are registered fragmentally. In the right side of the river, many anthropic landforms are observed (railroad line embankment, escarpment, slope stabilization), while in the left slopes are noticed natural escarpment and a series of small and shallow landslides affecting the actual motor road, but not affecting the future project road.
- **KM 3.5 – 5.3.** Within this segment, the river Dzirula is sharply meandering. The width of the valley floor varies from 40 m to 300 m; the flood-plain and above-flood-plain terraces are well-defined; the left slope of the river valley is relatively steep, with its grade changing from 25° to 45° and the grade of the right slope changing from 10° to 25°. The valley slope surfaces are dissected with lateral inflows and numerous small erosion gullies. On this segment, the river Dzirula joins the river Kvirila, its right main tributary. Steep natural escarpment with well-defined edge are widespread on the left side of the river; from km 4+800 to 5+300 the slope is unstable, since landslide scarps and deposits are observed.
- **KM 5.3 – 6.3.** This segment is located within the western end of the Zemo Imereti Highland, in the river Kvirila valley that in this section is wide. The valley slopes are steep and partly dissected with lateral erosion gullies. The valley floor is represented with the river channel, the flood-plain and above-flood-plain alluvial terraces. The height of the second terrace surface is 7 – 17 m above the river level. Within this segment, one shallow left tributary flows into the river Kvirila from the south. On both sides of the valley, angle of gradient of the slopes varies from 15° to 40°. The slopes are mainly forested and stable.
- **KM 6.30 – 10.1.** In the Colchis Piedmont Undulated Zone, the middle part of the route will run from the northern periphery of the city Zestaphoni to the north-western part of village Argveta. Within this zone, there are several streams and gullies, with a general NE-SW orientation, deeply cut into relief. Between the valleys' bottom and the slope crests, the difference between absolute elevations varies between 20 and 70 m. The slopes grade varies between 14° and 27°. The slopes of the above-said gullies are covered with vegetation and stable. The valleys are characterized by a concave or flat bottom.
- **KM 10.1 – 14.7.** The last part of the Project road will run on the Colchis alluvial plain, which has absolute elevations of 145-150 m. The relief is slightly sloped (1° - 6°) south-westward. This section is characterized by the presence of 3 alluvial fans, wide from 350 m to 800 m. Natural stable escarpments are detected. In this area several anthropic landforms are present, including road embankment, edges of anthropic escarpment, deposit areas and the GAA industrial area of Zestaphoni.

F.2 Biodiversity

General

460. The project corridor crosses forest areas, agricultural land plots, hilly forest slopes, residential areas and riparian ecosystems. 17.3 hectares (ha) of the municipality of Zestaphoni is covered by forest and shrubbery.
461. Due to human pressures natural vegetation has been taken over by agricultural crops and other human development. In these areas arable lands and pastures have developed. Some of the animal species typical for the area have moved to other areas in away from

human activity. Over the time the fauna of the region has changed significantly. 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. The natural forest massifs have significant value from biodiversity protection viewpoint, because of their importance as migration route for the local animal species.

Biodiversity Study

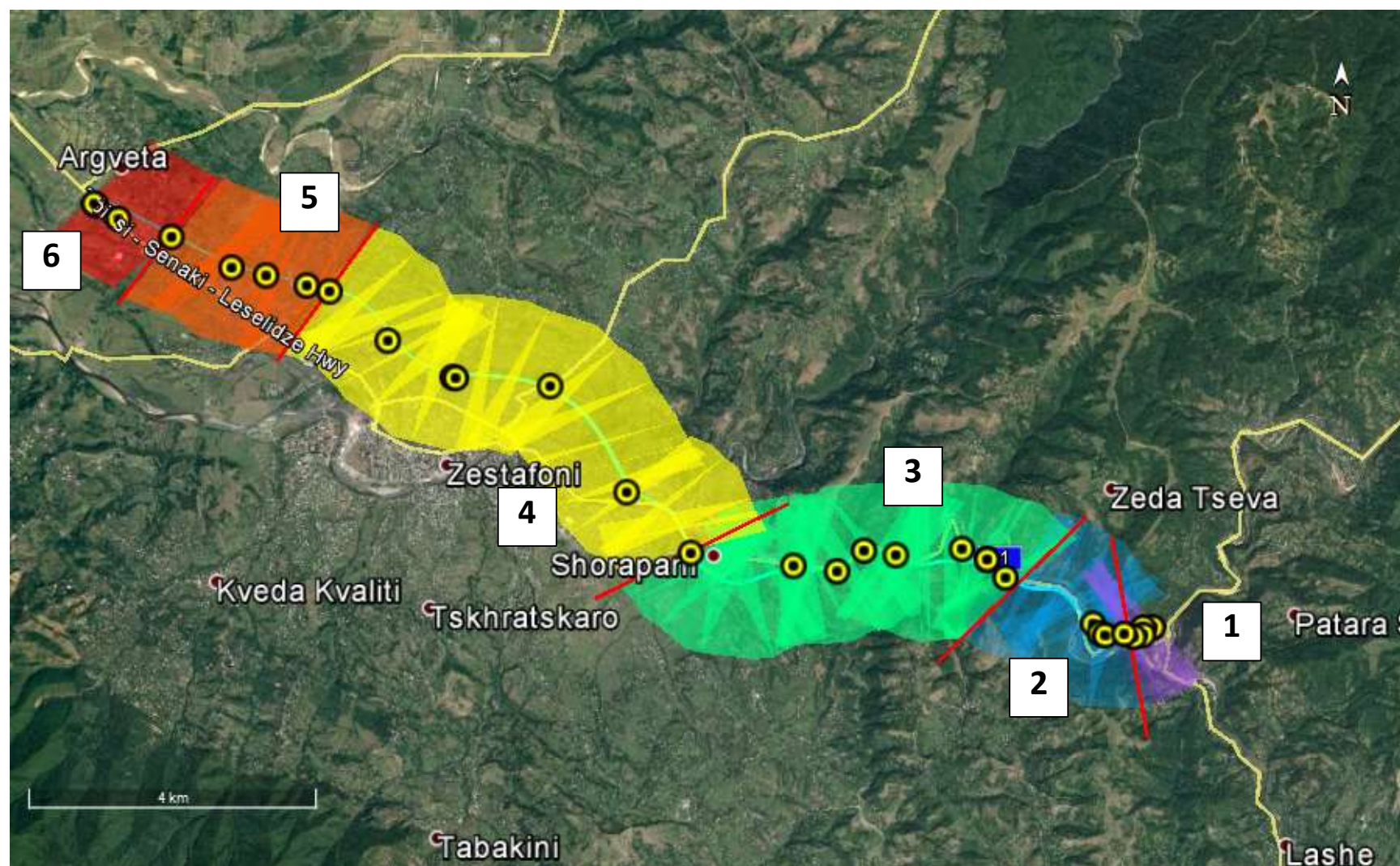
462. To fully understand the biodiversity in the Project area a biodiversity study was carried out by the LCF. The study was based on two aspects, firstly existing data was collected and analyzed in the form of a 'desk-top' study'. This was then followed up with field surveys carried out on August 8-9 and September 22-23, 2017. 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

Habitat in the Project Area

463. The study area has been divided in 6 sections according to the habitat's types based on collection of desk-top data and also field surveys undertaken in August 8-9 and September 22-23, 2017. **Figure 50**, below illustrates the six sections and describes the flora observed during the site visit.

Figure 50: The study area with indication of the transects and boundaries of the habitats



Habitat Area 1

(coordinates X=4660943.97, Y=347314.70; X=4660861.22, Y=346918.69)

Conservation Status of the Habitat = HIGH

Located near Kveda Tseva village, in the neighboring forest massif. Is situated on limestone hill of the southern slope of the valley. Natural vegetation is heavily altered and only units of original forest remains are observed in the form of young and middle-aged trees of Georgian oak (*Quercus iberica*), Common maple (*Acer campestre*), European ash (*Fraxinus excelsior*), young and mid-term Sweet chestnut (*Castanea sativa*) trees. In the underwood Common hazel (*Corylus avellana*) shrubs dominate. Plants typical for dry ecotopes mainly Oriental hornbeam (*Carpinus orientalis*) are registered. Other species are seldom met. In the understory Butcher's-broom (*Ruscus colchicus*) and mosses are present. In the areas where hornbeam growth is not dense Hawthorn (*Crataegus sp.*), Gaiter-tree (*Thelycrania australis*), Pomegranate (*Punica granatum*), Black locust (*Robinia Pseudoacacia*); Ailanthus (*Ailanthus altissima*), etc are registered.

In this section of alignment forest density accounts for (0.3-0.4); canopy density 21-30%; slope tilt 10-20-25°. Two young trees Persian walnut trees (*Juglans regia*) – protected species under the Georgia Red List (VU category) have been registered. The trees are planted in the fenced in area. A number Georgian Red List species were identified during the State Forest Fund Inventory, some of which can be found in this habitat area.

The transects surveyed within the habitat:

Y	X
4667087	332826.9
4666866	333159.7
4666602	333887.2
4666163	335707.3
4666160	334710.6

Habitat Area 2

(coordinates X=4660861.22, Y=346918.69; X=4661669.72, Y=345296.51)

Conservation Status of the Habitat = HIGH

The forested zone bordering to the first site – near Kveda Tseva village; the southern slope of the forest, which is bordered by railway line from the south-west; the specie composition of the vegetation is as follows: common hornbeam (*Carpinus caucasica*), Georgian oak (*Quercus iberica*), Norway maple (*Acer platanoides*), common maple (*Acer campestre*), sweet chestnut (*Castanea sativa* VU), European pear (*Pyrus caucasica*), Oriental hornbeam (*Carpinus orientalis*). On the south slope two samplings of European Yew trees (*Taxus baccata*, Red List of Georgia VU category) have been registered (GPS X 42.086772 Y 43.114246 and X 42.086170; Y 43.143955). In the understory the following shrubs and grasses have been found: February daphne (*Daphne mezereum*), Blackberry (*Rubus*), English ivy, (*Hedera helix*), Butcher's-broom (*Ruscus colchicus*), Solomon's seal, (*Poligonatum glaberrimum*), Bracken (*Pteridium tauricum*), common fern (*Dryopteris filix mas*).

The forest is young with inclusion of individual mid-term and mature (old-growth) trees. Density is low (0.3-0.4); canopy density percentage 30-40-%; slope tilt 21-30-35°. Trees belong to C category (timber).

Moderately modified habitat; man-caused impact medium. Of protected species two young Chestnut trees (*Castanea sativa* – VU) and two European Yew trees (*Taxus baccata* – VU). A number Georgian Red List species were identified during the State Forest Fund Inventory, all of which can be found in this habitat area.

The transects surveyed within the habitat:

Y	X
4667061	332857.4
4666605	333889.0
4666045	335182.4

Habitat Area 3

(coordinates X=4661669.72, Y=345296.51; X=4662103.27, Y=340960.28)

Conservation Status of the Habitat = LOW

Located on rocky massif of the north slope, near the central highway, where the forest is sparse (0.1-0.2) and belongs to the young forest grove group; the gradient of the slope is 25-350. Mixed vegetation types are distributed mainly of mezo-xerophilous type: Oriental hornbeam (*Carpinus orientalis*), Black locust (*Robinia Pseudoacacia*), Hawthorn (*Crataegus sp.*), Common plum (*Prunus divaricate*), Common maple (*Acer campestre*), Ailanthus (*Ailanthus altissima*), Common alder (*Alnus barbata*), Willow (*Salix*), Persimmons (*Diospyrus*), Fig tree (*Ficus carica*), Common hazel (*Corylus avellana*). In the upland meadows grasses are represented by: Wormwood (*Artemisia phyllostachys*), Astrodaucus orientalis, Foxtail (*Alopekurus*), (*Sambucus ebulus*), Milfoil (*Achilea setacea*), Creeping Savory (*Satureia spicigera*), Common chicory (*Cichorium intybus*), etc.

The quantity and density (0.3-0.4) increases farther in the forest. Slope tilt is 10-200. In the edges Deodar cedar (*Cedrus deodora*) is planted in rows. The trees are young and mid-term.

Moderately modified habitat. Impact – tree felling, grazing. Protected species not found.

The transects surveyed within the habitat:

Y	X
4666086	335515.5
4665920	335577.8
4665935	335758.3
4665806	336053.2
4664591	337726.5
4664438	339069.7
4662958	340094.0



Habitat Area 4

(coordinates X=4662103.27, Y=340960.28; X=4665805.66, Y=336053.21)

Conservation Status of the Habitat = LOW

Shorapani village, left bank of the river, riparian floodplain meadow (0-5⁰), where only ruderal grassland and shrubbery is distributed. Middle-aged cedar trees are grown in rows according to age composition between floodplain and highway. Shrubs are presented by Blackberry (*Rubus*), European dwarf elder (*Sambucus ebulus*), Greenbrier (*Smilax excelsa*), Hawthorn (*Crataegus sp.*), stc. Between the forest and existing road mid-term Deodora Cedar (*Cedrus deodora*) trees. Construction is not likely to affect these plantations.

The habitat is strongly modified. The area is uses as a pasture. Grasses are represented by Blackberry (*Rubus*), Wormwood (*Artemisia phyllostachys*), Astrodaucus orientalis, Milfoil (*Achilea setacea*), Creeping Savory (*Satureia spicigera*), Common chicory (*Cichorium intybus*), Foxtail (*Alopekurus*), European dwarf elder (*Sambucus ebulus*), etc.

Similar habitats are found in riparian forest located close to the residential area/settlement.

The transects surveyed within the habitat:

Y	X
4664580	337729.4
4662103	340960.3
4661897	342373.0
4661807	342973.6



Habitat Area 5

(coordinates X=4665805.66, Y=336053.21; X=4666602.41, Y=333887.24)

Conservation Status of the Habitat = LOW

the road goes through overpass from the left bank of Dzirula river to the right river bank, crosses the road leading to Zeda Sakara via tunnel that ends near the ruins of former cognac factory, on the forested and abandoned plot (0-5-15⁰), which borders with a hill from the south. Trees and bushes are represented by: Persimmon (*Diospyros*), Ailanthus (*Ailanthus altissima*), Persian walnut (*Juglans regia* VU), Black locust (*Robinia pseudoacacia*), Honey locust (*Gleditschia triacanthos*), Oriental plane (*Platanus orientalis*), Pomegranate (*Punica granatum*), Oriental hornbeam (*Carpinus orientalis*), Hawthorn (*Crataegus* sp.), Plum (*Prunus divaricata*), Fig tree (*Ficus carica*), Pokeweed (*Phytolacca americana*), European dwarf elder (*Sambucus ebulus*) and invasive species Canadian goldenrod (*Solidago canadensis*).

The transects surveyed within the habitat:

Y	X
4661924	345048.6
4662077	344703.7
4662013	343789.9
4660842	347179.8
4660943	347181.2
4660861	346918.7



Habitat Area 6

(coordinates X=4666602.41, Y=333887.24; X=4667086.80, Y=332826.86)

Conservation Status of the Habitat = HIGH

This is the marginal line of urban zone of Zestaphoni city, bordered by GAA from the south-west. The project corridor will cross the meadow (0-5⁰) and the motorway, which connects the city to the suburbs. Along the road plantations of Poplar are registered. The corridor goes west towards Argveta, crosses homestead plots (vineyards, orchards), turns south – to a meadow. The meadow is bordered by mature and over mature Elm Zelkova (*Zelcova carpinifolia*, VU) groves with Persian walnut trees (*Juglans regia*, VU), mature Oriental hornbeam (*Carpinus orientalis*), Plum (*Prunus divaricata*), Black locust (*Robinia pseudoacacia*). In the last section of the road near Argveta the interchange construction is in process.

In the limits of the section 6 of alignment corridor corn, grapes, fruits are cultivated. Part of the area is used as a pasture. Two protected species Persian walnut trees (*Juglans regia*, VU) and Elm Zelkova (*Zelcova carpinifolia*, VU) are found to be in the project impact zone. No areas of State Forest Fund are found in this area.

The transects surveyed within the habitat:

Y	X
4661670	345296.5
4661010	346491.5
4660879	346583.8
4660944	347314.7

464. 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.³⁰

465. Further, large portions of the Project road are located within tunnels 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.
466. State Forest Fund – 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.
467. According to the ToR for this EIA:

6. ³⁰ IFC Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources. January, 2012

“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:

- 1. Cadastral measurement drawing for the relevant plot of the alignment (.shp files);*
- 2. 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’;*
- 3. In accordance with the Georgian legislation, provide relevant information on obtaining a cutting permit for species included in the Red List (if any);*
- 4. Prepare Tree Compensation Plan according to the de-listing documentation”*

468. The Project area has been surveyed to determine the extent of the SFF that will be affected by the Project. Cadastral drawings are provided as part of **Appendix F**.

469. An inventory of the timber resources has also been prepared. A total of 1,428 trees more than 8cm in diameter were recorded for de-listing, including the following Georgian red-listed species:

- 77 Zelkova (greater than 8cm in diameter)
- 85 Chestnut (greater than 8cm in diameter)
- 38 Bladder Nut (greater than 8cm in diameter)
- 1 Yew Tree (greater than 8cm in diameter)
- 3 Circassian walnut (greater than 8cm in diameter)

470. In addition, a further 5,804 trees less than 8cm in diameter were recorded for de-listing including the following Georgian re-listed species.

- 159 Zelkova (less than 8cm in diameter)
- 2 Chestnut (less than 8cm in diameter)
- 250 Bladder Nut (less than 8cm in diameter)

All of these species identified in the SFF inventory were located in Habitat Area 1 or 2. The full list of the trees to be de-listed is presented in **Appendix F** along with a map of the area.

471. Information relating to the compensation for tree cutting according to national legislation is outlined in **Section G.6.1**.

F.2.2 Fauna

F.2.2.1 Mammals

472. Information available from references (primary and secondary data sources) have been used as a basis for description of the area. According to available information there are two species (Caucasian squirrel and 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 near threatened (NT) (see **Table 44**).

473. During the site visit the list of species listed above was taken as guidance. The 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.

474. **Otter (*Lutra lutra*)** is known to be found in Kvirila river, 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 km³. 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. 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. The bridge locations areas (**Figure 51**) have been checked with particular care. No presence of otter has been registered in this portion of the Project road during site surveys. However, they are known to be present in other portions of the river upstream.

Figure 51: Areas Checked for the Presence of Otters



475. **Caucasian squirrel (*Sciurus anomalus*)** can be met in the deciduous forest. 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 feces. 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. The main hazard for this specie is Siberian/red squirrel - invasive species. During the site visit the trees within the RoW of the new alignment (with exclusion of the areas where tunnels are planned) have been checked. Neither burrows, nor squirrels have been registered in the studied area. The review of the habitat along the alignment is not optimum for existence of the Caucasian squirrel. Therefore, construction and subsequent presence (operation) of the highway will not change the population trend.
476. **Bats** (order Chiroptera) 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 within the project area and in its vicinities.
477. **Lesser horseshoe bat (*Rhinolophus hipposideros* Bechstein)** 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 in the southern part of the range, and in attics and buildings in the northern part of it. 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.

478. **Particoloured bat (*Vespertilio murinus*)** 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 two at a time, and are stuck onto the chest of the mother during flight.

479. **Common pipistrelle (*Pipistrellus pipistrellus* Schreber)** 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.

480. Indirect and short-term impact is expected on the above-mentioned species. Indirect impact means damage of the section of the ecosystem, which is significant for animals for receiving energy in the form of the food; also, replacement of migration corridors is meant under it, which will increase the background stress for fauna representatives, living in the neighboring habitats.

481. During the transect surveys within the studied corridor no mammals have been observed. Only traces of activity of the European pine marten have been registered.

Table 44: Mammals, identified within the project area based on literary sources

№	Latin name	Common name	Red List of Georgia	IUCN	Other protection	Number of section
1	<i>Erinaceus concolor</i> Martin.	Southern whitebreasted Hedgehog		LC		1/2/3/4/5/
2	<i>Suncus etruscus</i> Savi.	Pygmy whitetoothed shrew		LC	Appendix III of the Bern Convention.	1/2/3/
3	<i>Rhinolophus hipposideros</i> Bechstein.	Lesser horseshoe bat		LC	Bonn Convention (Eurobats); Bern Convention; Annex II (and IV) of EU Habitats and Species; Some habitat protection through	1/2/3

№	Latin name	Common name	Red List of Georgia	IUCN	Other protection	Number of section
					Natura 2000	
4	<i>Pipistrellus pipistrellus</i> 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	<i>Eptesicus serotinus</i> 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	<i>Vespertilio murinus</i> 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	<i>Dryomys nitedula</i> 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	<i>Arvicola terrestris</i> Linnaeus.	Eurasian water vole		LC		4
9	<i>Microtus arvalis</i> Pallas.	Common vole		LC		1/2/3/4/5/
.10	<i>Terricola nasarovi</i> Shidlovsky.	Nazarov pine vole		LC		1/2/3/
11	<i>Sylvaemus uralensis</i> Pallas.	Pygmy wood mouse				1/2/3/
12	<i>Mus musculus</i> Linnaeus.	House mouse		LC		1/3/4/5/
13	<i>Sciurus anomalus</i> 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.	1/2/3
14	<i>Lutra lutra</i> 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.	4
15	<i>Mustela nivalis</i> Linnaeus.	Least weasel		LC	Appendix III of the Bern Convention.	1/2/3/4/5
16	<i>Felis</i>	Wild cat		LC	CITES Appendix II	1/2/3/

Nº	Latin name	Common name	Red List of Georgia	IUCN	Other protection	Number of section
	<i>silvestris</i> Shreber.				(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).	
17	<i>Canis aureus</i> Linnaeus.	Golden jackal		LC		1/2/3/4
18	<i>Vulpes vulpes</i> Linnaeus.	Red fox		LC		1/2/3/4
19	<i>Canis lupus</i>	Wolf		LC	Bern, CITES Appendix II	1/2/3/
20	<i>Sus scrofa</i> Linnaeus.	Eurasian wild boar		LC		1/2/3/
21	<i>Martes martes</i>	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.	1/2/3/

VU = Vulnerable; LC = Least Concern; NT = Near Threatened

F.2.2.2 Reptiles

482. According to the literary sources, 8 species of reptiles are known to be present in the Project area, out of which 2 are lizards, 2 – turtles and 4 – snakes (see **Table 45**). From reptiles worth to mention is endemic lizard met in the Mtkvari valley. The only Red-Listed species that is recorded on the nearby territory of the Project area is the Mediterranean turtle.

Table 45: Reptiles, known within the project area based on literary sources

Nº	Latin name	Common name	Georgian Red List	IUCN	Other protection	Section N
1.	<i>Testudo graeca</i> Linnaeus	Mediterranean turtle	VU	VU	-	1/4/
2	<i>Emys orbicularis</i>	European Pond Turtle	LC	NT	-	4
3.	<i>Natrix natrix</i> Linnaeus.	Ring snake	LC	LR/LC	Bern Convention	4/5
4.	<i>Natrix tessellate</i> Laurenti.	Dice snake	LC	LC	Bern Convention	4/5
5.	<i>Coronella austriaca</i> Laurenti.	Smooth snake	LC	LC	Bern Convention	1/2/
6.	<i>Xerotyphlops vermicularis</i>	Blind Snakes	DD	LC	-	1/2/3/

№	Latin name	Common name	Georgian Red List	IUCN	Other protection	Section N
	Strauch.					
7.	<i>Darevskia derjugini</i>	Artwin Lizard	LC	LC	Bern Convention	1/2/3/
8.	<i>Darevskia rudis</i>	Spiny-Tailed Lizard	LC	LC	Bern Convention	1/2/3/
9.	<i>Anguis fragilis</i>	Caucasian Slow Worm	LC	LC	Bern Convention	2/

VU = Vulnerable; NT = Near Threatened and LC = Least Concern, LR = Low risk, DD-Data Deficient

483. Due to the fact that it was extremely hot during the surveys, activity of reptiles was low as they were avoiding overheating. During the site survey only the Artwin lizard has been registered.



Figure 52: Darevskia derhugini
(coordinates 346891.28; 4660857.92)



Figure 53: Pelophylax ridibundus
(coordinates 340072.18; 4662963.5)

F.2.2.3 Amphibians

484. According to the literary sources, the main amphibian species present in the area include:

Table 46: Amphibians, known within the project area based on literary sources

№	Latin name	Common name	Georgian Red List	IUCN	Other protection	Section N
1.	<i>Hyla arborea</i> Linnaeus	European Tree Frog	LC	LC	Bern Convention	4/5/
2.	<i>Pelophylax ridibundus</i> Pallas.	Lake frog	LC	LC	Bern Convention	4/5
3.	<i>Rana macrocnemis camerani</i> Boulenger.	Longlegged Wood Frog	LC	LC	Bern Convention	3/4/

LC = Least Concern

485. During the site survey the listed species have one individual Lake frog has been registered near Shorapani crossing (see **Figure 53** above).

F.2.2.4 Insects

486. The insects known to be present in the project area are listed in the table below.

Table 47: Insects known within the project area based on literary sources

№	Latin Name	Common name	Georgian Red List	IUCN	Section N
1.	<i>Mylabris quadripunctata</i>	Four-spotted blister beetle	NE	NE	1/2/3/5/6/
2.	<i>Dorcus</i>	Lesser stag beetle	NE	NE	1/2/3/

№	Latin Name	Common name	Georgian Red List	IUCN	Section N
	<i>parallelipipedus</i>				
3.	<i>Libellula depressa</i>	Broad-bodied chaser	NE	NE	2/
4.	<i>Morimus verecundus</i>	Longhorn beetle	NE	NE	2/3
5.	<i>Pieris napi</i>	Green-veined white butterfly	NE	NE	1/2/3/5
6.	<i>Pieris rapae</i>	European cabbage butterfly	NE	NE	1/2/3/4/5
7.	<i>Plebeius argus</i>	Silver-studded blue butterfly	NE	NE	1/2/3/4/5/
8.	<i>Nymphalis antiopa</i>	Mourning-cloak butterfly	NE	NE	1/2/3/4/5/6/
9.	<i>Lampyrus noctiluca</i>	Glow-worm	NE	NE	1/2/3/4/5/
10.	<i>Geotrupes spiniger</i>	Dumbledor beetle	NE	NE	1/2/3/5/
11.	<i>Purpuricenus budensis</i>	Red long-horned Beetle	NE	NE	1/2/3/4/
12.	<i>Polyommatus amandus</i>	Amanda's blue butterfly	NE	NE	5/6
13.	<i>Polyommatus corydonius</i>	False chalkhill blue butterfly	NE	NE	1/2/3/4/5/6/
14.	<i>Polyommatus thersites</i>	Chapman's blue butterfly	NE	NE	1/2/3/4/5/6/
15.	<i>Cercopis intermedia</i>	Froghopper	NE	NE	1/2/3/4/5/6/
16.	<i>Vanessa atalanta</i>	Red admiral butterfly	NE	NE	1/2/3/4/5/6/
17.	<i>Vanessa cardui</i>	Painted lady butterfly	NE	NE	3/4/5/6/
18.	<i>Ischnura elegans</i>	Blue-tailed damselfly	NE	NE	3/4/
19.	<i>Panorpa connexa</i>	Scorpionfly	NE	NE	4/5/
20.	<i>Apis mellifera</i>	European honey bee	NE	NE	4/5
21.	<i>Bombus lapidarius</i>	Red-tailed bumblebee,	NE	NE	4/5/
22.	<i>Aphis urticae</i>	Dark green nettle aphid	NE	NE	1/2/3/
23.	<i>Pieris brassicae</i>	Cabbage butterfly	NE	NE	1/3/5/6
24.	<i>Pyrrhocoris apterus</i>	Firebug	NE	NE	1/2/3/4/5/6/
25.	<i>Lymantria dispar</i>	Gypsy moth	NE	NE	1/2/3/
26.	<i>Gryllus campestris</i>	Field cricket	NE	NE	4/5/
27.	<i>Decticus verrucivorus</i>	Wart-biter	NE	NE	4/5/6/
28.	<i>Tettigonia viridissima</i>	Great green bush-cricket	NE	NE	5/6/

NE = not evaluated

487. Within the project area Red cricket, blue railed damselfly have been met. No butterflies were registered.

Figure 54: *Gryllus campestris*
(coordinates 337730.19; 4664604.82)

Figure 55: *Ischnura elegans*
(coordinates 339946.92; 4662915.10)

488. The spiders known to be present in the project area are listed below.

Table 48: Insects, known within the project area based on literary sources

№	Latin name	Common name	Georgian Red List	IUCN	Section No.
1.	<i>Misumena vatia</i>	Goldenrod crab spider	NE	NE	1/2/3/
2.	<i>Pisaura mirabilis</i>	Nursery web spider	NE	NE	1/2/3/
3.	<i>Alopecosa schmidtii</i>	Wolf spiders	NE	NE	1/2/3/
4.	<i>Micrommata virescens</i>	Green huntsman spider	NE	NE	1/2/3/4/5
5.	<i>Agelena labyrinthica</i>	Eurasian grass	NE	NE	1/2/3/

		spiders			
6.	<i>Asianellus festivus</i>	Jumping spiders	NE	NE	1/2/3/
7.	<i>Araniella displicata</i>	Orb-weaver spider	NE	NE	1/2/3/
8.	<i>Dysdera crocata</i>	Sowbug hunter	NE	NE	1/2/3/
9.	<i>Phialeus chrysops</i>	Jumping spiders	NE	NE	3/4/5/
10.	<i>Argiope lobata</i>	Silver-faced	NE	NE	1/2/3/
11.	<i>Menemerus semilimbatus</i>	Jumping spiders	NE	NE	1/2/3/4/
12.	<i>Pardosa hortensis</i>	Wolf spiders	NE	NE	1/2/3/4/
13.	<i>Larinioides cornutus</i>	Furrow orb spider	NE	NE	1/2/3/4/5

NE = not evaluated

489. During the walkover several spider species have been registered as noted by the figures below.

Figure 56: *Pisaura mirabilis*
(coordinates 347288.84; 4660981.14)

Figure 57: *Pardosa hortensis*
(coordinates 344707.22; 4662074.4)

Figure 58: *Asinellus festivus* (coordinates 345050/30; 4661910.7

490. The round worms, bristle worms and beetles known to be present in the project area are listed below.

Table 49: Round Worms (Nematodes), known within the project area based on literary sources.

Nº	Scientific Name	English Name	Georgian Name	National Red List	International Red List
1.	<i>Tripylina arenicola</i>	-	-	NE	NE
2.	<i>Plectus annulatus</i>	-	-	NE	NE
3.	<i>Anaplectus granulosus</i>	-	-	NE	NE
4.	<i>Mesodorylaimus bastiani</i>	-	-	NE	NE
5.	<i>Eudorylaimus acutus</i>	-	-	NE	NE
7.	<i>Pungentus silvestris</i>	-	-	NE	NE
8.	<i>Enchodelus microdorus</i>	-	-	NE	NE
9.	<i>Bursilla monhystera</i>	-	-	NE	NE

NE = not evaluated

Table 50: Bristle Worms (Polychaetes), known within the project area based on literary sources

Nº	Scientific Name	English Name	Georgian Name	National Red List	International Red List
1.	<i>Aelosoma hemprichi</i>	-	-	NE	NE
2.	<i>Stylaria lacustris</i>	-	-	NE	NE
3.	<i>Aulophorus furcatus</i>	-	-	NE	NE
4.	<i>Specaria josinae</i>	-	-	NE	NE
5.	<i>Ophidonais serpentine</i>	-	-	NE	NE
6.	<i>Potamotrix bedoti</i>	-	-	NE	NE
9.	<i>Lumbricus terrestris</i>	-	-	NE	NE
10.	<i>Dendrodriloides grandis</i>	-	-	NE	NE

11.	<i>Eiseniella tetraedra</i>	-	-	NE	NE
13.	<i>Helodrilus cartlicus</i>	-	-	NE	NE

Table 51: Oribatida, known within the project area based on literary sources

Nº	Scientific Name	English Name	Georgian Name	National Red List	International Red List
1.	<i>Epilohmannia cylindrica</i>	-	-	NE	NE
2.	<i>Rhysotritia ardua</i>	-	-	NE	NE
5.	<i>Tectocephus velatus</i>	-	-	NE	NE
6.	<i>Oppiella fallax</i>	-	-	NE	NE
7.	<i>Quadroppia quadricarinata</i>	-	-	NE	NE
8.	<i>Suctobelbella falcate</i>	-	-	NE	NE
9.	<i>Achipteria nitens</i>	-	-	NE	NE
10.	<i>Sphaerozetes piriformis</i>	-	-	NE	NE
12.	<i>Chamobates cuspidatus</i>	-	-	NE	NE

F.2.3 Avi Fauna

491. 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 52** 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 59).

Figure 59: Significant Bird Habitat in Georgia

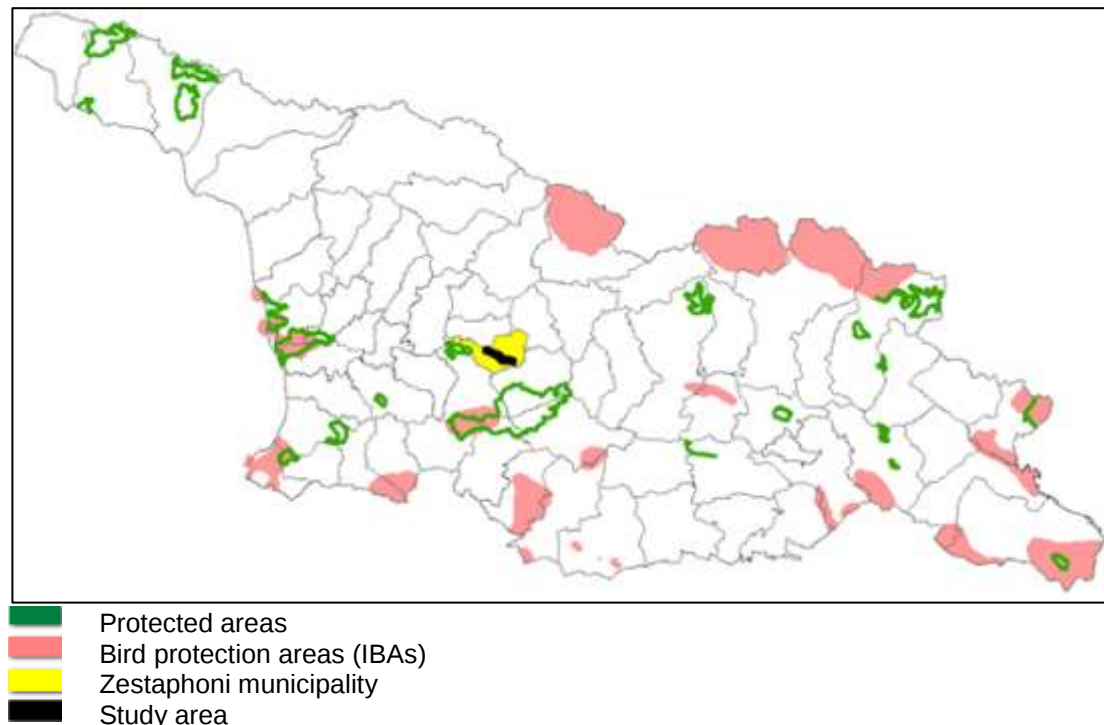


Table 52: Birds within the study area, known according to literary sources

#	Latin name	Common name	Georgian Red List	Season	IUCN	Other protection	Section
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#	Latin name	Common name	Georgian Red List	Season	IUCN	Other protection	Section
1.	<i>Motacilla alba</i>	White Wagtail	-	YR-R, M	LC	Bern Convention	1/2/3/4/5/6
2.	<i>Apus apus</i>	Common Swift	-	BB, M	LC	Bern Convention	1/2/3/4/5/6
3.	<i>Merops apiaster</i>	European Bee-eater	-	BB, M	LC		1/2/3/4/5/6
4.	<i>Corvus cornix</i>	Hooded Crow	-	YR-R	LC		1/2/3/4/5/6
5.	<i>Garrulus glandarius</i>	Eurasian Jay	-	YR-R	LC		1/2/3/4/5/6
6.	<i>Turdus merula</i>	Eurasian Blackbird	-	YR-R	LC	Bern Convention	1/2/3/4/5/6
7.	<i>Delichon urbicum</i>	House-Martin	-	BB, M	LC	Bern Convention	1/2/3/4/5/6
8.	<i>Sturnus vulgaris</i>	Common Starling	-	YR-R, M	LC		1/2/3/4/5/6
10.	<i>Columba livia</i>	Rock Dove	-	YR-R	LC		1/2/3/4/5/6
11.	<i>Columba oenas</i>	Stock Dove	-	YR-R	LC		1/2/3/4/5/6
12.	<i>Columba palumbus</i>	Wood-Pigeon	-	YR-R	LC		1/2/3/4/5/6
13.	<i>Hirundo rustica</i>	Barn Swallow	-	BB, M	LC	Bern Convention	1/2/3/4/5/6
15.	<i>Oriolus oriolus</i>	Golden Oriole	-	BB, M	LC	Bern Convention	1/2/3/4/5/6
16.	<i>Turdus viscivorus</i>	Mistle Thrush	-	YR-R, M	LC	Bern Convention	1/2/3/4/5/6
17.	<i>Erithacus rubecula</i>	European Robin	-	YR-R	LC	Bern Convention	1/2/3/4/5/6
18.	<i>Fringilla coelebs</i>	Chaffinch	-	YR-R, M	LC	Bern Convention	1/2/3/4/5/6
19.	<i>Cuculus canorus</i>	Common Cuckoo	-	BB, M	LC	Bern Convention	1/2/3/4/5/6
20.	<i>Phoenicurus phoenicurus</i>	Common Redstart	-	BB, M	LC	Bern Convention	1/2/3/4/5/6
21.	<i>Passer domesticus</i>	House Sparrow	-	YR-R	LC		1/2/3/4/5/6
22.	<i>Carduelis carduelis</i>	European Goldfinch	-	YR-R, M	LC	Bern Convention	1/2/3/4/5/6
23.	<i>Carduelis chloris</i>	Greenfinch	-	YR-R, M	LC	Bern Convention	1/2/3/4/5/6
25.	<i>Parus major</i>	Great Tit	-	YR-R	LC	Bern Convention	1/2/3/4/5/6
26.	<i>Lanius collurio</i>	Red-backed Shrike	-	BB, M	LC	Bern Convention	1/2/3/4/5/6
38.	<i>Turdus philomelos</i>	Song Thrush	-	YR-R, M	LC	Bern Convention	1/2/3/4/5/6
30.	<i>Aegithalos caudatus</i>	Long-tailed Tit	-	YR-R, M	LC	Bern Convention	1/2/3/4/5/6
36.	<i>Falco tinnunculus</i>	Common Kestrel	-	YR-R, M	LC	Bonn Convention , Bern Convention	1/2/3/4/5/6
37.	<i>Buteo buteo</i>	Common Buzzard	-	YR-R, M	LC	Bonn Convention , Bern	1/2/3/4/5/6

#	Latin name	Common name	Georgian Red List	Season	IUCN	Other protection	Section
						Convention	
38.	<i>Phalacrocorax carbo</i>	Great Cormorant	-	YR-R, M	LC		4
39.	<i>Ardea cinerea</i>	Grey Heron	-	YR-R	LC	Bonn Convention, Bern Convention	4
41.	<i>Egretta garzetta</i>	Little Egret	-	YR-R	LC		4
42.	<i>Nycticorax nycticorax</i>	Night-Heron	-	BB, M	LC	Bonn Convention, Bern Convention	4
44.	<i>Tadorna ferruginea</i>	Ruddy Shelduck	-	YR-R	LC		4
45.	<i>Anas platyrhynchos</i>	Mallard	-	YR-R, M	LC	Bonn Convention, Bern Convention	4
46.	<i>Milvus migrans</i>	Black Kite	-	YR-R, M	LC	Bonn Convention, Bern Convention	1/2/3/4/5/6
47.	<i>Accipiter nisus</i>	Sparrowhawk	-	YR-R, M	LC	Bonn Convention, Bern Convention	1/2/3/4/5/6
48.	<i>Accipiter gentilis</i>	Goshawk	-	YR-R, M	LC	Bonn Convention, Bern Convention	1/2/3/4/5/6
51.	<i>Charadrius dubius</i>	Little Ringed Plover	-	YR-R, M	LC	Bonn Convention, Bern Convention	4
52.	<i>Larus ridibundus</i>	Black-headed Gull	-	YR-R, M	LC		4
55.	<i>Upupa epops</i>	Common Hoopoe	-	BB, M	LC	Bern Convention	1/2/3/4/5/6
57.	<i>Corvus frugilegus</i>	Rook	-	YR-R, M	LC		1/2/3/4/5/6
60.	<i>Luscinia megarhynchos</i>	Luscinia megarhynchos	-	BB, M	LC		1/2/3/4/5/6
61.	<i>Phylloscopus collybita</i>	Common Chiffchaff	-	BB, M	LC		2/

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.

Table 53: Birds, observed within the project area during the survey

#	Latin name	Common name	Georgian Red List	Season	IUCN	Other protection	Section
1.	<i>Motacilla alba</i>	White Wagtail	-	YR-R, M	LC	Bern Convention	1/2/3
2.	<i>Apus apus</i>	Common Swift	-	BB, M	LC	Bern	1/3/4/5

#	Latin name	Common name	Georgian Red List	Season	IUCN	Other protection	Section
						Convention	
3.	<i>Merops apiaster</i>	European Bee-eater	-	BB, M	LC	-	2/3/
4.	<i>Charadrius dubius</i>	Little Ringed Plover	-	YR-R, M	LC	Bonn Convention, Bern Convention	4
5.	<i>Larus ridibundus</i>	Black-headed Gull	-	YR-R, M	LC	Bern Convention	4
6.	<i>Corvus cornix</i>	Hooded Crow	-	YR-R	LC	-	3/4/5/6
7.	<i>Garrulus glandarius</i>	Eurasian Jay	-	YR-R	LC	-	2/3/4/5
8.	<i>Turdus merula</i>	Eurasian Blackbird	-	YR-R	LC	Bern Convention	1/2/3/4
9.	<i>Delichon urbicum</i>	House-Martin	-	BB, M	LC	Bern Convention	2/3/4/
11.	<i>Upupa epops</i>	Common Hoopoe	-	BB, M	LC	Bern Convention	2/3/4/5
14.	<i>Luscinia megarhynchos</i>	Luscinia megarhynchos	-	BB, M	LC	-	1/2/3/
15.	<i>Turdus viscivorus</i>	Mistle Thrush	-	YR-R, M	LC	Bern Convention	1/2/3
16.	<i>Erithacus rubecula</i>	European Robin	-	YR-R	LC	Bern Convention	2/
17.	<i>Fringilla coelebs</i>	Chaffinch	-	YR-R, M	LC	Bern Convention	1/3/
19.	<i>Phoenicurus phoenicurus</i>	Common Redstart	-	BB, M	LC	Bern Convention	1/2/3
20.	<i>Passer domesticus</i>	House Sparrow	-	YR-R	LC	-	1/3/5/6/
21.	<i>Carduelis carduelis</i>	European Goldfinch	-	YR-R, M	LC	Bern Convention	1/2/3/
24.	<i>Parus major</i>	Great Tit	-	YR-R	LC	Bern Convention	2/3/5
25.	<i>Lanius collurio</i>	Red-backed Shrike	-	BB, M	LC	Bern Convention	2/3
26.	<i>Phylloscopus collybita</i>	Common Chiffchaff	-	BB, M	LC		2/
27.	<i>Turdus philomelos</i>	Song Thrush	-	YR-R, M	LC	Bern Convention	2/3

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.

F.2.4 Fish

General

492. A fish study has been undertaken on the sites where construction of bridges/river crossings is planned. The objective of the survey was to:

- Study and assess the baseline environmental condition within the project section;
- Survey of hidrobionts, fin particular, ichthyofauna living in the project area;
- Development of mitigation measures, taking into account the impact factors.

493. The study was prepared based on existing literature sources and the results of field study conducted from 18.07.2017 to 28.07.2017. In the field research information was used from the local population and amateur fishermen.

Methodology

494. The ichthyofauna study included desk top study, visual audits, field surveys, anamnesis (interview of the local population and amateur fishermen) and laboratory processing of the obtained material. The research methodology is fully coincided with the methods used in international practice.

495. Fish stock status has been be judged upon based on the following data:

- general mass of fish caught in the recent years;
- quantitative ratio of age groups;
- age of reaching the first and overall puberty of the population;
- direct influence of fish growth rate versus maturity;

Desktop Study

496. Work plan, survey route, locations for control catches and hydrochemical-hydrobiological sampling have been selected. A questionnaire for the local population and amateur fishermen was prepared.

Visual Audit

497. The visual audit to identify habitats for ichthyofauna species (geomorphology of the river bed in question, general hydrological characteristics, habitat hipsometria, relief, the river bottom hipsometria, visual - landscape background) has been carried out. Based on these data species theoretically present in the study area have been identified.

Field study

498. The field study method included:

- biological analysis of fish (length; weight; gender, maturity stage; collection, fattening coefficient, meristic and plastic characteristics, the digestive tract content);
- collection, labeling and preservation of scales for subsequent lab analysis;
- study of food base - hydroflora and hydrofauna; identification of macroinvertebrates and insects used for feeding;
- study of the status of living environment of both fish and invertebrates;
- determination of suspended solids; dissolved oxygen (using filed tester Oxi 330i); water and air temperature; pH measurements - on-site;
- sampling of water for lab analysis;
- assessment of species composition of zoobenthos and protozoa - periphyton species composition and biomass.

499. For control catches cast nets (weight 7.0 kg, mesh size 14 mm) were used. The catches were performed in control points selected along 50 m and 100 m sections. Sports-amateur fishing tools were used during the study. (No special permit or license was required). Research parameters include research of all biotic and abiotic factors related to the ecological niche.

500. During the survey catch and release principle was kept to. Every fish in the catch was registered in a special field log.

Interviews

501. The interview of local population and amateur fishermen was carried out to highlight the full picture of the Kvirila River and the Dzirula River ichthyofauna species composition. For this purpose, amateur fishermen with at least 5-10 years of fishing experience have been selected. The questionnaire was drawn up so to reduce the risk of false information (overestimation/bragging). Information confirmed by three or more respondents was assumed as reliable. During the entire study period, 5 fishermen were interviewed. (For results see **Table 56: Results of the interview of local population.**)

Laboratory Research

502. Study of age, growth and growth rate were identified through laboratory analysis of fish scales collected during the field survey.

503. The following tables indicate the fish species found in both rivers.

Table 54: List of fish species available in the rivers in the project area

Type	Kvirila River	Dzirula River
Brown trout (<i>Salmo trutta morfa fario</i> Linnaes, 1758)	+	-
Colchic barbel (<i>Barbus tauricus rionica</i> Kamensky, 1899)	+	+
Chub (<i>Leuciscus leuciscus</i> Linnaeus, 1758)	+	+
Colchic chondrostoma (<i>Chondrostoma colchicum</i> Derjugin, 1899)	+	+
Colchic khramulya (<i>Capoeta sieboldi</i> Steindachner, 1864)	+	+
monkey goby (<i>Neogobius fluviatilis</i> , Pallas 1814)	+	+
Spined loach (<i>Cobitis taenia</i> Linnaeus, 1758)	+	+
Common bleak (<i>Alburnus alburnus</i> , Linnaeus, 1758)	+	+

Table 55: Species found as the result of fishing in the project area

Common name	Latin name
Colchic khramulya	<i>Capoeta sieboldi</i> Steindachner, 1864
Common dace	<i>Leuciscus leuciscus</i> Linnaeus, 1758

504. Five fishermen were interviewed within the framework of the baseline survey: Amiran Gegetashvili; Beso Kalandadze; Misha Macharashvili; Tengo Kapanadze; Giorgi Tsertsvadze. **Table 56** provides a list of the questions asked and the answers received during the interview.

Table 56: Results of the interview of local population.

#	Question	Interview results
1	What species of fish are spread in Kvirila and the Dzirula Rivers?	Mainly: trout (only in the head of Kvirila), barbel, chub, chondrostoma, khramulya, goby, cobitis, alburnus.
2	Which fishing equipment do the local fishermen prefer?	The places are good for the throw nets and for fishing-rods, thus, it is hard to say which is of higher priority.
3	How many fishes can a skilled fisherman catch in 6 hours?	It depends on the situation, sometimes you may not catch at all, or sometimes you can easily catch 10-20 fish.
4	What local fishermen use as a squid when fishing with a fishing	Mostly, earthworms as well as worms found under the stones.

	rod?	
5	Is fishing for personal consumption or for sale?	Just for personal consumption.
6	How often are the facts of poaching and how are they fighting against them?	Poachers appear either at night or very early so that no one can notice them. There are sanctions for poaching, thus, people try not to poach.
7	Which restrictive measures do the poachers use?	They use mainly electrofishing devices.
8	Do you remember the case of catching a mature fish (with a hard roe) and was there a brown trout among them?	Seldom. The trout spawn can be seen in the head of the rivers, and the rest fish lay their eggs in spring and summer.
9	Can you describe the hard roe?	In autumn-winter period the trout roe is quite large, tasty, of orange colour, or sometimes red. Some mentioned that khramulya roe is toxic, therefore they do not eat it. The roe of the other fish is used.
10	Have you ever seen alevins with a yolk sac or a yellow shining spawn?	The trout alevins can be seen before the spring floods, but in the head of rivers. In the project area alevins of the other fish spawning in spring and summer period can be seen near the banks.
11	How popular is the project section for fishermen?	Fairly popular. One can see 2-3 fishermen on the edge of the river. In the section after Dzirula - Kvirila confluence, turbidity of water is high. Fish avoid the turbid water, therefore fishing in that area is pointless. The main fishing sites are in the Dzirula before the Dzirula-Kvirila confluence.
12	When does fish spawn in the project area?	Fish spawns in spring and summer.

505. The following species have been found in the catch during the study in the Dzirula River:

Colchic khramulya (<i>Capoeta sieboldi</i> Steindachner, 1864) - 2 units.	
Chub (<i>Leuciscus leuciscus</i> Linnaeus, 1758) - 1 unit.	

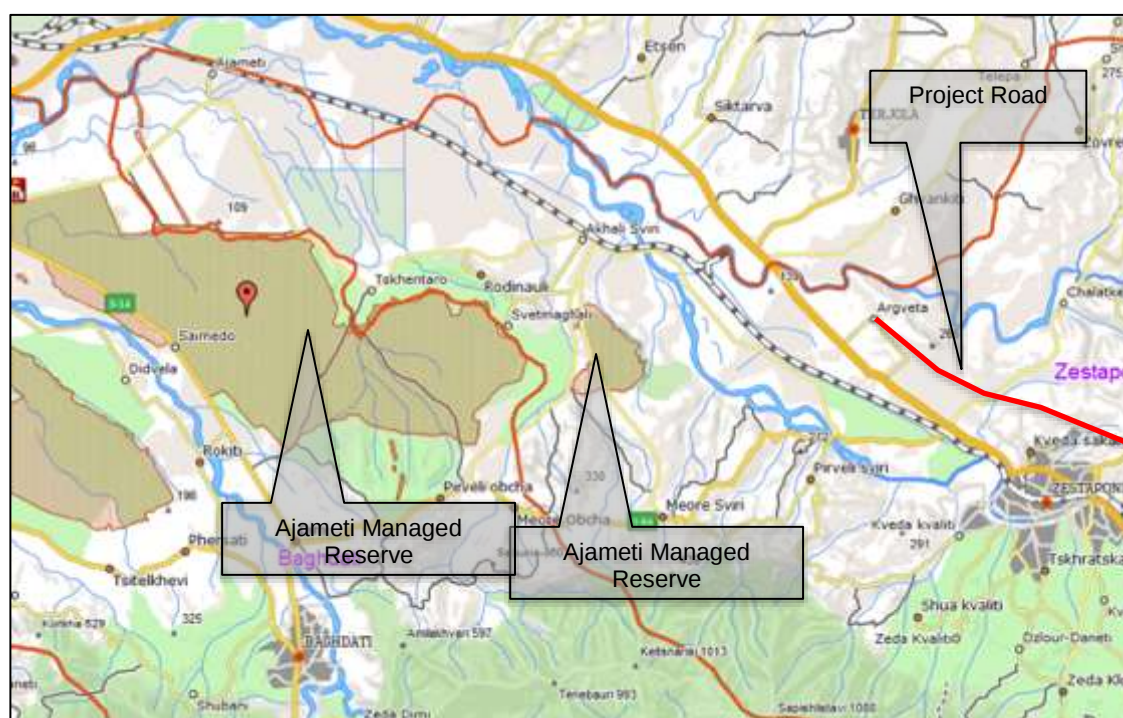
506. On the bottom of the Dzirula River, in the project area, colonies of invertebrate species (food base for fish) have been registered. Hydroflora, represented by perythiton, the main food base for khramulya was found. Hydroflora and hydrofauna of the Kvirila River is sparse. This is conditioned by high concentration of suspended solids. In this section fish was not registered.

F.2.5 Protected Areas

507. The nearest protected area to the Project road is the Ajameti Managed Reserve, which is located approximately 5 kilometers south west of the end point of the road (km14.7), see **Figure 60**.³¹

508. In April of 1928, 20 ha of Kutaisi forested area was declared a nature reserve and in 1935 Ajameti Botanical Reserve was established at the ground level of the Ajameti forest massif. Ajameti was formed as a strict nature reserve in 1946 to preserve rare and relict Imeretian Oak and Elm Zelkova trees. The famous oaks of Ajameti are ancient natural treasures, with some of the trees being over 250 years old.

Figure 60: Location of the Ajameti Managed Reserve (reserve comprises several portions)



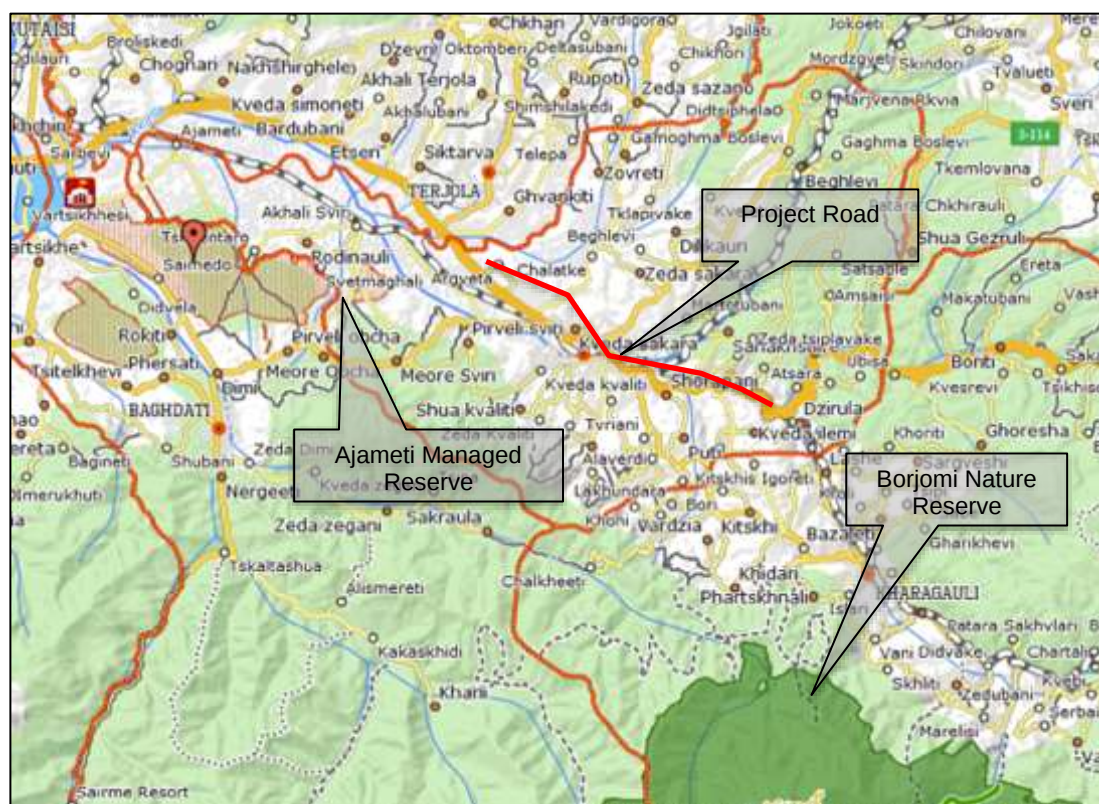
³¹ Managed nature reserves were created in 1997, according to the Law on Animals, on the basis of forest and hunting farms.

Figure 61: Ajameti Managed Reserve



509. The only other protected area in the region is the Borjomi Nature Reserve which is located more than 20 kilometers south of the start point of the Project road, see **Figure 62**.

Figure 62: Protected Areas Within the Vicinity of the Project Road



510. 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:

- Caucasian Grouse *Lyrurus mlokosiewiczii* (IUCN Category – NT)
- Corncrake *Crex crex* (IUCN Category – LC)
- Great Snipe *Gallinago media* (IUCN Category – NT)
- Eastern Imperial Eagle *Aquila heliaca* (IUCN Category – VU)

F.3 Economic Development

F.3.1 Industries & Agriculture

511. Viticulture is the main economic activity in the municipality of Zestaphoni providing 80% of agricultural output. Its development is supported by favorable soil-climatic conditions. Vineyards occupy 5,000 hectares within the municipality. There are two active wine producing factories in the municipality.

512. The Rioni River Basin is abundant with mineral resources. The upper courses of the basin are rich in non-ferrous metal and non-metal mineral deposits, specifically manganese which can be found in large deposits in mines close to Chiatura some 20km north east of Zestaphoni. The manganese ore deposits near Chiatura, first discovered in 1849, have been exploited since 1879. The ores include pyrolusite and psilomelane (oxide ores) and rhodochrosite (carbonate ore). The country's largest producer, Chiaturmanganets, mines manganese ores from open cast and underground operations in Chiatura, which are supplied to the nearby GAA plant in Zestaphoni.

513. Founded in 1933 by Georgian scientist Giorgi Nikoladze, Georgian Manganese's Zestaphoni Ferroalloy Plant has grown to become Georgia's largest silicomanganese processing plant and was recently purchased by an American company renaming the plant Georgian American Alloys. GAA produced over 187,000 metric tons of silicomanganese in 2012, however the mining and production of the manganese is not without its environmental problems, including impacts to air quality and impacts to the water quality of the Kvirila river, both issues are discussed above. The Project road passes almost adjacent to the north of the plant for around 2 kilometers between KM 9.7 and KM 11.8. As noted above soil samples and groundwater samples have been taken in this area to determine if contaminated the land exists within the vicinity of the GAA factory.

Figure 63: Location of GAA – Approximately Km 9.5 – Km 10.7



Figure 64: Location of GAA – Approximately Km 10.7 – Km 12.5



514. Other important industrial facilities plants in the Project area include “Saqkabeli” in Zestaphoni and “Elektroelementi” in Shorapani.

515. Agricultural land plots cover 7,027 ha of the municipality or 46% of the whole territory. 5,159 ha out of the above-mentioned area are arable lands. As for greenhouse areas, it totals approximately 6 ha. Detailed information on Imereti region and Zestaphoni Municipality is given in **Table 57**. Other than grapes, melon and maize are predominant crops grown in the region and have been noted within the Project corridor, specifically from KM 7.0 onwards.

Table 57: Agricultural Areas (Hectares)

	Imereti	Zestaphoni
Total Agricultural	65,737	7,027
Arable	51,033	5,159
Pasture	5,410	363
Greenhouse	462	6

516. Source: www.geostat.ge

F.3.2 Infrastructure and Transportation facilities

F.3.2.1 Road, Rail and Air

Roads

517. The road network in the Project area is dominated by the existing E-60 which links Tbilisi with Batumi. The key issue with the existing road within the Project corridor is the route through Zestaphoni which often becomes choked with traffic. The existing road does not bypass the town, rather it creeps through the town in a rather strange fashion, including a specific pinch point around the GAA factory. In the summer this point becomes extremely congested and long traffic delays can be experienced as people make their way too and from Tbilisi and Batumi for summer vacations. Numerous local roads feed onto the E-60 in Zestaphoni, and these roads vary in condition from good to very poor.

Rail

518. The main line from Tbilisi to Batumi runs broadly parallel with the Project road until it reaches Zestaphoni. In fact, in the first section of the road, between KM 0.0 and KM 6.0 the railway line and the road are only separated by a couple of hundred meters, with the road running south of the railway line. At one location, the new road alignment passes within 20 meters of the railway line (KM 2.5) and eventually passes over the railway line at KM 6.3 (see **Figure 65**) as the road heads north west to start its bypass around Zestaphoni.

Figure 65: Location of Road Crossing Railway Line

519. Georgian Railways own and operate the rail services in Georgia. There are two live lines on this route, one on a higher elevation and one on a lower elevation. The line on the higher elevation operates 4 trips per day, the lower line accommodates approximately 40 journeys per day.

F.3.2.2 Utilities

520. Networked water supply and sewage systems only exist within the main towns and cities of Georgia, including Zestaphoni. Power is provided to villages in the region and is supplied by the company “EnergoProGeorgia”. Villages mainly use groundwater resources for potable and home use.

F.3.2.3 Housing Stock

521. The housing stock in the Project area comprises mainly one or two storey houses that are distributed mainly along the local roads that weave their way around the valley slopes. The only multiple storey residential buildings observed within the Project area are located in Shorapani at KM 4.3 (within 100 meters) and KM 7.9 (road

Figure 66: Buildings at KM 4.3

passes beneath these buildings in a tunnel).

F.3.3 Tourism and Recreation

522. Zestaphoni is not considered an important or significant area for tourism and recreation. A recent study of foreign visitors to Imereti region indicated that less than 2% of the visitors visited Zestaphoni for recreation or vacation.³²

523. According to RD environmental division, there are no exceptional landscapes requiring special attention along the project corridor.

F.4 Social and Cultural Resources

F.4.1 Socio-economic conditions

F.4.1.1 Administrative Issues

524. The Project road is located within the Region of Imereti. Imereti occupies a territory of approximately 6,552km² (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, Zestaphoni, Terjola, Samtredia, Sachkhere, and Khoni); 3 towns (Shorapani, Kulashi and Kharagauli); and 529 villages.

525. The Project road is located within Zestaphoni Municipality which covers a total area of 423 km² and includes the towns of Zestaphoni and Shorapani as well as numerous small villages as illustrated by **Figure 67**. Of its total areas 7,027 ha is occupied by agricultural land plots and 16,500 ha area – by forest.

Figure 67: Towns and Villages of Zestaphoni Municipality

526. The following settlements have been identified within the Project area.

- Kveda Tseva (KM 0)
- Shorapani (KM 4.0 – 6.0)
- Zestaphoni (KM 6.0 – 11.0)
- Kveda Sakara (KM 11.0 – 12.0)
- Argveta (KM 13.0 – 15.0)

F.4.1.2 Demographics

527. 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 Zestaphoni was 58,401 in 2014 of which the majority was classified as rural population (see **Table 58** below).

Table 58: Population of Imereti and its Municipalities

	Total Population	Urban	Rural
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7. ³² Second Regional Development Project, Imereti Regional Development Program, Imereti Tourism Development Strategy. Strategic Environmental, Cultural, Historical and Social Assessment. World Bank, 2014

	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
Zestaphoni 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

528. According to statistics provided by Geostat, there are 12,700 pensioners, 8,200 socially unprotected people and 780 Internally Displaced People (IDPs) registered as living in Zestaphoni.

529. 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%).³³ There are no ethnic minorities or indigenous people in the project area.

F.4.2 Community Health & Education

F.4.2.1 Health

530. Several medical facilities have been identified in the Project area as listed below.

Table 59: Medical Facilities in the Project Area (within 1 km)

#	Name	Location	Distance from the new alignment (m)
1	Shorapin Medical Faculty	Kveda Ilemi	450
2	Ilmis Medical Faculty	Shorapani	1,000
3	Tskhratskaro Medical Faculty	Zestaphoni	210
4	Geo Hospital's Zestaphoni Outpatient Center	Zestaphoni	340
5	Lower Sector Medical Outpatient	Zestaphoni	10

Figure 68: Lower Sector Medical Outpatient

³³ www.geoxtati.ge. 2014

F.4.2.2 Safety

531. 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. Focusing the analysis on the Khevi – Argveta section, 351 collisions, 78 persons killed and 648 persons injured. Finally, along the F4 section 130 collisions occurred, with 30 persons killed and 218 persons injured. These data are summarized in **Table 60**, whereas **Table 61** shows the collisions rates in terms of “crashes per km”. **Table 62** shows the details of the F4 section.

Table 60: 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
F4	16	130	218	30

Table 61: 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
F4	16	8.13	13.63	1.88

Table 62: Collisions and Casualties in Section F4

Year	Collisions	Injured	Killed
2012	25	43	11
2013	26	40	6
2014	19	38	2
2015	29	49	5
2016	31	48	6

532. As regards the collisions in the section F4, there was a low peak in 2014, but in the last two years the trend is negative. In 2016, 31 collisions occurred in this stretch, that is the highest value observed in the observed period.

533. The figures below summarize collisions by type and cause. The most part of collisions (56%) occurs between 2 or more motor vehicles; 7% of them result in the overturning of a vehicle. 24% of collisions involve pedestrians, thus showing that the protection of vulnerable road users is a major issue in this section. Another relevant category of collisions are those with obstacles (18%). As regards the causes of the crashes, 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).

Figure 69: Collisions by type (section F4, period 2012 – 2016)

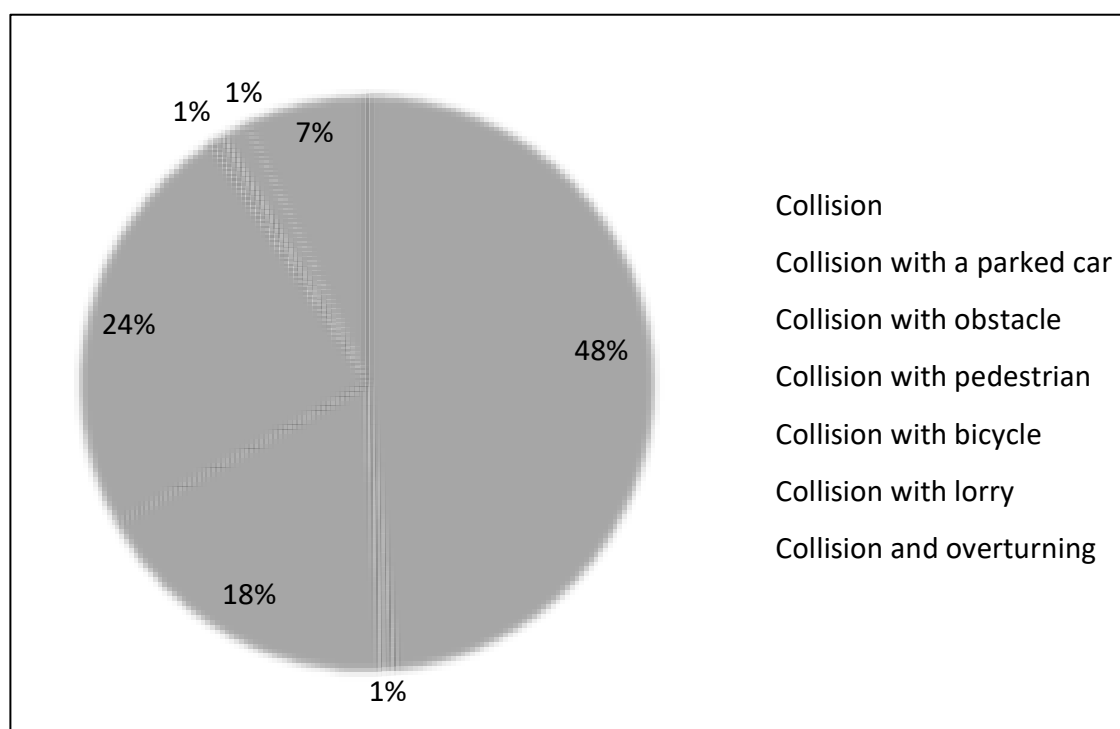
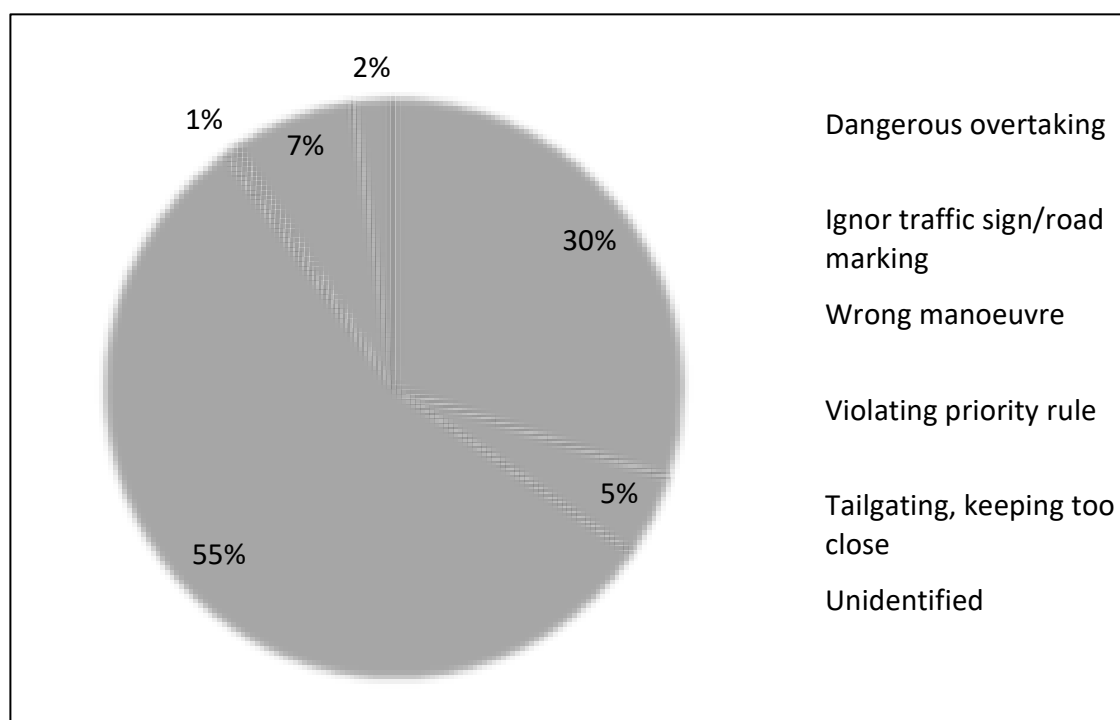


Figure 70: Collisions by cause (section F4, period 2012 – 2016)



E.4.2.3 Education and Educational Facilities

534. There are 33 public schools in Zestaphoni municipality, with 8,700 pupils. The nearest schools to the Project road are listed in the table below.

Table 63: Schools in the Project Area (within 1 km)

#	Name	Location	No. of	Distance from the new
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			Pupils	alignment (m)
1	Shorapani School	Shorapani	350	245
2	Public School of Shorapani	Shorapani	250	430
3	LEPL Zestaphoni N1 School	Zestaphoni	811	564
4	LEPL Zestaponi N6 School	Zestaphoni	432	650
5	Public school of Keda Sakare	Keda Sakare	214	1,000

F.4.3 Economy and Employment

535. According to the social survey undertaken for this Project, it is found that the average wage of the population in the target villages is 650 GEL. The majority (70%) interviewed in the social survey stated that the main source of income is wage, 20% of the surveyed families said that main source is pension/allowance, only 5 % said that it is self-employment.

536. According to the survey results on employment status, 34% of surveyed people are employed, almost 22% is unemployed, 11% are housewives, 17% students or pupils and 15% pensioners.

F.4.4 Waste Management

537. 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 European Union (EU). Currently solid waste disposal at the landfill is the only form of waste management in Georgia. The situation with 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.

538. 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.

539. 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;
- Privately owned BP landfill.

540. 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. Tbiliservice Group (municipal company established in 2007) manages Tbilisi's landfills.

541. 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.
542. 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.
543. Previously there was a landfill site in Zestaphoni adjacent to Kvaliti village. The area of the site was 2.2 hectares and received 15,000 m³/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. As such there appears to be no landfill in Zestaphoni anymore.

F.4.5 Physical and Cultural Resources

Regional Context

544. 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.
545. 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). During the XV century, after the fall of the Georgian feudal monarchy, Imereti became a separate feudal kingdom.

Project Corridor

546. Within the Project corridor the following physical cultural resources have been identified:
- **Shorapani Fortress** - Shorapani fortress is a monument of ancient times and of the Middle Ages. In historical sources, the fortress is mentioned by Strabo (I-BC - I

AD), according to whom Shorapani fortress was so enormous that it contained the entire city population. According to Leonti Mroveli (IX century), the original fortress was built by the King Parnavaz I of Kartli in the III century BC. In the VI century, during the battle between Persia and Byzantium, the fortress passed from hand to hand, but it did not lose its strategic importance. The fortress was occupied by the Ottomans in 1730, and was recaptured by the King Solomon I of Imereti in 1770. Since 1983, excavations began here; the nearby territory was completely cleared and the eastern, western and northern parts of the wall became visible. Under the structures, earlier buildings of previous times were discovered. Structures of antiquity covered with flat and curved tiles and Colchis Amphorae were found. Archaeological artifacts from Shorapani fortress and adjacent area are preserved in Janashia National Museum funds. Today, arched support column of the ancient fortress are found. From the fortress to the river Kvirila passes a 60 meter tunnel of the VI century. The tunnel was restored in the late feudal era.

Figure 71: Shorapani Fortress

- **Other Archaeological Sites** – Argveta is also another area of archaeological importance. Artifacts from this area are preserved in the State museum. Archaeological finds were unearthed in 1980 during construction of a house in Argveta. These artifacts (iron axes, iron dagger, arrow heads) are now preserved in Givi Jaoshvili Zestaphoni Ethnographic Museum. According to the register these artifacts belong to early ancient period. The area seems to be an interesting area from archaeological point of view. However the area is remote from the new alignment. Archaeological materials were also found in the Zestaphoni area during construction of the GAA facility and are kept in Zestaphoni Ethnographic Museum. These items include pottery from early ancient to late ancient time. In the same area bronze dagger was found.



Figure 72: : Stonework in Zestaphoni

Visual surveys of the alignment near the west portal of the passage under the Zestaphoni-Chiatura road detected some stonework which may have some archeological importance. In addition, a mound located 200m north to the plant may be the site of ancient settlement, while in the flatland, between the hill and the plant and old burial may be present. Finds from the area preserved in Zestaphoni museum allow to assume this possibility. Maps indicating the locations of these potential archeological sites are indicated in **Figure 75**.

- **Churches** – Only one church has been identified within the vicinity of the Project road, St Ninos, which is located approximately 300 meters south of the exit to tunnel 6, close to the boundary of the GAA facility. Numerous other churches are dotted around Zestaphoni, and Shorapani, but none of them are close enough to be impacted by the Project. Maps indicating the locations of the churches are indicated in **Figure 75**.

- **Cemeteries** – Only one cemetery has been identified within 250 meters of the Project road. The cemetery is located approximately 50 meters south of tunnel TUN 4.0.06-AT/TA

Figure 73: Cemetery close to Tunnel TUN 4.0.06-AT/TA.

- **Other Sites of Potential Cultural Value** – A small natural spring is located around km 10, close to the northern boundary of the GAA facility (see **Figure 74**). Several visitors to this area were noted during site visits.

Figure 74: Natural Spring Adjacent to the GAA Facility (KM 10.1)

Figure 75: Churches, cemeteries and places of worship in the region

(yellow circle- church, red circle – Shorapani fortress, green hexagons – cemeteries, orange hexagons – cemeteries with churches)

1. St Nino church, approximate distance 260m; 2 – St Nickolas church, approximate distance 650m, 3 – cemetery, approximate distance 630m; 4 – Shorapani fortress , approximate distance 590m

F.4.6 Noise & Vibration

F.4.6.1 General

547. Noise and vibration within the Project corridor can be discussed in two parts, firstly the parts of the corridor that broadly follow the existing alignment, and secondly the part of the corridor that bypass to the north of Zestaphoni, more than 500 meters from the existing road.

548. Noise levels within the first part 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. In the second part of the corridor the alignment traverses a predominantly rural / residential landscape with the exception being the portion of the alignment that passes just to the north of the GAA facility. Noise and vibration monitoring has been undertaken in both parts of the road for this EIA to determine baseline noise levels which will be used as part of the noise and vibration model presented later in this report.

F.4.6.2 Existing Noise & Vibration Levels

549. Baseline noise and vibration monitoring was undertaken in September, 2017 at a nine locations. **Table 64** describes the sample locations and rationale for their selection. The sampling locations are mapped in **Figure 76**.

Table 64: Noise and Vibration Monitoring Locations

Sample ID	Coordinates	Approximate Location	Rationale for Site Selection
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N01	42 ° 05'31.75"N / 43° 07'47.68"E	KM0.0	Start of F4, opposite a small cluster of residential properties.
N02	42 ° 05'42.77"N / 43° 06'23.19"E	KM2.2	Adjacent to a roadside restaurant. Site of embankment cutting.
N03	42 ° 05'31.72"N / 43° 04'53.87"E	KM4.3	Shorapani residential area, location of a school and exit of Tunnel 3.
N04	42 ° 05'58.49"N / 43° 04'26.10"E	KM5.5	Adjacent to residential properties.
N05	42 ° 06'14.75"N / 43° 03'51.79"E	KM6.3	At the portal to Tunnel 4.
N06	42 ° 06'56.22"N / 43° 02'57.23"E	KM8.3	Close to the portal to Tunnel 5 adjacent to residential properties.
N07	42 ° 07'02.90"N / 43° 02'08.61"E	KM9.5	Residential area at the portal to Tunnel 6 and at the end of Bridge 4.
N08	42 ° 07'36.01"N / 43° 01'11.19"E	KM11.0	North of the GAA facility and south of a residential cluster.
N09	42 ° 07'54.20"N / 42° 59'41.87"E	KM13.4	Adjacent to a small cluster of residential properties.

Figure 76: Noise and Vibration Monitoring Locations

Vibration Results

550. **Table 65** 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 weak and non-perceptible.

Table 65: Baseline Vibration Monitoring Results

	Displacement, mm; peak values			Velocity, mm/s; true RMS			Transversal vibration value in dBV	Comment
	Longitudinal X	Transversal Y	Vertical Z	Longitudinal X	Transversal Y	Vertical Z		
NV A-1	0.001	0.051	0.000	0.000	0.440	0.000	78	Edge of the E-60 highway
NV A-2	0.005	0.002	0.000	0.000	0.010	0.000	40	14.9m from the centerline of E-60 highway
NV A-3	0.000	0.000	0.000	0.000	0.000	0.000		Next to internal road in Shorapani
NV A-4	0.033	0.010	0.001	0.000	0.000	0.000		15.2m from the centerline of E-60 highway
NV A-5	0.000	0.000	0.000	0.000	0.000	0.000		Next to the local road

NV A-6	0.000	0.000	0.00 0	0.000	0.000	0.00 0		87.5m from the centerline of Gomi-Sachkhere-Chiatura-Zestaphoni road, in about 30m from the street - Zestaphoni
NV A-7	0.000	0.000	0.00 0	0.000	0.000	0.00 0		Next to existing internal road – Kvemo Sakara
NV A-8	0.000	0.000	0.00 0	0.000	0.000	0.00 0		Next to existing internal road – Kvemo Sakara
NV A-9	0.000	0.000	0.00 0	0.000	0.000	0.00 0		Next to existing internal road – Argveta

Note:

Vibration velocity level (Lv) in dB has been defined as follows:

$$Lv = 20 \times \log_{10}(V/V_{ref})$$

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 #297/6 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)

$$Lv = 20 \times \log_{10}(0.44/0.00005)=20 \times 3.9=78\text{dB (NVA-1)}$$

$$Lv = 20 \times \log_{10}(0.01/0.00005)=20 \times 2=40\text{dB (NVA-2)}$$

Noise monitoring results

551. **Table 66** provides the baseline noise monitoring results. The monitoring results show that noise levels close to the existing road are elevated above IFC daytime and nighttime standards. However, as the Project corridor enters the rural bypass around the north of Zestaphoni noise levels get lower and are within IFC guideline limits for daytime and nighttime noise.

552. Additional 24 hour noise monitoring was undertaken at 5 locations in April and May, 2019 to calibrate the updated noise model. The full results are presented in **Appendix I**.

Table 66: Baseline Noise Monitoring Results

#	Time	Wind speed, m/s	Wind direction	L _{eq} , dBA	L _{min} , dBA	L _{max} , dBA	L _{eq} , dBA	L _{DN} , dBA	L _{DEN} , dBA	L ₁₀ , dBA	L ₅₀ , dBA	L ₉₀ , dBA	National limit (residential), Leq,dBA	IFC/WHO limit (residential), LAeq, dBA	EU limit, Leq, dBA	Comment
NVA-1																
1	12:30 -13:50	1.3	W	65.0	52.3	80.0	72.2	72.3	77.1	50.13	60.3	74.1	55 (Day) 45 (Night)	55 (Day) 45 (Night)	60 (Day) 55 (Evening) 45 (Night)	Edge of the E-60 highway
2	19:30-19:50	1.4	W	78.0	55.0	85.0										
3	01:30 -01:50	1.0	W	47.8	45.0	65.0										
4	06:55–07:15	1.0	W	55.5	50.0	68.0										
NVA-2																
1	13:00-13:20	2.0	SW	68.3	54.0	75.0	62.4	62.6	62.8	46.1	50.3	63.4	55 (Day) 45 (Night)	55 (Day) 45 (Night)	60 (Day) 55 (Evening) 45 (Night)	14.9m from the centerline of E-60 highway
2	18:50-19:10	1.6	SW	52.0	49.0	80.0										
3	01:00 -01:20	1.0	SW	45.0	42.0	65.0										
4	06:50-07:10	1.0	SW	48.5	44.0	68.4										
NVA-3																
1	10:30 -10:50	2.0	SW	49.0	46.0	56.0	54.2	58.4	60.5	48.3	50.0	56.6	55 (Day) 45 (Night)	55 (Day) 45 (Night)	60 (Day) 55 (Evening) 45 (Night)	Next to internal road in Shorapani
2	18:20-18:40	1.6	SW	59.0	54.0	78.0										
3	00:30-00:50	1.2	SW	48.0	46.0	56.0										
4	06:20 -06:40	1.0	SW	51.0	50.0	55.0										
NVA-4																
1	12:00-12:20	2.0	W	76.0	70.0	85.0	73	73.1	73.1	46.62	63.3	76.0	55 (Day) 45 (Night)	55 (Day) 45 (Night)	60 (Day) 55 (Evening) 45 (Night)	15.2m from the centerline of E-60 highway
2	17:50-18:10	1.2	W	76.0	53.0	83.0										
3	24:00-24:20	1.1	W	50.5	48.0	60.0										
4	05:50-06:10	1.0	W	45.0	43.0	55.0										
NVA-5																
1	10:00 -10:20	1.6	NW	57.0	54.0	61.0	72.0	72.0	72.0	43.4	50.7	71.7	55 (Day) 45 (Night)	55 (Day) 45 (Night)	60 (Day) 55 (Evening) 45 (Night)	Next to the local road
2	17:20-17:40	1.2	NW	78.0	55.0	82.0										
3	23:30-23:50	1.1	NW	44.4	40.0	50.0										
4	05:20-06:40	1.0	NW	43.0	41.0	55.0										
NVA-6																
1	09:10-09:30	1.0	SW	32.3	31.7	40.7	33.2	40.0	40.0	31.9	32.2	34.2	55 (Day) 45 (Night)	55 (Day) 45 (Night)	60 (Day) 55 (Evening) 45 (Night)	87.5m from the centerline of Gomi-Sachkhere-Chiatura-Zestaphoni road, in about 30m from the street - Zestaphoni
2	16:40-17:00	1.0	SW	35.0	33.0	40.0										
3	23:10-23:30	1.2	SW	32.0	30.6	38.3										
4	04:10-04:30	1.0	SW	31.9	31.0	47.7										
NVA-7																
1	08:30-08:50	1.5	NW	33.0	29.0	38.0	41.3	47.3	47.3	32.7	39.3	50.1	55 (Day) 45 (Night)	55 (Day) 45 (Night)	60 (Day) 55 (Evening) 45 (Night)	Next to existing internal road – Kvemo Sakara
2	16:10-16:30	1.1	NW	45.4	42.0	50.0										
3	22:50-23:10	1.0	NW	42.0	39.5	46.0										

Section F4 of the Khevi-Ubisa-Shorapani-Argveta Road (E60 Highway)
Environmental Impact Assessment

#	Time	Wind speed, m/s	Wind direction	L _{eq1} , dBA	L _{min1} , dBA	L _{max1} , dBA	L _{eq1} , dBA	L _{DN1} , dBA	L _{DEN1} , dBA	L10, dBA	L50, dBA	L90, dBA	National limit (residential), Leq,dBA	IFC/WHO limit (residential), LAeq, dBA	EU limit, Leq, dBA	Comment
4	04:10-04:30	1.1	NW	32.5	30.0	35.3										
NVA-8																
1	07:30-07:50	2.2	S	42.0	38.0	44.0	43.8	48.0	48.0	35.0	42.0	46.2	55 (Day) 45 (Night)	55 (Day) 45 (Night)	60 (Day) 55 (Evening) 45 (Night)	Next to existing internal road – Kvemo Sakara
2	15:30-15:50	1.1	S	48.0	45.0	55.1										
3	22:30-22:50	1.1	S	42.0	40.0	44.2										
4	03:30-03:50	1.3	S	32.0	30.0	35.0										
NVA-9																
1	07:00-07:20	2.0	SW	39.0	35.0	48.0	44.9	49.7	49.7	35.5	41.5	47.8	55 (Day) 45 (Night)	55 (Day) 45 (Night)	60 (Day) 55 (Evening) 45 (Night)	Next to existing internal road – Argveta
2	15:00-15:20	1.1	SW	49.4	45.0	55.0										
3	22:10-22:30	1.0	SW	44.0	42.0	52.0										
4	03:00-03:20	1.2	SW	34.0	31.0	38.0										

Note:

Daytime values are marked in red

Orange highlight indicated the sites where registered noise was found to be in allowable limits

L90, L50, L10 – statistical level = level exceeded 90%, 50% 10% of time respectively

L_{eq} – equivalent sound level

L_{DEN} – equivalent sound level/average equivalent level over 24 hr period. 5dBA is added for the interval from 19:00 to 23:00; 10dBA added for the time interval from 23:00 to 07:00

L_{DN} – average equivalent sound level over a 24 hour period, with a penalty added for noise during the nighttime hours of 22:00 to 07:00

G. Environmental Impacts and Mitigation Measures

G.1 Introduction

553. 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

554. 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

555. The description of each impact will have the following features:

- 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).
- Description of the sensitivity and importance value of the receiving environment or receptors.
- Extent of change associated with the impact.
- Rating of the significance of the impact.
- Description of appropriate mitigation and management measures and potential effectiveness of the proposed measures.
- Characterization of the level of uncertainty in the impact assessment.
- 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:
 - magnitude
 - spatial scale
 - timeframe^{[1][2][3][4][5][6][7][8][9][10]}

556. Magnitude is determined from quantitative or qualitative evaluation of a number of criteria including:

- Sensitivity of existing or reasonably foreseeable future receptors.
 - Importance value of existing or reasonably foreseeable future receptors, described using the following:
 - inclusion in government policy.
 - level of public concern.
 - number of receptors affected.

- intrinsic or perceived value placed on the receiving environment by stakeholders.
- economic value to stakeholders^[17]
- Severity or degree of change to the receptor due to impact, measured qualitatively or quantitatively, and through comparison with relevant thresholds:
 - legal thresholds—established by law or regulation
 - 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
 - normative thresholds – established by social norms, usually at the local or regional level and often tied to social or economic concerns
 - preference thresholds—preferences for individuals, groups or organizations only, as distinct from society at large
 - reputational thresholds—the level of risk a company is willing to take when approaching or exceeding the above thresholds

557. 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.

558. 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.

559. 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.

560. 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.

561. The characteristics are outlined in **Table 67**.

Table 67: 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

Characteristic	Sub-components	Terms Used to Describe the Impact
		Direct, indirect or cumulative or induced
Phase of the Project		Construction, operation, decommissioning or post closure
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)

Characteristic	Sub-components	Terms Used to Describe the Impact
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 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

562. 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 68** and described as follows:

- **Part A:** Define impact consequence using the three primary impact characteristics of magnitude, spatial scale and duration.
- **Part B:** Use the matrix to determine a rating for impact consequence based on the definitions identified in Part A; and
- **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.

563. Using the matrix, the significance of each described impact is rated.

Table 68: 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^{[1][1]}_[SEP] - Receptors highly amenable to positive change^{[1][1]}_[SEP] - 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^{[1][1]}_[SEP] - Limited public concern expressed during stakeholder consultation - Limited value attached to the environment	- Some receptors affected^{[1][1]}_[SEP] - Receptors likely to experience some improvement in their situation - Relevant positive thresholds occasionally exceeded
	Minor	- No or limited receptors within the zone of impact^{[1][1]}_[SEP] - Receptors not sensitive to change^{[1][1]}_[SEP] - Minor deterioration, nuisance or harm to receptors^{[1][1]}_[SEP] - Change not measurable or relevant thresholds never exceeded - Stakeholders have not expressed concerns regarding the receiving environment	- No or limited receptors affected^{[1][1]}_[SEP] - Receptors not sensitive to change^{[1][1]}_[SEP] - 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					
PROBABILITY (of exposure to impacts)		CONSEQUENCE			
			Low	Medium	High
		Definite	Low	Medium	High
		Possible	Low	Medium	High
		Unlikely	Low	Low	Medium

G.3 Mitigation, Management and Good Practice Measures

564. 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.

565. The following mitigation hierarchy will be utilized in selecting practical mitigation measures for unacceptable impacts as follows (in order of preference):

- Avoid the impact wherever possible by removing the cause(s).
- Reduce the impact as far as possible by limiting the cause(s).
- Ameliorate the impact by protecting the receptor from the cause(s) of the impact.
- 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

566. Based on the impact assessment methodology discussed above, **Table 69** presents the possible impacts of the proposed Project. Each impact is discussed further in this chapter.

Table 69: 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
	C	Contaminated Soil	Nearby	L	H	L	H	MAJ	MT	SMALL	HIGH	POSS	H

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
Hydrology			communities / Water bodies										
	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
	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
Flora & Fauna	O	Ground water supply degraded by new tunnels.	Nearby communities	M	M	L	-	MOD	LT	SMALL	MED	POSS	M
	C	Degradation of habitat caused during site clearing.	Terrestrial wildlife	M	H	L	-	MOD	L/F	SMALL	LOW	DEF	L

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	Tree cutting.	Terrestrial wildlife	H	H	L	M	MAJ	ST	SMALL	MED	DEF	M
	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	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
		located by the road.											
	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	Communities /	H	H	H	M	MAJ	ST	INTER	MED	DEF	M
OHS / Community Health and Safety	C	Accidents and injuries during the construction phase.	Communities / 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
Emergencies	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

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
	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
	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
	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	Communities /	H	H	H	M	MAJ	ST	INTER	MED	DEF	M
OHS / Community Health and Safety	C	Accidents and injuries during the construction phase.	Communities / 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
Emergencies	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
	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	Contractors	H	H	L	H	MAJ	H/F	SMALL	HIGH	DEF	H

		from construction equipment.	staff / Nearby communities										
	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

567. The potential impacts of the Project to air quality are described as follows:

Design and Pre-construction Phase

568. 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 quarries and 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

569. During construction, air quality is likely to be degraded by a range of operational activities including:

- Exhaust emissions from the operation of construction machinery (e.g. Nitrogen Oxides (NO_x), Sulfur Oxides (SO_x) and Carbon Monoxide (CO));
- Open burning of waste materials; and
- Dust generated from quarries haul roads, unpaved roads, exposed soils and material stock-piles.

570. Dust is the major air quality problem from construction sites. Dust is a problem for a variety of reasons, as outlined below:

- 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.
- 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.
- 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.
- 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.
- 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

571. 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); SO₂; carbon dioxide (CO₂); 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.

572. 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.

Time frame of the model

573. The modelling has been developed for each of the below scenarios:

- Scenario year 2019
- Scenario year 2034.

574. The number of vehicles has been divided in 24 hours according to the provided traffic flow; the results of the modelling will be represented into values of concentration/time (hourly levels) for the considered pollutants in correspondence of the selected receptors.

Spatial domain and receptors

575. The model takes into consideration an area by 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. Six main receptors have been inserted in group of three at the north and south of the road. They have been used for the considerations in terms of respect or excess of allowable limits.

Results

576. The results of the modelling are organized as follows:

- Scenario 2019 (probable start of road service).
- Scenario 2034.

577. The values of the concentration of pollutants are calculated in correspondence of the six selected receptors. 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 put into evidence that the values only refer to the traffic in the new road, and do not consider any other external source.

**Table 70: Average yearly contribution of the road traffic to the background
(concentration / $\mu\text{g}/\text{m}^3$)**

Receptors		PM10	PM2.5	NO ₂	NO _x	CO	SO ₂	C6H6
Receptor 1 North	1	0.315	0.236	7.393	14.706	2.314	0.005	0.01
Receptor 2 North	2	0.156	0.113	3.171	6.553	1.072	0.002	0.005
Receptor 3 North	3	0.088	0.062	1.730	3.491	0.563	0.001	0.002
Receptor 1 South	1	0.617	0.469	9.215	23.806	4.666	0.01	0.021
Receptor 2 South	2	0.236	0.174	3.173	8.419	1.688	0.004	0.007
Receptor 3 South	3	0.164	0.119	2.094	5.584	1.128	0.002	0.005

578. 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. With reference to the PM₁₀ it can be assumed with high confidence a background value of 17 $\mu\text{g}/\text{m}^3$ in is in accordance with the field measurements carried in September 2017.

Scenario for the interval years 2019 to 2034

579. The following estimations have been calculated according to **Table 70**, which reports the estimated increments/year of the average monthly concentration for the expected traffic increments. When background values are available, they are considered into the calculations.

580. The average resulting values are presented in the below **Table 71** and **Table 72** which shows the increments, the background and the final expect values.

Table 71: - PM₁₀ ($\mu\text{g}/\text{m}^3$) Comparison of expected values at 2019, background and limits

Receptor		Δ estimated yearly increment (aver.) PM ₁₀	Background level	Total	Limits (year)
Receptor 1 North	1	0,315	17	17.315	40.0
Receptor 2 North	2	0,156	17	17.156	40.0
Receptor 3 North	3	0,088	17	17.088	40.0
Receptor 1 South	1	0,617	17	17.617	40.0
Receptor 2 South	2	0,236	17	17.236	40.0
Receptor 3 South	3	0,164	17	17.164	40.0

581. The data analysis confirms that the emission of PM₁₀ generated by the traffic, at 2019, is very limited and even taking into account the background levels 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.

Table 72: - NO₂ (µg/m³) Comparison of expected values at 2019, background and limits

Receptor	yearly estimated Δ (average increment) NO ₂	Background level	Total	Limits (in one year)
Receptor 1 North	7.393	-	7.393	40
Receptor 2 North	3.171	-	3.171	40
Receptor 3 North	1.730	-	1.730	40
Receptor 1 South	9.215	-	9.215	40
Receptor 2 South	3.173	-	3.173	40
Receptor 3 South	2.094	-	2.094	40

582. The impact of the NO₂ emissions can only be perceived in the proximity of the road; there are no background data available.

583. The application of increment of emissions determined by the expected increase of traffic, permitted to develop the following tables (**Table 73, Table 74, Table 75 and Table 76**) where the yearly increment of pollution for the considered pollutants is put into evidence. This data is also mapped in **Figure 77** to **Figure 88**.

Table 73: General scenario at 2034 for PM₁₀, NO_x and NO₂

Receptors	PM ₁₀	PM _{2.5}	NO ₂	NO _x	CO	SO ₂	C6H6
Receptor 1 North	0.442	0.332	7.850	17.745	3.267	0.007	0.014
Receptor 2 North	0.220	0.160	3.417	8.019	1.528	0.003	0.007
Receptor 3 North	0.125	0.088	1.879	4.276	0.813	0.002	0.004
Receptor 1 South	0.872	0.663	10.299	29.579	6.612	0.015	0.029
Receptor 2 South	0.337	0.250	3.631	10.609	2.424	0.005	0.011
Receptor 3 South	0.235	0.171	2.429	7.103	1.635	0.004	0.007

Table 74: Yearly scenario 2019 to 2034 for PM₁₀ (including background at 2019)

year	Receptor 1 North	Receptor 2 North	Receptor 3 North	Receptor 1 South	Receptor 2 South	Receptor 3 South
2019	17.32	17.16	17.09	17.62	17.24	17.16
2034	17.44	17.22	17.12	17.87	17.34	17.24

Table 75: Yearly scenario 2019 to 2034 for NO₂ (No background)

year	Receptor 1 North	Receptor 2 North	Receptor 3 North	Receptor 1 South	Receptor 2 South	Receptor 3 South
2019	7.39	3.17	1.73	9.21	3.17	2.09
2034	7.85	3.42	1.88	10.30	3.63	2.43

Table 76: Yearly scenario 2019 to 2034 for CO (No background)

year	Receptor 1 North	Receptor 2 North	Receptor 3 North	Receptor 1 South	Receptor 2 South	Receptor 3 South
2019	2.31	1.07	0.56	4.67	1.69	1.13
2034	3.27	1.53	0.81	6.61	2.42	1.63

584. 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.

585. 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.

Figure 77: PM10, 2019 (Km 0 – Km 8)

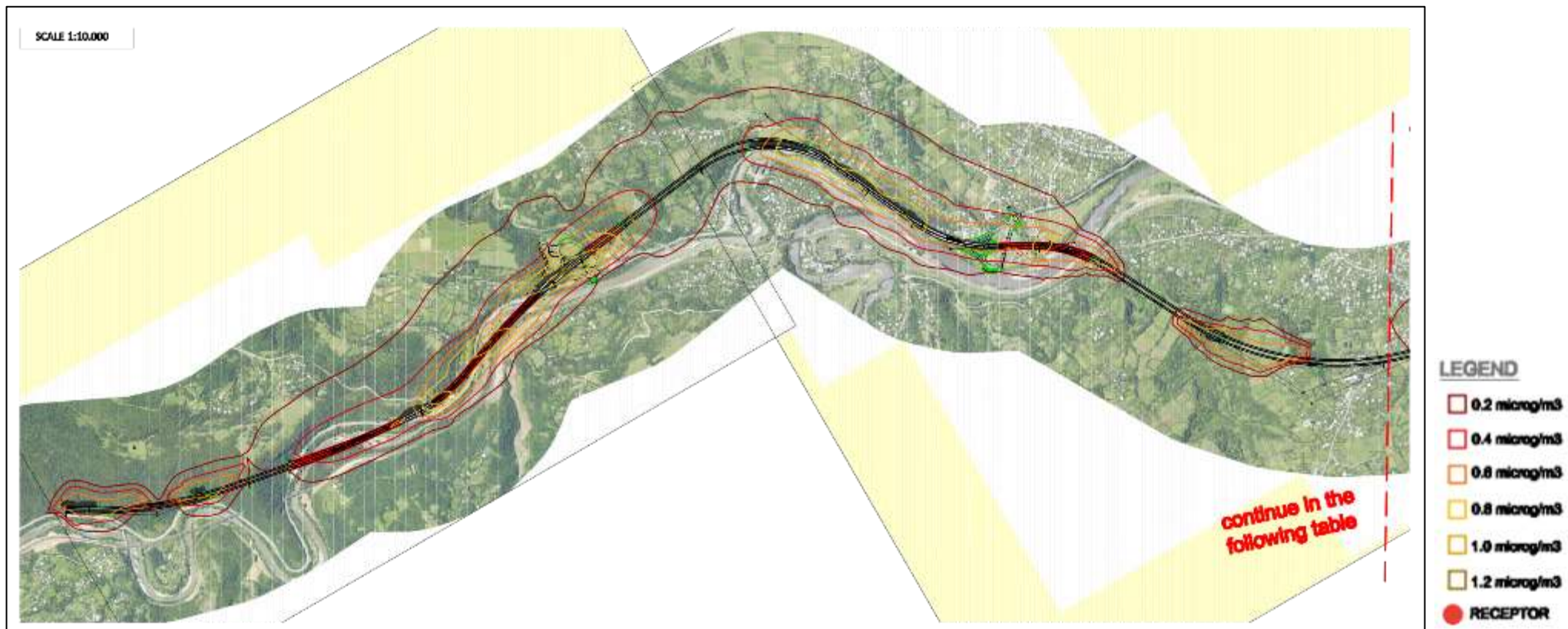


Figure 78: PM10, 2034 (Km 0 – Km 8)

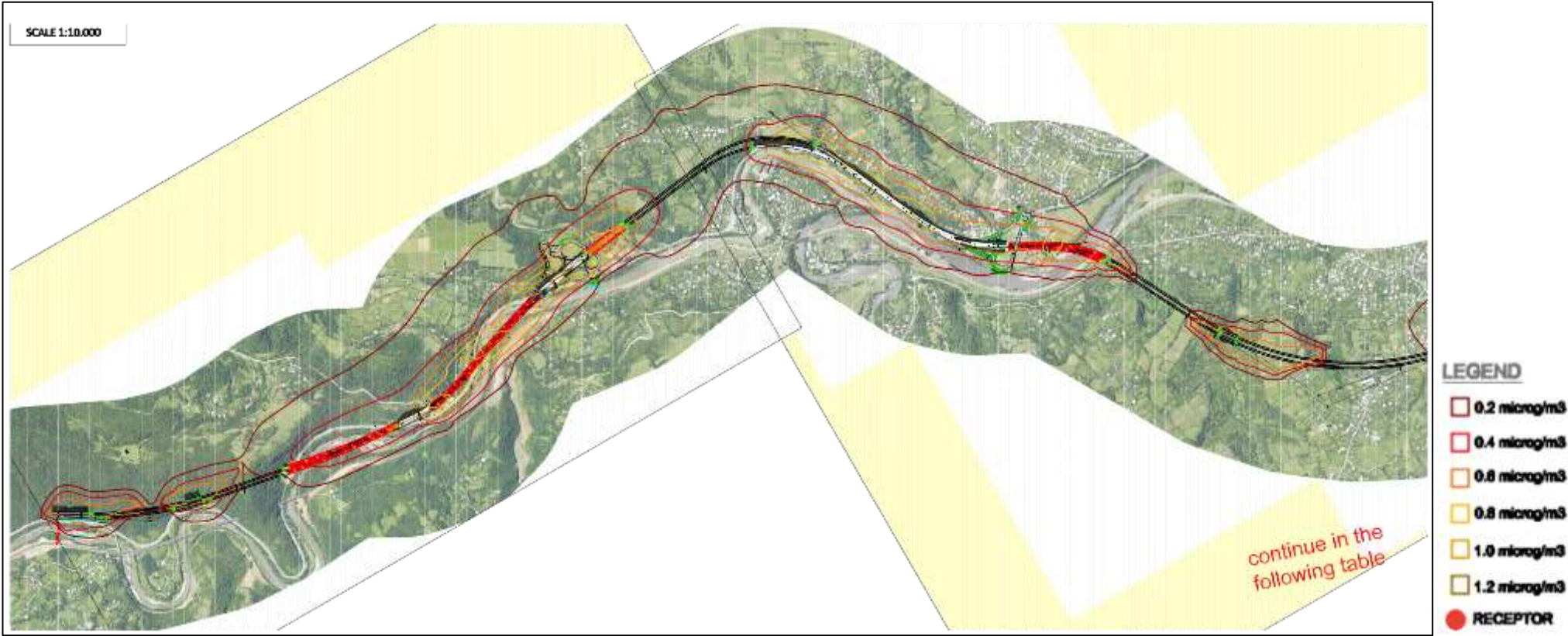


Figure 79: PM10, 2019 (Km 8 – Km 14.7)

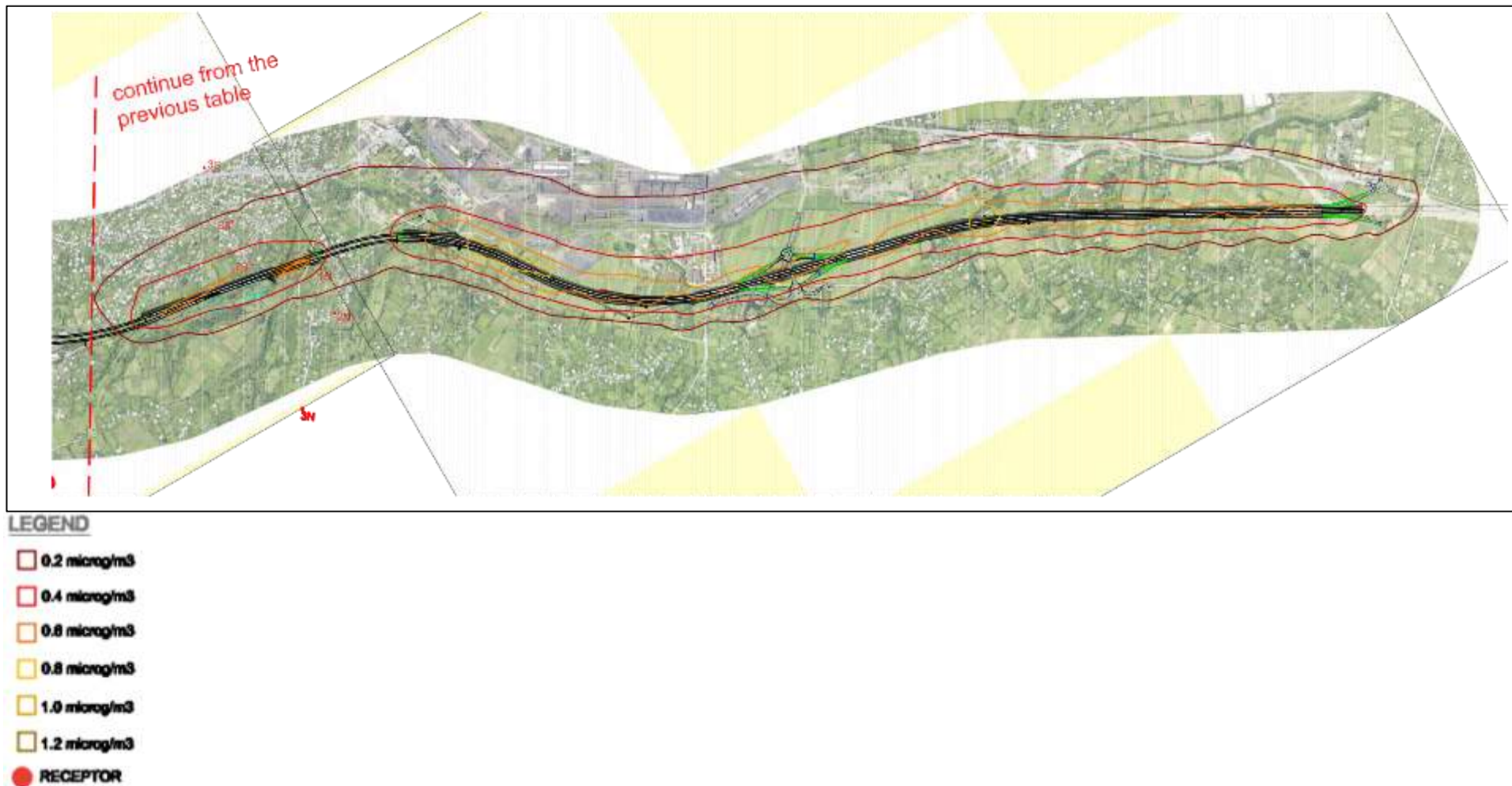


Figure 80: PM10, 2034 (Km 8 – Km 14.7)



Figure 81: NO2, 2019 (Km 0 – Km 8)

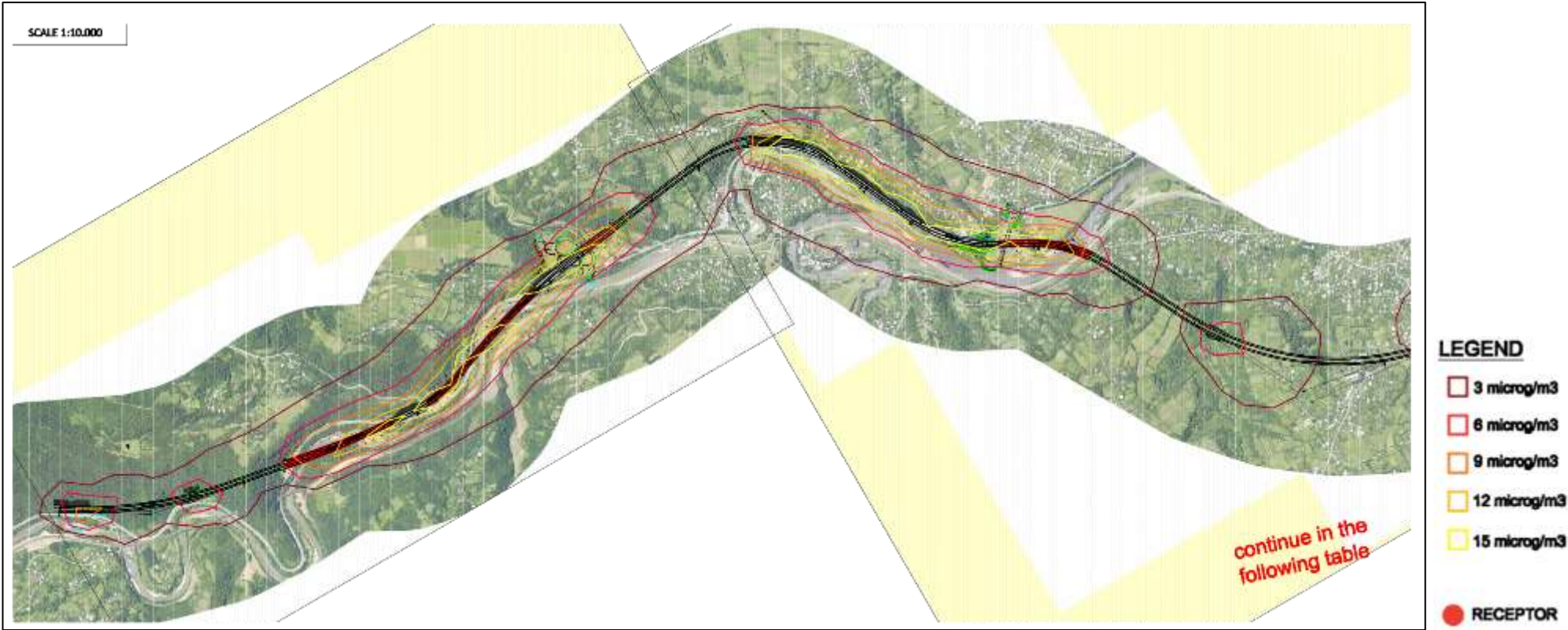


Figure 82: NO2, 2034 (Km 0 – Km 8)

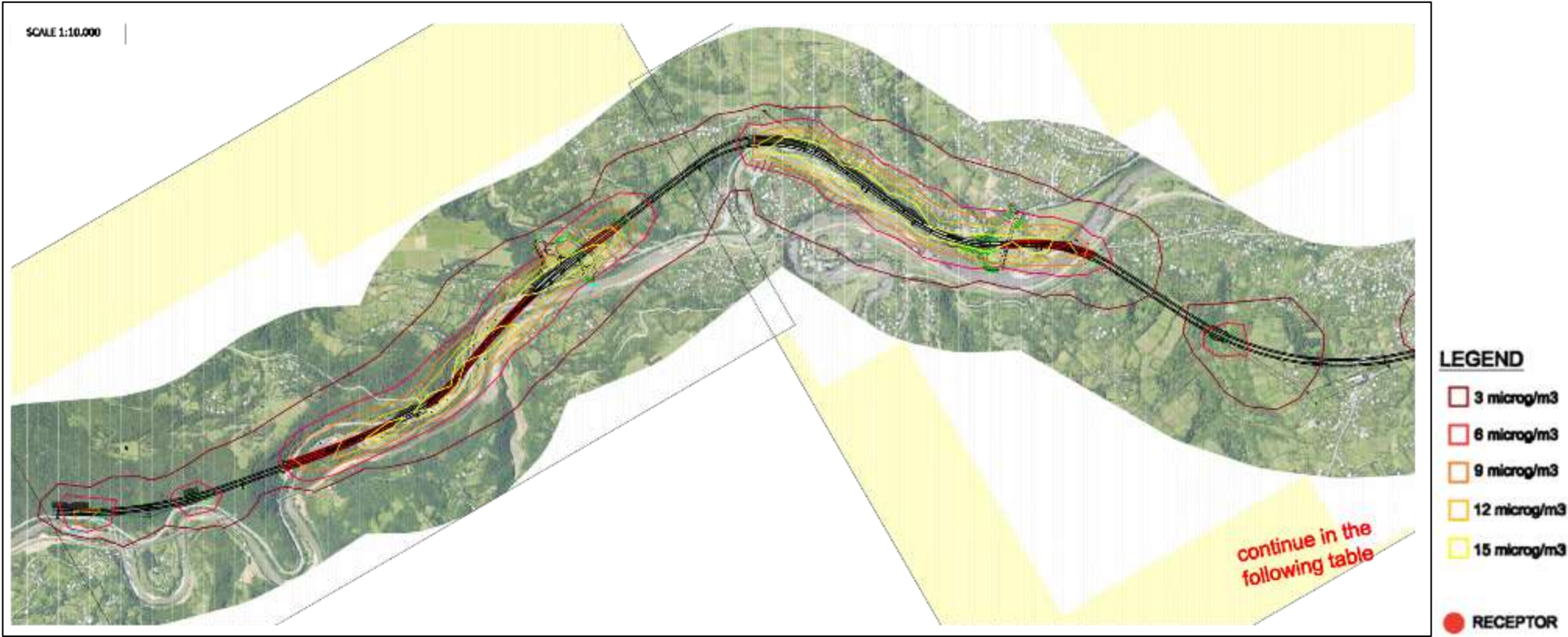


Figure 83: NO₂, 2019 (Km 8 – Km 14.7)

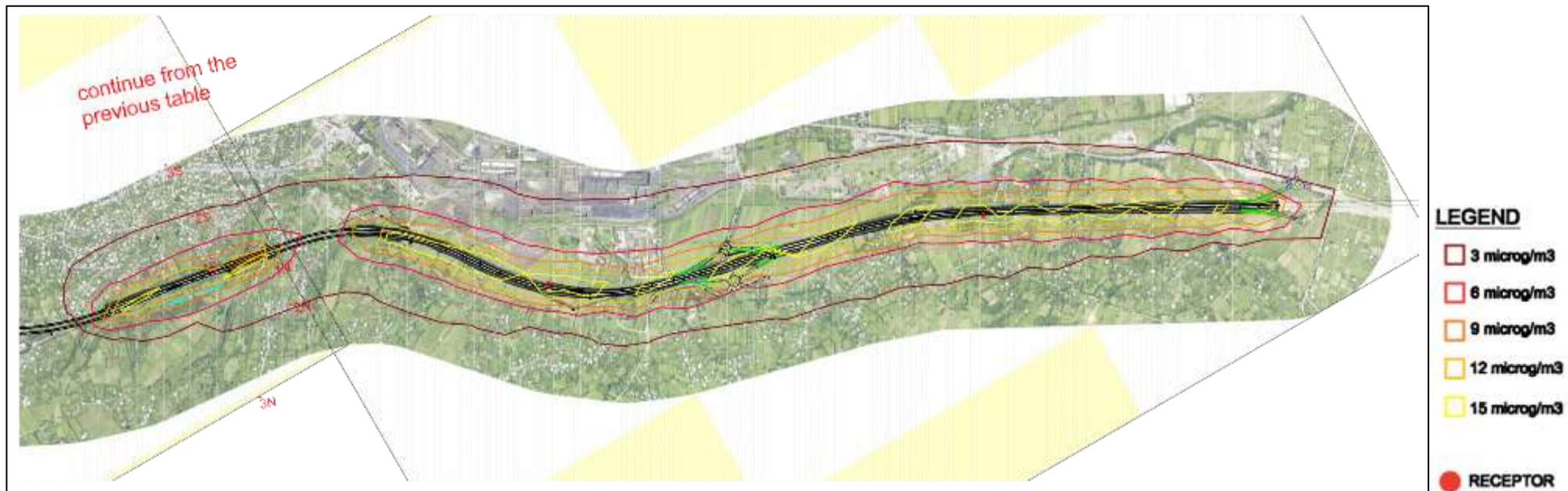


Figure 84: NO₂, 2034 (Km 8 – Km 14.7)

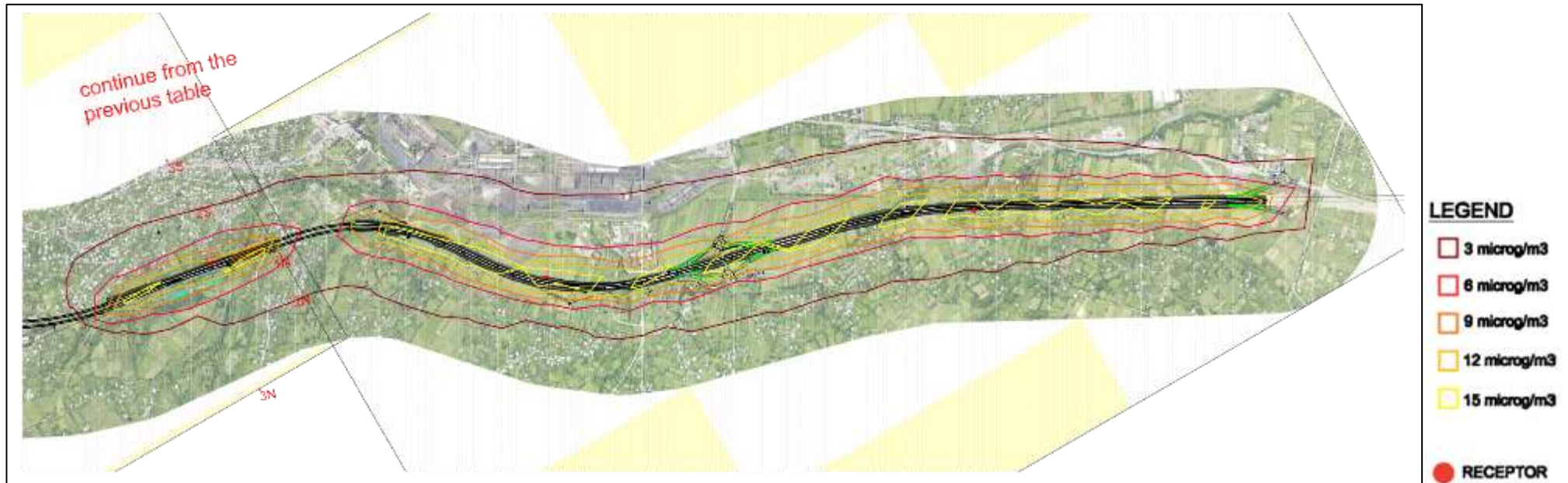


Figure 85: CO, 2019 (Km 0 – Km 8)

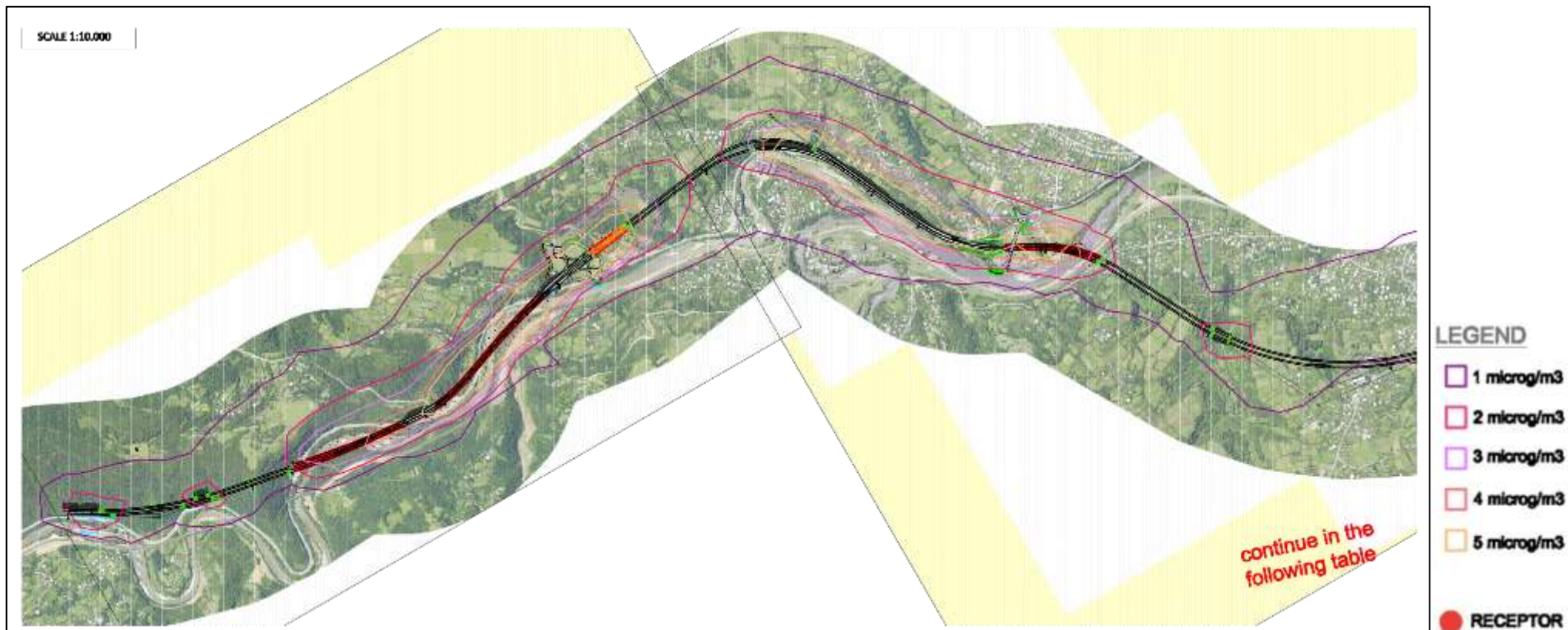


Figure 86: CO, 2034 (Km 0 – Km 8)

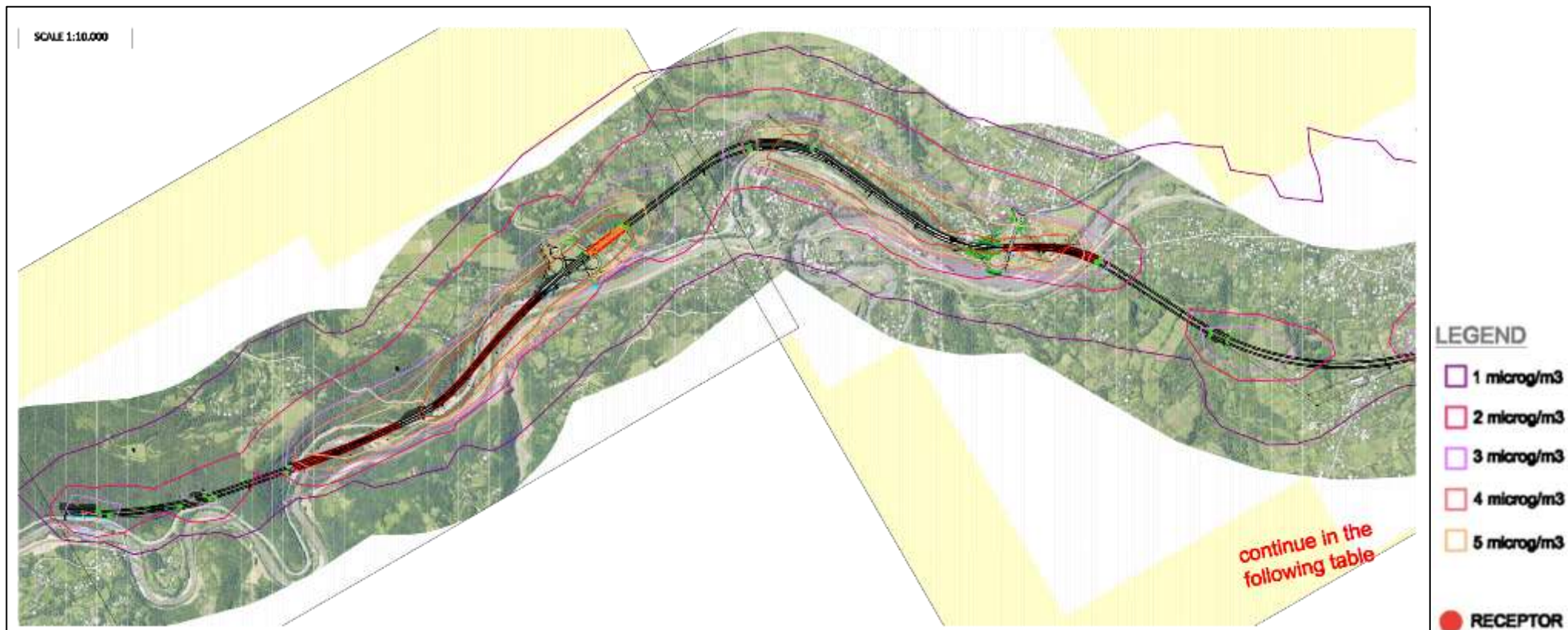


Figure 87: CO, 2019 (Km 8 – Km 14.7)



Figure 88: CO, 2034 (Km 8 – Km 14.7)



586. 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.

587. In addition, it is reasonable to consider that in the next years a large part of the obsolete and aging vehicles now in circulation will be substituted by less polluting ones with additional benefits to air quality.

Mitigation and Management Actions

Pre-construction Phase

588. Locations for 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).

589. 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.

590. 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.

Construction Phase

591. 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.

592. 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.

593. 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.

594. 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 programmes.
- 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.
- Implement a regular vehicle maintenance and repair program.

Operational Phase

595. 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

Greenhouse Gas (GHGs) Emissions

596. 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 costs over a 40 year period this figure rises to 3.94 ktCO₂/km. Given a road length of 14.77 km, this would result in around 58,200 tCO₂ of GHG emissions from the construction and O&M phases of the Project over a 40 year period.

Table 77: 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)

597. Source: IEA ETSAP – Technology Brief T14 –August 2011

598. 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 CO₂ per day, or 94,661 tons of CO₂ 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 CO₂ would be generated by traffic using the road per year.

599. 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 the 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

600. The transport sector is vulnerable to changes in climate variables, expected changes in the frequency and intensity of extreme weather events, and increased sea level. The following are a few examples of the potential effects:

- Changes in temperature—both a gradual increase in temperature and an increase in extreme temperatures—are likely to impact road pavements (for example, heat-induced heaving and buckling of joints).
- Changes in temperature will also impact the behaviour of permafrost and thus the infrastructure lying on permafrost.
- Changes in precipitation and water levels will impact road foundations.
- Extreme weather events such as stronger and/or more frequent storms will affect the capacity of drainage and overflow systems to deal with stronger or faster velocity of water flows.

- Stronger or faster velocity of water flows will also impact bridge foundations.
- Increased wind loads and storm strengths will impact long span bridges, especially suspension and cable-stayed bridges.
- High levels of precipitation may threaten embankment stability.
- Increase in scouring of roads, bridges, and support structures.³⁴

Mitigation and Management Measures

601. Detailed pavement implications for climate change are scarce but growing in number and include work on the effect of rising average temperatures, changes in precipitation patterns, and increasing freeze-thaw cycling on pavement performance. The focus of these efforts is to integrate climate change into pavement design and predict pavement performance based on future climate scenarios. Most work has offered general advice or predictions but has stopped short of recommending immediate changes in practice.³⁵

602. Most climate change impacts are projected to occur slowly over a long period of time and as such providing mitigation measure for topics such climate change impacts on pavement design need to be taken over time and cannot be determined in a study like this. Notwithstanding the above a number of simple measures can be taken to ensure that in the short term that extreme precipitation events do not result in significant impacts to the Project, they include:

- Increase ditch and culvert capacity;
- Maintain positive cross slope to facilitate flow of water from surface;
- Increase resistance to rutting;
- Reduce splashing/spray through porous surface mixtures;
- More frequent use of elevated pavement section;
- Improve visibility and pavement marking demarcation; and
- Ensure that all embankments are seeded to help increase stability.

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, 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.

G.5.3 Soils

Potential Impacts to Soils

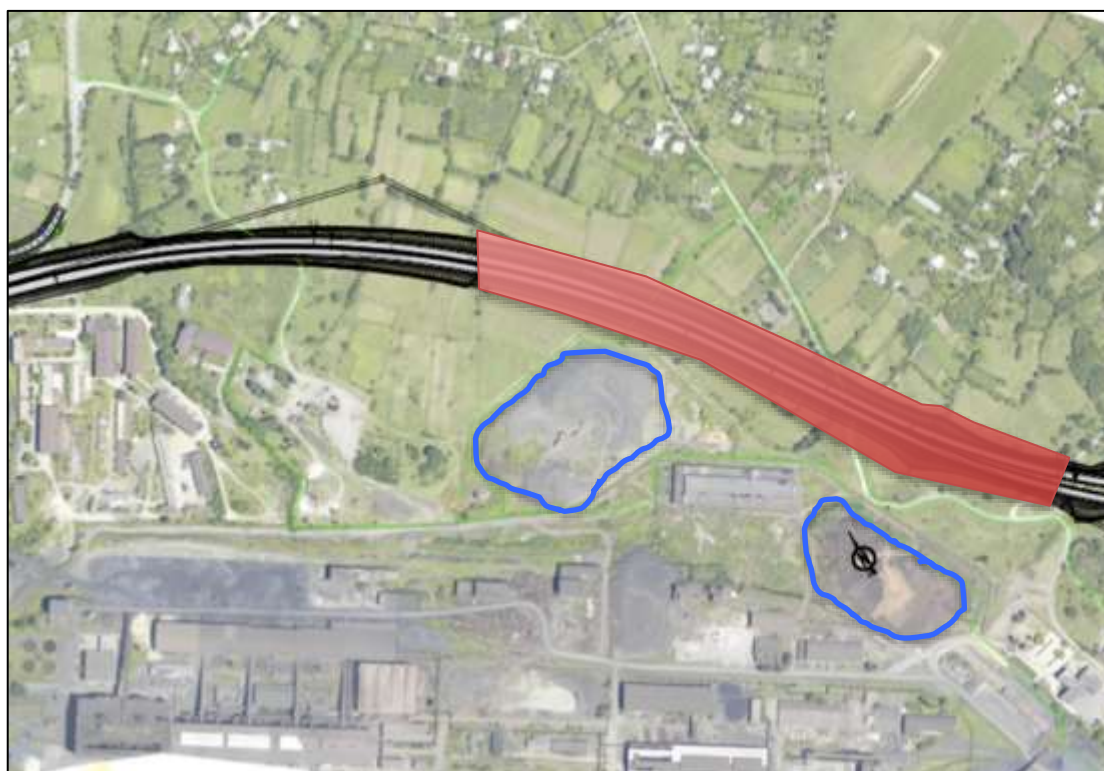
603. Potential impacts to soils include:

³⁴ Climate Proofing ADB Investment in the Transport Sector. ADB, 2014.

³⁵ Climate Change Adaptation for Pavements. US Department of Transport, Federal Highways Administration, 2015

- 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 ^{[[1]]}water erosion and covering of top soil by project works.
- 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.
- Induced Changes - Induced changes in the Project Area leading to industrial and commercial development are conceivable, thereby decreasing soil availability for agricultural purposes.
- 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.
- Contaminated Land - Soil samples taken to the north of the GAA plant have indicated that this area does not comprise levels of soil contamination above Dutch Intervention Levels or Italian standards for residential areas. Arsenic and Lead were identified in the samples above the current national limits, but within the proposed new national limits. However, only two soil samples were taken in this location and it is possible that soil contamination could still exist in the area north of the GAA. The Project road runs parallel to the GAA plant for approximately 1.3 kilometers, but the potential for pollution is considered to be confined to a smaller area, around 500 meters in length, and is focused around large two piles of waste material sited on the northern boundary of the GAA (see **Figure 89**). In this portion of the Project road the road level will be raised on an embankment. An average of 50 cm of topsoil will be stripped from an area more than 40 meters wide over this 500 meter section, that equates to around 10,000 m³ of top soil to be removed.

Figure 89: Location of Potentially Contaminated Land (spoil heaps in blue)



604. Although the two soil samples taken as part of this EIA did not show significant levels of contamination it is considered prudent to undertake additional sampling of these soils prior to their disposal to ensure that they are not contaminated and can be disposed of as non-hazardous waste.

Mitigation and Management Actions

Pre-construction phase

Loss of Soil for Agricultural Production

605. Before the commencement of the construction works of the Project, the RD must prepare the LARP. The section relating to **Land Use**, discusses this issue in more detail.

Contaminated Land

606. An additional four samples will be taken by the Engineer prior to the start of construction and the findings added to this EIA as an addendum to this report. Two of the samples will be taken in the area identified in **Figure 89** and two within the alignment to the east and west of this area, however, the final precise locations shall be determined by the Engineer. If the results show that the monitored parameters are within the proposed national limits of outlined in **Section D** and the Dutch target values no further soil sampling will be considered necessary. Should the results of the monitoring indicate any elevated levels of contamination further testing of the excavated soils in this area will be required during the construction phase by the Contractor. The procedure for any construction phase testing is as follows:

- The Contractor shall identify a temporary storage area for material excavated from the area identified in **Figure 89**. The area should be fenced and signposted. The area shall comprise an impermeable surface to prevent leachate from the stockpiles potentially contaminating soils and groundwater in the area of the storage area.
- The Contractor shall strip the topsoil in the area of **Figure 89** in batches of 5,000 m² and store the mixed material in the temporary storage area (the stockpile). The height of the stockpile shall be no more than 2 meters. The Contractor may choose to have more than one stockpile, depending upon the rates of excavation in this area.
- The Contractor shall then divide the stockpile into quadrants of 250m³. The Engineer will hire a certified laboratory to take a soil sample from each of the quadrants for further chemical analysis (a stockpile of 2,500m³ would require 10 samples). Sampling should be uniformly distributed throughout the stockpile, including sampling at depth. The Engineer will be present during the sampling to confirm that the correct number of samples were taken and that the sampling was undertaken in line with the relevant national legislative requirements.
- If the results show the all of the samples are within the proposed national limits of outlined in **Section D** and the Dutch target values the material can be removed from the stockpile area and disposed of as non-hazardous material.
- If any of the ten samples show elevated levels of contamination the material from the respective contaminated quadrants of 250 m³ will be disposed of as hazardous waste. Any other non-contaminated quadrants may be disposed of as non-hazardous waste. Final disposal of any contaminated soil must be undertaken at a waste management facility licensed to handle such wastes. As with normal waste materials, the Contractor will be obliged to keep records of any hazardous materials removed from the site, including:
 - Volume of soil removed;
 - Details of any identified contamination;
 - Soil stockpile (and/or storage container) unique identifier;

- Date excess soil was excavated from each location and subsequently transported to a disposal facility;
 - Details of the vehicle transporting the soil to a disposal facility;
 - Details of the disposal facility; and
 - Date the excess soil arrived at the disposal facility.
- The Contractor will also provide a copy of the licensed waste management contractors contract to the Engineer before any contaminated soil is removed from the site. The Engineer will also be responsible for undertaking an additional due diligence review of the waste management contractor's disposal site.
607. Alternatively, the Contractor may wish to explore alternative methods to treat the contaminated waste so that it can be disposed of as non-hazardous waste. If the Contractor chooses this option, he will be responsible for the preparation of a Contaminated Spoil Treatment Plan that will outline the procedures and methods for treating the waste. The plan will be submitted to the Engineer for approval.
608. In many countries the concept of 'the polluter pays' is attributed to issues such soil contamination. It is likely that any contamination found in this area would have originated from the GAA, but the GAA has changed ownership several times during its life and it may be difficult to apportion liability to the current owners of the site. Accordingly, if any elevated levels of contamination are found that need to be removed during construction works the costs of removal and disposal should be borne by the RD. The Contractor will be responsible for implementation of the Contaminated Soil Management Plan.

Construction Phase

609. Potential adverse impacts will be avoided or otherwise mitigated by ensuring the Contractor complies with the following:
- 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.
 - 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.
 - Conversion of Agricultural Soils Due to Indirect/Induced Impacts - Although the EMP contains provisions controlling direct impacts of land takings for both the road and ancillary functions (asphalt plants, construction camps, etc.), control of the induced impacts is largely beyond the scope of the Project.
 - Contamination Due to Spills or Hazardous Materials. The Contractor, with oversight from the Engineer, will ensure that:
 - 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).

- 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.
- 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.

Residual Impact Significance

Construction Phase – MINOR

If the mitigation measures suggested are implemented, the residual impacts of the Project will be minor. Careful management of any contaminated soils will be required at this stage to ensure there are limited impacts to the health of workers working in these areas, if contamination is present.

Operational Phase – MEDIUM

The erosion protection measures outlined above will prevent impacts occurring into the operational phase of the Project. However, although the measures outlined above will mitigate short term impacts, in the long term a solution for the disposal of contaminated soils must be found otherwise residual impacts will be medium.

G.5.4 Hydrology

Potential Impacts to Hydrology

Pre-construction Phase

610. The following potential impacts to hydrological conditions exist within the Project corridor:

- 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.
- 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.

611. 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

612. 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 (only around 5 piers will be constructed within the river itself). Surface water monitoring did not indicate any elevated levels of contamination in the groundwater of both the Dzirula or the Kvirila rivers as such it is considered highly unlikely that the river bed silt is contaminated by manganese or any other pollutant and will therefore not need to be disposed of as hazardous waste. No other pollution of riverbed sedimentation is anticipated as a result of the construction activities in the river.
613. 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.
614. Water Use – Technical water may be sourced from the Dzirula and Kvirila rivers. The required amounts, potentially 200 m³ per day (0.002 m³/s) are insignificant given the flow rates of these major rivers.
615. Tunnel Construction – Impacts associated with tunnel construction are discussed below.
616. 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.

Operational Phase

617. 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.
618. 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.

Mitigation and Management Actions

Pre-construction Phase

619. Drainage and Flooding - Consideration in the design phase has been 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. If, during the operational phase of the Project, the rehabilitated road does result in increased run-off and flooding, the RD will be responsible for rectifying this issue.
620. 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.
621. 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.
622. 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.
623. 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. 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.
624. 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, Kvirila and Borimela rivers. 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:
- 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.
 - 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, Kvirila and Borimela rivers. 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 (including wetlands).
- 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.
- Construction and work sites will be equipped with sanitary latrines that do not pollute surface waters.
- 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.
- Spill cleanup equipment will be maintained on site. 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. Disposal of such waste 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.

625. 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.

Construction Phase

626. 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.

627. 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**.

628. Bridge Construction - Concerning bridge construction works, the Contractor will:
- 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.
 - Carry out bridge construction works without interrupting the traffic on the Project 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 is dumped in the river.
 - 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.
 - 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.
629. 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.
630. Tunnel Construction - Mitigation associated with tunnel construction are discussed below.

Operational Phase

631. 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.
632. 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) Reinststate 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

633. Potential flood events are discussed above under the **Hydrology** section) and increased precipitation is discussed above under the section on **Climate Change**.
634. Generally, landslides in the Project area do not affect the project alignment, except for the mass movements identified above around KM 0.6 affecting TUN 4.0.01-TA/AT and its eastern and western portals. The impacts from the landslides are not considered significant enough to warrant major mitigation measures as part of the detailed design. However, minor mitigation measures e.g. safety nets have been included in the design.
635. 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.

Mitigation and Management Actions

514. None required.

Residual Impact Significance

Construction Phase – NONE

No residual impacts are anticipated.

Operational Phase – NONE

G.6 Biodiversity

G.6.1 Flora and Fauna

Potential Impacts

636. The main concerns for impacts on ecological receptors are disturbances caused by site clearance/preparation, the spread of invasive species and contamination of feeding, breeding and resting habitats. Another concern is poaching due to a lack of regulation.

Site Clearance

637. 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.

638. 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.

639. Site clearance/preparation and movement of equipment results in the removal of top soil which can negatively influence several soil functions which are relevant in nature and environmental protection, e.g. carbon storage, and a decrease in biological activity.

640. 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.

641. Loss of habitat results in the loss of breeding, feeding and nesting sites for all species including highly mobile ones.

642. 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.

643. The Project road has been designed in such a way that 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 rivers. However, during the construction there may be some minor, short term fragmentation of habitat caused by access roads and other temporary facilities.

Pollution and Waste Generation

644. 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.
645. Pollution of the rivers can result in contamination of sites that may currently be suitable habitat for feeding and breeding of fish species.
646. Work Sites in and around Rivers – A number of bridges will be constructed across the 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.

Light Pollution

647. 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.

Lack of Regulation

648. 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.

Impacts on Ecosystems

649. 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.
 - (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. [E]
[SEP]
 - (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.

Impacts on Wildlife Habitat

650. 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. [L]
[SEP]
- (ii) Construction activities will result in generation of noise and dust which will drive wildlife away from areas surrounding the Project site.
- (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. [L]
[SEP]

651. 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. 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.

Protected Species

652. 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 Khrumulya (GRL – VU)

653. 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.

Mitigation and Management Measures

General Tree Protection

654. 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.

Cutting of Trees on Private Land

655. Compensation shall be paid to all affected tree owners as per the Project LARP.

Cutting of Trees in State Forest Fund Land

656. 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 F**.

657. A total of 7,232 trees have been identified in State Forest Fund areas. Of these, 204 are Georgian Red-listed species greater than 8cm in diameter and 411 are Georgian Red-listed species less 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.

658. 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 be 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.

659. 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.

660. 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

IUCN / GRL Species

661. Mitigation Measures are proposed in Table 78 below.

Table 78: 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 include 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 $\geq 1.5\text{m}$ 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 Gmelin – Caucasian Squirrel	• 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: • 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.
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	

Other Fauna

662. Table 79 below provides mitigation measures for other species

Table 79: Other Species Mitigation Measures

Species	Mitigation
<i>Fish</i>	• 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 determine 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.
<i>Reptiles &</i>	• Re-plantation will result in some habitat restoration. Reptile and

Amphibians (herpetofauna)	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

663. 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 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 Biodiversity Action Plan. 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. ^[L]_{SEP}
 - (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. [L]
[SEP]

- (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 into 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. [L]
[SEP]
- (vii) Noise and dust pollution should be managed using the specific noise and air quality mitigation measures outlined in this EIA.

Operational Phase

664. 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

TERRESTRIAL FLORA & FAUNA

Construction Phase – MINOR/MODERATE

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.

Operational Phase – 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

Construction Phase – MODERATE

A number of bridge piers will be constructed within the Dzirula 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 are disturbed by the Project works.

Operational Phase – 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 Forests and Protected Areas

Potential Impacts

665. No protected areas or forest reserves are located within the Project area. The nearest protected area to the Project road is the Ajameti Managed Reserve, which is located approximately 5 kilometers south west of the end point of the road and is unlikely to be impacted by Project works.

Management & Mitigation Actions

666. 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

667. 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. The main area that is likely to be impacted is portion around KM 5.5 close to Shorapani.

668. 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. Blocking of access routes will be temporary while structures, such as side drains and culverts, are constructed, however access via diversions or temporary access routes must be provided at all times.

669. The new alignment also crosses above and adjacent to the existing railway line at a number of locations. The bridge works above the railway line at KM 13.1 may cause specific issues due to its close proximity to railway. Specific attention needs to be paid by construction workers in this area to ensure that they are not involved with an accident on the line. In addition, the Contractor needs to take care to ensure that any construction equipment interferes with passing trains. Special care will also need to be undertaken when excavating the tunnel portal in this area to avoid rock falling on the tracks. Vibration from bridge piling may also affect the railways tracks.

670. Notwithstanding the above, the potential beneficial impacts to transport are significant. The road, when complete, will offer reduced travel times, smoother ride (resulting in less vehicle maintenance and less damage to perishable goods) and safer driving conditions.

Utilities

671. 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.

Mitigation and Management Actions

Transportation

672. To mitigate the potential impacts the Contractor will:

- Submit a Traffic Management Plan to local traffic authorities prior to mobilization and include the plan as part of his SEMP;
- Provide information to the public about the scope and schedule of construction activities and expected disruptions and access restrictions;
- Allow for adequate traffic flow around construction areas 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, should be maintained during the construction phase and rehabilitated at the end of construction.

673. 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 will need to 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.

674. To prevent potential environmental, health and safety issues arising whilst working in the area above the railway line at KM 6.3 and at Bridge BR 4.0.1.AT/TA, the Contractor will be responsible for the preparation of an Environmental, Health and Safety Method Statement for working in these areas. The statement shall address issues relating to:

- Restrictions relating to blasting;
- Excavation of the tunnel portal;
- Vibration impacts on tracks;
- Working above live tracks; and
- Coordination with GR.

Utilities

675. During construction all utilities in the Project area shall be kept operational, particularly during the winter months. Facilities 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 Method Statements for working around the railway line 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.

G.7.2 Land use

Potential Impacts

676. 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 to the north of Zestaphoni and the fact that large portions of the road run beneath ground reduces the level of resettlement and compensation.

677. Under ADB SPS (2009), the RD must prepare the Land Acquisition and Resettlement Plan (LARP). Then, the RD will implement the plan and acquire the land before the commencement of the construction works at any part of the site.

Management & Mitigation Actions

678. The key mitigation for land use is implementation of the LARP. For 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

Construction Phase – 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.

Operational Phase – NONE

No residual impacts are anticipated if the LARP is implemented correctly.

G.7.3 Waste Management

Potential Impacts

General Construction Waste

679. Road construction will inevitably generate solid and liquid waste products including:

- Inert waste – for example, concrete, metal, wood and plastics.
- Hazardous waste – acids and alkaline solutions, waste oils and oily sludge, batteries, and bitumen.

680. 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.

681. 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 80** indicates the main types of waste and an estimate of volumes (based on similar road construction projects).

Table 80: 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	1 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

682. 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.

Tunnel and Other Spoil Material

683. A large volume of spoil material will be generated from the tunneling works. Estimates provided by the Projects Tunnel experts indicate that as around 1,027,200 m³ of spoil material will be generated from the tunneling. Another 1,184,100 m³ of cut will be generated from excavation works on slopes, etc. Where practical the spoil will be re-used as embankment material. Estimates indicate that approximately 1,519,800 m³ can be re-used as embankment material, which would leave approximately 691,500 m³ as static balance.
684. Assuming that most of the embankments are located in the bypass area to the north of Zestaphoni, the average journey distance to transport the spoil material from tunnels to the embankment areas may be around 8 kilometers. To transport material to the embankment areas approximately 250,000 truck journeys will be required, or an average of 277 a day over the 30 month construction period.
685. Disposal of the static balance would require an area of 82,980 m² with a height of 10 meters if they were to be disposed of in one spoil disposal location. Preliminary investigations with the RD indicate that the spoil material could be re-used as embankment material at the Kutaisi Bypass where material is required to construct a further two lanes of the bypass. A field visit to the Kutaisi area did not indicate any sensitive land uses in this area which has already been acquired by the RD for the future construction works in this area. Disposal of spoil material in this location will require close coordination between the contractors of both projects and the RD. To transport this volume of material to Kutaisi Bypass over 115,250 truck journeys will be required, or an average of 128 per day over the 30 month construction period. The distance to the Kutaisi site is around 35.5 kilometers.

Mitigation and Management Actions

686. To ensure waste management is adequately controlled during both the construction and operational phase of the Project, the Contractor shall be responsible for a range of measures including:

Waste Management Plan (WMP)

687. The WMP shall include items relating to the safe handling and management of:

- Domestic waste
- Food waste
- Recycled Waste
- Plastic
- Metals
- Wood
- Construction Waste
- Hazardous Waste
- Liquid Waste

Recycling and Reuse

688. 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, approximately 1,519,000 m³ of spoil material will be re-used for embankments.

Storage of Hazardous Wastes

689. 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).

Waste Disposal

690. 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.

Waste Spoil Material

691. The responsibility for identifying the final disposal areas for tunnel and embankment spoil material identified above, lies with the Contractor. Initial consultations with the RD indicate that the remaining static balance of 691,500 m³ could be re-used at the Kutaisi Bypass. However, Spoil material from F4 will be generated at different times and in different volumes throughout the construction phase. At this stage of the Project the construction schedule for F4 is not known and as such it is not possible to draw up plans for the disposal of spoil material at Kutaisi bypass. If the Contractors for F4 and Kutaisi can, in coordination with RD, agree to re-use the materials F4 Contractor will be responsible for preparing a Spoil Disposal and Re-use Plan specifically for the Kutaisi

site. There are several important steps the Contractor should follow before temporary storage of spoil material can commence:

1. The Georgian EIA regulation states that the spoil storage areas shall be agreed with the local municipality and MoEPA.
2. As soon as the area is identified the MoEPA will request a Spoil Disposal Plan for Arrangement of Spoil Disposal Area and a Re-cultivation Plan from the Contractor. 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.
3. The plan will indicate:
 - a. The location of disposal area (layout, coordinates etc).
 - b. Agreement with the land owner.
 - c. Category of the land.
 - d. Distance from the surface water source.
 - e. Provide information on route of spoil transportation and means of transport (including routes avoiding, where possible, sensitive receptors).
 - f. Schedule of the timing of material transport (excluding night-time transport on local roads (but not the existing E-60) between 10pm and 6am).
 - g. Any necessary improvements to local roads to cater for the increased level and types of trucks using the roads.
 - h. The scheme of dumping.
 - i. The maximum height of disposed soil and anti erosion measures.
 - j. Describe re-cultivation of disposal area.
 - k. Provide coordinates of the spoil area.
 - l. Provide profile drawings of the spoil area.
 - m. Provide time stamped photographs of the pre-disposal site conditions.
4. 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.

692. If there is no agreement between the Contractors of F4 and the Kutaisi Bypass regarding the re-use of the materials the Contractor will be responsible for the preparation of a separate Spoil Disposal Plan for Arrangement of Spoil Disposal Area and a Re-cultivation Plan for a separate site which will be indicated and provided by the employer. 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.

693. Excavation for tunnels 4.0.01-AT/TA, 4.0.02-AT/TA and 4.0.03-AT/TA shall start at portals located adjacent to the existing road and as such materials can be moved directly from the portals to the disposal areas using the existing road. Tunnels 4.0.04-AT/TA, 4.0.05-AT/TA and 4.0.06-AT/TA are located north of Zestaphoni and Shorapani. 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.

694. It should be noted that by using Kutaisi bypass as a disposal location for the spoil, all truck journeys will have to pass through the urban centre of Zestaphoni.

Liquid Waste

695. The issue of liquid waste, including concrete sludge, camp run-off water, vehicle washing water, batching plant wastewater, etc., is discussed above under sections relating to **Hydrology** and **Construction Camps**.

Operational Phase

696. 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 & Batching Plants

Potential Impacts

697. 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:

Design and Siting

698. 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.

Concrete Batching Plants

699. 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).

Asphalt Plants

700. 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.

Temporary Storage Sites

701. 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

Construction Camps

702. 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.

703. 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.

704. 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.

705. 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.

706. 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.

707. 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**.

Concrete Batching Plants

708. 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.

Asphalt Plants

709. 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.

Temporary Storage Areas

710. 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 clearly 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

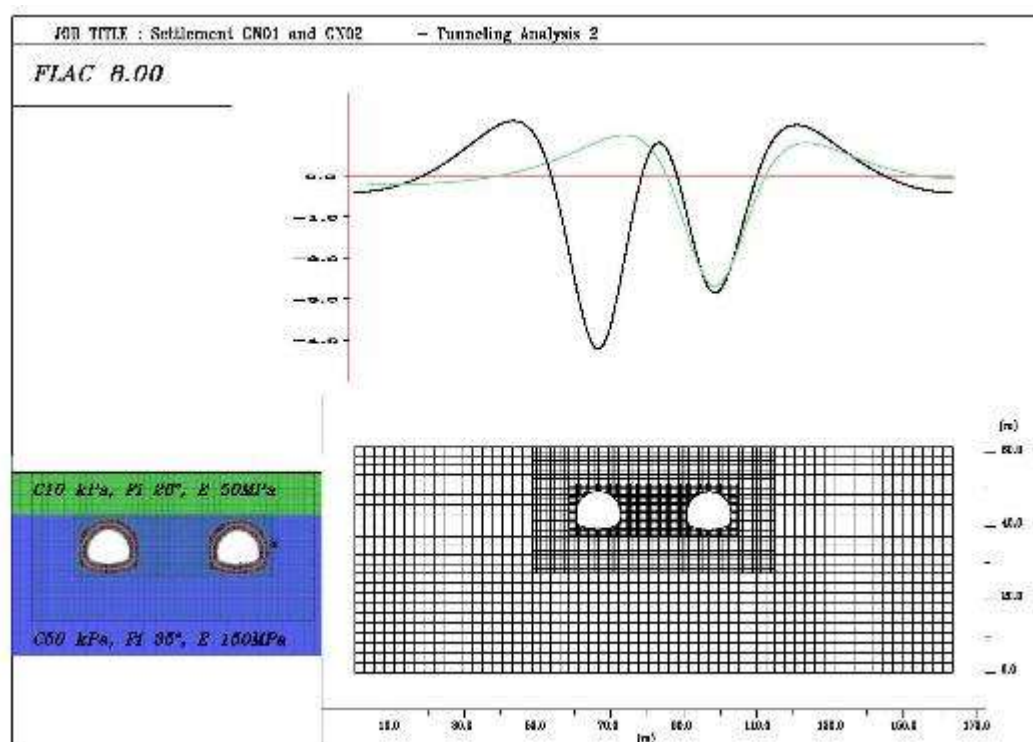
Potential Impacts

711. The main typical environmental problems linked to the construction of underground works are listed below:
- Triggering of surface settlements, structures collapses and slope instabilities
 - Drying up of springs and groundwater alterations
 - Storage and use of excavated materials (Addressed in **Waste Management** above).
 - Noise (Addressed in sections on **Noise** and **Vibration** below).
 - Vibrations (Addressed in sections on **Noise** and **Vibration** below).
 - Pollution of groundwater, mainly after the realization of stabilization works by injections.

Surface Settlements & Slope Instabilities

712. 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:
- Excavation technique.
 - Dimension and geometry of the excavation.
 - Type of excavated material.
713. There are six double tube tunnels in the F4 section. Analysis undertaken by the Detailed Design Team indicates that settlement of no more than 4.5mm will occur above all tunnels. **Figure 90** illustrates the anticipated settlement for Tunnel TUN 4.0.06 AT/TA, the least overburden.
714. This 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 and broken glass in windows as a result of vibration which is discussed below.

Figure 90: Settlement Analysis for Tunnel TUN 4.0.06 AT/TA



Dewatering

715. 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.

Drying up of Springs and Groundwater

716. 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 potential impact the flow of rivers and groundwater dependent trees. These phenomena can persist even after the tunnel construction if the final alignment is not completely waterproof.

Mitigation Measures

Drying up of Springs and Groundwater

717. The Contractor will develop 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. 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 Engineer 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 two 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 recharge to pre-construction levels new boreholes will be constructed for the affected persons.

Dewatering

718. 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

Construction Phase – MINOR

If the mitigation measures suggested are implemented residual impacts will be minor.

Operational Phase – 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

719. 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.

720. 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.

721. 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.

722. 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%.

723. 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.

724. 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.

725. 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 area including small roadside shops and restaurants in Zestaphoni. The level of trade with road users will fall, but they will still be able to provide their services to the local community.

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

726. 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

727. Potential impacts due to the proposed construction can be identified as follows:

Workforce, Jobseekers and Social Conflict.

728. 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.

Pressure on Social Infrastructure and Services.

729. 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.

Road Safety.

730. Construction of the Project Road will require a large amount of vehicle movements, locally and regionally. These may result in a slight increase in the total number of road traffic accidents between vehicles, pedestrians and vehicles and livestock and vehicles.

Air quality and noise.

731. Potential air and noise issues and their impacts to the local population are discussed above under items **Air Quality, Construction Camps and Batching Plants** and **Noise**.

Blasting

732. Depending in the rock type and explosive strength, rocks can go up to 50 m and can potentially damage structures. For the above reason, surface blasting or blasting near the mouth of the tunnel is not recommended.

Community Severance.

733. 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.

Operational Phase Impacts

Road Safety.

734. Pedestrian overpasses and underpasses have been proposed as part of the Detailed Design. This will help reduce road accidents involving pedestrians crossing the road. The improved road condition is also likely to lead to a reduction in traffic accidents.

Air Quality & Noise

735. These issues are discussed in detail under sections relating to **Air Quality** and **Noise**.

Mitigation and Management Measures

Pre-construction Phase

736. 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

Road Safety

737. The Contractor will be responsible for preparing a traffic management plan (TMP) for the construction phase of the Project. 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 any school.

Blasting

738. 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.

Community Severance

739. 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.

Social Conflicts.

740. 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.

741. 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.

G.8.3 Workers' Rights & Occupational Health and Safety

Occupational Health and Safety

742. 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.

Sexually Transmitted Diseases

743. See the section on **Community Health and Safety** for impacts and mitigation relating to STDs.

Worker Rights

744. 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

745. The Project is expected create more than 400 direct employment opportunities during the peak of the construction period, which will be approximately 30 months in duration. The majority of workers will be engaged by the Contractor and will consist of a semi-skilled to skilled workforce.

746. The expected impacts on worker rights and H&S as a result of construction, activities and Project operation are as follows:

- Risk to workers H&S due to hazardous construction activities; and
- Violation of workers' rights.

747. 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.

Mitigation Actions

748. An OHS Plan will be prepared by the Contractor to manage worker safety. 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.
 - (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.

749. 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.

750. 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

751. 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).

Mitigation Measures

Construction Phase

752. The Contractor will be responsible for preparation of an Emergency Response Plan (ERP) which will include sections relating to:

- Containment of hazardous materials;
- Oil and fuel spills;
- Fire, gas leaks and explosions;
- Work-site accidents; and
- Earthquake and other natural hazards.

753. 593. 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

754. As noted previously, no physical cultural resources have been identified within the Project corridor that are likely to be significantly impacted by Project works with the

exception of one cemetery identified approximately 50 meters south of tunnel TUN 4.0.06-AT/TA and a small natural spring located to the north of the GAA.

755. It is possible, given the rich cultural heritage of Georgia, that chance finds could occur during excavation works, particularly to the north of Zestaphoni.

Mitigation Actions

756. The cemetery identified above is unlikely to be impacted by construction works, however, it is required that during the construction phase the northern boundary of the cemetery be fenced off to ensure that there is no encroachment into this area by construction workers or equipment.

757. According to the detailed design, the road at KM10.1 will pass within 15 meters of the natural spring. However, the road will be elevated in this area and a high embankment will be constructed that will extend out almost adjacent to the spring. A short section of noise barrier, around 20 meters is recommended in this area so that people may continue to use this spring. In addition, during the construction works the spring shall be fenced on the northern side to prevent construction works impacting upon the spring.

758. 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

Construction Phase – MINOR

If the mitigation measures suggested are implemented residual impacts will be minor.

Operational Phase – NONE

G.8.6 Visual Impact

Potential Impacts

759. 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.

760. 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.

761. 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.

762. However, when in place, the new alignment will change the landscape substantially. The elevated interchanges and retaining walls in some sections, along with areas of cut slopes will impact upon the view along the valley.

763. 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.

764. Management & Mitigation Measures

765. Tree re-planting, as indicated under the section on **Flora and Fauna**, 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 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.

G.8.7 Vibration

766. Vibration from 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.

767. The effects of vibration can be assessed as:

- General annoyance, sleep disturbance, etc;
- Potential cosmetic damage to properties; and
- Potential structural damage to properties.

768. The sources of vibration can broadly divided into two parts:

1. Vibration Impact of Construction Activities on the Surface (General construction works including construction equipment movement, pile driving, compaction, hammering (hydraulic or pneumatic), operation of batching plant and generators, etc.); and

2. Vibration Impact of Tunnel Construction.

769. The propagation of vibration from construction activities are different in nature from the vibration from tunneling. The construction activities are undertaken essentially on ground surface and spreads basically as two-dimensional waves. In contrast, the tunneling is undertaken below the surface and spreads in three-dimension. For this reason, the impact of the two is assessed separately.

770. The proposed criteria for damage to buildings are shown in **Table 81**. These are derived from British Standard BS 6472 and are German Standards DIN 4150-3:1999.

Table 81: Criteria for Structural Damage Due to Vibration

No Damage Likely	PPV < 5 mm/s
Cosmetic Damage Risk	PPV 5 to 15 mm/s
Structural Damage Risk	PPV > 15 mm/s

Vibration Impact of General Construction Activities on the Surface

771. **Table 82** provides an indication of the approximate vibration levels that may be expected for various vibration sources.

Table 82: Approximate Vibration Levels for Various Sources ³⁶

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 (levels typical of a large rock breaker operating in hard sandstone)	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
Pile driving/removal	1 to 3 mm/s at distances of 25 m to 50 m depending on soil conditions and the energy of the pile driving hammer
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 (smooth road 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

³⁶ Northern Expressway Environmental Report: Noise and Vibration technical Paper. 2007.
http://www.southroad.sa.gov.au/_data/assets/file/0019/13780/Noise_and_Vibration_Technical_Paper.pdf

772. These levels are well below the threshold of any possibility of damage to structures due to vibrations from typical construction activities related to roller, compactors, and movement of construction equipment.

Vibration Impact of Bridge Construction

773. The piling for the bridge piers are likely to generate relatively more vibrations which depends on soil condition. However, even under extreme conditions, the vibration is unlikely to exceed 10 mm/s beyond 25 m. The following presents a summary of the properties within 25 meters of each bridge:

- BRI 4.1.01-AT/TA – No properties.
- BRI 4.1.02-AT/TA - Potentially one residential property and a road side restaurant are located within 25 meters. The restaurant will most likely be demolished to accommodate the bridge.
- BRI 4.1.03-AT/TA - No properties.
- BRI 4.1.04-AT/TA – No residential properties are located within 25 meters of the piers. However, several commercial and light industrial properties are located beneath the bridge. These may be need to be removed to accommodate the bridge.
- BRI 4.1.05-AT/TA – Four properties identified.

Vibration Impact of Tunnel Construction

774. The main cause for concern in these tunnel areas is vibration nuisance for residents. In these tunnels (hard rock: porfirites) two tunneling techniques could potentially be used, blasting, or hydraulic hammering. Blasting is intermittent, with pauses between each blast to remove rock and set charges for the next blast. On the other hand hydraulic hammering is continuous causing uninterrupted vibration.

775. Tunnels TUN 4.0.06 AT/TA (and the last portion of TUN 4.0.05 AT/TA have less overburden and the potential vibration impacts could be greater than at the other tunnels. As such the use of the rod header which is the technology that minimize the vibrations during excavation is recommended. This technique is possible because the rock is softer in this area than in the other portions of the road (calcarenites).

776. In addition to the above, a basic analysis of the vibration impacts around the end portion of TUN 4.0.05 AT/TA and all of TUN 4.0.06 AT/TA was undertaken by the design team. The analysis indicated that levels of impact in these areas was reduced for standard buildings due to the proposed excavation technique and the attenuation provided by the cushion of weathered rock and arable/vegetal soil in this area. In addition, the type of foundations of the buildings, shallow and small, will be an additional damping factor. On the other hand, the quality of the buildings in this area is poor, there are frequent “voluntary additions” such as terraces, and patios which are not properly built; these elements could be more sensitive to vibrations. However, the basic analysis suggests that the level of threshold, above 5 mm/s should not be reached for long periods and the peak energy of excavation should not produce vibrations able to reach the buildings with intensity and frequency in the damaging range.

777. The vibration study carried out by the Design Teams vibration expert is provided by **Appendix I** of this EIA Report. The conclusion of this study is summarized below:

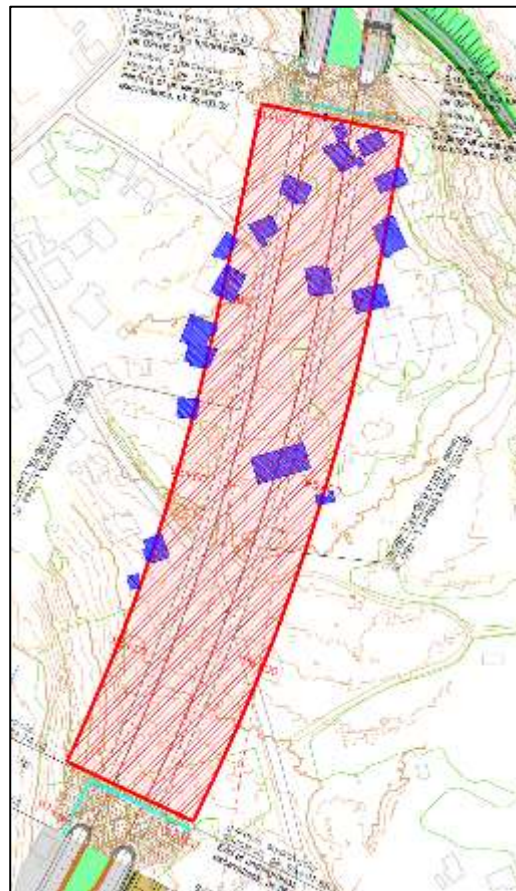
- The vibrations generated at the source will propagate with velocity of 10 mm/s;
- The vibration will travel in 2 meters of weathered calcarenite and 5 meters of alluvial soil (which present a much lower stiffness);
- In this superficial layer the vibrations will be strongly attenuated and the expected value at the surface will be 5-4 mm/s;

- At this point the coupling with the foundations will generate a further damping effect whose amount depends on the type of foundation.

778. For the above consideration an area of influence has to be considered with a distance from the source of 20 meters (total width about 75 meters) also in consideration of the poor quality of the building.

779. Following the conclusions of the vibration study it is recommended to proceed with photo-documentation of the state of the buildings, to avoid conflicts with the population and to set up a couple of monitoring stations to have reference data to provide in case of controversy (see **Figure 91**).

Figure 91: Area of influence and buildings potentially affected by excavation of tunnel TUN 4.0.06 AT/TA



780. The Contractor will be in charge of monitoring vibration in the potentially impacted area under supervision by the Engineer and RD. The procedure of initial survey, monitoring during construction and managing of the possible claim of the household, as well as the competence and responsibility is described below.

Potential Operational Vibration Impacts

781. 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.”³⁷

Mitigation Measures

Construction Phase

782. The following phased mitigation measures for construction induced vibration are recommended:

Tunnels - TUN 4.0.01 AT/TA, TUN 4.0.02 AT/TA, TUN 4.0.03 AT/TA, TUN 4.0.04 AT/TA (potentially TUN 4.0.05 AT/TA)

1. 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 surveys undertaken (see below for survey requirements). The TBP will also include a vibration monitoring plan to monitoring vibration levels and frequency around the blasting sites. The objectives of the monitoring will be to:
 - a. Ensure that vibration levels in the communities are within the adopted criteria levels;
 - b. Maintain record of vibration to settle any potential conflicts; and
 - c. Monitor changes in the vibration levels due to possible changes in the rock formation and take appropriate corrective actions.

Vibration data will be documented, reviewed, and preserved by the Contractor. It will be regularly shared with the Engineer, RD, ADB, ministry of Environment and the community as part of the monthly progress report.

2. A survey will be undertaken within a 250 meter corridor of tunnel TUN 4.0.02-AT/TA to determine the pre-blasting conditions of all buildings within the corridor. This tunnel is one of the most remote tunnels with a very low number of properties within 250 meters. The survey will be commissioned by the Contractor at his own charge and will identify and record any existing damage to the structures. The survey will cover the following aspects:
 - a. Overall condition of the structures, both exterior and interior;
 - b. Documentation of defects observed in the structure using digital imagery along with notes, measurements and sketches; and
 - c. Documentation of pre-existing cracks using digital imagery along with notes, measurements and sketches.

The survey will be accompanied with consultations with the affected household to explain the extent and reason for the survey, confirm the findings of the survey (affected households shall sign the survey form saying they agree with the findings) and the process for reporting any grievances regarding vibration impacts. The households will be provided with materials that summarize the grievance redress process. If the households do not allow the survey they shall be informed by the Contractor that they will not be authorized in the future to claim any damage.

3. Tunneling shall then start from tunnel TUN 4.0.02-AT/TA at its western portal. In the initial stages, the blasting induced vibration shall be measured as a function of maximum instantaneous charge and distance from the blasting site. This data shall be then used to define damage risk zones in damage risk maps.

³⁷ http://www.fhwa.dot.gov/environMent/noise/regulations_and_guidance/analysis_and_abateme nt_guidance/polguide09.cfm

4. Using the damage risk map and the tunnel boring schedule, the Contractor in consultation with the RD and the Engineer, will identify the houses that are likely be affected and the impact duration and schedule. As noted above there is assumed no risk of structural damage for the houses, but the pressure of the blasting could cause some cosmetic damages, mainly relating to the breaking of windows. Before start of blasting, all residents shall be informed of the exact hour of the blasting and they will be invited to open the windows in order to avoid them breaking.
5. With respect to blasting the following are key recommended mitigation measures:
 - a. No blasting will be carried out within 100 m of the portal of any tunnel.
 - b. Blasting will be scheduled during the day only.
 - c. 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.
6. Both during and after the tunnel excavation if any damage to properties is reported by the property owners the survey will be repeated to ascertain that the blasting is the cause of the damage comparing the damage with the previous survey. If this is the case, the Contractor will repair the damage and the cost will be on charge of the RD. If the Contractor has no previous survey to compare the cost of the repairs will be with him.
7. If the damages are significantly more than what expected, the Contractor shall change the method of blasting (decreasing the energy of blasting) or if this is ineffective, cease blasting and employ another less invasive method (rod header).
8. Regarding vibration nuisance it is strongly recommended that hydraulic hammering not be used in order to limit constant vibration nuisance. If the Contractor decides to use this method and substantial complaints are received from the community, the Contractor will be obliged to use an alternative technique.
9. In addition the following measures shall be applied relating to tunnel blasting;
 - a. No blasting will be carried out within 100 m of the portal of the tunnel;
 - b. Blasting will be scheduled during the day only; and
 - c. 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.

Tunnels - TUN 4.0.06 AT/TA (potentially TUN 4.0.05 AT/TA)

1. The Contractor will develop a detailed Tunnel Excavation Plan (TEP) for each tunnel as part of the overall construction schedule. The TEP shall follow exactly the same procedures as the TEP for the tunnels mentioned above, but shall include assessment shall include surveys of structural damage.
2. Despite the fact that the basic vibration analysis has indicated that blasting should not have significant impacts in this area, it is recommended that the tunneling technique be limited to the use of the rod header to minimize the vibrations during excavation and ensure no structural damage.

Bridges

783. It is noted that only a few properties will potentially suffer cosmetic damage from bridge piling works. It is however recommended that the Engineer undertakes cosmetic condition surveys of all properties within 50 meters of bridge piles as per the vibration surveys recommended above for the tunnels. If there are any claims or reports of damage the affected house will be surveyed against the pre Project survey and repairs will be undertaken as appropriate by the Contractor.

Residual Impacts

Construction Phase – MINOR / MODERATE

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

784. The potential noise related issue during construction of the project is disturbance to sensitive receptors in the Project area.

785. 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.

786. 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.

787. 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.

788. 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.

789. 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 83. The list includes all equipment except vehicles and some minor pieces of equipment.

Table 83: 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

790. Source: Source: Batumi Bypass EIA. ADB 2017.

791. Using this data, the expected noise level, $Leq(8\text{-hr})$, is calculated. The predicted noise levels at 100 m from the source are shown in Table 84. 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 84: Predicted Noise Level for Construction Equipment (dBA)

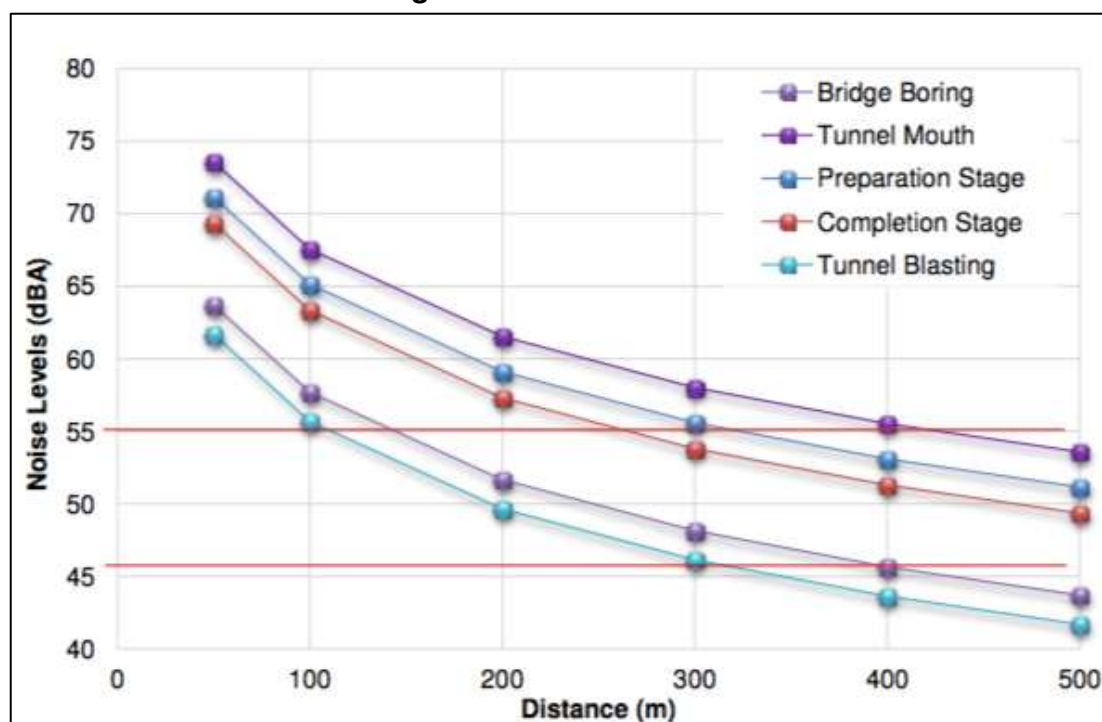
Equipment	Actual Max	Usage Factor (%)	Leq (dBA) at Various Distance					
			50m	100m	200m	300m	400m	500m
Road – Preparation Stage								
Dozer	81.7	30	64.2	58.1	52.1	48.6	46.1	44.2
Excavator	80.7	30	63.2	57.1	51.1	47.6	45.1	43.2
Grader	85	30	67.5	61.4	55.4	51.9	49.4	47.5
Roller	80.0	15	59.4	53.4	47.4	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

Equipment	Actual Max	Usage Factor (%)	Leq (dBA) at Various Distance					
			50m	100m	200m	300m	400m	500m
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

792. 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 92. Following assumptions were made during calculation:

- 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. [L] [SEP] Blasting will not be used for excavation at the tunnel mouth and portal. [L] [SEP]
- Boring is used for bridges whereas the jack hammer is used for tunnel mouth. [L] [SEP]
- 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. [L] [SEP]

Figure 92: Construction Noise



793. 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.

794. 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

795. 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.

796. 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

797. 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 exceedance 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 something 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

636. To assess the impacts of operational noise within the Project area a noise model has been prepared.

798. 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.

799. 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:

- Knowledge of the noise source, or sources, for which associated environmental noise levels are of interest.
- 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).
- 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).

800. 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:

801. Information considered in the development of the model - **Table 85** shows the requirements for specifying a noisy environment:

Table 85: 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)
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).

802. 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.

803. In the 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.

804. To calculate the propagation the algorithm takes into account:

- The absorption associated with the propagation of noise through the atmosphere **(very low due to the short distance)**
- 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).**
- 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).**
- 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).
- 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).

Variability

805. 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 86: 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 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 our case due to linear modelization of traffic)

Algorithms for Outdoor Sound Propagation

806. 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 Methode du Presion du Bruit - Routes 2008” and the following norms:

- Industrial Noise
 - ISO 9613 incl. VBUI (International, EC-Interim)
 - CONCAWE (International)
 - VDI 2714, VDI 2720 (Germany)
 - DIN 18005 (Germany)
 - ÖAL Richtlinie Nr. 28 (Austria)
 - BS 5228 (United Kingdom)
 - Nordic General Prediction Method (Scandinavia)
 - NORD 2000 (Scandinavia)
 - Ljud från vindkraftverk (Sweden)
 - Harmonoise, P2P calculation model (International)
 - NMPB08 - Industry (France)
 - CNOSSOS-EU (2014)
- Road Noise
 - NMPB-Routes-96 (France, EC-Interim)
 - RLS-90, VBUS (Germany)
 - DIN 18005 (Germany)
 - RVS 04.02.11 (Austria)

- STL 86 (Switzerland)
- SonRoad (Switzerland)
- CRTN (United Kingdom)
- TemaNord 1996:525 (Scandinavia)
- Czech Method (Czech Republic)
- NMPB-Routes-08 (France)
- TNM (USA)
- CNOSSOS-EU (2014) Industrial Noise

Standards, regulations and guidance notes

807. The following standards, regulations and guidance notes have been considered as part of the model:

- ISO 9613-2, Acoustics — Attenuation of sound during propagation outdoors Part 2: General method of calculation.
- BS 4142, Method for rating industrial noise affecting mixed residential and industrial areas.
- 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.
- BS 7445, Description and measurement of environmental noise.
- IPPC H3 Horizontal Noise Guidance. Part 1 'Regulation and Permitting' and Part 2 'Noise Assessment and Control'.
- Calculation of Road Traffic Noise 1988, Department of Transport, Welsh Office.
- Calculation of Railway Noise 1995. Department of Transport.
- The CAA Aircraft Noise Contour Model: ANCON Version 1. DORA Report 9120, Civil Aviation Authority 1992.
- PPG 24 Planning Policy Guidance: Planning and Noise. Department of the Environment 1994. TAN11 (Wales); PAN56 (Scotland).
- BS 9142: 2006 Assessment methods for environmental noise — Guide, 2003/01534 12 July 2006.

Simulation parameters

808. 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.

809. To model noise, the design study of the new road design and detailed traffic forecasts immediately after construction and for the next 20/25 years have been taken into account.

810. Modelling of noise level was performed using 2037 traffic flow for Day and Night time as provided in the Engineering Design documents package with a difference between day and night of 70% for light vehicles and 30% for trucks.

Table 87: Daily average vehicles/day (working day) (2017 – 2037)

Year	Car	Mini Buses<15, PickUps	Buses & Trucks	Trailers & > 3 axels	Total
	65,6%	17,0%	11,9%	5,5%	

Year	Car	Mini Buses<15, PickUPs	Buses & Trucks	Trailers & > 3 axels	Total
	65,6%	17,0%	11,9%	5,5%	
2017	13,335	3,448	2,410	1,116	20,310
2018	14,002	3,621	2,521	1,167	21,311
2019	14,757	3,816	2,645	1,225	22,443
2020	15,636	4,043	2,790	1,292	23,761
2021	16,663	4,309	2,958	1,369	25,298
2022	17,753	4,591	3,135	1,452	26,930
2023	18,712	4,838	3,290	1,523	28,364
2024	19,722	5,100	3,453	1,599	29,874
2025	20,550	5,314	3,586	1,660	31,111
2026	21,414	5,537	3,724	1,724	32,399
2027	22,313	5,770	3,868	1,791	33,741
2028	23,172	5,992	4,010	1,856	35,030
2029	24,064	6,222	4,157	1,925	36,368
2030	24,858	6,428	4,288	1,985	37,559
2031	25,679	6,640	4,423	2,048	38,790
2032	26,526	6,859	4,563	2,112	40,060
2033	27,401	7,085	4,706	2,179	41,372
2034	28,306	7,319	4,855	2,247	42,727
2035	29,240	7,561	5,007	2,318	44,126
2036	30,205	7,810	5,165	2,391	45,571
2037	31,201	8,068	5,328	2,467	47,064

811. 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:

- 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);
- Full amortization of the old vehicles; and
- 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).

Numeric model

812. The forecast of noise emissions on 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.

Receptors to be investigated

813. 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.

Traffic forecasts

814. 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.

815. 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 the table below.

Table 88: Traffic Flux Per Day, 2017

Year	Car	Mini Buses<15, PickUPs	Buses & Trucks	Trailers & > 3 axles	Total
2017	13335	3448	2410	1116	20310

816. 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.

817. 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.

818. 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.

819. 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 89**). 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 89: 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

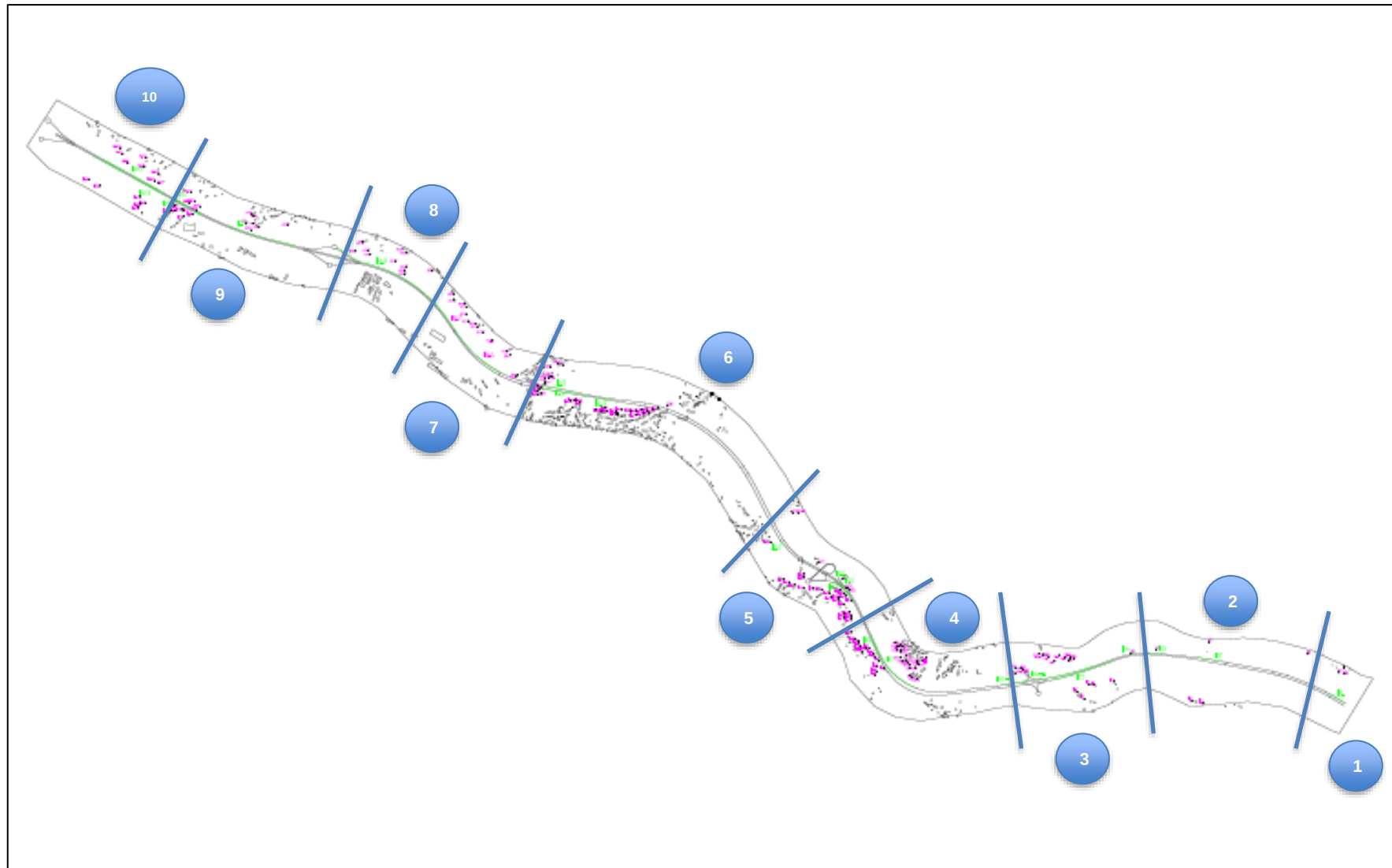
Year	Car (70%)	Mini Buses<15, PickUP (30%)s	Buses & Trucks(30%)	Trailers & >3 axle (30%)s	Total
2021	11664,1	1292,7	887,4	410,7	14254,9
2022	12427,1	1377,3	940,5	435,6	15180,5
2023	13098,4	1451,4	987	456,9	15993,7
2024	13805,4	1530	1035,9	479,7	16851
2025	14385	1594,2	1075,8	498	17553
2026	14989,8	1661,1	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
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

Modeling Results

820. The first step in the analysis of noise levels 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. Instrumental noise monitoring at each potential noise receptor in the Project corridor to determine ambient conditions is not possible and as such the noise model also included the baseline scenario showing the current noise levels in the Project corridor. This baseline was achieved by analyzing the most recent instrumental noise monitoring results (April and May 2019) in the locations they were measured and the traffic volumes on the existing roads.

821. For the purpose of the analysis the model has been divided into set portions as shown in Figure 93.

Figure 93: Noise Model Road Portions



822. The following tables show the results for different portions of the Project road for daytime and nighttime periods. Green cells represent compliance with daytime and nighttime IFC guideline limits, blue cells represent those receptors within 1 dB of the IFC guideline limits, orange cells represent receptors within 3 dB of the IFC guideline limits and red cells represent receptors more than 3 dB above IFC guideline limits. Yellow cells represent receptors that will be expropriated as part of the Project (per Project LARP) and Purple cells are commercial properties.

Table 90: Portion 1 Predicted Noise Levels

Receivers	Base Line		Year 1 (2024)		Year 10 (2033)		Year 15 (2038)	
			Vehicles=5061 Car= 70% Other=30% Speed vehicles= 80 km/h		Vehicles=9871 Car= 70% Other=30% Speed vehicles= 80 km/h		Vehicles=11774 Car= 70% Other=30% Speed vehicles= 80 km/h	
	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)
R1	49	39	51	42	53	45	54	45
R2	50	41	52	43	53	44	54	45
R3	37	28	43	35	46	38	46	38
Total Above IFC Limit	0	0	0	0	0	0	0	0

Table 91: Portion 2 Predicted Noise Levels

Receivers	Base Line		Year 1 (2024)		Year 10 (2033)		Year 15 (2038)	
			Vehicles=5061 Car= 70% Other=30% Speed vehicles= 80 km/h		Vehicles=9871 Car= 70% Other=30% Speed vehicles= 80 km/h		Vehicles=11774 Car= 70% Other=30% Speed vehicles= 80 km/h	
	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)
R4	52	51	57	53	60	54	60	55
R5	62	61	66	62	68	63	68	64
R6	39	38	70	62	73	65	74	66
L1	22	21	26	22	28	23	28	24
L2	24	22	27	23	29	25	30	25
Total Above IFC Limit	0	1	1	0	1	1	1	1

Table 92: Portion 3 Predicted Noise Levels

Receivers	Base Line		Year 1 (2024) Vehicles=5061 Car= 70% Other=30% Speed vehicles= 80 km/h		Year 10 (2033) Vehicles=9871 Car= 70% Other=30% Speed vehicles= 80 km/h		Year 15 (2038) Vehicles=11774 Car= 70% Other=30% Speed vehicles= 80 km/h	
	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)
R7	52	52	59	54	62	55	62	56
R8	51	50	57	52	60	54	60	55
R8	53	52	58	54	61	55	62	56
R10	50	49	55	51	58	52	58	53
R11	51	50	56	52	59	54	60	54
R12	52	51	57	52	59	54	60	54
R13	55	54	59	55	61	56	62	57
R14	54	53	58	54	60	55	61	56
R15	53	52	57	53	60	55	60	55
R16	53	52	57	53	59	54	59	55
R17	53	52	56	53	58	54	59	54
R18	65	64	66	65	67	66	67	66
R19	63	62	63	62	64	63	65	63
R20	66	65	66	65	67	66	68	66
R21	44	43	58	51	62	54	62	54
R22	36	35	57	49	61	53	61	53
L3	42	41	51	45	54	47	55	48
L4	40	39	47	41	50	44	50	44
L5	43	42	48	44	51	46	52	46
L6	31	30	49	41	53	45	53	45
L7	43	42	56	49	59	51	59	52
Total Above IFC Limit	3	14	12	2	14	8	14	9

Table 93: Portion 4 Predicted Noise Levels

Receivers	Base Line		Year 1 (2024) Vehicles=5061 Car= 70% Other=30% Speed vehicles= 80 km/h		Year 10 (2033) Vehicles=9871 Car= 70% Other=30% Speed vehicles= 80 km/h		Year 15 (2038) Vehicles=11774 Car= 70% Other=30% Speed vehicles= 80 km/h	
	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)
R22	39	39	57	50	61	53	61	53
R23	56	55	58	55	59	56	60	57
R23	56	55	58	56	60	57	60	57
R23	57	56	59	57	60	57	61	58
R24	57	56	59	56	60	57	61	58
R24	57	56	59	57	61	58	61	58
R24	58	57	60	57	62	58	62	59
R25	56	55	58	56	60	57	60	57
R25	57	56	59	56	61	57	61	58
R25	57	56	59	57	61	58	62	58
R26	54	53	56	53	58	54	58	55
R27	54	53	58	54	60	55	60	56
R28	54	53	57	54	59	55	60	55
R29 H	52	51	53	51	54	52	54	53
R29 H	53	52	53	52	55	53	55	53
R30	53	52	54	52	55	53	56	53
R31	51	50	53	51	54	51	55	52
R32	41	40	45	41	48	43	48	43
R33	54	53	58	54	60	55	60	56
R34	54	53	58	54	60	56	61	56
R35	54	54	58	55	61	56	61	56
R36	54	53	57	54	60	55	60	55
R37	51	50	55	51	58	53	58	53

Receivers	Base Line		Year 1 (2024) Vehicles=5061 Car= 70% Other=30% Speed vehicles= 80 km/h		Year 10 (2033) Vehicles=9871 Car= 70% Other=30% Speed vehicles= 80 km/h		Year 15 (2038) Vehicles=11774 Car= 70% Other=30% Speed vehicles= 80 km/h	
	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)
R38	52	51	56	52	59	54	59	54
R39	51	50	55	51	58	53	58	53
R40	54	53	58	54	61	55	61	56
R41	52	51	56	52	59	54	59	54
R42	51	50	55	51	58	53	59	53
R43	49	48	54	50	57	51	57	52
R44	53	52	57	53	60	55	60	55
R45	49	48	54	49	57	51	57	52
L8	59	59	69	63	72	65	73	66
L9	51	50	55	51	57	53	57	53
L10	48	47	53	49	56	50	56	51
L11	44	43	50	45	53	47	53	47
L12	62	61	68	63	71	65	72	66
L13	57	56	62	58	65	59	65	60
L14	55	54	59	56	62	57	62	57
L15	42	41	45	42	47	43	48	44
L16	40	39	43	40	45	42	46	42
L17	50	49	53	50	55	51	56	52
L18	40	39	43	40	45	41	46	41
L19	38	37	41	38	44	39	44	40
L20	35	34	39	35	41	37	42	37
L21	33	32	37	33	39	35	40	35
L22	33	32	36	33	38	34	39	34
L23	38	37	41	38	44	39	44	40

Receivers	Base Line		Year 1 (2024)		Year 10 (2033)		Year 15 (2038)	
	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)
L24	41	40	44	41	46	42	47	43
L25	40	39	43	40	46	41	46	42
L26	41	40	45	41	48	43	48	43
L27	30	29	34	30	37	32	38	32
L28	31	30	36	32	38	33	39	34
Total Above IFC Limit	10	30	10	2	28	3	32	6

Table 94: Portion 5 Predicted Noise Levels

Receivers	Base Line		Year 1 (2024)		Year 10 (2033)		Year 15 (2038)	
	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)
R46	64	63	68	64	70	66	71	66
R47	57	56	63	59	66	60	67	61
R48	53	52	62	56	66	59	66	59
R49	33	32	52	44	55	48	56	48
R50	42	41	55	48	58	51	58	51
R51	42	41	48	43	51	45	51	45
R52	43	42	48	43	50	45	51	45
L29	38	37	46	40	49	42	49	43
L30	60	59	66	61	69	63	69	63
L31	47	46	53	48	56	50	56	50
L32	61	60	67	62	69	64	70	64

L33	43	42	51	45	54	47	54	48
L34	45	44	53	47	56	49	56	50
L35	53	52	61	55	64	57	64	58
L36	40	39	50	44	54	46	54	47
L37	43	42	52	46	55	49	56	49
L38	51	50	56	52	58	53	59	53
L39	54	53	57	54	59	55	59	56
L40	50	49	57	52	60	54	61	55
L41	43	43	57	50	61	53	61	54
L42	53	52	57	53	59	55	60	55
L43	57	56	59	57	61	58	61	58
L44	59	58	60	58	61	59	61	59
L45	59	58	60	58	61	59	62	59
Total Above IFC Limit	7	12	8	4	12	12	15	13

Table 95: Portion 6 Predicted Noise Levels

Receivers	Base Line		Year 1 (2024)		Year 10 (2033)		Year 15 (2038)	
			Vehicles=5061 Car= 70% Other=30% Speed vehicles= 80 km/h		Vehicles=9871 Car= 70% Other=30% Speed vehicles= 80 km/h		Vehicles=11774 Car= 70% Other=30% Speed vehicles= 80 km/h	
	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)
R53	54	44	54	45	55	46	56	46
R54	36	33	61	53	65	57	65	57
R55	35	32	57	49	61	53	61	53
R56	34	31	54	46	57	49	58	50
R57	33	31	52	44	55	47	56	48
R58	33	30	56	48	59	51	60	52
R59	31	28	52	44	55	47	55	47

Receivers	Base Line		Year 1 (2024)		Year 10 (2033)		Year 15 (2038)	
	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)
R60	30	27	52	44	55	47	56	48
R60	29	26	50	42	53	45	53	45
R61	27	24	44	36	48	40	48	40
R61	28	25	44	37	48	40	48	40
R62	29	25	58	50	62	54	62	54
R63	32	29	49	41	52	44	52	45
R64	27	22	45	37	49	41	49	41
R65	28	25	43	35	46	38	47	39
R66	27	24	37	29	40	32	40	33
L46	47	46	52	48	55	49	55	50
L47	36	27	43	35	46	38	47	39
L48	37	31	39	32	41	34	42	35
L49	45	42	46	43	46	43	47	44
L50	46	36	47	37	47	38	48	38
L51	62	60	62	60	62	60	63	61
L52	51	49	52	50	53	51	53	51
L53	51	49	51	49	52	50	53	50
L54	51	49	51	49	51	50	52	50
L55	46	45	47	45	49	46	49	46
L56	31	25	41	33	44	36	45	37
L57	30	26	38	31	42	34	42	34
L58	40	38	41	39	43	39	44	40
L59	36	33	40	35	43	37	43	37
L60	31	25	46	38	49	41	50	42

Receivers	Base Line		Year 1 (2024)		Year 10 (2033)		Year 15 (2038)	
	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)
L61	43	41	45	42	46	43	47	43
L62	30	27	39	32	43	35	43	35
L63	24	20	53	45	57	49	57	49
L64	26	20	59	51	63	55	63	55
L65	23	20	59	51	62	54	62	54
L66	22	20	58	50	61	53	62	53
L67	26	24	56	48	59	51	60	52
L68	33	31	47	39	50	42	50	43
L69	35	33	53	45	57	49	57	49
L70	37	35	55	48	59	51	59	51
Total Above IFC Limit	1	4	8	10	12	15	15	16

Table 96: Portion 7 Predicted Noise Levels

Receivers	Base Line		Year 1 (2024)		Year 10 (2033)		Year 15 (2038)	
	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)
R66	31	28	42	34	45	37	45	38
R67	16	13	43	35	47	39	47	39
R68	16	13	44	36	48	40	48	40
R69	17	15	41	33	45	36	45	37
R70	17	15	42	34	45	37	45	37

Receivers	Base Line		Year 1 (2024)		Year 10 (2033)		Year 15 (2038)	
	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)
R71	14	12	48	40	52	43	52	44
R72	12	10	51	43	54	46	55	47
R73	10	8	53	45	56	48	57	48
R74	11	8	52	44	56	48	56	48
R75	10	8	55	47	58	50	59	51
R76	10	7	53	45	57	48	57	49
R77	10	7	53	45	56	48	57	49
R78	10	7	53	45	57	49	57	49
R79	10	7	54	46	58	49	58	50
R80	11	8	50	42	54	46	54	46
Total Above IFC Limit	0	0	0	2	7	9	7	9

Table 97: Portion 8 Predicted Noise Levels

Receivers	Base Line		Year 1 (2024)		Year 10 (2033)		Year 15 (2038)	
	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)
R81	9	6	52	44	56	48	56	48
R82	7	5	57	49	61	52	61	53
R83	9	6	55	47	58	50	59	51
R84	9	7	52	44	56	48	56	48
R85	12	6	53	45	56	48	57	48

Receivers	Base Line		Year 1 (2024)		Year 10 (2033)		Year 15 (2038)	
	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)
R86	9	6	50	42	53	45	54	46
R88	12	8	57	49	61	53	61	53
R89	12	9	54	46	57	49	58	50
R90	10	8	56	48	60	52	60	52
R91	11	6	48	40	52	44	52	44
	0	0	3	5	8	8	8	9

Table 98: Portion 9 Predicted Noise Levels

Receivers	Base Line		Year 1 (2024)		Year 10 (2033)		Year 15 (2038)	
	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)
R92	11	7	50	42	54	46	54	46
R93	12	8	54	46	58	50	58	50
R94	12	9	55	47	58	50	59	51
R95	14	10	57	49	61	53	61	53
R96	13	10	56	48	59	51	60	52
R97	11	9	54	46	58	50	58	50
R98	11	9	53	45	57	49	57	49
R99	24	22	59	51	63	55	63	55
R100	17	15	55	47	59	51	59	51
R101	27	24	59	51	63	55	63	55
R102	25	23	58	49	61	53	61	53
R103	30	28	55	47	59	51	59	51

Receivers	Base Line		Year 1 (2024)		Year 10 (2033)		Year 15 (2038)	
	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)
L71	19	17	54	46	57	49	58	50
L72	18	16	50	42	54	46	54	46
L73	18	16	53	45	57	49	57	49
Total Above IFC Limit	0	0	5	11	13	15	13	15

Table 99: Portion 10 Predicted Noise Levels

Receivers	Base Line		Year 1 (2024)		Year 10 (2033)		Year 15 (2038)	
	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)
R104	36	33	59	51	62	54	63	55
R105	38	34	59	51	63	55	63	55
R106	34	32	52	44	56	48	56	48
R107	37	35	54	46	58	50	58	50
R108	35	34	52	45	56	48	56	48
R109	39	37	49	42	52	45	53	45
R110	38	36	54	46	57	49	58	50
R111	37	35	57	49	60	52	60	52
L74	20	18	53	45	57	49	57	49
L75	20	17	51	43	54	46	55	47
L76	25	23	54	46	57	49	58	50
L77	21	19	50	42	53	45	54	46
L78	29	26	48	40	52	44	52	44

Receivers	Base Line		Year 1 (2024)		Year 10 (2033)		Year 15 (2038)	
	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)
L79	34	30	49	41	52	44	53	45
L80	32	29	46	38	49	42	50	42
L81	37	35	46	40	49	42	49	43
L82	41	39	50	43	53	46	53	46
L83	41	39	50	44	54	46	54	47
Total Above IFC Limit	0	0	3	6	9	12	9	13

823. Generic 4-meter-high noise barriers, 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 tables and figures below show the results for each of the road portions within the Project area.

824. Green cells represent compliance with daytime and nighttime IFC guideline limits, blue cells represent values within 1 dB of the ambient, orange cells represent receptors within 3 dB of the IFC guideline limits and red cells represent receptors more than 3 dB above IFC guideline limits.

Portion 1 Analysis

825. The model indicates that during the operational phase none of the receptors will be exposed to noise levels above the IFC guideline limits up to 2038. No mitigation measures are therefore required.

Portion 2 Analysis

Table 100: Portion 2 Modelled Noise Barriers

Barrier	length (m)	height (m)	Portion
B2	280	4	2
B3	170	4	2
B4	50	4	2

Figure 94: Portion 2 Proposed Noise Barrier Locations

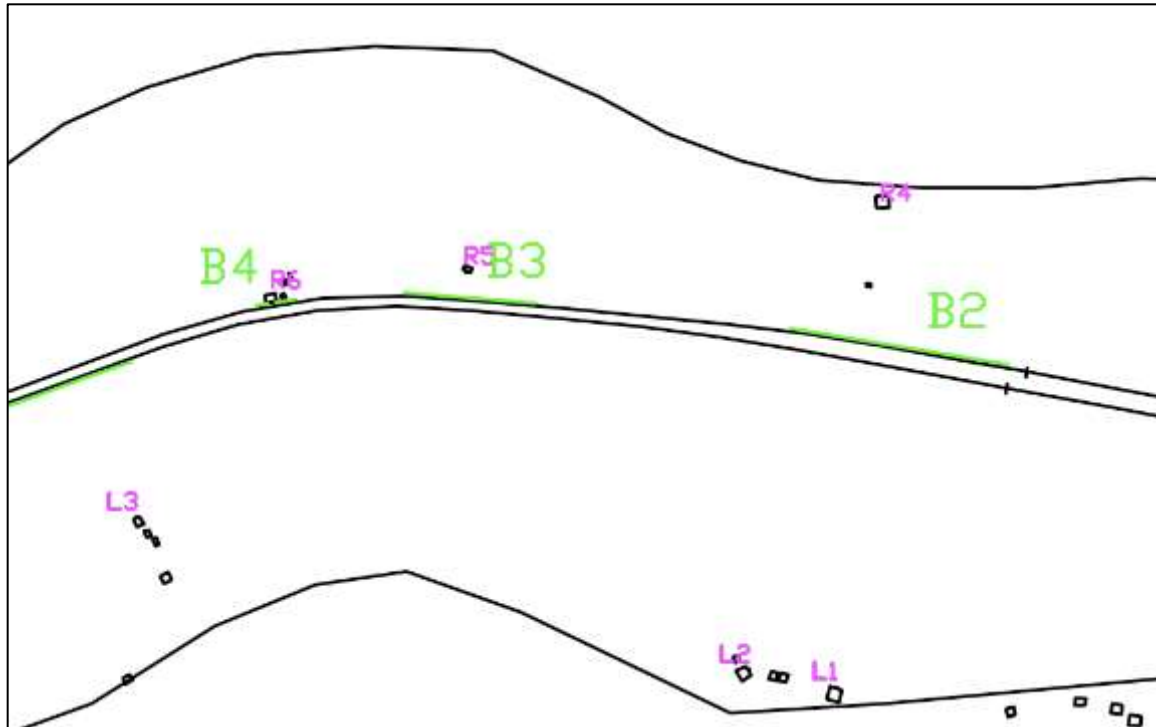


Table 101: Portion 2 Noise Model Results with Noise Barriers

Receiver s	Base Line		Year 1 (2024)		Year 10 (2033)		Year 15 (2038)	
	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)
R4	52	51	51	43	54	46	55	47
R5	62	61	58	50	61	53	62	54
R6	39	38	42	34	45	37	46	38
L1	22	21	23	15	26	18	27	19
L2	24	22	25	17	28	19	28	20

826. The model results for Portion 2 are summarized as follows:

Table 102: Portion 2 Noise Results Summary

	Baseline	2024 Without Mitigation	2033 Without Mitigation	2024 With Noise Barrier	2033 With Noise Barrier
Total number of Non-compliance	0	1	1	0	0

827. Receptors L1 and L2 are not impacted during the operational phase. Receptors R5 and R6 will be expropriated so barrier B3 and B4 are not required. Barrier B2 is

effective at reducing noise levels below IFC limits for receptor R4 and is recommended.

Portion 3 Analysis

Table 103: Portion 3 Proposed Modelled Noise Barriers

Barrier	length (m)	height (m)	Portion
B5	620	4	3
B6-1	600	4	3
B6-2	300	4	3

Figure 95: Portion 3 Proposed Noise Barrier Locations

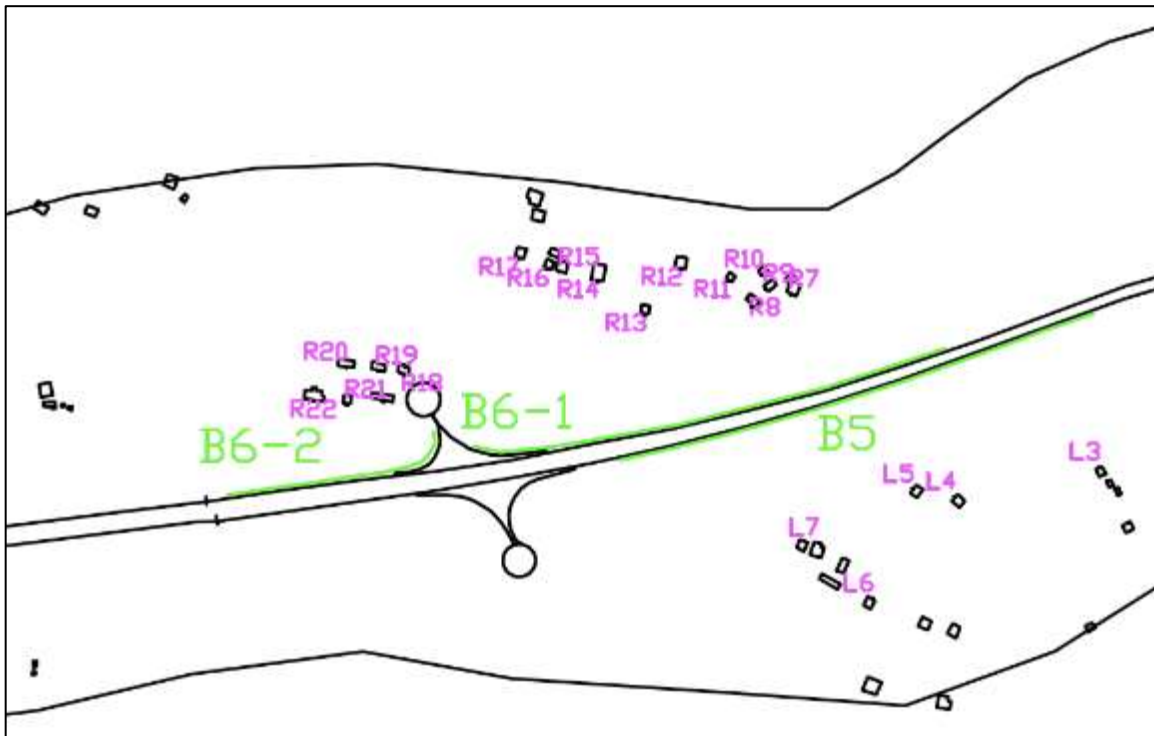


Table 104: Portion 3 Noise Model Results with Noise Barriers

Receivers	Base Line		Year 1 (2024)		Year 10 (2033)		Year 15 (2038)	
	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)
R7	52	52	55	47	58	50	58	50
R8	51	50	50	42	53	45	54	46
R8	53	52	49	40	51	43	52	44
R10	50	49	49	41	52	44	52	44
R11	51	50	48	40	51	42	51	43
R12	52	51	49	41	52	44	53	45

Receivers	Base Line		Year 1 (2024)		Year 10 (2033)		Year 15 (2038)	
	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)
R13	55	54	50	41	52	44	53	45
R14	54	53	50	42	53	45	54	46
R15	53	52	50	42	53	45	54	46
R16	53	52	50	42	53	45	54	46
R17	53	52	50	42	53	45	54	46
R18	65	64	51	43	54	46	55	47
R19	63	62	49	41	52	44	53	45
R20	66	65	53	45	56	48	56	48
R21	44	43	58	50	61	53	61	53
R22	36	35	57	49	60	52	61	53
L3	42	41	49	41	52	44	52	44
L4	40	39	45	37	48	40	49	41
L5	43	42	46	38	49	41	49	41
L6	31	30	47	39	50	42	51	43
L7	43	42	53	45	56	48	57	49

828. The model results for Portion 3 are summarized as follows:

Table 105: Portion 3 Noise Results Summary

	Baseline	2024 Without Mitigation	2033 Without Mitigation	2024 With Noise Barrier	2033 With Noise Barrier
Total number of Non-compliance	0	12	14	2	4

829. Most of the receptors benefit from the proposed noise barriers. They are all recommended. Note R21 and R22 are apartment blocks of three floors.

Portion 4 Analysis

Table 106: Portion 4 Proposed Modelled Noise Barriers

Barrier	length (m)	height (m)	Portion
B7	700	4	4
B8	330	4	4

Figure 96: Portion 4 Proposed Noise Barrier Locations

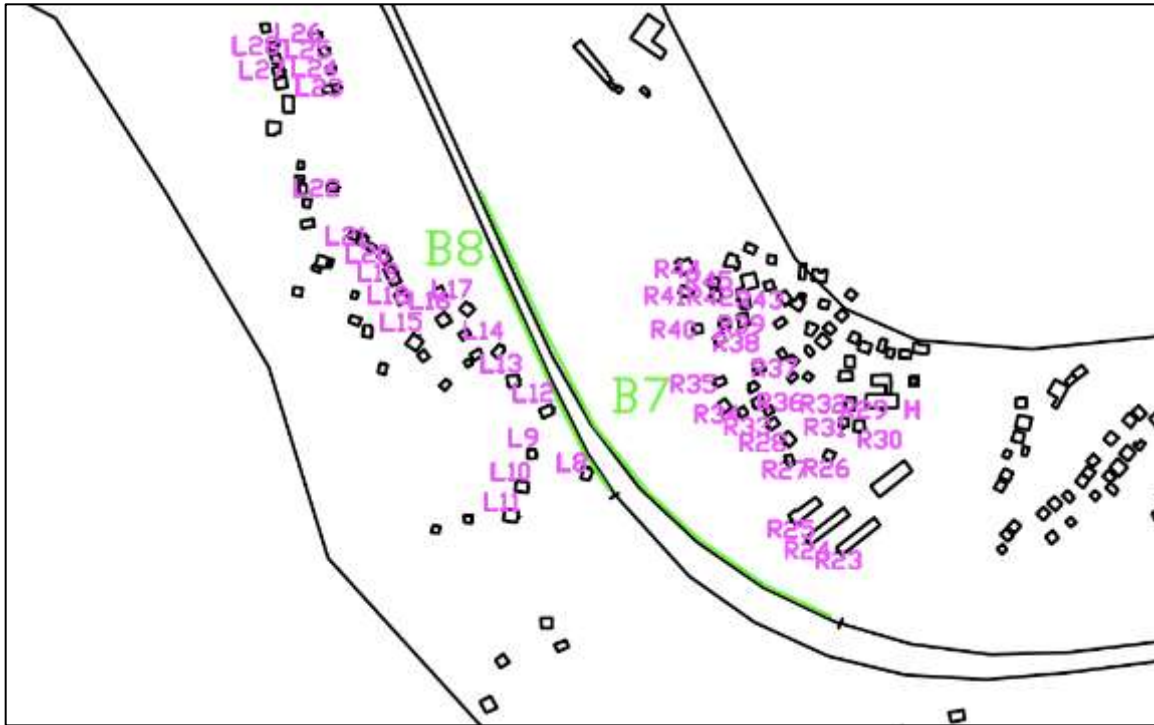


Table 107: Portion 4 Noise Model Results with Noise Barriers

Receivers	Base Line		Year 1 (2024)		Year 10 (2033)		Year 15 (2038)	
	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)
R22	36	35	57	49	60	52	61	53
R22	39	39	57	49	60	52	61	53
R23	56	55	45	37	48	40	49	40
R23	56	55	46	38	49	41	49	41
R23	57	56	46	38	49	41	50	41
R24	57	56	45	37	48	40	49	41
R24	57	56	46	38	49	41	49	41
R24	58	57	46	38	49	41	50	42
R25	56	55	45	37	48	39	48	40
R25	57	56	45	37	48	40	49	41
R25	57	56	46	38	49	41	49	41
R26	54	53	42	34	45	37	46	37
R27	54	53	45	37	48	40	49	41
R28	54	53	45	37	48	40	49	41
R29 H	52	51	37	29	39	31	40	32
R29 H	53	52	38	30	41	33	42	33
R30	53	52	38	30	41	33	42	34

Section F4 of Khevi-Ubisa-Shorapani-Argveta section (E60 Highway)
Environmental Impact Assessment

	Base Line		Year 1 (2024)		Year 10 (2033)		Year 15 (2038)	
Receivers	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)
R31	51	50	39	31	42	34	42	34
R32	41	40	39	31	42	34	42	34
R33	54	53	47	39	50	42	51	43
R34	54	53	47	39	50	42	51	43
R35	54	54	50	42	53	45	53	45
R36	54	53	49	41	52	43	52	44
R37	51	50	48	40	51	43	52	44
R38	52	51	48	40	51	43	52	44
R39	51	50	50	42	52	44	53	45
R40	54	53	51	43	54	46	54	46
R41	52	51	49	41	52	44	52	44
R42	51	50	50	42	53	44	53	45
R43	49	48	49	41	52	44	53	45
R44	53	52	51	43	54	46	55	47
R45	49	48	47	39	50	42	51	43
L8	59	59	49	41	51	43	52	44
L9	51	50	50	42	53	45	54	46
L10	48	47	47	39	50	42	51	43
L11	44	43	44	36	47	39	48	39
L12	62	61	57	49	60	52	61	53
L13	57	56	53	45	56	48	56	48
L14	55	54	54	46	57	49	57	49
L15	42	41	41	33	43	35	44	36
L16	40	39	39	31	42	34	43	35
L17	50	49	49	41	52	44	53	44
L18	40	39	39	31	42	34	43	35
L19	38	37	37	29	40	32	41	33
L20	35	34	35	27	38	30	39	31
L21	33	32	33	25	36	28	37	29
L22	33	32	33	25	36	27	36	28
L23	38	37	38	30	41	33	41	33
L24	41	40	41	33	44	36	45	37
L25	40	39	41	33	43	35	44	36
L26	41	40	43	35	46	38	47	39
L27	30	29	33	25	35	27	36	28
L28	31	30	34	26	37	29	38	30

830. The model results for Portion 4 are summarized as follows:

Table 108: Portion 4 Noise Results Summary

	Baseline	2024 Without Mitigation	2033 Without Mitigation	2024 With Noise Barrier	2033 With Noise Barrier
Total number of Non-compliance	30	10	28	2	2

831. Noise barriers in this section are all effective at reducing noise levels below IFC limits. All of the barriers are recommended.

Portion 5 Analysis

Table 109: Portion 5 Proposed Modelled Noise Barriers

Barrier	length (m)	height (m)	Portion
B9	300	4	5
B10	110	4	5
B11	50	4	5
B12	70	4	5

Figure 97: Portion 5 Proposed Noise Barrier Locations

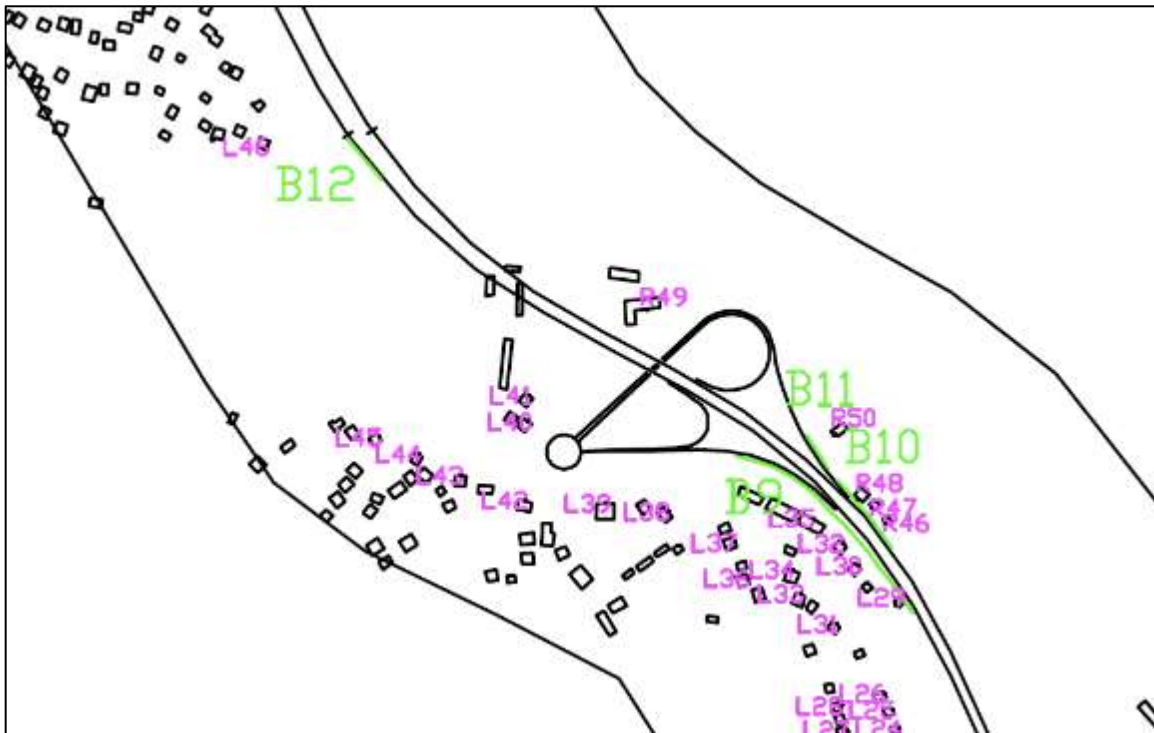


Table 110: Portion 5 Noise Model Results with Noise Barriers

	Base Line		Year 1 (2024)		Year 10 (2033)		Year 15 (2038)	
Receivers	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)
R46	64	63	55	47	58	50	58	50
R47	57	56	50	42	53	45	54	46
R48	53	52	51	43	54	46	54	46
R49	33	32	52	44	55	47	56	48
R50	42	41	51	43	53	45	54	46
R51	42	41	46	38	49	41	50	42
R52	43	42	46	38	49	41	50	42
L29	38	37	44	36	47	39	48	40
L30	60	59	59	51	62	54	63	55
L31	47	46	52	44	55	47	56	48
L32	61	60	58	50	61	53	62	54
L33	43	42	50	42	53	45	54	46
L34	45	44	52	44	55	47	56	48
L35	53	52	53	45	56	48	57	49
L36	40	39	50	42	53	45	54	46
L37	43	42	52	44	55	47	55	47
L38	51	50	54	46	57	49	57	49
L39	54	53	53	45	56	48	57	49
L40	50	49	56	48	59	51	60	52
L41	43	43	57	49	60	52	61	53
L42	53	52	54	46	57	49	58	50
L43	57	56	54	46	57	48	57	49
L44	59	58	53	44	55	47	56	48
L45	59	58	53	45	56	48	57	49

832. The model results for Portion 5 are summarized as follows:

Table 111: Portion 5 Noise Results Summary

	Baseline	2024 Without Mitigation	2033 Without Mitigation	2024 With Noise Barrier	2033 With Noise Barrier
Total number of Non-compliance	12	8	12	0	4

833. Receptors L40 and L41 are commercial properties. Again, the proposed noise barriers are all effective at reducing noise levels. They are all recommended.

Portion 6 Analysis

Table 112: Portion 6 Proposed Modelled Noise Barriers

Barrier	length (m)	height (m)	Portion
B13	170	4	6
B14	280	4	6
B15	310	4	6

Figure 98: Portion 6 Proposed Noise Barrier Locations

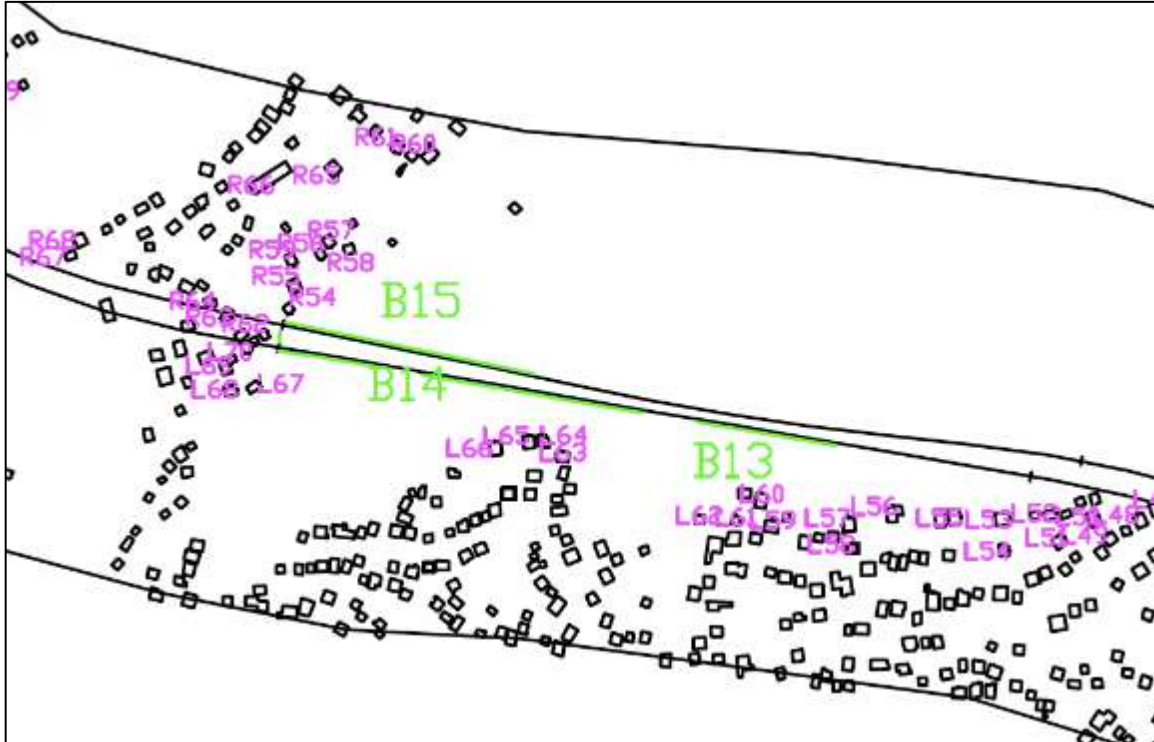


Table 113: Portion 6 Noise Model Results with Noise Barriers

Receivers	Base Line		Year 1 (2024)		Year 10 (2033)		Year 15 (2038)	
	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)
R53	54	44	43	35	46	38	46	38
R54	36	33	59	51	62	54	63	55
R55	35	32	55	47	58	50	59	51
R56	34	31	53	45	55	47	56	48
R57	33	31	51	43	54	46	54	46
R58	33	30	54	46	57	49	58	50
R59	31	28	51	43	54	46	55	46
R60	30	27	49	41	52	44	53	45
R60	29	26	47	39	50	42	50	42
R61	27	24	44	36	47	39	48	40

Section F4 of Khevi-Ubisa-Shorapani-Argveta section (E60 Highway)
Environmental Impact Assessment

Receivers	Base Line		Year 1 (2024)		Year 10 (2033)		Year 15 (2038)	
	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)
R61	28	25	43	35	46	38	47	39
R62	29	25	58	49	60	52	61	53
R63	32	29	48	40	51	43	52	44
R64	27	22	45	37	48	40	49	41
R65	28	25	43	35	46	38	47	38
R66	27	24	36	28	39	31	40	32
L46	47	46	50	42	53	45	54	46
L47	36	27	42	34	45	37	46	38
L48	37	31	35	27	38	30	39	31
L49	45	42	33	25	36	28	37	29
L50	46	36	30	22	33	25	34	26
L51	62	60	31	23	34	26	35	27
L52	51	49	36	27	38	30	39	31
L53	51	49	40	32	43	35	44	36
L54	51	49	32	24	35	27	36	28
L55	46	45	40	32	43	35	44	36
L56	31	25	40	32	43	35	44	36
L57	30	26	38	30	40	32	41	33
L58	40	38	36	28	39	31	40	32
L59	36	33	38	30	41	33	41	33
L60	31	25	45	37	48	40	49	40
L61	43	41	39	31	42	34	42	34
L62	30	27	38	30	41	33	42	34
L63	24	20	48	40	51	43	52	44
L64	26	20	53	45	56	48	57	49
L65	23	20	52	44	55	47	56	48
L66	22	20	52	44	55	47	56	48
L67	26	24	48	40	51	43	51	43
L68	33	31	42	34	45	37	45	37
L69	35	33	50	42	53	45	54	46
L70	37	35	54	46	57	49	57	49

834. The model results for Portion 6 are summarized as follows:

Table 114: Portion 6 Noise Results Summary

	Baseline	2024 Without Mitigation	2033 Without Mitigation	2024 With Noise Barrier	2033 With Noise Barrier
Total number of	4	10	16	5	11

Non-compliance					
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835. Barrier B15 has a minimal effect on the receptors R54 to R59. It is not recommended. Barrier B13 is not required as noise levels are predicted to be below the IFC limits in this area up to 2033. B14 is effective, only a few receptors in this area are marginally above the limits.

Portion 7 Analysis

Table 115: Portion 7 Proposed Modelled Noise Barriers

Barrier	length (m)	height (m)	Portion
B16	290	4	7
B17	680	4	7

Figure 99: Portion 7 Proposed Noise Barrier Locations

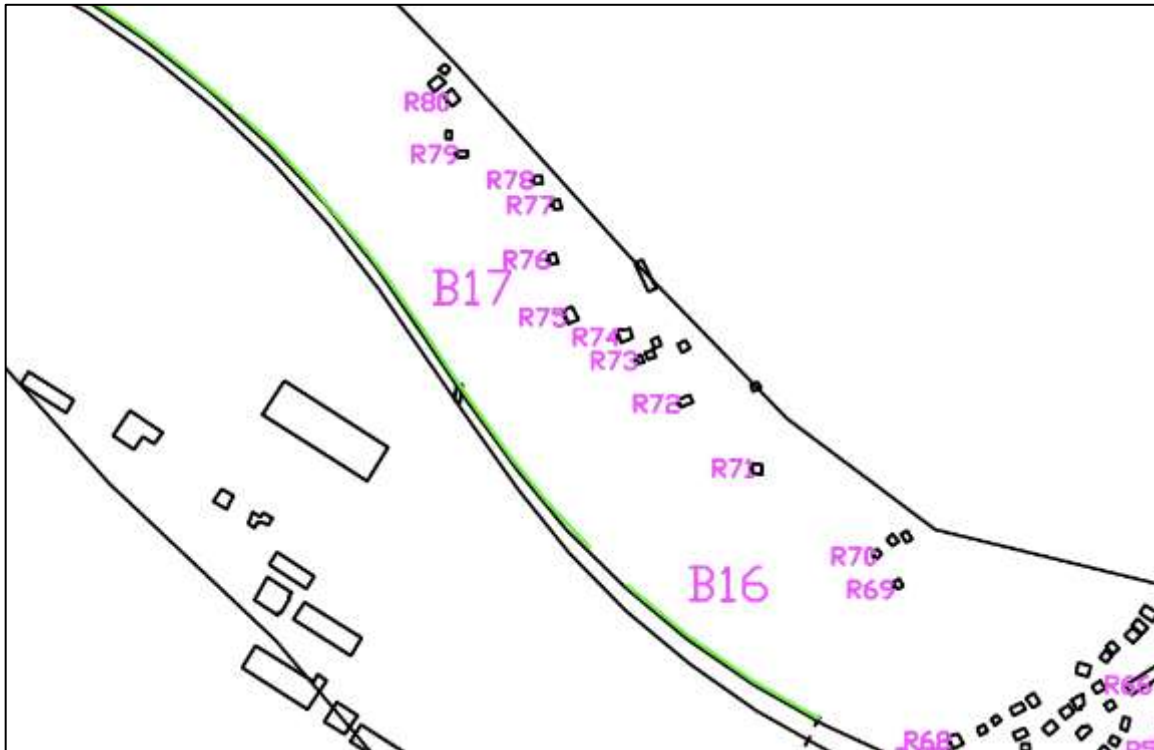


Table 116: Portion 7 Noise Model Results with Noise Barriers

	Base Line		Year 1 (2024)		Year 10 (2033)		Year 15 (2038)	
Receivers	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)
R66	27	24	36	28	39	31	40	32
R66	31	28	41	33	44	36	45	37
R67	16	13	40	32	43	35	44	36

	Base Line		Year 1 (2024)		Year 10 (2033)		Year 15 (2038)	
Receivers	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)
R68	16	13	40	32	43	35	44	35
R69	17	15	38	30	41	33	42	34
R70	17	15	39	31	42	33	42	34
R71	14	12	41	33	44	36	45	37
R72	12	10	40	32	43	35	44	36
R73	10	8	42	34	45	37	45	37
R74	11	8	41	33	44	36	44	36
R75	10	8	42	34	45	37	46	38
R76	10	7	41	33	44	36	45	37
R77	10	7	41	33	44	36	45	37
R78	10	7	41	33	44	36	44	36
R79	10	7	43	35	46	38	46	38
R80	11	8	41	33	44	36	45	37

836. The model results for Portion 7 are summarized as follows:

Table 117: Portion 7 Noise Results Summary

	Baseline	2024 Without Mitigation	2033 Without Mitigation	2024 With Noise Barrier	2033 With Noise Barrier
Total number of Non-compliance	0	2	9	0	0

837. Both barriers are effective, and both are recommended.

Portion 8 Analysis

Table 118: Portion 8 Proposed Modelled Noise Barriers

Barrier	length (m)	height (m)	Portion
B18	1000	4	8

Figure 100: Portion 8 Proposed Noise Barrier Locations

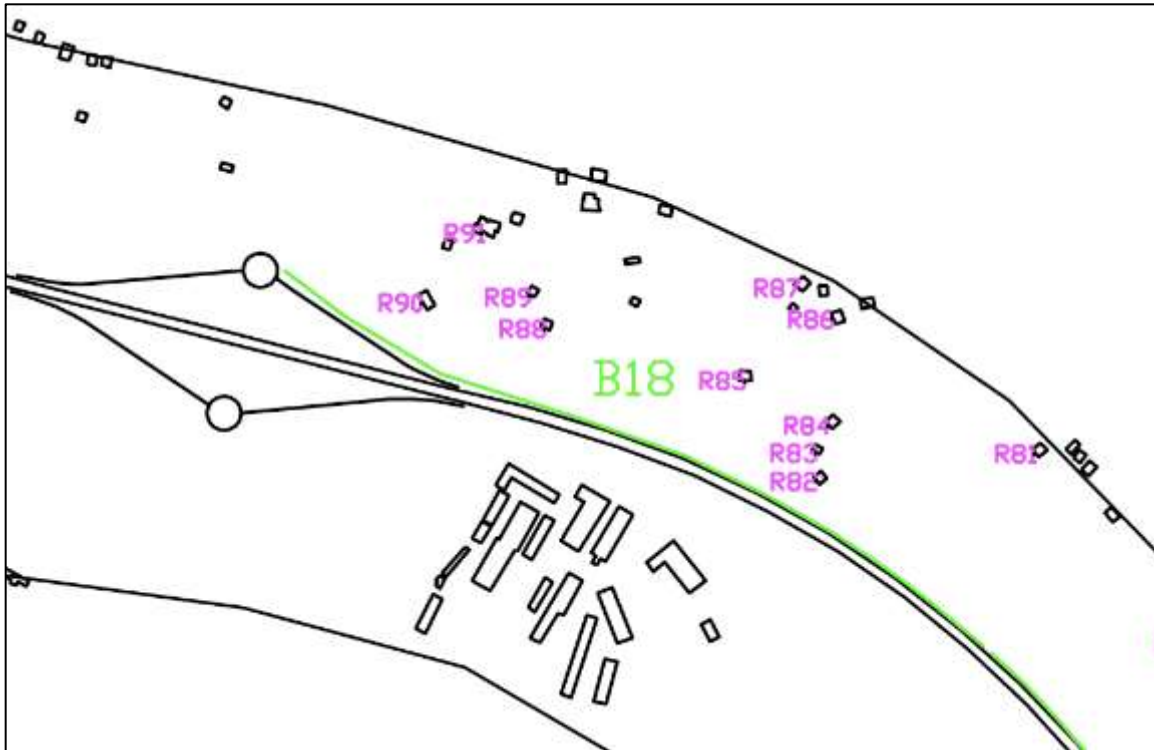


Table 119: Portion 8 Noise Model Results with Noise Barriers

Receivers	Base Line		Year 1 (2024)		Year 10 (2033)		Year 15 (2038)	
	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)
R81	9	6	42	34	45	37	46	38
R82	7	5	45	37	48	40	49	41
R83	9	6	45	37	48	40	49	41
R84	9	7	44	36	47	39	48	40
R85	12	6	45	37	48	40	49	41
R86	9	6	44	36	47	39	47	39
R88	12	8	53	45	56	48	57	49
R89	12	9	52	44	55	47	55	47
R90	10	8	55	47	58	50	58	50
R91	11	6	46	38	49	41	50	42

838. The model results for Portion 8 are summarized as follows:

Table 120: Portion 8 Noise Results Summary

	Baseline	2024 Without Mitigation	2033 Without Mitigation	2024 With Noise Barrier	2033 With Noise Barrier
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Total number of Non-compliance	0	5	8	1	3
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839. Barrier B18 is effective and recommended.

Portion 9 Analysis

Table 121: Portion 9 Proposed Modelled Noise Barriers

Barrier	length (m)	height (m)	Portion
B19	380	4	9

Figure 101: Portion 9 Proposed Noise Barrier Locations

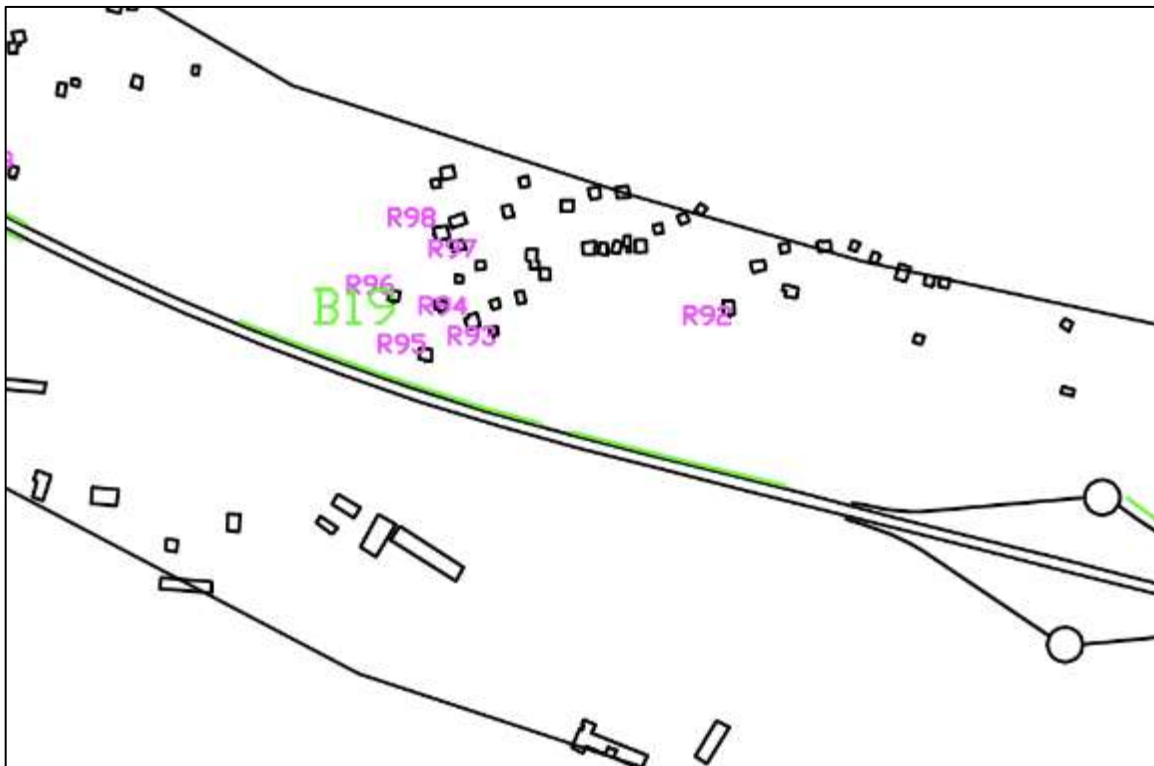


Table 122: Portion 9 Noise Model Results with Noise Barriers

	Base Line		Year 1 (2024)		Year 10 (2033)		Year 15 (2038)	
Receivers	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)
R92	11	7	44	36	47	39	48	40
R93	12	8	45	37	48	40	49	41
R94	12	9	45	37	48	40	49	41
R95	14	10	46	38	49	41	50	42

R96	13	10	47	38	49	41	50	42
R97	11	9	45	37	48	39	48	40
R98	11	9	45	37	48	40	49	41
R99	24	22	53	45	56	48	57	49
R100	17	15	47	39	50	42	51	43
R101	27	24	48	40	51	43	52	44
R102	25	23	48	40	51	43	52	44
R103	30	28	49	41	52	44	53	45
L71	19	17	46	38	49	41	50	42
L72	18	16	44	36	47	39	48	40
L73	18	16	45	37	48	39	48	40

840. The model results for Portion 9 are summarized as follows:

Table 123: Portion 9 Noise Results Summary

	Baseline	2024 Without Mitigation	2033 Without Mitigation	2024 With Noise Barrier	2033 With Noise Barrier
Total number of Non-compliance	0	11	15	0	1

841. Barrier B19 is very effective and recommended.

Portion 10 Analysis

Table 124: Portion 10 Proposed Modelled Noise Barriers

Barrier	length (m)	height (m)	Portion
B20	320	4	10
B21	350	4	10
B22	630	4	10
B23	370	4	10

Figure 102: Portion 10 Proposed Noise Barrier Locations

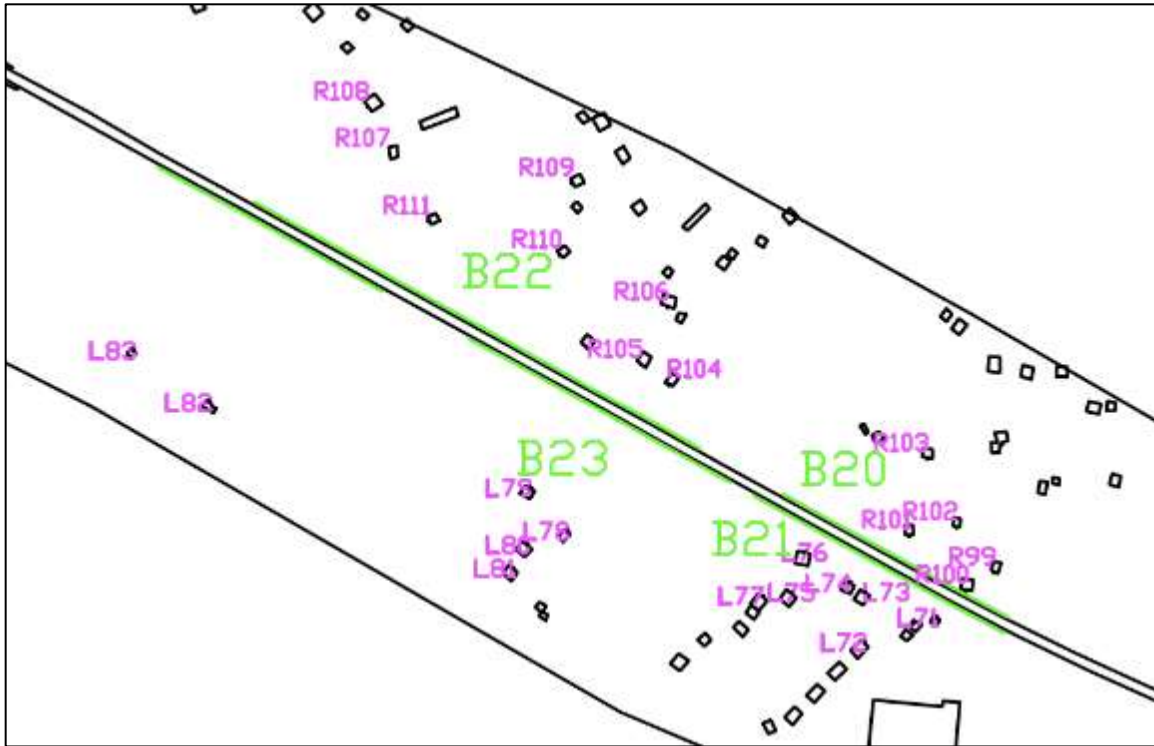


Table 125: Portion 8 Noise Model Results with Noise Barriers

Receivers	Base Line		Year 1 (2024)		Year 10 (2033)		Year 15 (2038)	
	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)
R104	36	33	49	41	52	44	53	45
R105	38	34	47	39	50	42	51	43
R106	34	32	46	37	48	40	49	41
R107	37	35	48	40	50	42	51	43
R108	35	34	48	40	51	43	52	44
R109	39	37	43	35	46	38	47	39
R110	38	36	42	34	45	37	46	38
R111	37	35	46	38	49	41	50	42
L74	20	18	44	36	47	39	48	40
L75	20	17	43	35	46	38	47	39
L76	25	23	45	37	48	40	49	41
L77	21	19	43	35	46	38	47	39
L78	29	26	40	32	43	35	44	35
L79	34	30	40	32	43	35	44	36
L80	32	29	38	30	41	33	42	34
L81	37	35	40	32	42	34	43	35

	Base Line		Year 1 (2024)		Year 10 (2033)		Year 15 (2038)	
Receivers	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)	Ld dB(A)	Ln dB(A)
L82	41	39	43	35	46	38	47	39
L83	41	39	45	37	48	40	48	40

842. The model results for Portion 10 are summarized as follows:

Table 126: Portion 10 Noise Results Summary

	Baseline	2024 Without Mitigation	2033 Without Mitigation	2024 With Noise Barrier	2033 With Noise Barrier
Total number of Non-compliance	0	6	12	0	0

843. Barrier B20, B21 and B22 are effective. The benefits of B23 are marginal with both affected receptors only 1 dB above the IFC limits in 2033 without noise mitigation. The barrier is not recommended.

Model Conclusions

844. The noise model identified 204 potential noise receptors within the Project corridor. Using the predictive and baseline models 121 receptors were found to be within IFC guideline limits by 2024 and 89 by 2033 (within 3dBA of the modeled ambient and/or 45 dBA / 55 dBA).

845. A noise barrier was then introduced to the predictive model. 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 leaving only 24 receptors above the IFC guideline limits, as summarized by the table below.

Table 127: Affected Receptors

# of receptors above IFC Guideline Limits	Portion										Total
	1	2	3	4	5	6	7	8	9	10	
2024 – No Mitigation	0	1	12	8	10	10	2	5	11	6	83
2033 – No Mitigation	0	1	14	12	28	16	9	8	15	12	115
2024 – With Noise Barrier	N/A	0	2	0	2	5	0	1	0	0	10
2033 – With Noise	N/A	0	4	3	2	11	0	3	1	0	24

Barrier											
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846. Given these findings, the following noise barriers are therefore recommended:

Table 128: Proposed Noise Barriers

Barrier No.	Length (m)	Height (m)
B2	280	4
B5	620	4
B6-1	600	4
B6-2	300	4
B7	700	4
B8	330	4
B9	300	4
B10	110	4
B11	50	4
B12	70	4
B14	280	4
B16	290	4
B17	680	4
B18	1000	4
B19	380	4
B20	320	4
B21	350	4
B22	630	4
Total	6,610	

847. 24 receptors will still be negatively impacted by higher noise levels even with the installation of these noise barriers. The following table lists these remaining receptors and by how much they exceed the IFC noise standards.

Table 129: Remaining Affected Receptors

		Level above IFC daytime / night time limit and / or 3 dBA above modelled ambient.
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		DAY	NIGHT
	Receptor	Lg dB(A)	Ln dB(A)
1	R7	3	-
2	R21	6	8
3	R22	5	7
4	R22	5	7
5	R22	5	7
6	R49	-	2
7	L37	-	2
8	L38	2	-
9	L42	2	-
10	R54	7	9
11	R55	3	5
12	R56	-	2
13	R57	-	1
14	R58	2	4
15	R59	-	1
16	R62	5	7
17	L64	1	3
18	L65	-	3
19	L66	-	3
20	L70	3	4
21	R88	1	3
22	R89	-	3
23	R90	3	5
24	R99	1	3

848. A range of potential mitigation measures were assessed for these remaining 24 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 even greater noise reduction effects.³⁸ 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

³⁸ Based on German Standard DIN 4109.

maintenance to be effective. As such this measure could not guarantee continued compliance through the Project lifecycle.

- **Expropriation** - The owner of the house will be given the option to relocate after selling their house to the RD. Their property will be included in the LARP.
- **Waiver** - An alternate to expropriation is that the property owner, despite the high noise, may want to stay in their house. In that case, a legally binding agreement will be executed between the RD and the receiver.

849. Given the above, the mitigation measures proposed for the remaining 24 receptors are the **expropriation and waiver options**. The RD will be responsible for consulting with the remaining 24 receptors to determine what option is preferable to the individual receptors. This activity shall be completed before construction commences and the results of the consultations shall be presented to the ADB for final review and approval. A corrective action plan will be prepared for the Project LARP during the construction phase to take into account any properties that may choose expropriation.

850. 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 nighttime 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 nighttime can lead to negative health impacts³⁹ and as such constructing residential properties in areas with high noise levels could have a detrimental impact on people's wellbeing.

851. 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.

852. 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.

853. Other countries, such as the UK have prepared guidelines which direct the planning process. Specifically, the UK's 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. Nighttime 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

³⁹ Guidelines for Community Noise, WHO.

of protection against noise. Nighttime 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. Nighttime noise between 57-66 dBA, daytime noise between 63-72 dBA.
- Category D - Planning permission should normally be refused. Nighttime noise greater than 72 dBA, daytime noise greater than 66 dBA.

854. As an example, if in the future a development of houses was planned close to the Project road in Zestaphoni 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.

855. 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.

Residual Impact Significance

Construction Phase – 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.

Operational Phase – LOW / MEDIUM

Residual impacts will be negligible for all of the identified receptors if the noise barriers are constructed and the remaining 24 receptors are expropriated. However, some property owners may choose to sign the waiver agreement and 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. However, the number of potentially affected receptors is only a small percentage of the overall population within the Project area. It should also be stated that, with the exception of one receptor, all of the remaining receptors are within IFC nighttime limits.

G.9 Induced and Cumulative Impacts

856. Induced impacts are not anticipated to be significant in this 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).

857. 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.

858. 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

Construction Phase – 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.

Operational Phase – None anticipated

G.10 Compliance Impacts

859. 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 SEMP's 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

860. 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 G**. 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

861. **Table 130, Table 131** and **Table 132** provide 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

862. 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. **Table 134** provides the monitoring actions required during the construction phase of the Project. **Table 134** provides the monitoring actions for the operational phase of the Project.

Table 130: Environmental Management Plan - Detailed Design / Pre-construction Phase

Subject	Potential Impact / Issue	Mitigation Measure	Responsibilities	Monitoring	Monitoring Responsibility & Schedule
Air Quality	Construction impacts	Preparation of an Air Quality Plan (AQP) which shall include the locations of haul routes.	- Contractor to prepare AQP - Engineer to review and approve AQP.	N/A	N/A
	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.	N/A	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.	- RD to prepare the LARP. - ADB to approve the LARP. - RD to implement the Plan.	N/A	N/A
Climate Change	Damage to roads and drainage systems due to increased flooding and more intense rainfall.	As part of the detailed design, the following measures will be considered: - Increase ditch and culvert capacity; - Maintain positive cross slope to facilitate flow of water from surface; - Increase pavement resistance to rutting; - Reduce splashing/spray through porous surface mixtures; - More frequent use of elevated pavement section; - Improve visibility and pavement marking demarcation; and - Ensure that all embankments are seeded to help increase stability.	Engineer to review design documents prior to the start of construction and make any additions as necessary.	N/A	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	- RD to prepare the RAP. - ADB to approve the	N/A	N/A

		Plan (the LARP), obtain the approval of ADB and then implement the plan and acquire the land.	- RAP. - RD to implement the Plan.		
	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.	N/A	N/A
	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.	N/A	N/A
	Soil contamination	- Analysis of four additional soil samples taken close to the GAA. - Addendum to this EIA including the results of the additional soil samples.	- Engineer to hire a licensed laboratory for the analysis. - Engineer to provide the results in an addendum to this EIA	ADB	Before the start of construction.
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 Response Procedure relating to the management and clear up of spills in these areas.	- Contractor to prepare the Plan. - Engineer to review and approve plan.	N/A	N/A
		- 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 shall 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	- DD Consultants - Engineer to review design documents prior to the start of construction.	N/A	N/A

		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.			
		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.	- 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	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.	N/A	N/A
	Drainage	Include 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.	DD Consultants	N/A	N/A
	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.	N/A	N/A
	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, Kvirila and Borimela rivers. - Contractor to prepare Camp Management Plan including the hydrology management measures outlined in this EIA.	- Contractor to select sites. - Engineer and MoEPA to approve sites.	N/A	N/A

Biodiversity	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 an action plan for the restoration of habitat that will be cleared prior to the start of construction. The plan shall be prepared by qualified biodiversity specialists. - The plan shall include restoration of the existing site, re-planting of spoil disposal site and re-planting at any other locations requested by MoEPA. - 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.	- Contractor to prepare and implement Plan. - Engineer to review and approve plan. - Contractor to survey trees for vulnerable species.	N/A	N/A
	Tree cutting	The LARP shall contain the compensation methods and payments for loss of trees on private land.	- RD to prepare the LARP. - ADB to approve the RAP. - RD to implement the Plan.	N/A	N/A
	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 which will be	- Contractor to perform site surveys with qualified specialists. - Contractor to prepare method statements for any affected areas. - Engineer to review and approve method	N/A	N/A

		sent to the Engineer for review and approval.	statements.		
	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	N/A
	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. - Engineer to review permit. - RD to make compensation payments.	N/A	N/A
	Impacts to Protected Areas	No haul route will pass through a protected area.	Contractor to implement mitigation.	N/A	N/A
	Impacts to birds from street lighting	Ensure that lower wattage lamps are used in street lights which direct light downwards to reduce glare.	DD Consultants to incorporate the measures.	N/A	N/A
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.	N/A	N/A
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	N/A	N/A

			findings of the road condition survey.		
	Traffic management	- Preparation of a traffic management plan as part of the SEMP. - 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.	- Contractor to prepare plan. - Engineer to review and approve plan.	N/A	N/A
Occupational Health and Safety	Worker Health and Safety	- Prepare an Occupational Health and Safety Plan (OHS Plan). - 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.	N/A	N/A
	Traffic Safety	Submit a Traffic Management Plan (TMP) to local traffic authorities prior to mobilization.	- Contractor to prepare TMP. - Engineer to approve TMP.	N/A	N/A
Emergency Response	Fires, explosions, earthquake, etc.	Preparation of an Emergency Response Plan (ERP).	- Contractor to prepare ERP - Engineer to review and approve ERP.	N/A	N/A
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.	N/A	N/A

Section F4 of Khevi-Ubisa-Shorapani-Argveta section (E60 Highway)
Environmental Impact Assessment

	Tunnel and Embankment Spoil	• Consultations between Kutaisi Bypass Contractor and RD to determine if the static balance from F4 can be re-used as embankment material for Kutaisi Bypass. • Preparation of a Spoil Re-use and Disposal Plan.	• Contractor to consult with RD and Kutaisi Bypass Contractor. • Contractor to prepare plan. • RD and Engineer to review and 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.	N/A	N/A
Noise	Noise barriers	Include areas for the installation of the identified noise barriers in Table 124: Portion 10 Proposed Modelled Noise Barriers in the Project detailed design.	• Detailed Design Consultant.	N/A	N/A
Vibration	Construction vibration	The Contractor will develop a detailed Tunnel Blasting Plan (TBP) as part of the overall construction schedule.	• Contractor to prepare Plans • Engineer to review and approve Plans.	N/A	N/A
SEMP Requirement	Preparation of SEMP	Prepare SEMP.	• Contractor to prepare SEMP. • Engineer to review and approve SEMP.	N/A	N/A
	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	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	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.	Contractor	N/A	N/A

		Ensure that names and contact numbers of representatives of GRCE and the Contractor are placed on the notice boards outside the construction site.			
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Table 131: 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. - 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.	- Contractor to implement mitigation. - Engineer to routinely monitor Contractors activities.	Engineers NES	Daily site inspections, throughout construction period.
	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,	- Contractor to implement mitigation. - Engineer to routinely monitor Contractors activities including	Engineers NES	Daily site inspections, throughout construction period.

		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.	vehicle maintenance records.		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. • 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.	• Contractor to implement mitigation. • 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.	Engineers NES	Daily site inspections, throughout construction period.

		- 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.			
	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. - If in case private lands are disturbed, the contractor should promptly inform the owner and agree on the ways to remedy the situation.	Contractor to implement mitigation.	Engineers NES	Daily site inspections, throughout construction period.

	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.
	Contaminated Land	Should the results of the additional soil sampling in the pre-construction phase indicate any elevated levels of contamination further testing of the excavated soils in this area will be required. The procedure for any construction phase testing is as follows: - identify a temporary storage area for material excavated from the area identified in this EIA. The area should be fenced and signposted. The area shall comprise an impermeable surface to prevent leachate from the stockpiles potentially contaminating soils and groundwater in the area of the storage area. - strip the topsoil in the area of the contaminated areas in batches of 2,500 m² and store the mixed material in the temporary storage area (the stockpile). The height of the stockpile shall be no more than 2 meters. It is possible to have more than one stockpile, depending upon the rates of excavation in this area. - divide the stockpile into quadrants of 250m³. - hire a certified laboratory to take a soil sample from each of the quadrants for further chemical analysis (a stockpile of 2,500m³ would require 10 samples). Sampling should be uniformly distributed throughout the stockpile, including sampling at depth. - If the results show the all of the samples are within the proposed national limits and the	- Contractor to implement mitigation. - Engineer to hire certified laboratory and review results. - Engineer to undertake periodic inspections of the stockpiles to ensure the correct procedures are being followed.	Engineers NES	Weekly inspections of stockpiles.

		Dutch target values the material can be removed from the stockpile area and disposed of as non-hazardous material. • If any of the ten samples show elevated levels of contamination the material from the respective contaminated quadrants will be disposed of as hazardous waste. Any other non-contaminated quadrants may be disposed of as non-hazardous waste. • Final disposal of any contaminated soil must be undertaken at a waste management facility licensed to handle such wastes. As with normal waste materials, the Contractor will be obliged to keep records of any hazardous materials removed from the site, including: ○ Volume of soil removed; ○ Details of any identified contamination; ○ Soil stockpile (and/or storage container) unique identifier; ○ Date excess soil was excavated from each location and subsequently transported to a disposal facility; ○ Details of the vehicle transporting the soil to a disposal facility; ○ Details of the disposal facility; and ○ Date the excess soil arrived at the disposal facility. ○ provide a copy of the licensed waste management contractors contract to the Engineer before any contaminated soil is removed from the site. • The Engineer will also be responsible for undertaking an additional due diligence review of the waste management contractors disposal site.			
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		Alternative treatment of contaminated land prior to disposal	- Contractor responsible for the preparation of a Contaminated Spoil Treatment Plan. - Plan approved by the Engineer. - Contractor to implement treatment measures and disposal. - Engineer to undertake periodic review and assessment of the activity and results.	Engineers NES	Weekly inspections of any proposed treatment activity.
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.	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.

		• Perform dewatering and cleaning of cofferdams to prevent siltation by pumping from cofferdams to a settling basin or a containment unit. • 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.			
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	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. - 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.	Contractor to implement mitigation.	Engineers NES	Monitor drainage channels on a weekly basis.
	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	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 permits.	Engineers NES	- Weekly inspections, throughout construction period. - Annual review of permits.
Biodiversity	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.	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
	Tree Re-planting	- Coordinate with the National Forest Agency to identify a site, or sites, within the Project area where 615 red-list species can be re-planted. - 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 coordinate with NFA. - 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.
	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 78 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 78 are followed.	Contractor to implement mitigation.	Engineers NES	Daily site inspections, throughout construction period.

Section F4 of Khevi-Ubisa-Shorapani-Argveta section (E60 Highway)
Environmental Impact Assessment

	Bats, Birds and Other non special status fauna.	- Ensure mitigation measures outlined in Section G.6.1 Biodiversity are followed If bats and other fauna are found during pre-construction site surveys. - Ensure the measures outlined in Table 79 are followed.	Contractor to implement mitigation.	Engineers NES	Daily site inspections, throughout construction period.
	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
	Fish Spawning	The Contractor shall consult with the MoEPA to determine when works in rivers should be ceased in order to limit impacts to fish spawning periods.	Contractor to implement mitigation.	Engineers NES	Review of documentation provided by MoEPA.
	Impacts to 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 burrows in these areas. If burrows 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.	Contractor to hire local ecologist. Contractor to prepare method statement. Engineer to review and approve method statement.	Engineers NES	Review method statement and periodically monitor works in this area.
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.
	Spoil	- 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.	Contractor to implement mitigation.	Engineers NES	Daily site inspections, throughout construction period.

		• Routine spraying of haul routes during dry periods.			
	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. • 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 any recommendations for re-use of asphalt. Contractor to implement mitigation.	Engineers NES	Daily site inspections, throughout construction period.

	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.

	Working Close to Railways Lines	The Contractor will be responsible for the preparation of an Environmental, Health and Safety Method Statement for working in the area above the railway line at KM 6.3 and at Bridge BR 4.0.1.AT/TA.	- Contractor to prepare method statements. - Engineer to review and approve method statements	Engineers NES	Weekly monitoring of works in these areas.
	Utilities	- All utilities in the Project area shall be kept operational, particularly during the winter months. - 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.	Contractor to implement mitigation.	Engineers NES	Weekly inspections, 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	Contractor to implement mitigation.	Engineers NES	Daily site inspections, throughout construction period.

		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.			
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.	Contractor to implement mitigation.	Engineers NES	Daily site inspections, throughout construction period.

		• 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 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.			
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		• 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.			
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	Contractor to implement mitigation.	Engineers NES	Daily site inspections, throughout construction period.

		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 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			
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		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 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.			
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Section F4 of Khevi-Ubisa-Shorapani-Argveta section (E60 Highway)
Environmental Impact Assessment

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.
	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.
	School Safety	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.	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.
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.	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

		- 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.			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 construction period.
PCR	Impacts to Cemetery	During the construction phase the northern boundary of the cemetery (50 meters south of tunnel TUN 4.0.06-AT/TA) shall be fenced off to	Contractor to implement mitigation.	Engineers NES	Weekly site inspections of the fencing.

		ensure that there is no encroachment into this area by construction workers or equipment.			
	Natural Spring	During the construction works the spring shall be fenced on the northern side to prevent construction works impacting upon the spring.	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; - 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. - 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.	Contractor to implement mitigation.	Engineers NES	Daily site inspections throughout construction period.

		• 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. • 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.			
Vibration	Tunneling Vibration	The Contractor shall follow the procedures outlined in Section G.8.6 of the EIA.	Contractor and Engineer to implement mitigation.	N/A	N/A
	Piling Vibrations	Condition surveys of all properties within 50	Engineer	N/A	N/A

		meters of bridge piles.			
	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.

Table 132: 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
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
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.	RD

Subject	Potential Impact / Issue	Mitigation / Monitoring Measure	Responsibilities
		- 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.	
Climate Change	GHGs	Measure and report annual GHG emissions.	RD

Table 133: Construction Phase Instrumental Monitoring

Issue	Monitoring	Locations	Schedule	Responsibilities	Reporting
Air Quality	Establish routine ambient air quality monitoring throughout the construction period. Baseline monitoring shall be undertaken once <i>before</i> 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 (PM₁₀ & PM_{2.5}). Nitrogen Oxide (NO_x) Sulphur Dioxide (SO₂)	• KM 4.4 • KM 5.8 • KM 6.4 • KM 9.2 • KM 12.6 • KM 13.3	Monitoring to be undertaken monthly during construction period (30 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.
Noise	Ensure that routine noise monitoring is undertaken throughout the construction period. Parameters to be monitored include: Laeq 1h (dBA)	• KM 4.4 • KM 5.8 • KM 6.4 • KM 9.2 • KM 12.6 • KM 13.3	Monitoring to be undertaken monthly both daytime and night-time measurements during construction period (30 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.

Issue	Monitoring	Locations	Schedule	Responsibilities	Reporting
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 all bridge sites crossing rivers (3 locations) during construction; 50 meters downstream of the bridge site.	Monitoring to be undertaken monthly 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 perform the monitoring activities.	Weekly reporting by the Engineer to affected parties.
Pre-construction soils	Analysis of four additional soil samples taken close to the GAA. Parameters to be monitored: All parameters tested in Section E , Table 23: Soil screening values and US EPA 16 PAHs.	Exact locations to be determined by the Engineer	Prior to the start of construction	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.
Soils	If required, undertake a soil sampling program on the stockpiles of excavated material to the north of the GAA. Parameters to be monitored: All parameters tested in Section E , Table 23: Soil screening values and US EPA 16 PAHs.	Contractor to divide the stockpiles into ten quadrants of mixed soil.	Monitoring to be completed before materials can be removed from the stockpile site.	The Engineer shall hire certified laboratory to perform the monitoring activities.	The certified laboratory shall provide the results to the Engineer within 20 days of the monitoring activity. The Engineer will immediately provide the results to the Contractor for disposal as hazardous or non-hazardous materials.

Table 134: Operational Phase Instrumental Monitoring

Issue	Monitoring	Locations	Schedule	Responsibilities	Reporting
Air Quality	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)	Same as during the construction phase.	Bi-annually during DLP	Engineer (during defects liability period)	Bi-annual submission of results to ADB.
Noise	Noise monitoring - Laeq 24h (dBA) both daytime and nighttime periods.	At all receptors within Project corridor	Twice per year during DLP	Engineer (during defects liability period)	Annual submission of results to ADB for two years after the completion of the project.
Final noise barrier monitoring	Undertake noise monitoring at sensitive receptors behind finished noise barriers to ensure the barriers are functioning according to their design.	At all identified receptors.	Once, daytime and nighttime	Contractor	Provide final results to RD within one month of the completion of construction of any noise barrier.

H.4 EMP Costs

674. 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 136** 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 135: 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
SFF	Compensation	Approx. 4,200	4,200	RD
Noise	Expropriation	Maximum 24 / Budget according to LARP	See LARP for costs	RD
Total Pre-construction costs	\$4,200			
Construction				
Standard site management Additional environmental measures	Septic Tanks	Included in Project Construction costs	-	Contractor
	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
	Vehicle washing bay	Included in Project Construction costs	-	Contractor

Section F4 of Khevi-Ubisa-Shorapani-Argveta section (E60 Highway)
Environmental Impact Assessment

Activity	Item	Number of Units / Unit cost /US\$	Cost estimate / US\$	Responsibility
	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	2 / \$1,000	\$2,000	Contractor
	Water bowzers	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
Re-planting of red-list species	Seedlings	615 / \$10	6,150	Contractor
Tunnel Excavation	Pre-condition surveys	Approximately 200 / \$100	20,000	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
Potentially Contaminated Soil	Disposal of soil.	TBD	TBD	Contractor
Training & Awareness Programs	Safety Training	Included in Project Budget	-	Contractor
	HIV/AIDS Training	4 / US\$1,000	4,000	Contractor
	Toolbox Training	Included in Project Budget	-	Contractor
	Construction orientation meetings	Included in Project Budget	-	Contractor
	Periodic meetings with stakeholders	Included in Project Budget	-	Contractor

Activity	Item	Number of Units / Unit cost /US\$	Cost estimate / US\$	Responsibility
Clean-up of construction sites.	Labor, waste disposal	Included in Project Budget	-	Contractor
Noise	Noise Barriers ⁴⁰	6,610 m / \$1,352 m	8,936,720	Contractor
Environmental Staff	EO	30 / US\$ 2,000	60,000	Contractor
	H&S Specialist x 12 (based on 600 workers)	360 / / US\$ 1,500	540,000	Contractor
	IES	5 / US\$ 20,000	100,000	Engineer
	NES	30 / US\$ 1,500	45,000	Engineer
	H&S Specialist	30 / US\$ 1,500	45,000	Engineer
Total Construction Costs	US\$			
Total Cost	US\$9,772,870			

Table 136: Pre-construction / Construction Phase Instrumental Monitoring Costs

Activity / Item	Frequency / Responsibility	Unit Cost	Cost /USD
Pre-construction soil sampling	Four locations prior to the start of construction / Engineer to hire certified laboratory.	400 per sample	1,600
Air Quality Monitoring	Monthly (six sites) / Engineer to hire certified laboratory.	200 per site	36,000
Soil Sampling	Ten samples from each of the eight stockpiles (2,500m ³) / Engineer to hire certified laboratory.	400 per sample	32,000
Noise Monitoring	Monthly (six sites) / Engineer to hire certified laboratory.	200 per site	36,000
Surface Water Quality Monitoring	Weekly during construction period at the bridge sites crossing rivers (three sites) / Engineer to hire certified laboratory.	200 per site	28,800
Groundwater levels	Weekly during construction period of each tunnel / Engineer to hire certified laboratory.	20 per site	2,880
Tunnel dewatering	Weekly during construction period of each tunnel / Engineer to hire certified laboratory.	200 per site	41,600
Vibration Monitoring	Continuous during tunneling. 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			186,880

⁴⁰ Cost estimate is provided by **Appendix G**

H.5 Specific EMP (SEMP)

863. 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.
864. 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:
- Waste Management 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.
 - Construction Camp Plan.
 - Asphalt Plant Plan.
 - Rock Crushing Plant Plan.
 - Concrete Batching Plant Plan.
 - Bridge Construction Plan (for each bridge construction site)
865. The SEMP will be submitted to the Engineer and RD for approval at least 20 days before taking possession of any work site. No access to the site will be allowed until the SEMP is 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

866. 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

867. 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

680. 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.

681. 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.

682. 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.

678. 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.

683. The monthly reports, which will include the weekly environmental checklists, shall contain sections relating to:

- (1) General Progress of the Project.
- (2) Environmental Incidents; e.g. spills of liquids, accidents, etc.
- (3) Progress of any environmental initiatives, e.g. energy savings, recycling, etc.
- (4) Records of any environmental monitoring, both observational and instrumental.
- (5) Conclusions and Recommendations.

684. 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.

868. 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

869. 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.

870. 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.
871. 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

872. 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.
873. 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.
874. Time Period – The NES shall be employed permanently over the duration of the construction period.

Engineers International Environmental Specialist

875. 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.
876. 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.
877. 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.
878. 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

879. 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. The specialists shall be hired under the F2 budget.

880. 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

881. 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 137: 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
	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

882. 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:

- 1. Begins early in the project preparation stage and is carried out on an ongoing basis throughout the project cycle;*
- 2. Provides timely disclosure of relevant and adequate information that is understandable and readily accessible to affected people;*
- 3. Is undertaken in an atmosphere free of intimidation or coercion;*
- 4. Is gender inclusive and responsive, and tailored to the needs of disadvantaged and vulnerable groups; and*
- 5. 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.*

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.”

883. 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 in November 2017 .

I.1.1 Scoping Consultations

884. Scoping consultations were held in June, 2017 in Zestaphoni. 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 138: Zestaphoni Scoping Consultation

Date: 7 th June, 2017
Location: Zestaphoni Town Hall
Panel Members:
Mr. Nick Skinner – International Environmental Specialist
Mr. Giansante Bonin – Team Leader
Ms. Maka Stamateli – National Environmental Specialist
Ms Lika Bubashvili – Environmental Specialist, Road Department of Georgia
Mr. Gia Sopadze – Head of Environmental Division, Road Department of Georgia

List of Participants: 40 Participants (see Appendix B for list)			
#	Question / Comment	Answer	EIA Status
1	In previous road projects in the region we have had bad experiences with disposal of spoil material, especially from tunnels. Locations were selected, but there was too much spoil material and as such locals were paid to allow spoil material to be dumped on their land.	We will ensure that adequate space is made available for spoil disposal. If additional areas are required for spoil material their locations will require approval by the Engineer and the RD.	Calculations of spoil material have been made and discussions have been held with the RD regarding the re-use of the material (See Section G.7.3). If other sites are to be chosen the Contractor will be responsible for following the procedures for spoil disposal also outlined in Section G.7.3 .
2	Where will the borrow pits be located?	The locations have not been finalized at this stage.	No borrow pits will be required as part of the Project.
3	Landslides are a problem in this region, the project must carefully manage this issue.	We are aware of this issue and will make sure that the detailed design takes landslide issues into account.	As noted in Section F.1.4 , several landslide areas have been identified. They are not anticipated to significantly impact on the Project, but further survey will be conducted. The Project is not anticipated to increase the chances of landslides occurring.
4	For every tree cut, at least three must be replanted as part of the project.	The exact tree-replanting requirements will be confirmed during the EIA preparation.	As noted in Section G.6.1 , all trees within State Forest Fund locations that will be cut shall be replaced.
5	How will issues be resolved during the construction phase?	There will be a grievance mechanism for complaints to be aired and regular consultations throughout the construction phase with affected villages.	Section I.3 provides the Grievance Redress Mechanism (GRM) for the Project. In addition, Section G.8.2 provides requirements for the Contractor to undertake monthly community meetings in villages along the alignment in order to discuss specific issues before reaching the GRM level.
6	We are concerned about access to our property, both during the construction phase and the operational phase of the project.	This issue is noted and we will try to ensure that access is maintained as far as is practical throughout the construction phase.	Careful consideration has been given to the issue of access in this section. Only a small section of the new road will affect the existing road, and in this location two interchanges will be constructed that will provide access to this area during the operational phase of the Project. In addition, Section G.7.1 states that the Contractor will ensure access to land and properties remains at all times during construction, through diversions, or temporary roads.
7	Will the Contractors repair access roads after construction works are completed?	We will include specific mitigation measures to ensure that access roads are left in the same condition as	Section G.7.1 makes recommendations for a condition survey of the roads and for any roads to be repaired by the Contractor if the Engineer deems it necessary.

		before the project.	
8	Will we be able to review your documents?	Yes, and we will hold a second round of consultations based on your review of the findings of this report.	As per Section I.3 , this report and a Georgian EIA will be published on the ADB and RD websites. In addition, a second round of consultations was held to discuss the draft EIA,
9	There are lots of cultural heritage sites along the corridor. How will they be protected?	We will identify all cultural heritage sites within the corridor and prepare mitigation measures to protect these resources.	Surveys of cultural heritage within the Project corridor have been undertaken (Section F.4.5) and none have been identified directly within the RoW with the exception of a small natural spring north of the GAA plant. Provisions have been outlined to protect this area, as well as a cemetery close to the Project alignment (see Section G.8.5). The Contractor will be responsible for following GoG procedures for chance finds as per Section.

Figure 103: Scoping Consultation in Zestaphoni, 7th June, 2017



I.1.2 Public Consultations

885. A second round of consultations were held in Zestaphoni in January 2018. Participants in the consultations were presented with the initial findings 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 139: Zestaphoni Public Consultation

Date: 17th January, 2018 Location: Zestaphoni Panel Members: Mr. Nick Skinner – International Environmental Specialist Zura Mgaloblishvili - Director of Gamma Consulting Ltd (LCF) Elene Mgaloblishvili, Social Specialist of Gamma Consulting Ltd (LCF)

List of Participants: 30 Participants (see Appendix D for list)			
#	Question / Comment	Answer	EIA Status
1	Is there a risk that construction of the highway results in loss of water in the wells around?	Impact on ground water is may be possible in the sections of the road where tunnels are planned. Prior to construction water wells in the boundaries of potential impact zone of tunneling works will be identified. Measures have been provided in the EIA to monitor groundwater and provide temporary/alternative source of potable water if impacts occur.	Impacts of groundwater from tunneling activities are addressed in Section G.7.5 - Tunnels .
2	Construction of the highway is planned in the mineral water spring behind the GAA. Will it be affected?	During the construction works the spring will be fenced from the northern side to prevent impact of construction works. Close to the area of interest, excavation works capable to affect the flow are not planned. Impact on the spring is not expected.	Protection of the spring behind GAA is addressed in Section G.8.5 - Physical and Cultural Resources
3	The lighting along the road will affect migratory birds. Has this risk been considered?	Illumination does have impact on wildlife, including birds (migratory and nocturnal). The impact cannot be fully avoided. However, modern Lower wattage flat lens lamps widely used on highways, direct light down and reduce glare. This enables to reduce light pollution effect to some extend.	Street lighting impacts and mitigation are addressed in Section G.6.1 – Flora and Fauna .
4	It is advisable to arrange additional access near Shorapani to make access to the highway for local population easier. Is this possible?	The design team has considered the aspect of access in considerable detail. However, in some instance not all of the access roads will be as convenient as they were with the existing road.	Access impacts are considered as part of the Detailed Design.

886. The meeting was also attended by Representative of MoEPA Irakli Pirckhaleishvili, Environmental Impact Permits Department, Senior Specialist in the Second category of the Permits Division. Other questions and comments raised by the participants, which are not related to environmental issues, are not included in the table above.

Figure 104: Consultation in Zestaphoni, January 17th, 2018

I.2 Planned Information Disclosure

887. It is anticipated that in compliance with ADB's SPS (2009) this document will be provided for disclosure on the ADB website and the RD Website (in local language).

888. The RD 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

889. 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.

890. 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.

891. The GRM should be established and operated in compliance with the Georgian Regulations and ADB Policy requirements.

892. 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

893. The Administrative Code of Georgia is the legal document defining the rules and procedures for the grievance review and resolution.

894. 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.

895. 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

896. Clauses 194 and 198 define the rules and procedures ensuring participation of the claimants in the grievance review process.

897. 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.

898. 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

899. 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.
900. The grievance redress mechanism should be scaled to the risks and adverse impacts of the project.
901. 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.
902. 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

903. 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.
904. 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.
905. 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.
906. 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.
907. 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.

908. 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

909. 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

910. 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.

911. 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 140: 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

912. 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.

913. 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

914. 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 141: 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)

915. **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

916. 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.)

917. 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.

918. 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:

919. 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.

920. 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.

921. 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.

922. 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.

923. 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.

924. 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.

925. 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.

926. 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.
927. The RD assists the claimant to prepare the official written claim addressed to the GRCE and supplements this by his information notes.
928. 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

929. 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.
930. 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.).
931. 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.
932. 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.
933. 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.
934. 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.
935. 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.

936. A brief description of all stages of Grievance Resolution Process are given in the below.

Table 142: 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 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

Steps	Action Level	Process
		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.
Stage 3	Step 4 ^[11] _{SEP} 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).^[11]_{SEP} 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

937. The Grievance Logs will be developed at GRCE level.

Grievance Log in GRCE

938. The GRCE Grievance Logs will be developed and maintained at the Municipal level.

939. 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.

940. The copies of the records/documents may be also kept in the municipal office.

I.3.10 Communication

941. 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

942. 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.4.11 Disclosure of the Grievance Process

943. 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

944. 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.

945. The identified residual impacts during the Construction Phase include:

- **Terrestrial Fauna** - 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. Residual Impacts will be **MINOR / MODERATE**.
- **Aquatic Flora and Fauna** - A number of bridge piers will be constructed within the Dzirula 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 are disturbed by the Project works. Residual Impacts will be **MODERATE**.
- **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 and Spoil Disposal** - 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. Residual Impacts will be **MINOR / MODERATE**.
- **Vibration** - 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. Residual Impacts will be **MINOR / MODERATE**.
- **Noise** - 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. Residual Impacts will be **MINOR / MODERATE**.

946. The identified residual impacts during the Operational Phase include:

- **Climate Change** - 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**.

- **Soils** - The erosion protection measures outlined above will prevent impacts occurring into the operational phase of the Project. However, although the measures outlined above will mitigate short term impacts, in the long term a solution for the disposal of contaminated soils must be found otherwise residual impacts will be medium. Residual Impacts will be **MEDIUM**.
- **Hydrology** - 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. Residual Impacts will be **LOW/MEDIUM**.
- **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**.
- **Employment and Local Businesses** - 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**.
- **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. Residual Impacts will be **LOW/MEDIUM**.
- **Noise** - According to the noise model residual impacts to a number of receptors will remain even after the construction of the noise barriers listed above. Further assessment of the impacts to these receptors will be on-going during the operational stage of the Project to confirm the findings of the model and if additional noise abatement measures are required, including for example; Fencing around individual properties, construction of earth embankments around groups of properties, installation of sound proof windows in properties and expropriation. Residual Impacts will be **MEDIUM**.

947. The total estimate costs of the environmental mitigation and management to be funded by ADB has been calculated at approximately US\$9,787,870, or approximately 3% 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

948. 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.
949. 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.