Environmental Impact Assessment

Project Number: 53178-001
May 2019

GEO: East–West Highway (Shorapani–Argveta Section) Improvement Project

Part 9 (Sections G–J, Appendixes A–C)

Prepared by the Roads Department of the Ministry of Regional Development and Infrastructure of Georgia for the Asian Development Bank.

(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 $ktCO_2$/km for a 26m wide road. Including operational and maintenance costs over a 40 year period this figure rises to 3.94 $ktCO_2$/km. Given a road length of 14.77 km, this would result in around 58,200 tCO_2 of GHG emissions from the construction and O&M phases of the Project over a 40 year period.

Table 77: Estimated Energy Consumption, CO_2 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 CO_2 per day, or 94,661 tons of CO_2 per annum. A decrease of 13% of GHG emissions can be achieved when driving at 90 km/h as opposed to transient driving at 60 km/h. If we apply this condition to the traffic forecasts in 2037 a figure of approximately 186,000 tons of CO_2 would be generated by traffic using the road per year.

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 he emissions of vehicles on a highway are lower than vehicles driving a urban type road similar to the existing one where the frequent bends and inclination as well as some traffic congestions do not allow a fluid drive. If a similar traffic flow should transit via the existing road, the emissions would be almost 20% higher.

Potential Impacts Upon the Project

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

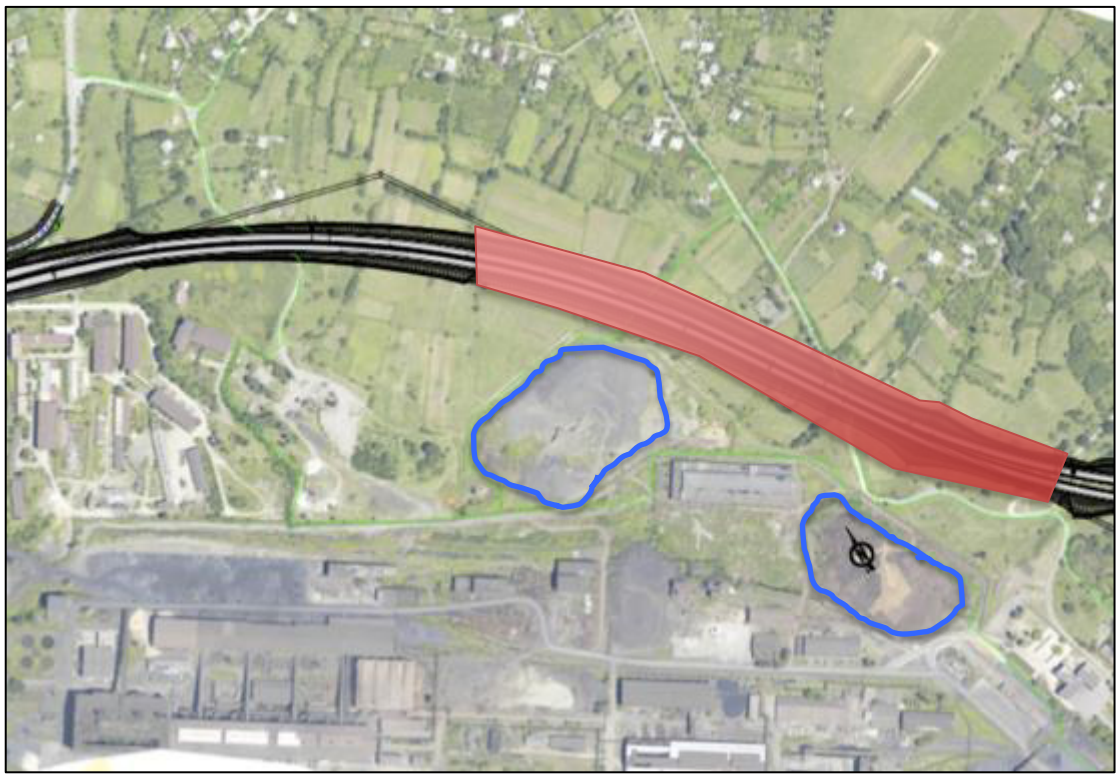
Potential Impacts to Soils

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 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 m^3 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 m^2 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 250m^3. The Engineer will hire a certified laboratory to take a soil sample from each of the quadrants for further chemical analysis (a stockpile of 2,500m^3 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 m^3 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.

<u>Construction Phase</u>

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 ensuing 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.
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- 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 m^3 per day (0.002 m^3/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 be given to the issue of drainage and culverts to ensure that drainage patterns are improved from the existing conditions and that increased run-off does not occur or result in flooding of areas previously undisturbed. During design, all drainage works have been designed based on the historical flood data and flood forecasting. A design discharge of 50 years return period is considered for culverts, and 100 years of bridges. 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 was will be undertaken by a waste management company contracted by the Contractor. The waste management company must have the required licenses to transport and dispose of hazardous waste before any such waste is removed from the site. The Contractor will keep copies of the company's licenses and provide waste transfer manifests at his camp site for routine inspection by the Engineer.

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.

<u>Construction Phase</u>

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.

<u>Operational Phase</u>

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) Reinstate disturbed areas – if the case.

Residual Impact Significance

Construction Phase – ***MINOR***

If the mitigation measures suggested are implemented, there will be no significant residual impacts.

Operational Phase – ***LOW/MEDIUM***

It is noted that the Project requires interceptor tanks for bridge run-off and this could also be applied to the road drainage network in general, if not residual impacts will occur during the operational phase as polluted road water run-off drains directly into surface water courses.

G.5.5 Natural Hazards

Potential Impacts

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 negative 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.

(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.
   (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.

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 Khramulya (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 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 included at least the following measures: • Marking the areas where otters are registered.

	• Implementation of works so to retains otter habitats in the water body and bank where feasible. • Constructing artificial holts to replace those that will be damaged or removed. • Implementation of works at daylight to allow a separation of human activity from the main peaks of otter activity (dawn/dusk). • Implementation of pollution prevention measures (soil and water) such as - arrangement of temporary surface water run-off control system consisting of settling ponds and drainage ditches, as well as other measures for soil, water, vegetation/flora and fauna impact mitigation listed in the EIA. • Avoiding significant change in lighting. This can be achieved by retaining the bank-side vegetation. In case necessary, additional planting along the bank-top to provide further screening to reduce light impact. Note: This will also work during operation. In addition to planting, to reduce impact during operation of the road location of the poles on design and construction stage should be selected so to be at a distance from the riverbed. • Arranging barriers in the sensitive areas to avoid accidental road kills (using otter-proof fences to stop otters getting into development sites) Note: The otter fence shall consist of a post, mesh and wire and ply board. The posts shall be ≥ 1.5m high, spaced at 2m intervals. Netting shall be mounted onto the supporting wire (welded wire mesh (2.0mm wire)) – gauge 50x50mm and 2000mm wide. The mesh shall be buried to 300mm and at top turned out at 45 degrees to the outrigger line. This mesh will thus be resistant to animal activity from the river side. On the upper slope side of the fence 10mm ply boards (1500 wide) shall be nailed to the support posts to provide damage protection and screening. • Tool-box briefings to contractors prior to those works commencing. • If live otters are encountered contractor is to cease work and contact the ecologist who will then liaise with the appropriate regulatory officers to discuss the encounter and how best to proceed from that point. • Mitigation relating to noise, air quality and water pollution are addressed under their specific headings within this section of the report.
Sciurus anomalus 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
Fish	• Use of sites designated for dumping to avoid polluting ecologically important aquatic habitat. • Use of sites designated for dumping will also prevent contamination of the aquatic food chain. • Hunting and poaching should be prevented to protect species of conservation importance and minimize loss of wildlife, which will already be undergoing habitat loss due to the Project. • The Contractor shall consult with the MoEPA to 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.
Reptiles &	• 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 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.

(b) If herpetofauna species are observed in the Project area during the surveys, they should be removed to other suitable habitat, with the help biodiversity experts to ensure proper handling. Herpetofauna species are most at risk because of their limited ability to re-locate. These species are at higher risk because of their limited ranges.

(c) If bird nests are observed during the site surveys (and also during construction), they should be carefully removed and placed in suitable habitat, with the help of biodiversity experts to ensure proper handling. An expert can help identify the species the nests belong to. If it is a species of conservation importance, special care should be taken.

This will reduce the risk of mortality faced by them as a result of Project-related activities.

(d) If roosting sites for bat species are identified, first priority needs to be given to protecting the roosting sites. Since the majority of roosts are used only on seasonal basis, the most common/effective method of avoiding the impact is planning of works for less sensitive period of time. Optimum time for implementation of works in the area where hibernation roosts are found is May-October. However, in the absence of this option, biodiversity experts should be consulted and if required the bats should be re-located with the help of experts to ensure proper handling and development of a plan for relocation that maximizes chances of its success. Research into relocation of bats is limited with documented success of relocations even more so. It is recommended that the following characteristics be taken into consideration for the species being relocated, to both assess feasibility and develop an effective relocation protocol:

- Dispersal from the release site.
- Size of the founder group.
- Habitat quality at the release site.
- Disease transmission.
- Anthropogenic effects on the founder population.
- Post-release monitoring.

Bat boxes can be considered as mitigation measure. However, it should be taken onto account preferences – for instance Lesser horseshoe bat can not use bat boxes whereas Common pipistrelle can use tree crevice-type box with 25-35 crevices and or tree hollow-type box (note: the latter type is rarely used as maternity roost).

(ii) Bridges should be designed with dry paths under the bridge on either side of the streams to facilitate movements of livestock and wildlife, the latter primarily at night when people are not around.

(iii) Poaching of wildlife shall be strictly prohibited.

(iv) The Contractor will be responsible for providing training sessions to his workers relating to environmental protection (including the ban on poaching).

(v) Ensure that lower wattage lamps are used in street-lights which direct light downwards to reduce glare.

(vi) Waste should be disposed without dumping on vegetation or allowing it to contaminate waterways. This will prevent contamination of habitat and the spread of pollution through the food chain.

(vii) Noise and dust pollution should be managed using the specific noise and air quality mitigation measures outlined in this EIA.

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 Shoropani.

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 m^3 of spoil material will be generated from the tunneling. Another 1,184,100 m^3 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 m^3 can be re-used as embankment material, which would leave approximately 691,500 m^3 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 m^2 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 m^3 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 m^3 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 Shoropani. 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.

<u>Liquid Waste</u>

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 clearing illustrate the conditions of the site prior to its clearing and use, so that it can be fully re-instated to its former conditions. The method statement shall also indicate what type of vegetation has been cleared at the site, and where this has occurred, the Contractor shall be responsible for replanting of any trees cut in these areas on a 1:3 basis.

Residual Impact Significance

Construction Phase – ***MINOR***

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

Operational Phase – ***LOW***

If the mitigation measures suggested are implemented residual impacts will be low as long as reinstatement plans are followed correctly.

G.7.5 Tunnels

Potential Impacts

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.

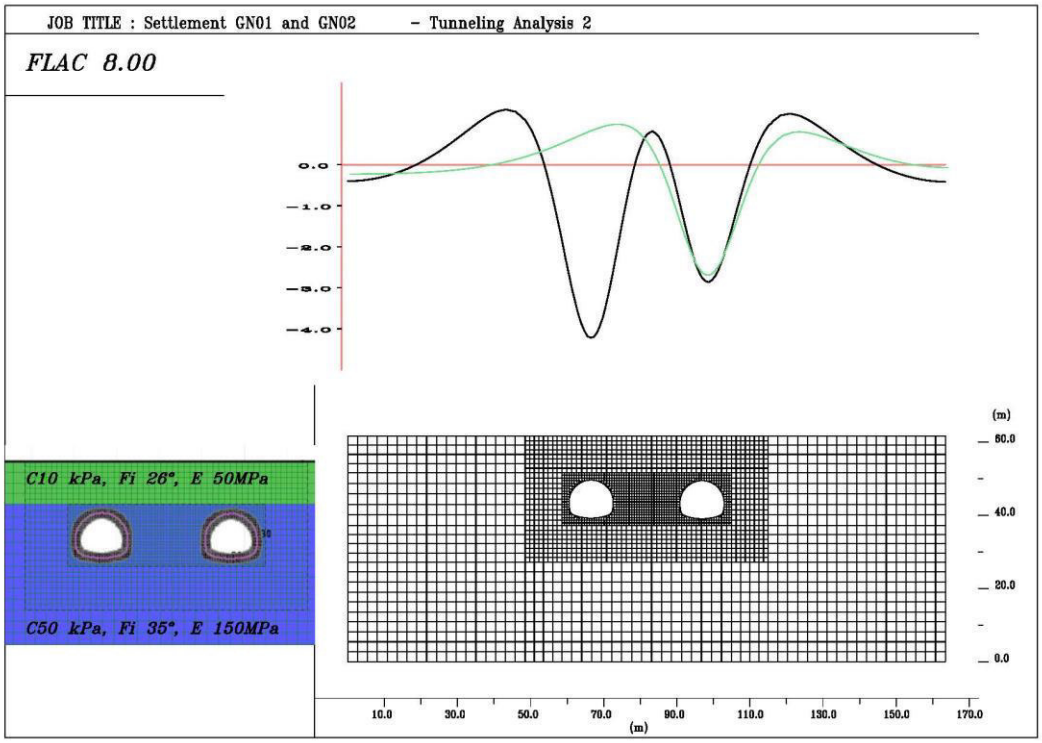
Surface Settlements & Slope Instabilities

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 re-charge 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 nea.

(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 someway to enhancing the aesthetic value of the Project especially as vegetation grows back around construction zones, and in all likelihood any negative opinion of the new road in terms of visual impact will decrease over time as people get used to the altered landscape.

G.8.7 Vibration

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:

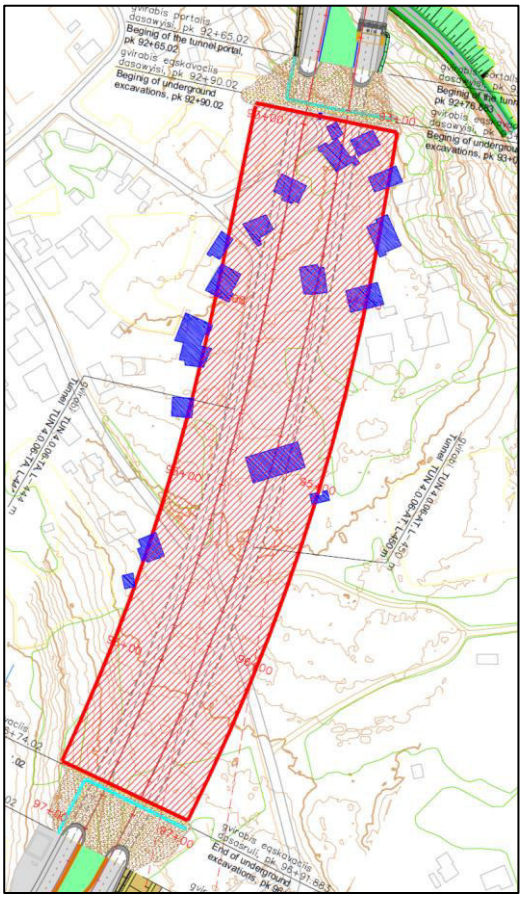
- The vibrations generated at the source will propagate with velocity of 10 mm/s;
- The vibration will travel in 2 meters of weathered calcarenite and 5 meters of alluvial soil (which present a much lower stiffness);
- In this superficial layer the vibrations will be strongly attenuated and the expected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

<u>Tunnels - TUN 4.0.06 AT/TA (potentially TUN 4.0.05 AT/TA)</u>

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.

<u>Bridges</u>

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-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

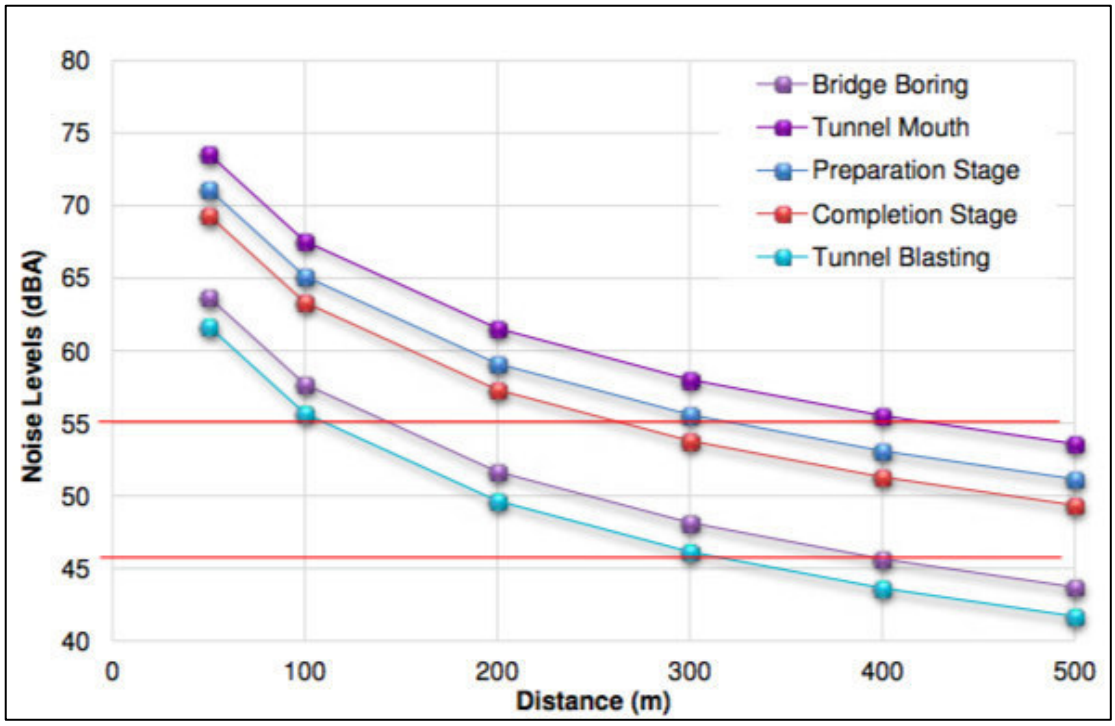
792. For a more detailed impact assessment, the construction noise was calculated at distances starting from 50 m to 500 m to see the extent of spreading of noise and separately for surface, bridge and tunnel. The modeling results for construction noise are shown in Figure 92**.** Following assumptions were made during calculation:

(i) It was assumed that the equipment working simultaneously in preparation stage are; dozer, excavator, grader, road roller, rock drill and dumpers whereas in completion stage the equipment are; compressor, paver, road roller, tractor and concrete mixers. Blasting will not be used for excavation at the tunnel mouth and portal.

(ii) Boring is used for bridges whereas the jack hammer is used for tunnel mouth.

(iii) The estimated shielding was taken as 2 dBA. Shielding is the reduction in noise due to addition of mitigation measures like barriers and dirt mound.

Figure 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 accidence of allowable limits is expected. Placing the barrier close to the source proves to be effective.

(iii) Give notice as early as possible to sensitive receptors for periods of noisier works such as excavation. Describe the activities and how long they are expected to take. Keep affected neighbours informed of progress.

(iv) Within normal working hours, where it is reasonable to do so:
  (a) schedule noisy activities for less sensitive times.
  (b) provide periods of respite from noisier works (for example, periodic breaks from jackhammer noise).

(v) The weekend/evening periods are important for community rest and recreation and provide respite when noisy work has been conducted throughout the week. Accordingly, work should not usually be scheduled during these times.

(vi) All mechanical plant is to be silenced by the best practical means using current technology. Mechanical plant, including noise-suppression devices, should be maintained to the manufacturer's specifications. Internal combustion engines are to be fitted with a suitable muffler in good repair.

(vii) Maintenance tools, machines and equipment so that they are in good conditions. When some wrong is found, they must be fixed immediately in order to reduce noise from the equipment.

(viii) Fit all pneumatic tools with an effective silencer on their air exhaust port.

(ix) Install less noisy movement/reversing warning systems for equipment and vehicles that will operate for extended periods, during sensitive times or in

close proximity to sensitive sites. Occupational health and safety requirements for use of warning systems must be followed.

(x) Turn off plant when not being used.

(xi) All vehicular movements to and from the site to only occur during the scheduled normal working hours, unless approval has been granted by the Engineer.

(xii) Keep good conditions of trucks that use to transport construction materials so they cause no loud noise and control the truck speed, to be not exceeded 40 km/hr when driving through communities, and not exceeded 80 km/hr when driving on highways.

(xiii) Where possible, no truck associated with the work should be left standing with its engine operating in a street adjacent to a residential area.

(xiv) Provision of noise protection kits such as ear plug, earmuff, for workers who are working in the area with noise level is higher than 85 dB(A). It is designated as a regulation that workers must wear protection kits in case of working in a noisy area.

Operational Phase Noise Impacts

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 tour 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 Metode 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 or new urban road has been performed using SOUND PLAN VER. 7.2 ray tracing software. Noise sound pressure results on receiving point are based on method BNPM (Basic Noise Prediction Method) and on German regulation BNPM, which is based on DIN 18005.

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

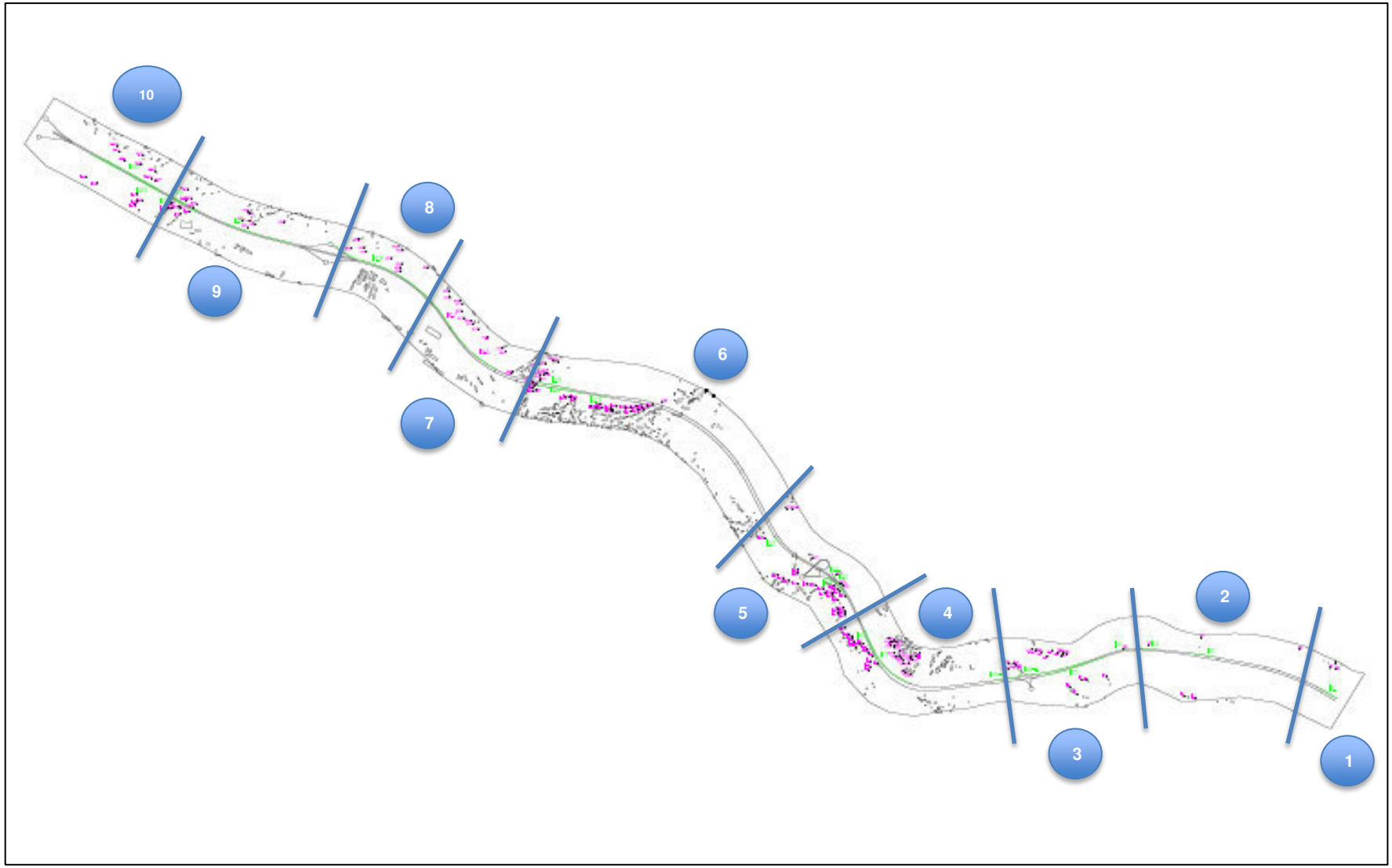
Year	Car (70%)	Mini Buses<15, PickUP (30%)s	Buses & Trucks(30%)	Trailers & >3 axle (30%)s	Total
2021	11664,1	1292,7	887,4	410,7	14254,9
2022	12427,1	1377,3	940,5	435,6	15180,5
2023	13098,4	1451,4	987	456,9	15993,7
2024	13805,4	1530	1035,9	479,7	16851
2025	14385	1594,2	1075,8	498	17553
2026	14989,8	1661,1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

	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	
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)
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

	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	
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)
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

	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	
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)
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

	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	
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)
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

	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	
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)
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

	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	
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	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

	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	
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)
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

	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	
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)
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

	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	
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)
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

	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	
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	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

	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	
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)
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

	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	
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)
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

	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	
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)
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

	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	
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	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

	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	
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)
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

	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	
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)
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

	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	
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)
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

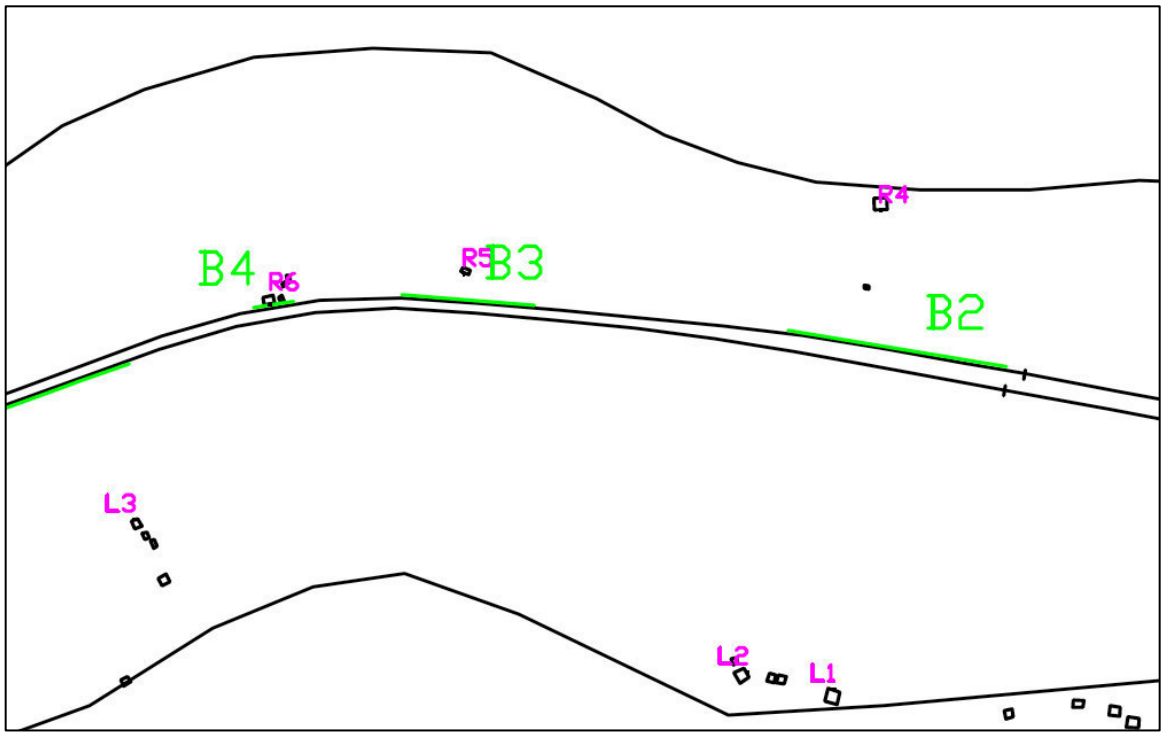


Table 101: Portion 2 Noise Model Results with Noise Barriers

	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)
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

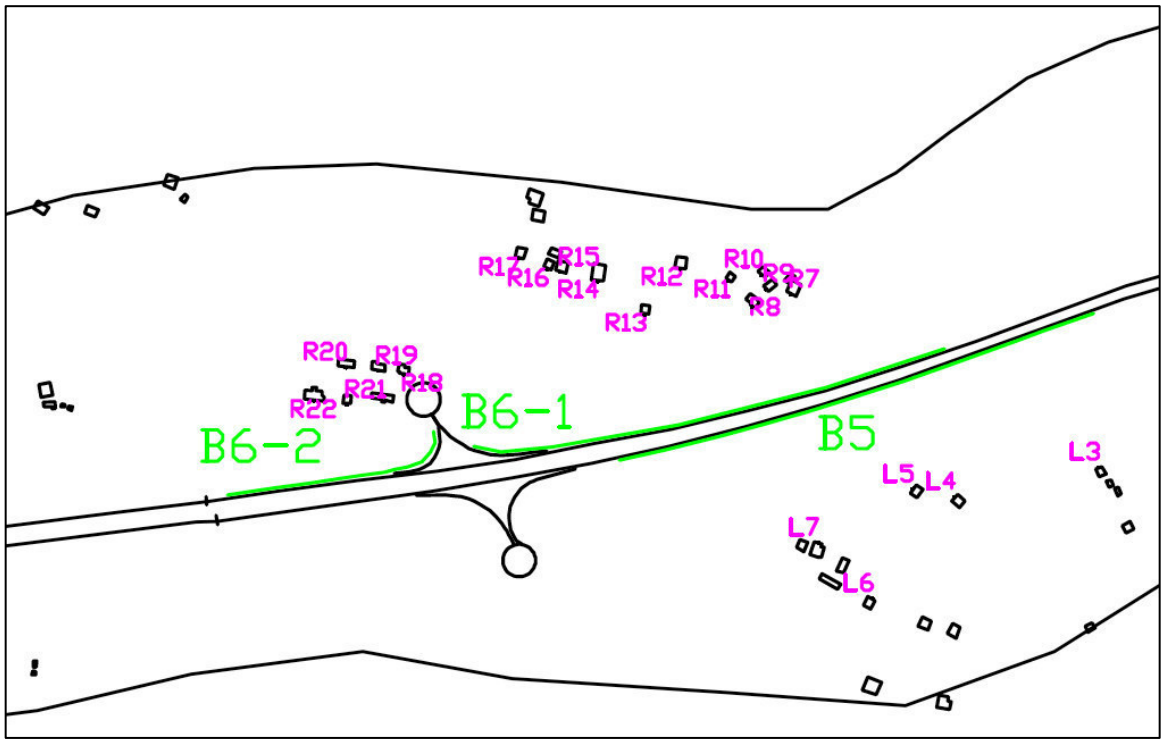


Table 104: Portion 3 Noise Model Results with Noise Barriers

	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)
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

	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)
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

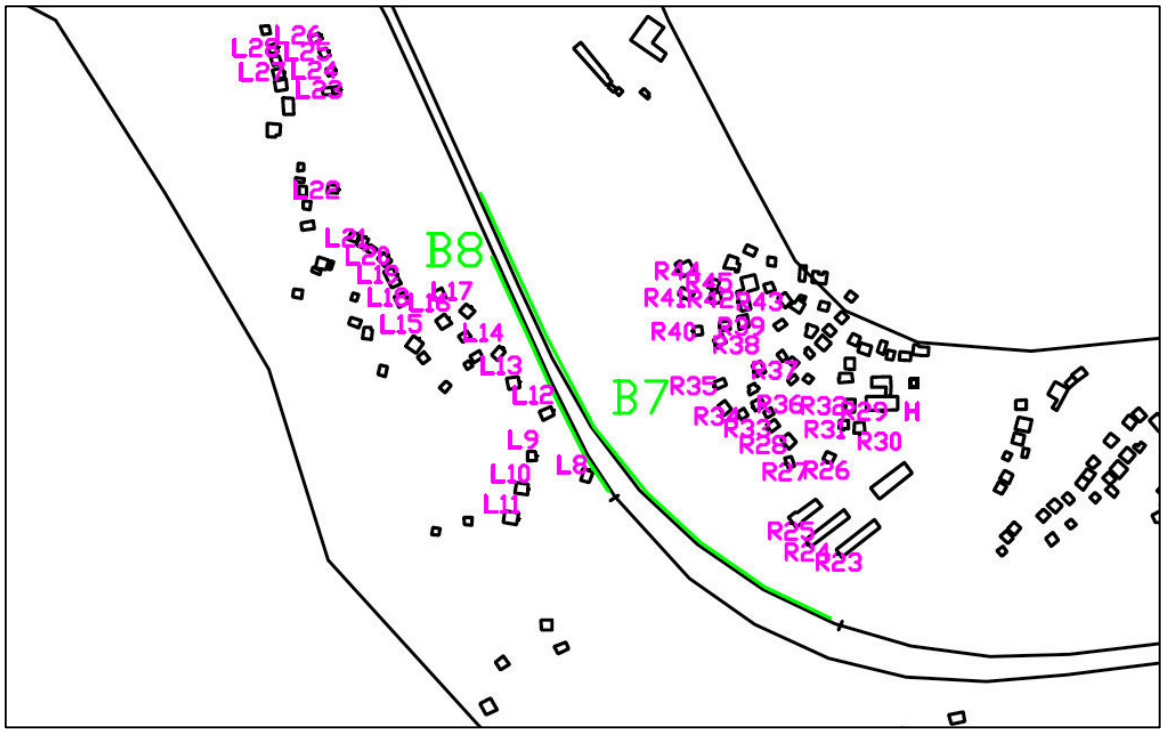


Table 107: Portion 4 Noise Model Results with Noise Barriers

	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)
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

	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

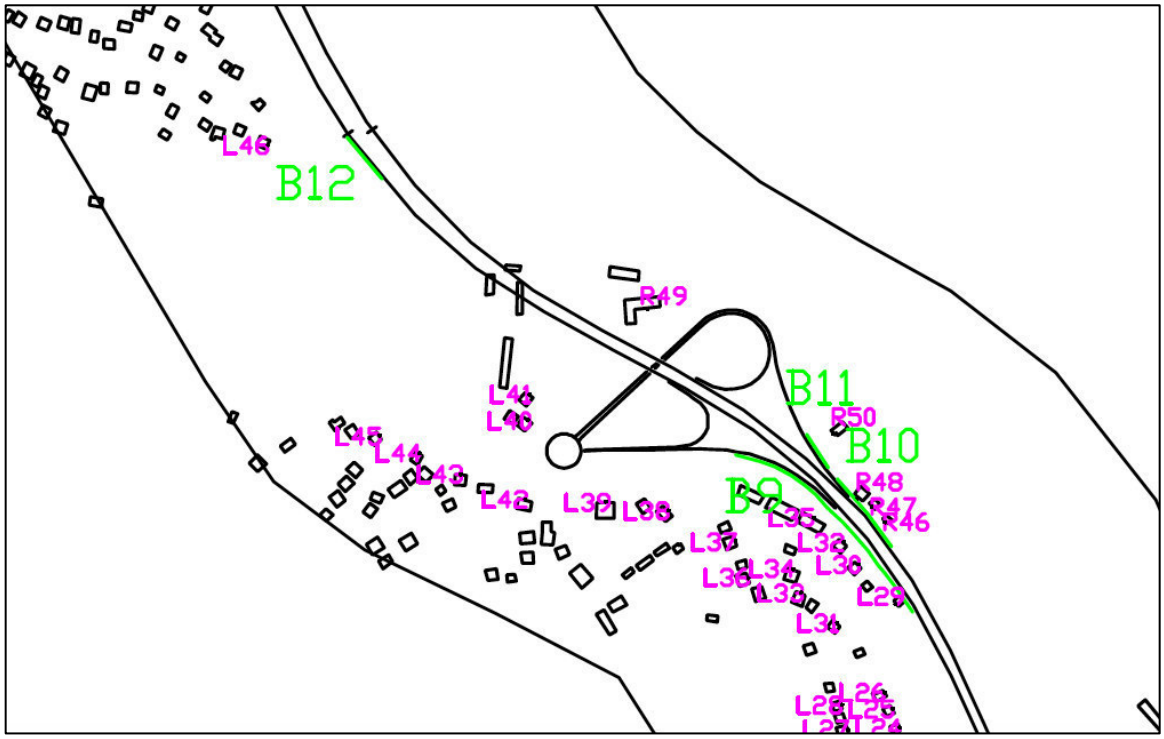


Table 110: Portion 5 Noise Model Results with Noise Barriers

	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

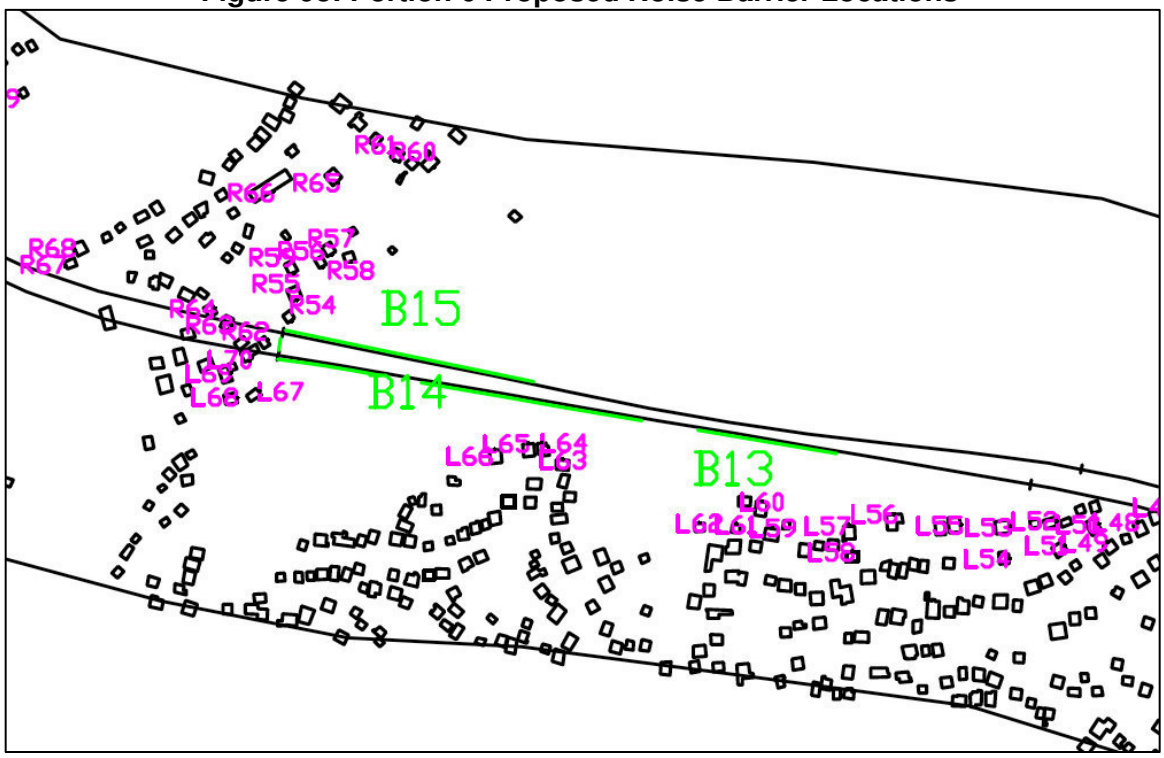


Table 113: Portion 6 Noise Model Results with Noise Barriers

	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)
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

	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)
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					

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

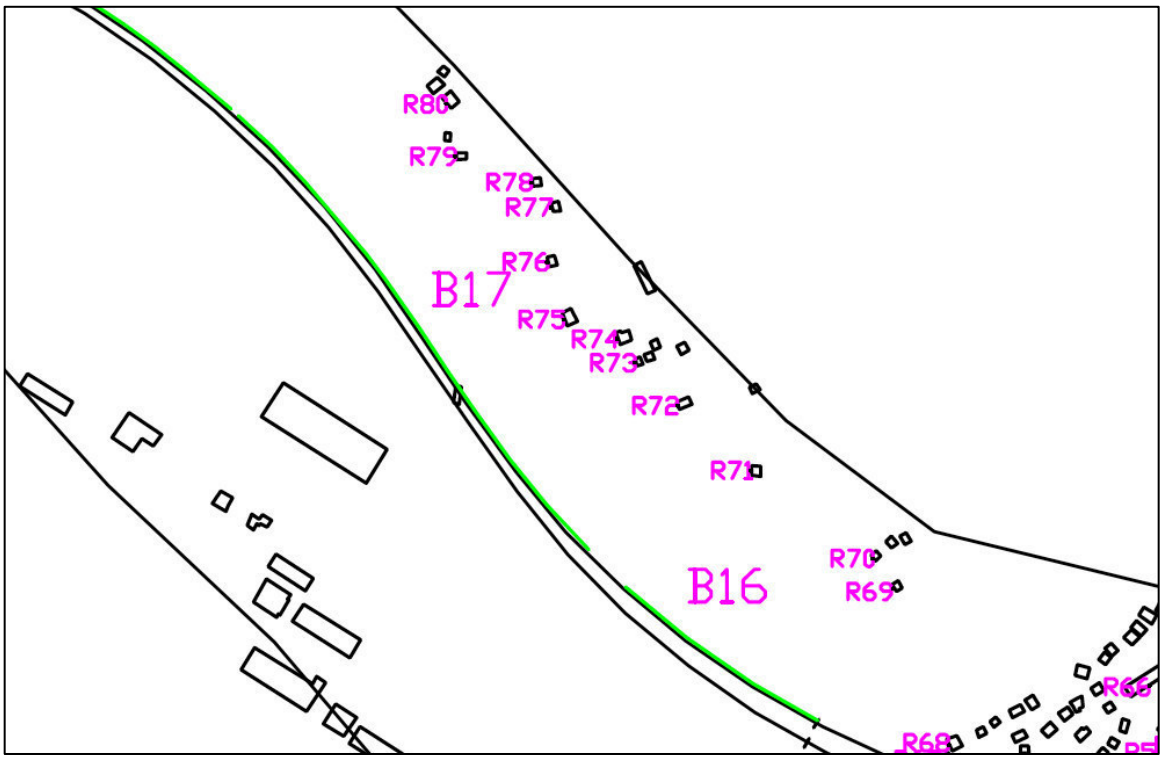


Table 116: Portion 7 Noise Model Results with Noise Barriers

	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

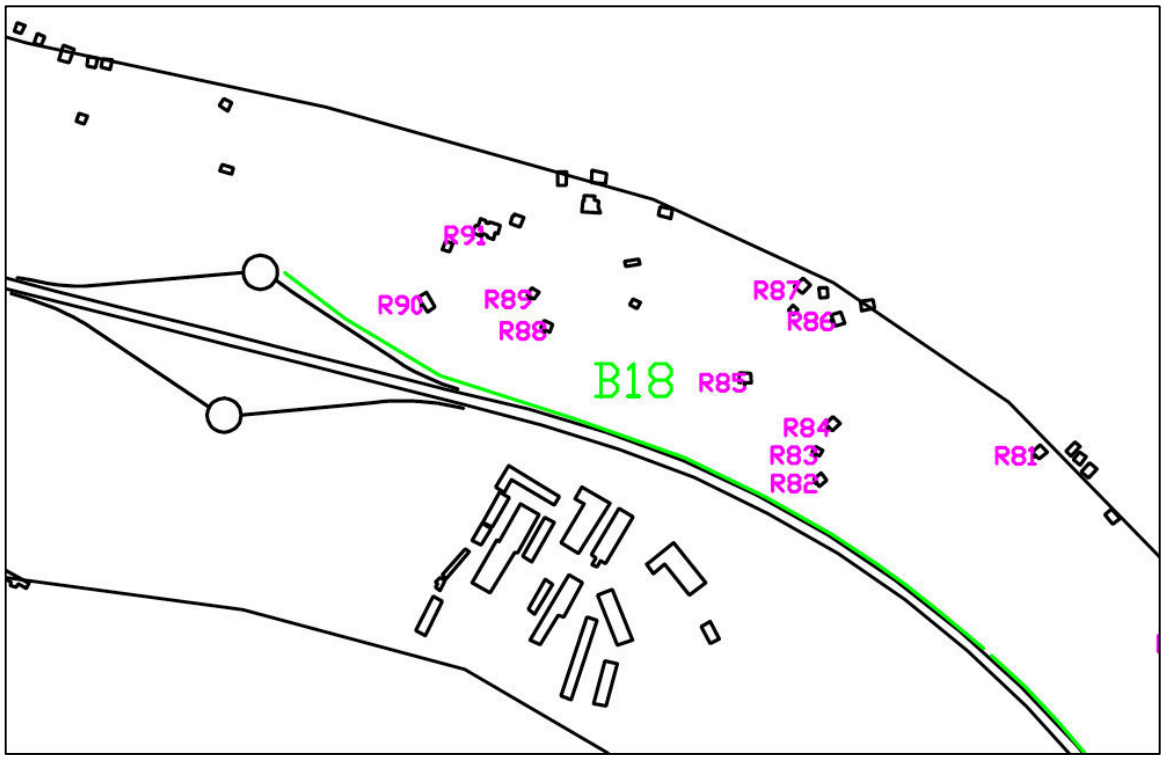


Table 119: Portion 8 Noise Model Results with Noise Barriers

	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)
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**

Total number of Non-compliance	0	5	8	1	3

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

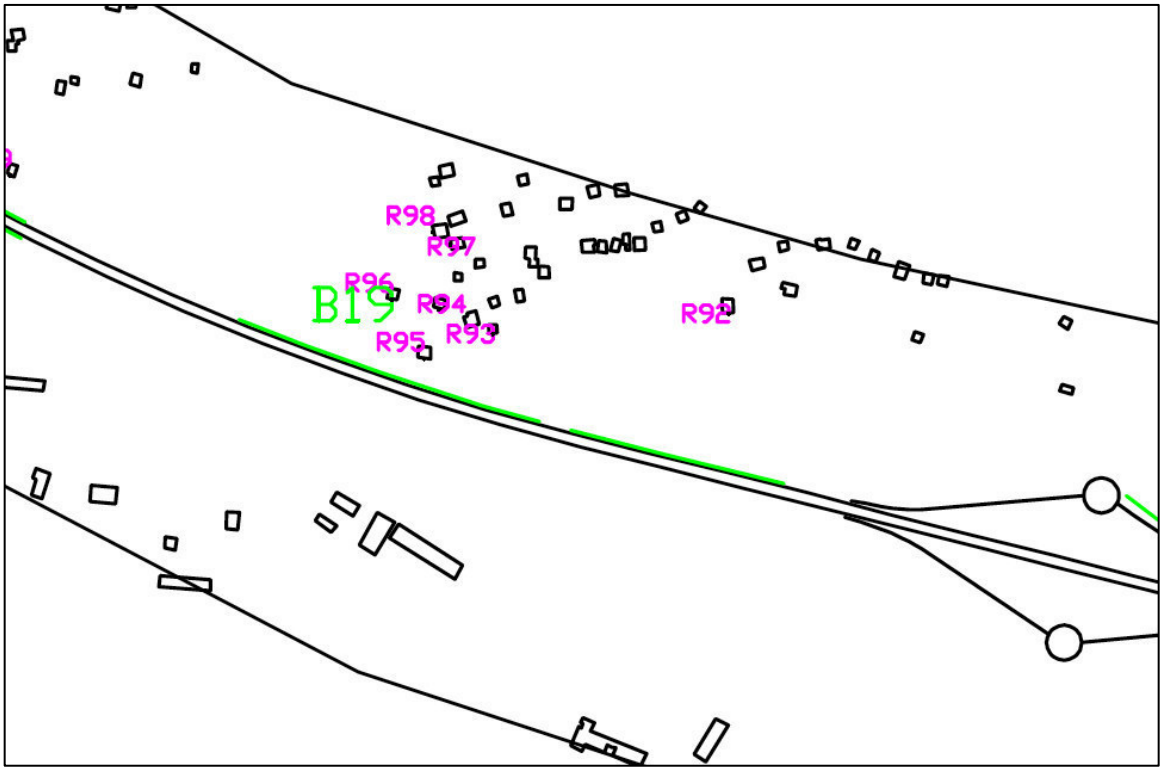


Table 122: Portion 9 Noise Model Results with Noise Barriers

	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

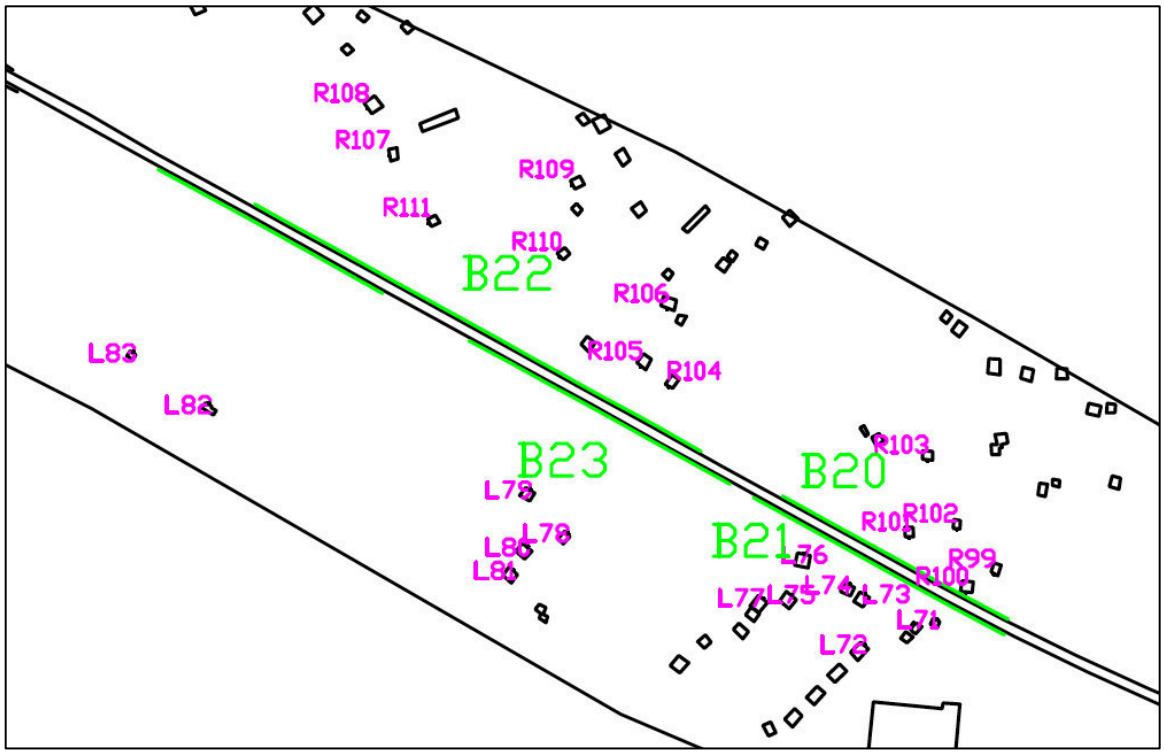


Table 125: Portion 8 Noise Model Results with Noise Barriers

	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)
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											

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.

		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 nightime noise as a result of increased traffic on the new road. WHO indicate that noise levels above 55 dBA for the daytime and 45 dBA for the nightime can lead to negative health impacts [39] 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 UKs Planning Policy Guideline Note 24 – Planning and Noise, provides noise exposure categories for new dwellings. Four categories are provided in the guidelines:

- Category A - Noise need not be considered as a determining factor in granting planning permission, although the noise level at the high end of the category should not be regarded as a desirable level. Nightime noise not exceeding 45 dBA, daytime noise not exceeding 55 dBA.
- Category B - Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level

[39] Guidelines for Community Noise, WHO.

of protection against noise. Nightime noise between 45-57 dBA, daytime noise between 55-63 dBA.

- Category C - Planning permission should not normally be granted. Where it is considered that permission should be given, for example because there are no alternative quieter sites available, conditions should be imposed to ensure a commensurate level of protection against noise. Nightime noise between 57-66 dBA, daytime noise between 63-72 dBA.
- Category D - Planning permission should normally be refused. Nightime noise greater that 72 dBA, daytime noise greater than 66 dBA.

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 nightime 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 SEMPs prior to the commencement of works.

(iii) Lack of Permits / Approvals – The Contractor must obtain a number of permits and licenses in order to comply with national environmental regulations. Any delay in obtaining these approvals, for example the EIA for the spoil disposal area, could delay the works schedule.

H. Environmental Management Plans and Institutional Requirements

H.1 Introduction

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

	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.			

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 m^2 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 250m^3. • hire a certified laboratory to take a soil sample from each of the quadrants for further chemical analysis (a stockpile of 2,500m^3 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: o Volume of soil removed; o Details of any identified contamination; o Soil stockpile (and/or storage container) unique identifier; o Date excess soil was excavated from each location and subsequently transported to a disposal facility; o Details of the vehicle transporting the soil to a disposal facility; o Details of the disposal facility; and o Date the excess soil arrived at the disposal facility. o 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.			

		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.			

	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.
Biodoversity	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.

	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.			

		• 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			

		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: o The system's storage capacity must be sufficient to store the runoff from the bunded areas generated by 20 mm of rain. o Water captured by the bunds will be diverted to a collection pit and then pumped to a storage tank for recycling. o 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). o Collection pits should contain a sloping sludge interceptor, to separate water and sediments. The sloping surface enables easy removal of sludge and sediments. o 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. o Wastewater stored in the recycling tank needs to be reused at the earliest possible opportunity.			

Community Health and Safety	Blasting	Blasting will be conducted using standard mining industry practices and procedures to ensure safety of personnel and equipment. This includes establishing a safety zone around the blast area, say to a distance of 500 m (actual distance will be established by the Contractor and approved by the Engineer based on the safety standards) and evacuating it.	Contractor to implement mitigation.	Engineers NES	Daily site inspections, throughout construction period.
	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: o schedule noisy activities for less sensitive times. o 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 ***before*** the start of the Construction work to provide robust data in addition to that provided in this report. The following parameters shall be monitored in line with IFC / EU averaging periods: Particulate Matter (PM_{10} & $PM_{2.5}$). Nitrogen Oxide (NO_X) Sulphur Dioxide (SO_2)	• 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	Septic Tanks	Included in Project Construction costs	-	Contractor
Additional environmental measures	Spill Kits	20 / US$200	4,000	Contractor
	Bunds for fuel and oil storage	Included in Project Construction costs	-	Contractor
	Waste containers	Included in Project Construction costs	-	Contractor
	Waste Storage areas	Included in Project Construction costs	-	Contractor
	Waste collection and disposal	Included in Project Construction costs	-	Contractor
	Storage areas for hazardous materials	Included in Project Construction costs	-	Contractor
	Sprinklers for rock crushing plant	Included in Project Construction costs	-	Contractor
	Drainage (including oil and grease interceptors)	Included in Project Construction costs	-	Contractor
	Vehicle washing bay	Included in Project Construction costs	-	Contractor

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 bowsers	Included in Project Construction costs	-	Contractor
	Water sprinklers (rock crushing plant)	Included in Project Construction costs	-	Contractor
	Dust control measures (rock crushing and batching plants)	Included in Project Construction costs	-	Contractor
	Tarpaulins	Included in Project Construction costs	-	Contractor
SFF Tree Cutting and tree removal	Labour	Included in Project Construction costs	-	Contractor
Fencing around red-list species (over 8cm in diameter)	Fencing	Approximately 200 / $50	10,000	Contractor
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**

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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 SEMPs are approved by the Engineer and RD. New topic specific or site specific EMPs may also need to be developed by the Contractor during the construction phase. These new plans will also need to be approved by the Engineer and the RD.

H.6 Bid Documents

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: 7th 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

Steps	Action Level	Process
		hearing will be held with the GRCE at a date fixed by the GRCE RD Contact Person. On the date of hearing, the aggrieved PAP will appear before the GRCE at the Municipality office for consideration of grievance. The member secretary will note down the statements of the complainant and document all details of the claim. The decisions from majority of the members will be considered final from the GRCE at Stage 1 and will be issued by the RD Contact Person and signed by other members of the GRCE. The case record will be updated and the decision will be communicated to the complainant PAP. After implementation of the agreed action the Protocol of Grievance Closure is prepared by the RD Contact Person. The protocol will be signed by the Chairman of GRCE and by the claimant.
Stage 2	Step 3 Decision from central RD GRCN	If any aggrieved PAP is unsatisfied with the GRCE decision, the next option will be to lodge grievances to the RD at the national level. GRCE should assist the plaintiff in lodging an official complaint to GRCN (the plaintiff should be informed of his/her rights and obligations, rules and procedures of making a complaint, format of complaint, terms of complaint submission, etc.). The aggrieved PAP shall produce documents supporting his/her claim, in accordance with the legal requirements (Administrative Code of Georgia). The GRCN of the RD shall review the complaint in compliance with the procedures specified in the Administrative Code of Georgia. If needed, a formal hearing will be held with the GRCN at a date fixed by the GRCN member secretary. On the date of hearing, the aggrieved PAP will appear before the GRCN at the RD office for consideration of grievance. The Contact person will note down the statements of the complainant and document all details of the claim. The plaintiff shall be informed of the decision.
Stage 3	Step 4 Court decision	If the RD decision fails to satisfy the aggrieved PAPs, they can pursue further action by submitting their case to the appropriate court of law (Rayon Court). The aggrieved PAP can take a legal action not only about the amount of compensation but also any other issues, e.g. occupation of their land by the contractor without their consent, damage or loss of their property, restrictions on the use of land/assets, etc.

I.3.9 Grievance Log

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 someway to enhancing the aesthetic value of the Project especially as vegetation grows back around construction zones, and in all likelihood any negative opinion of the new road in terms of visual impact will decrease over time as people get used to the altered landscape. Residual Impacts will be **LOW/MEDIUM.**

- **Noise** - 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).

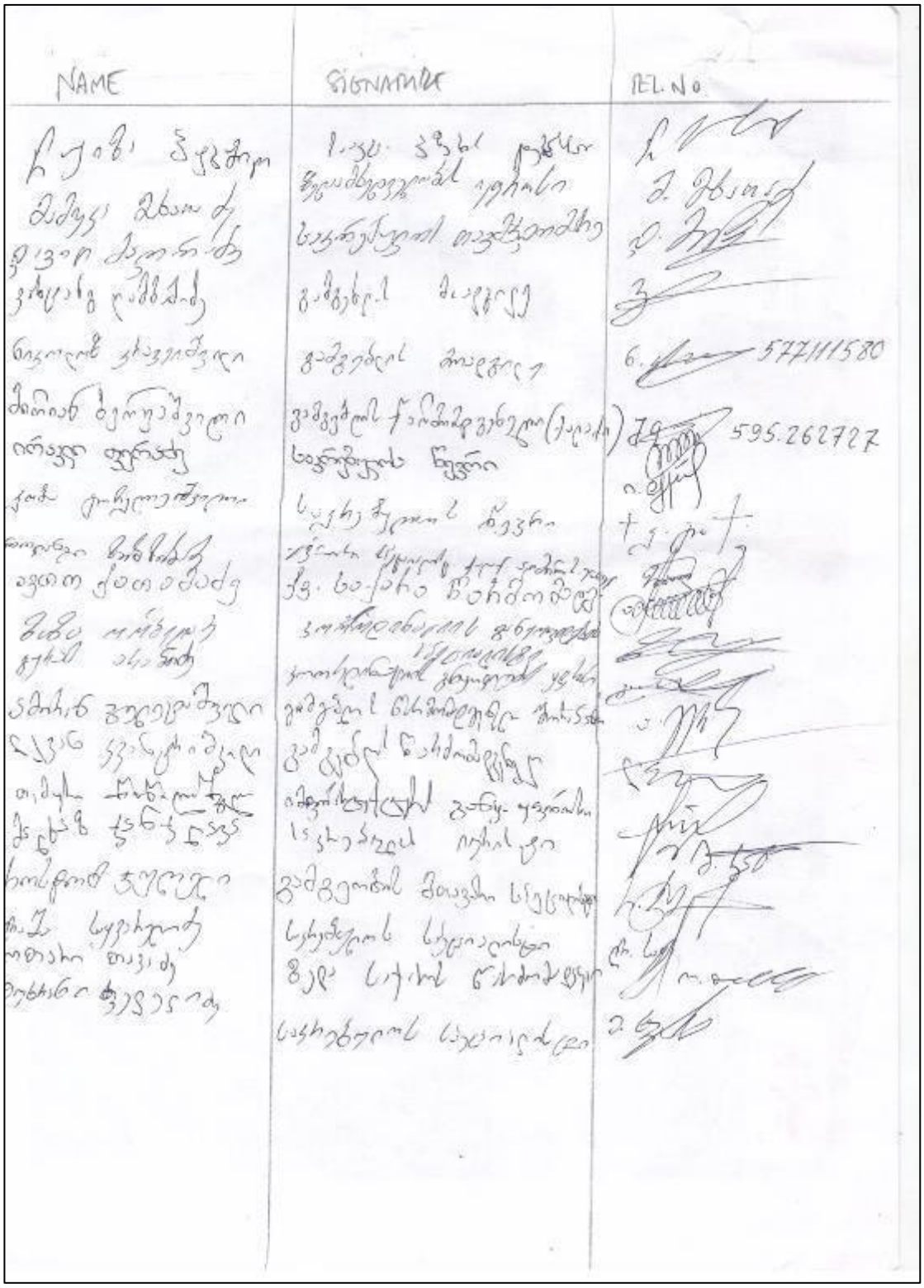
J.2 Recommendations

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.

APPENDIX A

List of Consultation Attendees, June 2017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APPENDIX B

Consultation Presentation, June, 2017

Project Overview

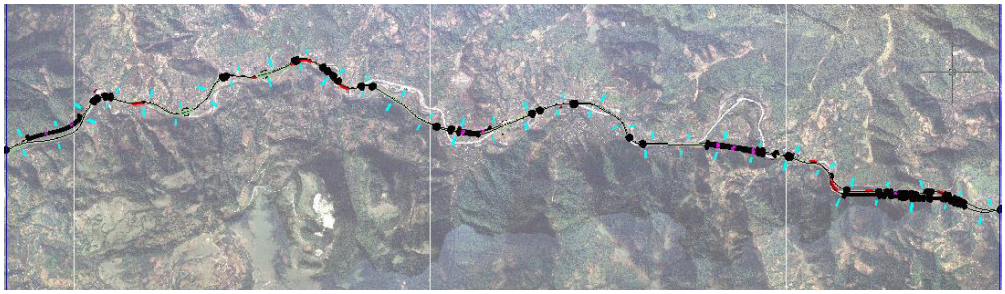
The Project is construction of a new road requiring new tunnels, bridges and other structures in order to allow traffic capacity expansion. Construction will be undertaken in difficult topographic and geological conditions without interrupting the traffic flow.

Item	Description
Road Length	41.665 km
Road Width / Number of Lanes	27m/4 lanes
Design Speed	100/80 km/h
Number of Bridges	77
Number of Tunnels	40
Construction Period	3 years

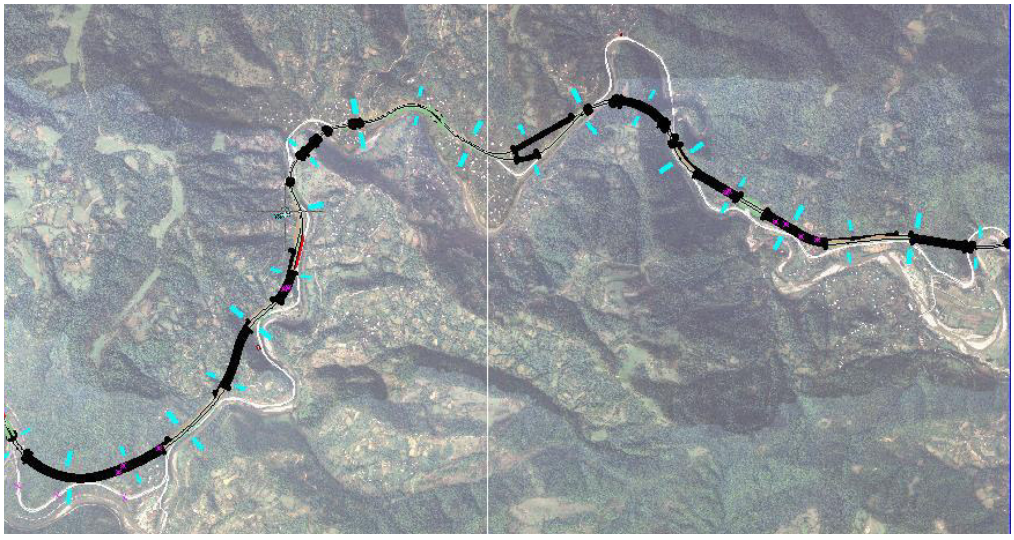
Project Location

Khevi-Argveta section of E60 Highway starts at the 9th km west from the existing Rikoti tunnel and ends near village Argveta. The entire section is divided in 3 Lots: F2-F3-F4

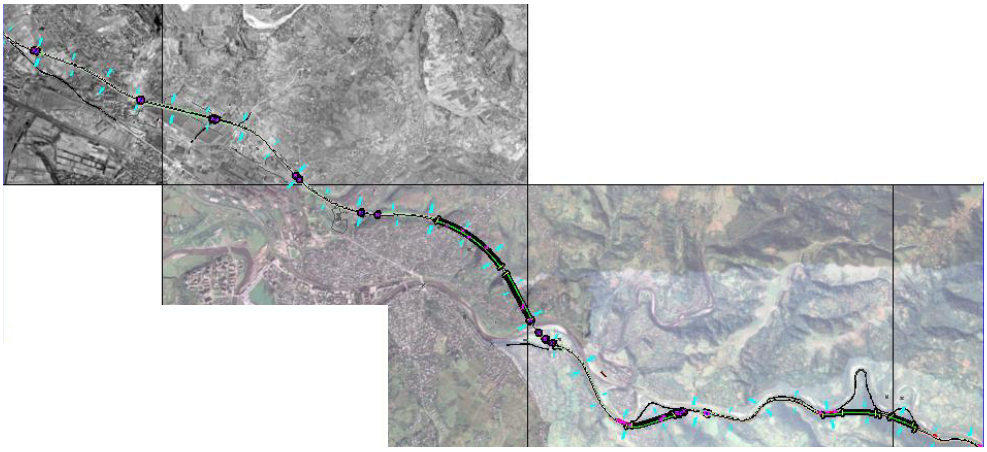
1st Lot: F2 (from km 8+880 to km 24+266 – Tot Length = 15.4 km)



3rd Lot: F4 (from km 34+695 to km 50+545 – Tot Length = 10.4 km)



2nd Lot: F3 (from km 24+266 to km 34+695 – Total Length = 10.4 km)



Need for the Project

Transport sector development in Georgia is essential for the achievement of sustainable economic growth, alleviation of poverty and promotion of tourism.

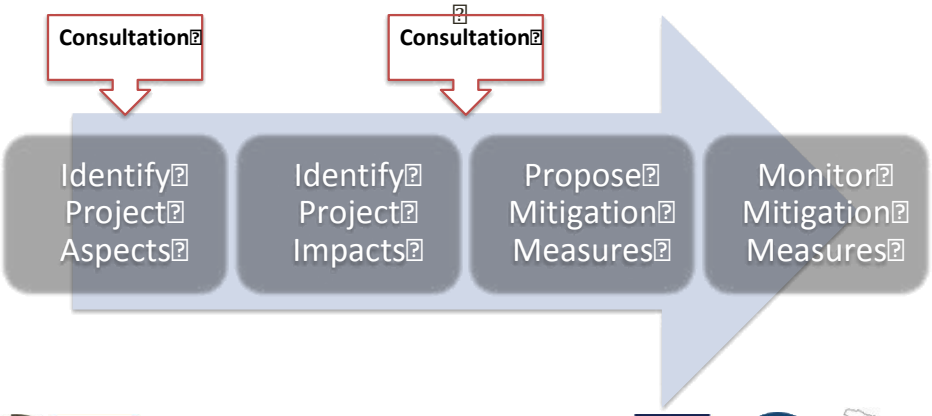
Deterioration of transport infrastructure increases the cost of doing business, deters foreign investment, hampers transit traffic growth, and leaves segments of the population out of mainstream economic activities.

Georgia's geographical location is at the center of East-West (Black Sea and Caspian Sea) and North-South (between Russia and Turkey) transit routes.

Trade with neighboring countries is therefore an important driver of Georgia's economy.

What is EIA?

"A process for predicting and assessing the potential environmental and social impacts of a proposed project, evaluating alternatives and designing appropriate mitigation, management and monitoring measures."



Need for Consultations

EIA of the Project is required by both Government of Georgia and the Asian Development Bank (ADB).

ADB specifically state:

"The borrower/client will carry out meaningful consultation with affected people and other concerned stakeholders, including civil society, and facilitate their informed participation."

For environment category A projects, such consultations will 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.

Type of Consultations

Second Round – review draft EIA and comment on the findings of the report

First Round – Initial discussions regarding the scope of the EIA and potential impacts

Other EIA Activities

1. Collection of Baseline Data, including surveys of flora, fauna & rivers.
2. Instrumental monitoring of existing air quality, noise and water quality.
3. Review regulatory requirements.
4. Examine potential alternatives.
5. Assess impacts using tools such as impact matrices and models (air and noise)
6. Prepare of Environmental Mitigation and Monitoring Plans

Potential Physical Impacts

Aspect	Potential Impact
Air quality	• Dust during construction – from vehicle movement, batching plants, blasting, tunneling, etc. • Vehicle and machinery emissions both during construction and operational phases of the project.
Soils	• Spills and leaks of hazardous liquids. • Poor management of borrow pits. • Soil Erosion during the operational phase.
Water Quality	• Spills and leaks of hazardous liquids into rivers. • Sedimentation of water ways. • Poor disposal of waste water from camp sites.
Climate Change	• Increased levels of GHGs from vehicle emissions. • Impacts of climate change to the Project, e.g. flooding.

Potential Biological Impacts

Aspect	Potential Impact
Flora	• Clearance of vegetation for road widening, borrow pits, construction camps and access roads. • Illegal cutting of trees. • Damage to trees and vegetation during construction.
Fauna	• Destruction of habitat for road widening, borrow pits, construction camps and access roads. • Blocking migration routes. • Degradation of river habitat and associated impacts to fish and other aquatic fauna.
Protected Areas / Forests	• Degradation of forests for road widening, borrow pits, construction camps and access roads.

Potential Socio-economic Impacts

Aspect	Potential Impact
Access	• Construction works impeding access to properties and shops / businesses.
Noise	• Elevated noise levels during both construction and operational phases of the project.
Traffic and Safety	• Construction traffic accidents. • Blasting during tunnel excavation and embankment works. • Accidents to workers. • Accidents involving the public at work sites.
Waste	• Illegal dumping of solid and liquid waste • Poor management of hazardous waste leading to pollution of soil, groundwater and health impacts
Cultural Heritage	• Road encroaching on cemeteries and sites of cultural value

APPENDIX C

List of Consultation Attendees, January 2018