Environmental Impact Assessment

September 2018
Final

GEO: East–West Highway (Khevi–Ubisa Section) Improvement Project

Section F2 of the Khevi–Ubisa–Shorapani–Argveta Road (E60 Highway)

Part 1 – Executive Summary

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Abbreviations and Acronyms

AADT	Annual Average Daily Traffic
AASHTO	American Association of State Highway and Transportation Officials
AM	Accountability Mechanism
ADB	Asian Development Bank
AST	Above Ground Storage Tank
AT	Argveta - Tbilisi
AQP	Air Quality Plan
BAP	Borrow Pit Action Plan
BAT	Best Available Technology
BGL	Below ground level
BoQ	Bill of Quantities
BOD	Biological Oxygen Demand
BRI	Bridge
CAREC	Central Asia Regional Economic Cooperation
CAP	Corrective action plan
ccTV	Closed Circuit TV
CFC	Chlorofluorocarbon
CIS	Commonwealth of Independent States
CO	Carbon monoxide
COD	Chemical Oxygen Demand
CO_2	Carbon Dioxide
Cr	Chromium
dBA	decibel
DD	Detailed Design
EA	Executing Agency
EAC	Environmental Assessment Code
EC	Electrical conductivity
EIA	Environmental Impact Assessment
EIB	European Investment Bank
EHS	Environmental Health and Safety
EMP	Environmental Management Plan
EM	Environment Manager
ERP	Emergency Response Plan
ES	Executive Summary
ESIA	Environmental and Social Impact Assessment
EU	European Union
EWH	East West Highway
EWHIPs	East West Highway Improvement Projects
FE	Iron
FS	Feasibility Study
GAA	Georgian American Alloys
GDP	Gross Domestic Product
GEOSTAT	National Statistics Office of Georgia
GEL	Georgian Lari
GHG	Greenhouse Gases
GoG	Government of Georgia
GOST	Technical Standard
GRM	Grievance Redress Mechanism
GRCE	Grievance Redress Committee
ha	Hectare

H&S	Health and Safety
HC	Hydrocarbon
HP	Horse Power
HZ	Hertz
IBA	Important Bird Area
IBC	Intermediate bulk storage containers
IFC	International Finance Corporation
IFI	International Finance Institutions
IEE	Initial Environmental Examination
IES	International Environmental Specialist
in/sec	Inch per second (25.4mm/sec)
IUCN	International Union for Conservation of Nature
km	Kilometer
km/h	Kilometers per Hour
Km^2	Square kilometer
LARP	Land Acquisition and Resettlement Plan
LC	Least Concern
LCF	Local Consulting Firm
L_{eaq}	Equivalent Continuous Level
MELT	Modified Eccentric Loader Terminal
mg/l	Milligram per liter
mg/m^3	Milligram per cubic meter
mg/kg	Milligram per kilogram
m^3/s	Cubic meters per second
m^3/h	Cubic meters per hour
m^3/d	Cubic meter per day
m	Meter
m^2	Square meter
m^3	Cubic Meter
m^3/s	Cubic meter per second
MAC	Maximum Allowable Concentrations
MCA	Multi-criteria analysis
MoEPA	Ministry of Environment Protection and Agriculture
MoESD	Ministry of Economy and Sustainable Development
MPE	Maximum Permissible Emission
MPC	Maximum permissible concentrations
MPD	Maximum Permissible Discharges
MSDS	Material Safety Data Sheet
$MtCO_2e$	Million tons of CO_2 equivalent
NES	National Environmental Specialist
NGO	Non-Governmental Organization
NH_4+	Ammonium
Nm^3	Normal cubic meter
NO_X	Nitrogen oxides
NO_2	Nitrogen Dioxide
NO_3	Nitrate
Ni	Nickel
NT	Near Threatened
OHS	Occupational Health and Safety
PA	Per Annum
PAP	Project Affected Person
PAH	Polycyclic aromatic hydrocarbons
PCR	Physical and cultural resources
PPV	Peak Particle Velocity
Pb	Lead

PM	Particulate matter
POPs	Persistent organic pollutants
PO_4	Phosphate
PMU	Project Managing Unit
PPE	Personal Protective Clothing
PPTA	Project Preparatory Technical Assistance
PPM	Parts per million
PSC	Pre-stressed concrete
SPM	Suspended Particulate Matter
RD	Road Department
RoW	Right of Way
SFF	State Forest Fund
SniP	Construction Standards
STD	Sexually transmitted diseases (such as HIV/AIDS)
SEMP	Specific Management Plan
SO_2	Sulfur Dioxide
SPS	Safeguard Policy Statement
TA	Tbilisi - Argveta
TBP	Tunnel Blasting Plan
TEM	Trans-European North-South Motorway
TMP	Traffic Management Plan
TOR	Terms of Reference
TSP	Total Suspended Particulates
TSS	Total suspended solids
TUN	Tunnel
UNEP	United Nations Environment Program
USAID	United States Agency for International Development
USD	United States Dollar
UST	Underground Ground Storage Tank
VU	Vulnerable
WB	World Bank
WHO	World Health Organization
WMP	Waste Management Plan
°C	Degrees Celsius
$\mu g/m^3$	Micrograms per cubic meter

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

Executive Summary

1. Introduction

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

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

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

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

2. Project Background

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

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

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

3. Project Description

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

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

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

Figure 1: Road Location Map

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

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

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

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

11. Twenty tunnels are proposed in Section F2:

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

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

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

14. The following types of culverts will be constructed:

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

15. Two different pavement structures will be used:

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

4. Alternatives

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

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

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

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

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

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

5. Description of the Environment

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

6. Impact Identification

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

Design / Preconstruction Phase

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

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

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

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

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

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

Construction Phase

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

that come with the movement of as many as 1,000 construction vehicles per day along the combined F2, F3 and F4 section.

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

Operational Phase

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

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

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

72. Noise – A noise model was developed for the EIA to determine the noise levels on the Project road in the year 2037. Using the current traffic levels a model was also prepared for the existing road. A comparison of the result of the 'ambient' noise levels against the forecast levels was then made to determine if the forecast noise was more than 3 dBA above the ambient. The results show that 25 of the 64 identified receptors are within 3 dBA of the modeled ambient. In addition, it is noted that a further four receptors will be below IFC guidelines for daytime and nighttime noise (45 and 55 DBA), meaning that a total of 29 receptors would be within IFC guideline limits in the predicted future scenario and 35 would be above the limits.

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

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

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

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

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

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

7. Mitigation and Management Actions

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

Design / Preconstruction Phase

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

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

- Asphalt Plant Plan.
- Rock Crushing Plant Plan.
- Concrete Batching Plant Plan.
- Bridge Construction Plan (for each bridge construction site)

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

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

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

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

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

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

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

88. General Tree Protection - Prior to the commencement of works the Contractor shall stake the boundary of the entire work site, including intersections and areas under bridges (this excludes within rivers and tunnels, but not tunnel portals). The Contractor shall then identify through a site survey if any Georgian Red-listed tree species are located within 5 meters of the site boundary. This survey will form part of the Contractors Clearance, Re-vegetation and Restoration Management Plan. If any of these trees are identified the contractor will be required

to place wood fencing around the tree in order to protect the tree during construction works, including its root zones. The Engineer will inspect all of the tree protection measures on a regular basis.

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

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

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

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

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

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

94. Tunnels – The Contractor will develop a ground water management plan for each tunnel under which shall be submitted for approval by the Engineer at least four weeks prior to the start of tunnelling works. The plan shall include routine monitoring of the groundwater levels in wells against baseline water levels (measured by the Contractor before the start of tunnel works) in the Project area which will be undertaken on a weekly basis by the Contractor within the vicinity of each tunnel he is excavating.

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

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

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

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

Construction Phase

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

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

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

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

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

104. The Project will clear approximately 33 hectares of natural habitat. The EIA has identified the different habitats affected and the size of each habitat to be cleared. To mitigate this impact the Project shall undertake a three phase approach. Firstly, the Contractor, as part of his Clearance, Re-vegetation and Restoration Management Plan, shall prepare a Biodiversity Action Plan (BAP) for the restoration of habitat within the Project corridor. This is of particular importance in the riparian environments where bridge construction occurs. The plan should be

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

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

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

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

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

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

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

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

112. Tunnels - Routine monitoring of the groundwater levels in wells in the Project area will be undertaken on a weekly basis by the Contractor within the vicinity of each tunnel under excavation. If drawdown levels in wells are significant the Contractor will provide a temporary source of potable water to the affected persons until the groundwater levels are recharged. The Contractor will pass all drainage water from the tunnel through a settlement tank. Weekly monitoring of the water quality from the tank will be undertaken by the Contractor to assess for any pollution. If the drainage water meets drinking water standards it can be considered for re-

use in any potentially depleted wells during the construction phase. The Contractor shall continue to monitor the water levels in the affected wells for a period of two months after construction is completed. If the wells begin to recharge to their pre-construction levels no further actions will be necessary. However, if the water fails to re-charge to pre-construction levels new boreholes, or alternative sources of water supply will be provided for the affected persons.

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

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

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

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

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

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

Operational Phase

119. Noise – 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, 14 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 14 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 14 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.

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

121. 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.

122. 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

123. 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:

124. 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.

125. 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.

126. 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

127. Two rounds of stakeholder consultations were undertaken, firstly in Boriti in 2017 and secondly in Kharagauli in 2018. The first round of consultations helped define the scope of the EIA. The second round of consultations were then undertaken on the draft EIA. During the consultations a number of issues were raised, such as disposal of tunnel spoil material, tree cutting and replanting, access to properties during construction and identification of sites of cultural heritage.

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

10 Conclusions

129. 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.

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

Construction Phase

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

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

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

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

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

(vi) Noise and Vibration – Despite the fact that comprehensive mitigation measures have been set to manage construction noise and vibration there may still be instances where construction works may result in unanticipated elevated levels of noise and vibration. However, these will only be temporary and localized. Good oversight from the Contractors HSE team and the Engineers environmental manager should limit the impact of these types of incidents. Residual impacts will be **MINOR**.

Operational Phase

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

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

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

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

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

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

(vii) Noise - Residual impacts will be negligible for all of the identified receptors if the noise barriers are constructed and the remaining 14 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 14 receptors are within IFC nightime limits. Residual impacts will be **LOW/MEDIUM** for any receptors choosing the waiver option.

11. Implementation

131. 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.

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

133. 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.

134. 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.