Roads Department of the Ministry of Regional Development and Infrastructure of Georgia

Environmental Impact Assessment of works for upgrading E-60 East-West Highway section between Agara – Zemo Osiauri section (km 114 to km 126)

Draft report

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COWI

Gamma

List of Acronyms

EA	Environmental Assessment
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EWH	East - West Highway
FS	Feasibility Study
HSE	Health, Safety, Environment
HS	Health and Safety
GoG	Government of Georgia
HGV	Heavy Goods Vehicle
KP	Kilometre Post
MCMP	Ministry of Culture and Monument Protection
MESD	Ministry of Economy and Sustainable Development of Georgia
NKUK	Nippon Koei UK
MLHSA	Ministry of Labour, Health and Social Affairs
NGO	Non-Governmental Organization
OP/BP 4.01	World Banks Operational Policy on Environmental Assessment
AH	Affected households
AP	Affected people
RAP	Resettlement Action Plan
QC/QA	Quality Control and Quality Assurance
RD	Roads Department of the Ministry of Regional Development and Infrastructure of Georgia
MoE	Ministry of Environment Protection
MRDIG	Ministry of Regional Development and Infrastructure of Georgia
RBG	Red Book of Georgia Protected Species
RoW	Right of Way
SEP	Stakeholder Engagement Plan
TEM	Trans-European Motorway
ToR	Terms of Reference
WB	The World Bank
WHO	World Health Organisation

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1 Non-technical summary

Introduction

Due to its geographical position Georgia has gained the status of an important transport corridor connecting Europe and Asia and the development of the transport infrastructure has become a national priority. The Government of Georgia requested the World Bank to support modernization of the East-West Transport Corridor. Two projects for the improvement of the E-60 East-West Highway have already been completed with the assistance from the World Bank and the Third East-West Highway Improvement project is under implementation Future investments will complete improvement of the Highway from Ruisi to the already rehabilitated Rikoti tunnel. A Regional Environmental Assessment (REA) and an Environmental Management Framework (EMF) were developed for the entire corridor Sveneti-Ruisi-Rikoti Tunnel.

This Environmental Impact Assessment (EIA) has been carried out for Agara - Gomi bypass (Zemo Osiauri)[1] section of the Highway, including an Environmental Management Plan (EMP). The objective of this EIA is to identify expected environmental impacts and risks of the proposed works, recommend measures for their mitigation, and develop a plan for monitoring environmental compliance during construction and operation of the section of E-60.

Technical and Environmental Standards and Regulations

Technical design of the highway improvement is in compliance with the Trans-European Motorway (TEM) standards. The project will be implemented in compliance with the Georgian legislation and environmental standards, as well as the World Bank's safeguards policies. According to the Georgian law, the proposed project requires EIA, conduct of the environmental expertise, and issuance of a permit for impacting the environment. The project triggers World Bank OP/BP 4.01 Environmental Assessment, OP/BP 4.11 Physical Cultural Resources, OP/BP 4.12 Involuntary Resettlement, OP/BP 4.04 Natural Habitats and OP/BP 4.20 Gender and Development.

[1] Ruisi-Rikoti section of the EW-60 Highway has been broken down into three segment for rehabilitation. According to the ToR these were: Ruisi-Agara (km 95 – km106); Agara East-Zemo Osiauri (km 106 –km121) and Zemo Osiauri-Rikoti Tunnel (km 121-km143). On the design stage the mentioned division has been revised. The first section was extended to include Agara bypass. This caused some changes in the chainage of subsequent section of the road. According to the new division the chainage of Agara East –Zemo Osiauri changed from km 106-121 to km 114 - km 126. Therefore hereinafter the section is referred to as Agara – Zemo Osiauri.

Environmental Screening

The proposed works for the improvement of the E-60 between Agara and Zemo Osiauri include widening of the existing carriageway for converting it from a two-lane into a four-lane motor road, and construction of a four-lane sections of road on a new alignment bypassing Gomi. Road works of the described scope and scale determine classification of the project as a Category A for environmental assessment purposes, requiring the conduct of a full scale Environmental Impact Assessment (EIA) and development an Environmental Management Plan (EMP).

Public Participation

The Bank policies and the Georgian legislation require meaningful public participation and involvement in the process of EIA and environmental management planning. The main principles of public consultation include:

- Conduct of at least two public consultation meetings for an environmental Category A
- project at the EIA inception phase and at the stage of mature draft EIA report;
- Disclosure of the draft EIA report to public through the convenient media in a national language;
- Announcement of the venue and time of stakeholder consultation meetings through central and local means of public communication;
- Invitation for written comments/questions on the draft EIA; and
- Incorporation of public feedback into the EIA report and re-disclosure of the finalized document.

The initial consultations on the environmental implications of the proposed project and the scope of the forthcoming EIA were carried out at the early stage of its preparation. Meeting with local community was held 25 September 2012. Information about terms of reference, alternatives under consideration, and the EIA procedure and permitting issues were presented.

The draft EIA report was posted on the web page of the Roads Department (RD) of the Ministry of Regional Development and Infrastructure of Georgia. Hard copies of the document were made available at the offices of Gomi and Khashuri local self governments located within the project implementation area. RD organized a public consultation meeting to discuss the draft EIA report. It was held on February 6, 2013, in the House of Justice of Gomi village. Members of the affected communities, including elected officials, as well as representatives of the local small and medium businesses attended the meeting. Stakeholders' questions for clarification pertained the expected impacts of highway construction on the agricultural lands and an agro-processing facility located along the right of way (RoW). They also inquired about job opportunities for local residents in the course of construction works, and flagged the importance of arranging convenient junctions between the local roads and the re-aligned sections of the highway. These issues are duely incorporated into the highway design and covered by the Resettlement Action Plan (RAP). Present EIA report carries mintues of the public constulation meeting

Sensitive Environmental Receptors and Potential Impacts

The Agara-Zemo Osiauri section passes through the significantly transformed landscape, away from protected areas and biodiversity hotspots. The main environmental impacts are expected at the construction phase and come from clearing of the right-of-way (RoW); establishment/operation of work camps and temporary access roads; operations/ servicing of construction machinery; earth works, works in river crossing/close to the riverbed (Suramula and Mtkvari rivers) and construction of bank protection structure along the left bank of the Mtkvari River

Clearing of the RoW will be required for widening of road in the sections where the highway alignment remains unchanged, and for cleaning a new route for the re-aligned sections. This would imply removal and stockpiling of topsoil, removal of shrubs, and cutting of up to 1490 trees and shrubs. Establishment of construction camps and access roads is associated with generation of solid waste and waste water, compression of soil, and noise disturbance for nearby population. Parking, operating and servicing of construction machinery will carry the risk of operational spills of oils and lubricants (i.e. the risk of soil and water pollution) and generation of noise, vibration, dust, and emissions. Construction of bridges and the bank protection structure can cause water pollution with liquid/solid waste. Increase of water turbidity, as a consequence carries risk of temporary impact on aquatic life. Construction material will be purchased from licenced quarries and producers, therefore assessment of impact of quarries and material production facilities on environment are excluded from the scope of this EIA. License for use of natural resources – in case contractor decides to use own quarry must be obtained from the Ministry of Energy and Natural Resources. Construction works will also have implications for the occupational health and safety of workers/personnel.

Impacts of the upgraded section of the road during its operation phase are less diverse. Three environmental aspects of the highway operation will be air pollution from automobile emissions, noise, and pollution of soil and surface water with litter and drainage from the highway as well as water pollution with liquid/powder cargo and/or fuel and lubricants from the cars as a result of traffic accidents on the road section passing near riverside and/or the accidents on the river crossings. The bank protection structure will not lead to flooding or any property on the right (unregulated) bank of the Mtkvari. Acceptable noise levels will not be exceeded in the short to medium term perspective and are likely only in case of traffic increase projected in a long term. The design allows for placing sound barriers in the future if needed. Finally, traffic safety will be an important issue with health, social, and environmental implications.

Project Alternatives

Various alignments of the highway carry different levels of environmental risks, which has been critical in environmental analysis of project alternatives.

No “showstoppers” have been identified during EIA and the anticipated impacts can be managed by application of adequate construction standards and good en-

vironmental practices. Nonetheless, a “do nothing” option was considered as one of the project alternatives. While it has no environmental and social impacts resulting from construction works, operating the highway in its current poor condition has negative environmental impacts from traffic jams, noise, low speed, and high emission. In the future with consideration of increase traffic flow, the situation will worsen. Under the "do nothing" scenario local communities would lose opportunity of benefiting from all positive effects associated with the highway improvement, including profits resulting from increased cargo turnover and tourism. Therefore, as the potential positive impacts of the project surpass its possible negative impacts, the “do nothing” option was discarded.

Out of the five considered alternative alignments considered at the feasibility stage three were discarded at an earlier stage due to the anticipated significant negative impacts, including alteration of land use patterns and major resettlement/compensation needs. Preferred alternative – widening of the road within the present alignment in one section and re-alignment of the road to bypass Gomi was analysed in depth.

Project Description

The project will support expansion of the existing two-lane road into a four-lane road, as well as construction of four-lane sections on a new alignment where re-routing is necessary. In the first section widening of road within the present right of way will occur. The new section will bypass Gomi and near vil.Agarebi (km26.00) continue north-westward bypassing vil.Kvemo Osiauri up to km 31. The length of Gomi bypass section of the E-60 Highway is 12 km. The new alignment will run in proximity to the Mtkvari riverbed. Minimum distance of the road from the river is 51 m, which means that the boundaries of protection zone for the Mtkvari (50m) are not violated. The project includes building of one two-layer overpass to Gomi; two underpasses; railway overpass and a 35 m long bridge over Suramula river; seven cattle crossings, fifteen reinforces concrete culverts, drainage ditches equipped with water wells and stone filters along the road (including bridge) to divert runoff from the carriageway as well as 3.8km long riprap structure along the Mtkvari river, most of which is not in contact with water and is designed mainly to provide additional protection of the new alignment.

A central reservation will separate two pairs of highway lanes. Paved shoulders will be provided for breakdown and emergency use. Surface water drains, safety barriers, lighting and signage will be arranged for safe operation of the upgraded section of the highway. Following the TEM Standard, each width of each lane will be 3.75 m; shoulders - 3.75 m; paved berm - 3.00 m; unpaved berm -

0.75 m; and the central reservation - 5.00 m (including safety barriers). The total width of the road will make 27.50 m. For highway sections to be upgraded without re-alignment, the existing carriageway will be repaired, and a new two-lane carriageway will be built alongside.

Based on experience gained from other similar road projects it can be assumed that construction may involve a total workforce of about 200. Out of these 60%

to 70 % may be local workforce, which could be hired as semi-skilled or un-skilled workers during the construction period.

Land acquisition issues are being studied by Eptisa. According to the survey team the project will affect 225 private land plots with total affected area of 372,362$m^{2,}$. 57 of the households will be affected severely, 15 - considered as vulnerable.

Environmental Impact Assessment Methodology

The EIA of Gomi bypass section of the highway is comprised of (i) determination of the scope of the work; (ii) collection of the detailed baseline data; (iii) assessment of expected impacts; (iv) outlining of mitigation measures; and (v) development of environmental management and monitoring plans.

The EIA process was a combination of desk work and field work, comprising of literature review, data collection from various agencies, visual observation (flora and fauna survey) and fact finding along the RoW, noise and air modelling and analysis of all collected information. Results of engineering-geological and topographic survey, technical information related to design of the bank protection structure, bridge and other components of the project were considered. Impacts of the project activities to be implemented outside the RoW - such as construction camps, temporary access roads, etc. - have been fully considered as well. On initial stage of the EIA, spatial boundaries of the study area were defined to allow identification and assessment of the expected impacts and to enable comparative assessment of project alternatives in a given environment.

Environmental Baseline

The EIA report presents information about the physical, biological, and socio-economic characteristics of the environment alongside the project alignment. The purpose of this description is to establish environmental baseline, to identify potential sensitivities, and to suggest adequate response through measures that are appropriate to avoid, minimize, or mitigate potential adverse impacts.

The 12 km section of the highway to be upgraded under the proposed project passes through rural areas, where environmental pollution is insignificant. No polluting or noise-intensive industries exist in the region nowadays. Physical environment around the subject section of the highway is not rich in its biodiversity. Landscape around it is mostly altered and land is either cultivated or degraded. There are no designated protected areas in the vicinity of the project site. No protected plant or fauna species are either recorded from the area or registered during field surveys.. Rivers and adjacent floodplains are the only types of sensitive habitats, which fall under potential direct impact zone of the project during the construction phase.

The baseline studies included the following components:

- Climate and meteorology;
- Geology, geomorphology;
- Hydrology, hydrogeology;
- Soils, landscape and land use;

- Air quality;
- Noise;
- Seismic conditions and hazardous processes
- Flora and fauna; and
- Historical, archaeological sites and
- Human environment.

According to the environmental baseline data, the highest environmental sensitivity of the proposed project is proximity of a part of the designed re-alignment to the river. Associated risks of the construction phase include impact on vegetation and soil, possible deterioration of water quality and disturbance of terrestrial and aquatic life, while risks of the operation phase is potential water damage to the road embankment. These risks were carefully examined from engineering and environmental viewpoints and were found moderate. Construction phase impacts may be mitigated by applying conventional good practice of works in waterways as described below.

Research of the social baseline revealed a single most sensitive human aspect of the project implementation, which is the required land take. Livelihoods of the majority of affected households considerably depend on the land plots and small businesses the ownership and use of which will be altered in the course of the project implementation. This finding emphasizes the importance of diligent planning and timely provision of adequate compensation and restoration of livelihoods to be conducted under the frames of the Resettlement Policy Framework developed for the project.

Expected Impacts and Mitigation

The results of the EIA show that majority of the potential environmental impacts of the project are associated with the construction phase and are temporary in nature. The main approach of the EIA was to provide adequate recommendations for the prevention or mitigation of negative environmental impacts of the project. These recommendations are applicable during road design, construction, and operation phases. Taking into account the location and sensitivity of human settlements and environmental receptors, the following mitigation measures were developed for mitigating the main risks associated with the project implementation:

- Impact on vegetative cover: Clearing of the right of way, especially in the re-aligned parts of the highway, will imply removal of vegetation, including cutting of trees. Loss of vegetation will be kept at the possible minimum. The trees removed from the State owned areas will be compensated through re-planting along the right of way at a ratio of 1:3, and those cleared from private land plots will be compensated in accordance with the Resettlement Action Plan. Selection of species for planting will be based on the natural composition of local flora. Greening of the construction sites along the right of way, as well as maintenance of the re-planted areas for a year will be included in the assignment of a works contractor. RD will be responsible for further maintenance of plantations.

- Disturbance of local communities: Movement of construction machinery, location of the temporary work camps, and temporary storage of construction materials and waste will be planned to avoid or minimize barriers for free movement of the local population. Deterioration of the air quality near populated areas will be controlled through oversight on the technical condition of construction machinery. Operation of engines in idle regime will be discouraged. Operation of construction machinery will be limited to the regular working hours.

- Operation of work camps and access roads: Work camps and temporary access roads will be located preferably in the already transformed areas to minimize landscape and ecosystem degradation. The camps will be organized to have designated areas for storage of materials and waste, and will be equipped with septic tanks. Areas designated for fuelling/servicing of machinery and for storing of hazardous substances will be provided with ground lining and barriers preventing release of spillage. After completion of works contractor will be obliged to remove all temporary facilities from the site and restore the area to the state close to intial.

- Air pollution: Air pollution can appear during earthworks, gravel crashing, concrete mixing, and transportation in case of improper maintenance and operation of equipment, inadequate storage of fine-grained materials, and movement of vehicles on unpaved or dusty surfaces. To reduce generation of dust and reduce emissions, construction equipment will be maintained in good working condition and mixing equipment will be sealed. Concrete mixing plants will be installed at least 300 m away from settlements windward. Speed limits will be set for construction vehicles and all loose material will be covered with tarpaulins when transported off-site with trucks. A wheel-washing facility will be provided and ensured that it is used by all vehicles before leaving all sites. All unpaved roads and significant areas of uncovered soil will be sprinkled during working hours in dry weather conditions.

- Operation of construction machinery: The technical condition of the construction machinery will be checked on regular basis to minimize air pollution from exhausts oil and soil/water pollution from leakage of fuel. The risk of operational and emergency spills of fuel and lubricants will be mitigated by designation of special parking and servicing sites, to be located away from waterways and other sensitive environmental receptors. The sites will be equipped with wastewater/spill capturing and treatment facilities.

- Earth works: Prior to excavation, top soil will be removed and stored separately for later reinstatement of the area. Landscape restoration will be carried out to ensure stabilization of slopes. This would include seeding of grass and planting trees.

- Construction of bridge and bank protection structure: Works in the waterways will be planned to avoid construction during fish spawning periods (June-September). River banks will be checked for stability in the course of works and reinforced as necessary to minimize erosion. Bar-

riers of inert materials will be used to avoid sedimentation from terraced sides of river beds. Working time will be minimized during filling the bridge footings with concrete. If temporary re-direction of river stream becomes necessary, piping, channels, and fish-passes will be arranged to allow alternative water flow and fish movement. Technical condition of machinery operated in and near waterways will be checked on daily basis to avoid leakage and operational spills of fuel and lubricants. No stockpiling of construction materials and waste will be allowed in or nearby the waterways. According to the design drainage ditches will filters arranged on the both sides of the carriageway (including bridge) will enable to avoid surface water pollution with runoff from the road or pollution of water in case of road accidents. Bank protection structure is a riprap built mostly on shore with minimum contact with the stream.

- Accumulation of construction waste: Temporary storage of waste will be organized by separating construction debris, household solid waste, and hazardous waste. The latter, comprising of used filters, tires, and lubricants from machinery, will be kept in a closed and isolated storage. Out transportation of waste from the construction sites will follow a time- bound schedule. Formal instructions will be obtained from local authorities for the final disposal of waste in the existing landfills. Access material, such as soil and rock, may be disposed outside municipal landfills if authorised by local authorities, as permitted by national legislation, and in compliance with conventional good environmental practice. Volumes of disposable waste will be minimized to the extent possible through re-cycling/reuse and back-filling of material as feasible.

- Operation of quarries and borrow pits: Purchase of inert construction materials will be allowed only from the licensed legal and/or physical bodies. Extraction of these materials will also be allowed on the grounds of a special license. Opening of new borrow pits will be avoided if those already in operation can be used instead. Operation of quarries and borrow pits, as well as extraction of gravel from river terraces, will be carried out strictly in accordance with the conditions of a license issued by the State authority and enforced by the Ministry of Energy and Natural Resources.

- Historical, cultural, and archaeological sites: All known historical and cultural monuments along the right of way were identified and mapped during the EIA. The Highway alignment will not cause physical damage to these monuments. There is a high likelihood of chance finds during earth works, though. Supervision of works by archaeologist is recommended. If an artefact is encountered by a works contractor chance find procedure will be followed.

- Occupational health and safety: Work camps will be established and operated to ensure the maintenance of adequate hygiene and sanitation. Workers and other personnel involved in the project will be provided with personal protection equipment and gear. They will receive training on the safety rules and course of action in case of emergencies.

Special safety regulations will be provided and conformed during works in waterways.

Environmental Management Plan

This EIA report contains the EMP with a full set of the proposed mitigation measures, as summarized above, and monitoring indicators. It also describes the role of RD in overseeing adherence of construction works with the recommended mitigation measures and identifies the needs for RD's technical and institutional capacity building for ensuring full environmental compliance of the project. A supervision consultant will be hired by RD to provide technical control and quality assurance of civil works. Environmental monitoring will be an integral part of the consultant's assignment and information on the compliance with EMP will be included into the supervisor's regular reporting to the RD. RD will have an overall responsibility for applying due environmental diligence. This will include ensuring quality of the supervision consultant's performance, site inspections, timely response to any issues identified by the consultant or by RD inspectors, and record keeping on all environmental aspects of the project implementation.

Before commencement of works the selected works contractor will be asked to develop and agree with the RD and the World Bank waste management (including spoil disposal), traffic management, health and safety and other plans listed in technical specification for tenderers. The works contractor will also develop and agree with the client a plan of greening and landscape reinstatement at a relevant stage of contract implementation.

Operation of the Highway

The improvement of the E-60 highway aims at minimizing the need of interventions during its operation and maintenance. Ensuring safe and good environmental performance will be a high priority at the operations stage and will comply with the requirements of the national legislation and the best international practices. RD, through an outsourcing arrangement, will permanently maintain and, in a longer term, improve greening along the right of way to be provided by the construction contractor for landscape reinstatement and as a compensation for trees removed during works. Regular collection of solid waste will be organized along highway. The State technical control of the highway through regular oversight and inspection will be provided.

Embankment to be constructed on the left bank of Mtkvari (Kura) river, where the re-aligned section of the highway passes along it, will not tangibly increase the risk of flood damage on the opposite bank due to (i) the modest length of the embankment, (ii) moderate levels of high water flow forecasted based on the historic hydrological data, and (iii) the existing pattern of land use on the right bank of the river. Based on modelling done, operation of the upgraded Gomi

bypass section of the highway is unlikely to cause increase of noise levels beyond the established acceptable levels in short to medium term perspective, and therefore no mitigation measures are required at present. In case the noise level limits are exceeded in future due to increase of traffic volumes forecasted in a long term perspective, RD will install noise barriers and consider additional greening along the rights of way.

2 Introduction

The Georgian Government has embarked on a programme to upgrade the major roads of the country, managed by the Roads Department (RD) of the Ministry of Regional Development and Infrastructure. The initial studies are focused on E-60 East-West Highway (EWH), which is the main route from the neighbouring Azerbaijan and Russia, with connections to Turkey and Armenia. Georgian government with its own budget completed the upgrade of the first 15 km of the E60 from outside of Tbilisi at Natakhtari to Agaiani. In 2006, International Development Association (IDA) approved the First East-West Highway Improvement Project (First EWHIP), to upgrade the next section on the E60 Highway from Agaiani to Igoeti (about 13 km) and additional financing for reconstruction of the Rikoti tunnel. Second East-West Highway Improvement Project (Second EWHIP) prolonged the upgrade from Igoeti to Sveneti, a segment of about 24 km, and was also funded by World Bank. Third East-West Highway Improvement Project (TEWHIP) was aimed at upgrading of the next consecutive section of the E60 East-West Highway from Sveneti to Ruisi (15 km). It received additional financing for upgrading of road segment between Ruisi and Agara bypass. This project is ongoing. Later the Government of Georgia approached the World Bank with the requiest to continue support with upgrading of the E-60. The Fourht East-West Highway Improvement Project is now under preparation. It will cover the section of the highway betrween Agara to the west of Gomi, located at 114- 126 km northwest of the capital Tbilisi (Figure 4.1).

Preliminary work on this section began with a Feasibility Study (FS) and a strategic environmental and social study. A Feasibility Study (FS) was conducted by Kocks Consult between December 2008 and August 2009. The Regional Environmental Assessment was carried out by Nippon Koei UK (NKUK) between March and August 2009.

The project must comply with the Georgian law and with the World Bank (lender) policy, both of which include environmental and social safeguards. The overall Fourth East-West Highway Improvement Project is classified as environmental assessment Category A.

According to the national regulations and requirements of the lender, full-scale EIA of the project was conducted.

The outcome of the EIA is a full scale analysis of the selected improvements, environmentally and socially sound and consistent with international practice.

The purposes of the EIA are to:

- examine the project's potential negative and positive environmental impacts and recommend any measures needed to prevent, minimise, mitigate, or compensate adverse impacts and to improve environmental performance;
- analyze project alternatives;
- provide technical information and recommendations for selection and designing of the best option out of several alternatives;
- ensure that affected communities are appropriately engaged on issues that could potentially affect them; and
- Develop an Environmental Management Plan, which will include a mitigation programme, a monitoring plan and assessment of institutional capacity for its implementation.

This report presents assessment of impact of the project on biophysical and social environment for Agara – Zemo Osiauri (114 km to 126 km) section of the road.

The Environmental Impact Assessment was prepared in cooperation with the Roads Department of the Ministry of Regional Development and Infrastructure and the Ministry of Environmental Protection of Georgia.

3 Legal and policy framework

3.1 Overview of Georgian environmental legislation and WB policy

The EIA for the present project has been developed with consideration of:

- the national environmental laws and regulations, the laws and regulations on the water, soil and air including relevant quality standards;
- the national laws and regulations related to social and land ownership issues;
- World Bank Policy and operation procedures;
- road construction related regulations in force in Georgia;
- requirements of the EHS Guidelines for Toll Roads together with the General EHS Guidelines document (International Finance Corporation, WB group, April 30, 2007);
- recommendations given in the WB technical paper No. 376 "Roads and the Environment. A Handbook" (1997).

The World Bank environmental and social safeguards include:
OP/BP 4.01 Environmental Assessment (1999, revised 2012),
OP/BP 4.04 Natural Habitats (2001, revised 2004),
OP 4.09 Pest Management (1998, revised 2004),
OP/BP 4.10 Indigenous People (2005),
OP/BP 4.11 Physical Cultural Resources (2006, revised 2007),
OP/BP 4.12 Involuntary Resettlement (2001, revised 2012),
OP/BP 4.20 Gender and Development (2003, revised 2012),
OP/BP 4.36 Forests (2002, revised 2004).

Environmental legislation of Georgia. Environmental legislation of Georgia comprises the Constitution, environmental laws, international agreements, by-laws, presidential decrees, ministerial orders, instructions, regulations, etc. Georgia is a party to international conventions, including the environmental ones. Below is a list of Georgia's environmental legislation as it pertains to the proposed project:

Table 3.1 List *of* environmental laws and regulations relevant to the project

Year	Law / Regulation
1994	Law on Soil Protection (amend. 1997, 2002)
1996	Law on Entrails (amend. 1999, 2002, 2004, 2005)

1996	Law on Environmental Protection (amend. 2004)
1997	Law on Wildlife (amend. 2001, 2003, 2004)
1997	Law on Water (amend. 2003, 2004, 2005, 2006)
1999	Law on Protection of Atmospheric Air (amend. 2000, 2007, 2008)
1999	Forestry Code of Georgia (amend 2000 2001, 2003, 2005, 2006)
1999	Law on Compensation of Damage from Hazardous Substances (amend 2002, 2003)
2002	Regulation on Environmental Impact Assessment approved by Order No. 59 of the Minister of Environment.
2005	Law on Red List and Red Book of Georgia (amend. 2006)
2005	Law on Licences and Permits
2007	Law on Environmental Impact Permit
2007	Law on Ecological Expertise
2007	Law on Service of Environmental Protection
2007	Law on Public Health
2011	Methodology for Estimation of Environmental Damage

Laws and regulations related to social and land ownership aspects applicable to the project include:

Table 3.2 List of social and land ownership related laws relevant to the project

Year	Law / Regulation
1997	Civil Code of Georgia
1997	Law on Compensation of Land Substitute Costs and Damages due to Allocating Agricultural Land for Non-Agricultural Purposes
1999	Law on Rules for Expropriation of Ownership for Necessary Public Needs
2005	Law on Privatization of State-owned Agricultural Land
2005	Law on Registration of Rights to Real Estate
2007	Law on Cultural Heritage
2007	Law on Public Health
2007	Law on Entitlement of Ownership Rights to Lands Possessed (Employed) by Physical and Legal Persons of Private Law

Other laws relevant to the project

Table 3.3 Other laws relevant to the project

Year	Law / Regulation
1994	Law on Roads
1999	Law on Traffic safety
1999	Law on State Complex Expertise and Approval of Construction Projects
1999	Law on Licensing Design-Construction Activities
2006	Law on Regulation and Engineering Protection of Coastline and River Banks

Road construction related regulations in force in Georgia. Design of bridges, viaducts, overpasses and pipes is regulated by norms and rules 2.05.03-84. Design of road tunnels - by norms and rules II-44-78.

Construction norms and rules (SNR 2.05.02-85 Motor roads) regulate traffic safety, environmental issues, set forth main technical and traffic operation norms, crossings and intersections, paving aspects, etc.

According to this document for category I road[2] the following environmental aspects are distinguished:

- the distance to residential area must be at least 200m from the edge of the carriageway;
- along with technical and economical aspects environmental impacts must be taken into account;
- prior to arrangement of temporary infrastructure and preparation of road embankment, topsoil must be removed and stockpiled until subsequent use for recultivation after completion of construction and removal of all temporary facilities;
- in case the road is built near the residential area (in a distance of 200 m), noise reduction measures (speed reduction) must be allowed for. For this purpose, shield walls, plant barriers, etc may be suggested.
- roads along the rivers, lakes and reservoirs must be built with consideration of protection zone boundaries for the surface water bodies.

3.2 Environmental permitting procedure – national and WB regulations

According to the national legislation, the project needs the impact permit issued by the MoE based on the conclusions of the EIA report submitted by the proponent for the consideration of decision-makers.

The permit application/issuance procedure for the planned development, including EIA coordination and establishment of the timeframes for information disclosure and public review and discussion under ***The Law of Georgia on Environmental Impact Permits*** will include the following steps:

Step 1. Publication of information on the project in central and regional newspapers. The advertisement has to include the project title, location, place and the date, time and venue of public disclosure meeting(s). It will also identify locations where the EIA can be reviewed and where comments may be submitted.

[2] Road categories are attributed according to daily intesnsity of traffic: caregory I –7000 vpd; category II – 3000-7000 vpd; category III –1000-3000 vpd; IV – 100-1000 vpd; V- up to 100 vpd

Step 2. Within one week after publishing the information in the newspapers, the proponent will submit the EIA report (hard copy and electronic version) to the Ministry of Environment Protection. A period of 45 days is allowed for receiving public comments on the EIA. Between 50 and 60 days after publication, a series of meetings to receive comments from the stakeholder (which may include government agencies, local authorities, NGOs, community members) must be carried out. Within five days of the meetings, minutes of the meetings (summary of comments and discussions) are to be submitted to the Ministry of Environment Protection.

Step 3. All comments received from the stakeholders at the meeting or in writing will be reviewed and addressed in the final version of the EIA. A copy of all written comments, the minutes together with the comment-response section will be included in the final EIA as an Annex. The final EIA will be submitted to the Ministry of Environment Protection and made available to the public, along with a project location map, an executive summary, of the planned development, reports on emissions and allowable limits. The permit will then be issued or denied within 20 days from registration of the submission.

According to the national regulations (Law on Construction permit, 2004; Law on Licenses and permits 2005) construction/ modernisation of highway requires Construction Permit. (Procedures for obtaining the permit are described in the Law of Georgia of Construction permit.)

According to the national legislation administrative body issuing the permit (the Ministry of Economy and Sustainable Development) ensures involvement of the other Ministries including the Ministry of Environment Protection in permitting process. For the project subjected to construction permit, authorisation (construction permit) incorporates elements of environmental impact permit.

Environmental impact permit is required for running asphalt/concrete plant. License for use of natural resources – in case decision is made to use own quarry are required under the national legislation (Authority responsible for issuing the licence is Ministry of Energy and Natural Resources). All other issues such as temporary disposal of inert construction waste and unusable asphalt are regulated based on agreement with local muncipal authorities.

According to the World Bank regulations the section of the road under consideration was screened as Category A project. According to the national regulations and requirements of the lender, full-scale EIA of the project is to be conducted.

3.4 Comparison of the national environmental legislation and WB requirements

The following considerations reveal the main differences between the World Bank guidelines and the national legislation:

- Screening and Classification: The Bank's guidelines provide detailed description of procedures for screening, scoping and conducting EIA and explain a complete list of stages, which are not envisaged under the national legislation.

- Considering ecological risk, cultural heritage, resettlement and other factors, the Bank classifies projects supported by them under categories A, B and C. As mentioned, in the Georgian national legislation, EIA is carried out only if a developer seeks to implement projects listed in the Governmental Decree on the Procedure and Terms of the Environmental Impact Permit. This list is compatible with the category A projects of the Bank classification. According to the Georgian legislation EIA is not required in other instances, while the World Bank guidelines may require limited EA or Environmental Reviews for the B category activities, as well.

- Environmental Management Plans: The Georgian legislation does not specify format of environmental management plans (EMPs) and stage of their provision for the projects subject to EIA and do not request EMPs for the projects not requiring EIAs. The World Bank guidelines require EMPs for Category A and B projects and provide detailed instructions on the content.

- Involuntary Resettlement: The national legislation does not take into account the issue of involuntary resettlement at any stage of environmental permit issuance. The Georgian legislation considers social factor only with regard to life and health safety (e.g. if a project contains a risk of triggering landslide, or emission/discharge of harmful substances or any other anthropogenic impact). Thus, the national legislation does not consider resettlement as an issue in the process of issuing environmental permits, unlike the Bank which takes a comprehensive approach to this issue.

- Responsibility for the EIA: While the Bank's document establishes the responsibility of a Borrower for conducting the environmental assessment, the national legislation provides for the responsibility of a project implementation unit to prepare the EIA and ensure its consultation. According to the Georgian legislation the MoE is responsible for monitoring of project implementation and compliance with the standards and commitments provided in the EIA with a less clearly defined role in relation to EMPs. The "Project Proponent" is responsible for implementing "self-monitoring" programs for the projects subject to the EIA. The WB guidelines stress the role of EMPs, which are important for all categories of projects and the Project Proponent is

requested to ensure inclusion of monitoring schemes and plans in the EMPs. Monitoring of performance compliance against the EMPs is an important element of the WB requirements.

- Consultation: The Bank provides for consultations for A and B Category projects (at least two consultations for Category A projects) and requires a timetable of consultations from the Borrower. Until recently the national legislation contained only a brief reference to this issue without providing real tools of its fulfilment. The amendments to the Governmental Decree On the Procedure and Conditions of Environmental Impact Assessment established the requirement of public consultation of the EIA, which obligates a developer to (i) ensure public consultation of the EIA, (ii) disclose the information, (iii) receive comments within 45 days, (iv) arrange consultation not later than within 60 days of the publication date, invite stakeholders and determine the consultation venue).

The present EIA was carried out with consideration of both the national and the WB requirements complementarity basis.

3.5 Institutional Framework

The GoG agencies undertaking supervisory, monitoring, project management, procurement or financial responsibilities are described below.

The RD responsibilities will include, at a minimum, accepting the feasibility study and final designs and accepting road sections after completion of rehabilitation. Maintenance also falls under the responsibility of the RD, but is sourced out to private enterprises. Maintenance includes winter maintenance, regular checks and repair of the road, including drainage facilities, bridges, guardrails, road signs etc. Garbage collection alongside the road also is among the duties of RD through contracted company.

MoE is in charge of issuing the Environmental Impact Permit for the Project, following the examination of the EIA and the subsequent State ecological examination. The rights of the MoE as the competent authority are the following:

- to intermit, limit or stop any activity which has or is likely to have adverse impact on the environment, as well as unreasonable use of natural resources;
- to issue a series of licenses (for natural resources use) and permits (for environmental pollution);
- to control the execution of mitigation measures by the developer; to receive free and unrestricted information from the developer about the utilization of natural resources, monitoring systems, waste management etc. and explanations from authorities concerning the Project.

The following ministries/departments of the government play a certain role in the approval/agreement process for the Project, including but not limited to:

- Ministry of Economy and Sustainable Development;
- Department of Natural Resources under the Ministry of Energy and Natural Resources;
- Agency of Protected Areas under the Ministry of Environment Protection (MoE);
- National Environmental Agency of the MoE;
- Department of Cultural Heritage Preservation (under the Ministry of Culture and Monument Protection);
- Department of Spatial Planning and Construction Policy of the Ministry of Economy and Sustainable Development;
- Ministry of Labour, Health and Social Affairs; and
- Ministry of Agriculture.

The Local Executive Bodies perform the main administrative functions in each district, including the local land-use issues and land allocation function.

4 Description of the project

4.1 Project objectives and structure

Development objectives of the EWHIP-4 are to

a. contribute to the gradual reduction of road transport costs and to improve road safety along the section upgraded under the project; and

b. strengthen the capacity of the Roads Department (RD) and relevant government entities to plan and manage the road network and improve road traffic safety.

The Project consists of the following components:

Component 1: Improvement and asset management of the East-West Highway.

a. Upgrading of existing 2-lane E60 East-West Highway to a 4-lane dual carriageway from Agara bypass to the village of Gomi, including a bypass of this village which ends at Zemo Osiauri.

b. Maintenance of the E60 4-lane carriageway between Natakhtari and Ruisi.

c. Civil works to improve road safety and access roads on the existing East-West Highway between Natakhtari and Kashuri and along the existing E60 alignment between Gomi and Khashuri.

d. Environmental improvement measures along completed sections of the E60 highway between Natakhtari and Ruisi.

e. Construction supervision and quality assurance services.

Component 2: Institutional strengthening
This component provides for the implementation of activities to further deepen institutional strengthening efforts being undertaken under ongoing Bank supported projects. The activities are as follows:

Component 2A - Institutional strengthening of the MRDI

a. Review and updating of road sector strategy.

b. Support to the MRDI to improve road safety management capacity in Georgia and regulatory environment for the local construction industry.

c. Measures to improve manpower planning and development in MRDI.

Component 2B - Institutional strengthening of the Roads Department

a. Organizational efficiency improvement and manpower planning and development measures.
b. Development of a strategic roadmap for the development and implementation of Intelligent Transport Systems (ITS) along the E60 corridor, from Tbilisi to Turkish Border.

Component 3: Preparation of supporting studies for future projects for the development of the East-West Highway (Estimated Cost: USD 11.9 million)

This component will finance activities for the definition and design of civil works included in Component A and preparatory studies for the future westward upgrading of the E60. The planned activities include:

a. Study to define the scope of the maintenance interventions along some upgraded sections of the E60 4-lane carriageway e.g. Natakhtari to Ruisi.

b. Road safety improvement studies and designs.

c. Update of feasibility studies and undertaking of preliminary engineering design of new Rikoti Tunnel and 60km of highway between Chumateleti and Argueta.

Component 4: Project management support (Estimated Cost: USD 1.5 million)

a. Implementation support to RD. This activity provides for the financing of contract management services to the RD for: (i) main civil works and (ii) consulting contracts under the project.

b. Financial audits and project monitoring and evaluation services.

4.2 Background

The program to upgrade the major roads of the country initiated by the Government of Georgia aims to improve transportation and transit of goods to the neighbouring countries. The program is managed by the Roads Department of the Ministry of Regional Development and Infrastructure (RD) and focuses initially on the E-60 East -West Highway, which runs from Russia and Azerbaijan, with connections to Turkey and Agara – Zemo Osiauri section of the E-60 highway Armenia. For planning purposes the E-60 has been divided into various sections. The project under consideration is a part of 49 km Ruisi-

Rikoti section of the highway which, according to the Terms of Reference included the following road sub-sections:

- Ruisi-Agara (km 95 – km106);
- Agara-Zemo Osiauri (km 106 –km121) and
- Zemo Osiauri-Rikoti Tunnel (km 121-km143).

The existing road from Ruisi to Rikoti is a two-lane carriageway road with a paved width of about 9.00 m and the shoulder width varying between 2.50 m and 3.00 m. Upgrading of the section will convert the present two-lane road to a four-lane highway, comprising 2 two-lane carriageways separated by a central reservation, with a paved shoulder for breakdown and emergency use, plus surface water drains, safety barriers, lighting, signage, etc.

The ToR for the FS requires the adoption of the TEM Standard (Trans-European North-South Motorway). To meet these requirements each lane will be 3.75 m wide and each carriageway will be provided with a 3.75 m shoulder, 3.00 m paved and 0.75 m unpaved berm; the central reservation will be 5.00 m (including safety barriers) so the completed road will be 27.50 m wide. Where the existing road is widened, the present carriageway will be repaired and refurbished, and a new two-lane carriageway will be built alongside.

On the design stage the mentioned division has been revised. The first section has been extended to include Agara bypass. This caused some changes in the chainage evaluated on Ruisi – Agara EA stage, which covered km 95 – km 144 instead of the chainage indicated above. Consequently the break down of other two sub-sections changed. According to the ‘new’ division, this EIA deals with the chainage from km 114 to km 126 and includes section from Agara to Zemo Osiauri.

Agara – Zemo Osiauri bypass section (Figure 4.1.) of the E-60 highway is a part of 49 km road between Ruisi and Rikoti. It begins west to Agara, at km 114 from Tbilisi, follows existing alignment up to km 117, turns south to bypass Gomi, crosses existing road south west to Agarebi village at km 122 and continues to the north west in direction to Osiauri, crosses the railway line at around km 124 and Suramula River at km 124.6.

The new Gomi bypass section runs through unsettled landscape – mainly arable lands and meadows close to the Mtkvari riverbed.

Figure 4.1 Agara – Zemo Osiauri section.

Along the section under consideration, construction of the following is envisaged:

- one two-level intersection to Gomi (overpass)
- underpass at (272+55.8.6)
- railway overpass (289+13.00)
- bridge over Suramula River (295+81.59)
- underpass (298+44.00)
- four, 30 m long spare crossings for traffic redirection (pk191+00; 228+00; 263+00;307+00)
- seven cattle crossings (underground passage)
- fifteen reinforced concrete culverts
- drainage ditches (on both sides of the road) equipped with stone filters and intake wells. Total quantity of filters 140 units. Average distance between filters is L- 140 m. At least one filter between two culverts
- 11 PVC culverts pipes
- bank protection structure (in addition to existing one available along the riverbed)

Drawings and detailed description of the road design is given in Annex 7.

4.3 Traffic volume

According to the Roads Department, the traffic in 2008 averaged between 5.800 and 9.100 vehicles per day on the existing road sections. Travelling westwards traffic flow splits at the intersection of E-60 and the Khashuri – Borjomi Road in Khashuri. The main traffic flow continues along the E-60 corridor towards Rikoti Tunnel and about 1/3 of traffic continues westward towards the city of Borjomi.

Recent traffic flows data in the studied road sections is missing. However comprehensive traffic survey was implemented by Kocks Consult during the preparation of the Feasibility study. Available traffic flow data was adjusted using daily and seasonal conversion factors and linked with forecasted economic growth in the country.

Annual and daily average traffic and its composition at selected locations in the study corridor was included in the EIA report (according to the traffic survey performed by Kocks Consult).

4.4 Mobilization and construction phase

4.4.1. Mobilization

Works will be carried out by the contractor identified through international tendering. Prior to commencement of works, the contractor must identify the location of the camp, equipment stationing area and agree on/receive a permit for its use from the state or the land owner.

Preconstruction activities connected with the highway modernization works specified in the project documentation include the following:

- Preparation of temporary camp sites in the vicinity of the road bed in accordance with environmental requirements;
- Selection of temporary disposal sites for construction debris of the highway and materials;
- Selection of temporary sites for separate stockpiling of productive (topsoil) and other excavate soil;
- Land acquisition/compensation;
- Obtaining permits for the operation of asphalt/concrete plants (in case construction plans to use them);
- Obtaining mining licenses or concluding sub-contracts for the supply of aggregate materials (use of licenced suppliers rather than development of new quarries is advisable);
- Developing waste management plan and having it approved by the client;
- Developing traffic management plan and having it approved by the client;
- Development of work camp or construction yard site map and having it agreed with the client.

Prior to construction the following infrastructure from the RoW area must be removed: abandoned water pipeline (2235m)), fibre glass cable (6350m); gas pipeline (300m), 10kV transmission line (2000m). Impact of these works has not been considered in this EIA, as no details on the planned activities are available.

4.4.2. Road construction works

The construction process involves a variety of activities, such as:

- RoW cleaning via excavators/bulldozers and removal of debris to agreed location.
- Trench arrangement with a backhoe crawler excavator for drain systems and ditches.
- Arrangement of water wells and ditches equipped with filters.
- Soil rolling with hardware. Import of inert materials with trucks, roll 500-800 mm for bed formation.
- Ready-made concrete filling with special vehicles for 280 mm concrete pavement arrangement.
- Handling the road upper layer manually; Unifying spot resilient carburizing; road marking; Barrier and traffic sign arrangement;
- Repair works for the existing highway if needed-mainly small scale works, with the means of backhoe crawler excavator, concreting, etc.
- Landscape harmonization and tree planting;

The Project will comprise the following interventions:

- stripping and stockpiling of topsoil;
- preparation of the ground - clearing (removal of trees, bushes, debris);
- grading operations and the laying of cross-drain pipes/culverts. In fill areas, the grading is brought up in layers and compacted. In cuts, the excavation is carried on until the subgrade elevation is reached, and then the earth is compacted;
- base course forming on the subgrade. The base course material may be gravel, sand, crushed stone, or more expensive and permanent materials;
- surface course forming over the base. This material may be sand, asphalt, blacktop, concrete, or similar materials;
- replacement, repair and rehabilitation of existing bridges;
- construction of selected short bypasses and a new short connection;
- provision of road furniture and marking in accordance with international standards.

Along with the mentioned above, bank protection structure will be arranged. This in its turn will include – preparation of riverbed and banks, excavation, importation of riprap material, arrangement of riprap and backfilling of excavated soil.

Construction works shall be performed in conformity with valid standards, norms, recommendations and instructions. The works shall be performed in accordance with typical technological diagrams as well as design specifications, following the Best Available Technology practice and provisions set in Technical Specifications (Section VI, Volume. III of the Bidding documents)

It is expected that the construction phase should take up to 24 months

4.4.3. Off-site works

Off-site works will relate to the extraction of construction materials from already existing licensed quarries. The contractor should purchase required materials from an authorised, licensed provider.

During the design stage licensed quarries were defined, pre-testing of material performed. Results proved that inert material on the project area, in general, fits requirement for fillers, pavements and base materials, but in most cases, needs sieving.

Table 4.7. List of quarries in the region

Region	Distance to the settlement, km		License	Owner	Material	Annual yield
Khashuri	Khashuri	10	00168	Gomi 98	Sand, gravel	38500
Qareli	Akhalsopeli	1.5	00239	Ushangis bichebi	Sand, gravel	90000
Khashuri	Khashuri	3	00326	Kama	Sand, gravel	180000
Khashuri	Khashuri	3	00326	Kama	Sand, gravel	180000
Khashuri	Khashuri	3	00326	Kama	Sand, gravel	180000
Khashuri	Agarebi	0.5	00368	Guram Kilaberidze. P.e	Sand, gravel	300000
Khashuri	Khashuri	5 - 10	00369	Guram Kilaberidze. P.e	Sand, gravel	400000
Qareli	Mokhisi	3.5	00386	Gzebi +	Sand, gravel	150000
Khashuri	Station Gomi	3	00398	Akvariumi	Sand, gravel	220000
Qareli	Qareli	8 - 10	00450	Rostom Mikhanashvili. P.e	Sand, gravel	200000
Gori	Gori	8 - 9	00459	Valeri +	Sand, gravel	50000
Qareli	Qareli	8 - 10	00502	Balasti X	Sand, gravel	400000
Qareli	Urbnisi	1	00518	Deltekari	Sand, gravel	200000
Qareli	Station Qareli	4	00527	Broli	Sand, gravel	115000
Qareli	Station Qareli	0.5 - 1	00550	Bazaltis industrial	Sand, gravel	142000
Qareli	Agara	0.6	00553	Bazaltis industrial	Sand, gravel	142000
Qareli	Station Agara	1.5	00570	Givi Gakashvili P.e	Sand, gravel	70000
Qareli	Qareli	8	00616	Pent holding	Sand, gravel	40000
Gori	Gori	1 - 1.5	00649	Serviceair Ltd	Sand, gravel	800000
Khashuri	Khashuri	1.5	00693	Sergo Betashvili .	Sand, gravel	143550
Khashuri	Khashuri	5	00775	David Kharazishvili	Sand, gravel	30000
Khashuri	Station Gomi	2	00874	David Belidze	Sand, gravel	50000
Khashuri	Khashuri	4	00889	Teona Ltd	Sand, gravel	177900
Khashuri	Khashuri	4	00889	Teona Ltd	Sand, gravel	177900
Khashuri	Khashuri	12	00938	Gomi alkohol and spirit production	Sand, gravel	25000
Khashuri	Khtsisi	1	01009	Solomon Akhalkatsi	Sand, gravel	263700
Khashuri	Khashuri	2	01079	Teona Ltd	Sand, gravel	9300
Gori	Khidistavi	0.5 - 1	01080	Horizonti Ltd	Sand, gravel	255600

Khashuri	Khashuri	5 - 6	01120	Akvariumi Ltd	Sand, gravel	84600
Khashuri	Khashuri	2.5	01181	Givi Mchedlidze	Sand, gravel	73800
Khashuri	Khashuri	2.5	01181	Givi Mchedlidze	Sand, gravel	73800
Khashuri	Khashuri	2.5	01181	Givi Mchedlidze	Sand, gravel	73800
Gori	Gori	3 - 4	100003	Revaz Gogiashvili	Sand, gravel	617100
Gori	Gori	3 - 4	100003	Revaz Gogiashvili	Sand, gravel	617100
Khashuri	Khtsisi	2	100133	Tamaz Shatirishvili	Sand, gravel	93900
Gori	Station Uflistikhe	1	100179	Mshenebeli Ltd	Sand, gravel	66300
Khashuri	Khashuri	4	100187	David Kiparoidze	Sand, gravel	137000
Khashuri	Khashuri	4	100187	David Kiparoidze	Sand, gravel	137000
Gori	Gori	1	100277	Nuovo Global Ltd	Sand, gravel	186600
Gori	Gori	3 - 4	100318	Agmashenebeli Ltd	Sand, gravel	59400
Khashuri	Tskhramukha	1	100397	Datuna 2006 Ltd	Sand, gravel	180000
Gori	Skra	1	100400	Malkhaz Tramakidze	Sand, gravel	60000
Gori	Khidistavi	1,5	100430	Kakhaber Songulashvili	Sand, gravel	55000
Qareli	Qareli	2,5	100441	Rocco Agostino e figli Ltd	Sand, gravel	173100
Khashuri	Kriskkhevi	1,8	100465	Teona Ltd	Sand, gravel	160000
Khashuri	Khtsisi	1	100550	Progresi Ltd	Sand, gravel	86400
Khashuri	Khtsisi	1,7	100551	Progresi Ltd	Sand, gravel	151800
Khashuri	Khashuri	4 - 5	100816	JSP + Ltd	Sand, gravel	0
Khashuri	Khashuri	4 - 5	100816	JSP + Ltd	Sand, gravel	0
Khashuri	Tskhramukha	1.1 - 1.2	100901	Gza 2009 Ltd	Sand, gravel	26100
Khashuri	Kvishkheti	2 – 2.5	100965	Msheneblobis ganviTarebis kompania Ltd	Sand, gravel	131000
Khashuri	Khashuri	10	00290	Organizacia-beTania Ltd	Quartz Sand	50000
Khashuri	Khashuri	10	01188	Samsheneblo qvisha Ltd	Quartz Sand	310200
Gori	Sveneti	1.5	100146	Givi Abalaki mermeze	Sand, gravel	520000
Gori	Sveneti	1.5	100146	Givi Abalaki mermeze	Sand, gravel	520000
Gori	Akhalsopeli	1.5	100458	Ashtrom International Ltd	Crushed Stone	172000
Gori	Sveneti	1,2	100526	Ashtrom Contracting Georgia Ltd	Sand, gravel	123200
Gori	Gori	5 - 6	100565	Ashtrom International represent.	Sand, gravel	336000

Khashuri	Odzisi	1,5 - 2	100771	Sak.Sasheni	Quartz Sand	274500
Khashuri	Kemperi	0	559	Alkazar Ltd	Quartz Sand	700000
Khashuri	Kemperi	0	559	Alkazar Ltd	Quartz Sand	700000
Khashuri	Station Khashuri	5 - 6	01028	Levan Gelashvili	Sand	9000
Khashuri	Khashuri	5 - 5,5	100847	Guram Kilaberidze	Quartz Sand	77000

The contractor may run own quarry, but in this case surveys, quality analysis and obtaining licences and permits from relevant authorities will be required. Abstraction of inert construction material from 50m strip along the riverbed or from the sites where abstraction may alter riverbed or affect engineering structures is prohibited. Only licenced quarry can be used.

Licencing is regulated by the law of Georgia on Liences and Permits. The body responsible for licencing is the Ministry of Energy and Natural resources (LEPL Agency of Natural Resources). At the same time, together with inspection service it ensures control and supervision of the resource usage. The terms, ruls and conditions of a licence for each specific object are set in the licence. The licence is issued through auction. According to the law, the licence is granted to the proponent presenting the best proposal from the view of resource and environment protection, economically acceptable and best technical proposal. Validity of a licence for abstraction of construction material is 30 years (20.11.2009 N 2114).

Resource use, environmental protection and safety requirements are listed in the licence. The licence holder is obliged to ensure sustainable use of the resource with due regard of environmental and resource protection rules; guarantee safety of works with consideration of ambient air, water, soil, forest, protected areas, historical and cultural monuments and buildings protection norms. The licence holder is obliged to stop opertation if any rare plant or object of aesthetic value is found. The fact must be immediately communicated to relevant governmental authorities. The owner is responsible for restore and ameliorate disturbed land.

The licence can be terminated in case of incompliance with licence conditions, including environmental requirements. Liquidation or conservation costs are covered by the resource user. In case of licence termination the owner automaticaly loses right on the land plot.

If the contractor decides to use own quarry the following requirements must be met:

- It must be ensured that there is sufficient resource in the proposed quarry to make a site financially viable; including rehabilitation expenses.
- Topsoil must be removed and stockpiled until reintroduction. The topsoil should not be buried, driven on, excessively handled, contaminated or stockpiled so as to hinder final land-use.
- If required, erosion protection must be provided;
- To ensure safe operation the access tracks must be of adequate width: in the case of one-way traffic, the track should be twice the width of the widest vehicle; in the case of two-way traffic - three times the width of the widest vehicle to use the track.
- Gates and fences should be designed, regularly inspected and repaired to prevent unauthorised entry; signs at any hazardous locations on a site indicating the hazard must be provided.

- Operation and decommissioning of the quarry must be performed in compliance with the conditions of the quarrying license and with due regard of environmental standards
- Upon completion of works, the quarry and the adjacent area affected by the development should be recultivated: the topsoil reinstated, the status of the site restored to the state close to the initial state (for instance, the site may be planted with vegetation).

The sourcing site must be agreed with environmental authorities. Previously exploited or new sites may be used if it doesn´t substantially affect the environment. The advantage of using existing sites is that no new sites would be affected by abstraction. The Contractor shall be responsible for locating and selecting materials complying with the Specification and for ensuring that materials processed for incorporation into the Works comply with the Specifications. Material Report developed under the project provides information on available options (quarries) in the region.

Sourcing from river terraces

Should material be abstracted from the riverbed, the riverbed and the landform must not be affected. Abstraction of gravel should not be carried out in high water period. The operation site must be protected by a gravel mound (up to 2m wide).

In compliance with the national legislation (Law on Natural Resources) abstraction of inert material from a riverbed is prohibited in case activity violates stability of any hydrotechnical structures (dam, retaining wall, etc). Sourcing from the section where solid drift is not sufficient for ‘feeding’ the banks is not allowed. In such areas inert material abstraction from the river terrace within 50 m strip from the riverbed is also banned.

5 Methololgy

The work of the EIA consist of the six main activities that are common to most EIA studies conducted to international standards. These comprise:

1. Collection of baseline data describing the existing environment (the physical, biological and human (socio-economic and socio-cultural)) in the area likely to be affected by the proposed project. Desktop studies and field surveys conducted to address important gaps in the existing data, up to date information on topics and areas where significant negative impacts are expected - collected.
2. Identification of impacts, assessment of their significance and development of mitigation measures (avoidance of impacts is preferred over mitigation by both Bank safeguards and Roads Department policy.)
3. Analysis of alternatives in terms of location, technology, design and operation, including the “zero alternative".
4. Development of environmental management plan (EMP) according to World Bank OP 4.01 Annex C.
5. Stakeholder consultation and disclosure (conducted according to national law and the World Bank policy).
6. Development of the EIA report.

This project consisted of a review of literature including both primary sources and government and consultant reports. Botanical and faunistic surveys have been carried out. Field works were performed by biodiversity team (botanists and fauna specialists) in 19-20 May 2011; 29 July 2011; 5-6 August 2011 and 9-10 September 2012.

Objective of the botanical study was to identify plant communities within the section of interest, reveal sensitive populations and, if found, provide quantitative characteristics thereof. With consideration of expected direct and indirect impact the corridor – 100 m on each side of the centreline – was surveyed. The method of survey was walkover. The main types of plants, as well as composition, distribution, dominant species, biome sensitivity and commercial value of plants were assessed. The presence of endemic, rare and other protected species in the project impact zone was identified.

Faunistic field survey was organised with the purpose of verifying the data obtained from the literature on the animal species composition and areas of their occurrence. A simple methodology of surveying animal footprints, droppings and dwellings was applied to collect information on key species of mammals and birds.

For identification of the background quality of the soil along the road samples were collected (September 10, 2012). Taking into account that the area is mostly rural and no significant sources of pollution, except for the road itself are available, four average samples were collected. The samples were collected from both sides of the road in 1-200m from the carriageway at the sampling depth of 0-10cm. The total amount of soil collected from one site is 1 kg. Prior to sampling, the sampling spots were cleared of grass and stones. Samples were collected in plastic bags, labelled and delivered to the lab for testing. The samples are dried, averaged and sieved.

Methods of soil analysis

Cu, Zn, Pb, Ni, Co, Co, Cd	ISO 11047, ISO 11466 - Aqua Regia extract Determination of Cu, Mn, Fe, Mn, Co, Pb, Cd, Ni, Zn, Cr, Ni. Al
As	ISO 2590 - General method for the determination of arsenic – Silver diethildithiocarbamate photometric method

The sample analysis revealed that concentration of all metals is below relevant maximum allowable concentrations adopted in the EU.

Physico-mechanical properties of the soil have been studied by GeoTechService Ltd., under the contract with Transport Ltd.

Mtkvari and Suramula water was sampled (September 10, 2012) in the project area for identification of the background water qality. The samples were collected in 1.5 litre capacity plastic bottles. For Total Petroleum Hycrocarbon analysis water – 1 litre glass bottles was used. Samples were labelled and delivered to the lab the same day. Analysis were performed in compliance with ISO and EPA standards.

Methods of surface water analysis

Parameter	Method
pH	ISO 10523
Conductivity	ISO7888:1985
BOD	
COD	ISO 6060
NH4	ISO5664:1984
K	ISO 9964
Fe	ISO 6332
Cu	ISO 8288

Parameter	Method
Mn	ISO 6333
Zn	ISO 8288
Cl	ISO 9297
NO_2	ISO 7890
NO_3	ISO 6777
Pb	ISO 8288
TPH	EPA 418

Sampled were analysed by Gamma lab.

Long-term pollution levels were calculated using modelling software CAL-Roads View. It is an air dispersion modelling package for predicting air quality impacts of pollutants near roadways. For Agara - Zemo Osiauri road section, three alternatives (zero alternative, southern bypass and northers bypass) were modelled.

Initial data for pollution dispersion modelling

	"Zero" alternative	Project alternative 1	Project alternative 2

Year of prognosis		2025	2025	2025
Composition of traffic flow	Cars, vehicles/day	22446	22446	22446
	HGV*, vehicles/day	2040	2040	2040
	% of heavy transport in flow	8.3	8.3	8.3
	Total number of vehicles/day	24486	24486	24486
Speed limit, km/h	Cars (in settlements)	80 (60)	120**	120**
	HGV (in settlements)	80 (60)	100**	100**

*Heavy Goods Vehicles

**After road reconstruction all settlements will be bypassed therefore speed limit restrictions are not relevant.

Pollution modelling was performed considering worst-case meteorological conditions mainly described by wind direction, wind speed and atmospheric stability. Higher wind speed and unstable atmospheric conditions enable faster pollutant dispersion and lower concentrations. Therefore modelling was performed under stable atmospheric and worst meteorological conditions, estimated relying on the data obtained by the Gori meteorological observation post (lowest wind speed of 2.9 m/s; temperature reflecting winter period of - 1ºC). To model maximum possible pollutant concentrations, the worst-case wind angle was chosen as a run type.

30 min onetime maximum concentrations of carbon monoxide (CO), nitrogen dioxide (NO_2), and particulate matter up to 10 micrometers in size (PM_{10}) were calculated. Pollution dispersion maps are presented in *Annex 1*.

According to the WB policy, the air pollution impact assessment should be performed relying on guidelines and standards of both the WB and of the borrowing country; in cases they differ, the stricter ones should be applied. Maximum allowable pollutant concentrations according to the Georgian regulations (*Georgian Ministry of Labour, Health Care and Social Welfare (2003) Order 38/n "On approval of qualitative environmental standards: Acceptable limit concentrations of pollutants in atmospheric air of residential areas"*) and the WB recommendations (*EHS guidelines, "Air Emissions and Ambient Air Quality*", based on WHO guidelines) are given below. 30 min onetime maximum concentration under the Georgian standard is assumed to be the strictest and therefore applicable in the evaluation.

It is assumed that if modelled under the worst possible metheorological conditions, 30 min onetime maximum pollutant concentrations will not exceed limit concentrations given below, exceedances of limit concentrations indicated by longer time periods are not likely to occur neither.

Maximum Allowable Concentrations (MAC) according to the Georgian standards and WHO guidelines

		EHS Guidelines*	**Georgian standard**
CO	*1 hour*	30 mg/m^3 (25 ppm)	-
	8 hour daily maximum	10 mg/m^3 (10 ppm)	-
	30 min onetime maximum	-	5 mg/m^3

	24 hour	-	3 mg/m^3
NO_2	*1 hour*	200 µg/m^3(0.11 ppm)	-
	Annual	40 µg/m^3 (0.026 ppm)	-
	30 min onetime maximum	-	85 µg/m^3
	24 hour	-	40 µg/m^3
PM_{10}	*24 hour*	50 µg/m^3	300 µg/m^3
	Annual	20 µg/m^3	-
	30 min onetime maximum	-	500 µg/m^3

* EHS Guidelines are based on WHO Air quality guidelines for Europe

The Agara - Zemo Osiauri road section runs along rural landscapes, starting from the end of Agara and passing only one bigger settlement - Gomi, and a few stand alone dwellings. The number of population quantity in the settlement of Gomi is under 10,000, therefore background concentrations of pollutants are assumed to be 0 and are not included in dispersion modelling (Source: "Background Concentrations for Towns and Settled Areas where no Ambient Air Quality Observations are Held").

Long-term noise levels were calculated using the modelling software CadnaA (*Computer Aided Noise Abatement*). It allows calculation and evaluation of different scenarios by choosing and managing different types of noise sources (mobile sources - roads, railways, aircraft; point sources - industrial enterprises etc.), estimating complex structures of roads, bridges, and other structures. Calculation algorithms included in *CadnaA* estimate topography, traffic intensity, speed of vehicles, percentage of heavy transport in flow, road elevation and incline, number of building floors, and moreover - helps to design noise barriers. *CadnaA* calculates day, evening and night noise levels according to traffic intensity, speed and percentage of cars and heavy goods vehicles in the flow. Topography and other obstacles (for example, tree arrays) are also estimated. *CadnaA* uses numerical maps in calculation, and gives noise maps as calculation output, where noise levels are attributed to different colours - one colour covers 5 dBA noise level and is divided by isolines at every 1 dBA.

For Agara - Zemo Osiauri road section two scenarios were evaluated according to the project alternatives:

- *Noise dispersion calculations using forecasted traffic data (2025 year), assuming that the project was not implemented and the road was not upgraded (the "zero" alternative);*
- *Noise dispersion calculations using the same forecasted traffic flow (2025 year), assuming that the Project alternative 1 was implemented and road upgrading included southern bypass.*
- *Noise dispersion calculations using the same forecasted traffic flow (2025 year), assuming that the Project alternative 2 was implemented and road upgrading included northern bypass.*

All the three scenarios were calculated using the same forecasted traffic flow data for 2025 year (according to traffic survey performed by Kocks Consult, and given in Feasibility Study and Alternative Alignment Analysis for Upgrading the Section between Sveneti and Rikoti, 80 –144 km of the E 60 Highway, 2009). Different speed limits are envisaged, namely 120 km/h (cars) and 100 km/h (heavy goods vehicles) speed limit if the road is upgraded (for both Project alternatives 1 and 2); and 80 km/h (60 km/h in settlements) for both types of vehicles if the project is not implemented. The noise caused by traffic on the roads crossing the Agara - Zemo Osiauri road sub-section was also taken into consideration.

Project 1 alternative involves building two bypasses near Gomi and Khashuri, and road widening. The new road would go south from current road alignment near Gomi, and north near Khashuri, avoiding both settlements. It is anticipated that negative impacts resulted by road operation would only affect southern part of Gomi, as even with the bypass road would still go near some dwellings. Khashuri bypass is planned in a distance from nearest dwellings, therefore negative impacts of noise is not likely to affect the residents.

Project alternative 2 runs north from the current alignment, in a distance from Gomi settlement and Khashuri town. This option would preserve residents of Gomi and Khashuri from negative noise impacts because of road operation. Only few dwellings situated near the road along the route would be affected.

In addition to the increased traffic flow and speed, noise levels for the both project alternatives are expected to be higher because of the concrete pavement which increases noise levels approximately by 3 dBA as compared with the asphalt - concrete pavement.

Initial data for noise dispersion modelling

		"Zero" alternative	**Project alternative 1**	**Project alternative 2**
Year of prognosis		2025	2025	2025
Composition of traffic flow	Cars, vehicles/day	22446	22446	22446
	HGV*, vehicles/day	2040	2040	2040
	% of heavy transport in flow	8.3	8.3	8.3
	Total number of vehicles/day	24486	24486	24486
Speed limit, km/h	Cars (in settlements)	80 (60)	120**	120**
	HGV (in settlements)	80 (60)	100**	100**

*Heavy Goods Vehicles

**After road reconstruction all settlements will be bypassed therefore speed limit restrictions are not relevant.

In the context of the road upgrading, relevant environmental quality regulations and standards mainly relate to the control of air and noise pollution, which may be of concern during both construction and operation of the upgraded road.

The Georgian standards for traffic noise control are regulated by the Decree of the Minister of Health, Labour and Social Affairs (297n of August 16, 2001) on the „Approval of Environmental Quality Standards", which, among other things, specify the tolerable levels of traffic noise for different zones. According to the WB policy, noise and vibration issues during road operation should

be evaluated relying on the General EHS Guidelines "Environmental noise management" (issued by International Finance Corporation, 2007). Acceptable noise levels by both Georgian standards and EHS guidelines are presented in Table below.

Limit noise levels according the Georgian Noise Quality Standards and EHS Guidelines

	Georgian Noise Standards		**EHS noise guidelines**	
	7 am - 11 pm	**11 pm - 7 am**	**7 am - 10 pm**	**10 pm - 7 am**
	dBA	dBA	Equivalent, LA_{EQ}, 1 h, dBA	Equivalent, LA_{EQ}, 1 h, dBA
Areas bordering residential houses, schools, and other educational institution buildings	55	45	55	45
Areas bordering hospitals	45	35	-	-
Inside living environment - residential, rest home, hostels, dormitories in kindergartens and boarding schools	40	30	35	30
Inside hotel, hostel rooms	45	35	-	-

Neither Georgian standarts nor the EHS guidelines are indicating maximum allowable noise levels in the environment influenced by traffic noise. According to good international practise and standards used in Europe, the maximum noise level for urban areas, mainly influenced by traffic noise, is 65 dBA during the day and 55 dBA at night. These values were used in noise impact evaluation.

6 Baseline data

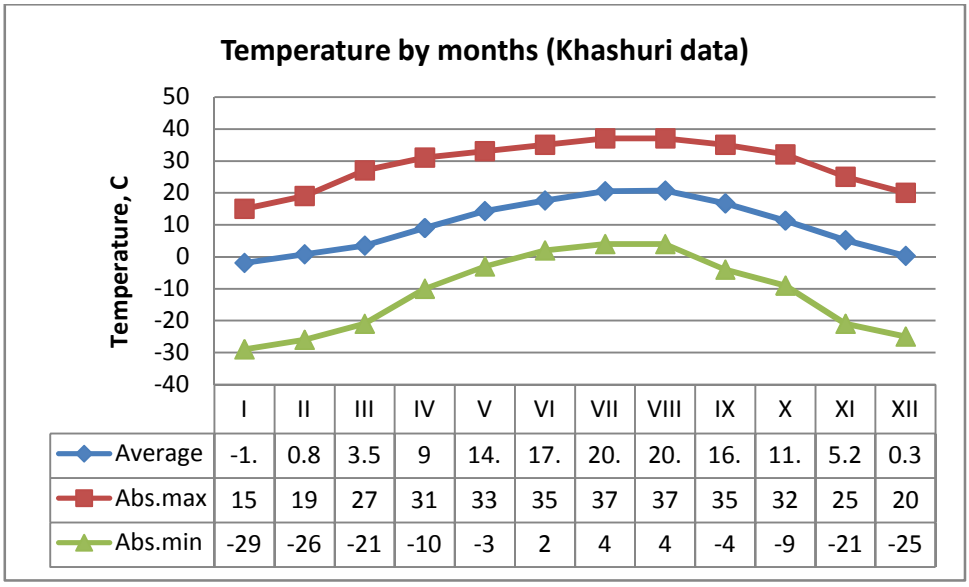
6.1 Physical conditions

6.1.1 Climate and meteorology

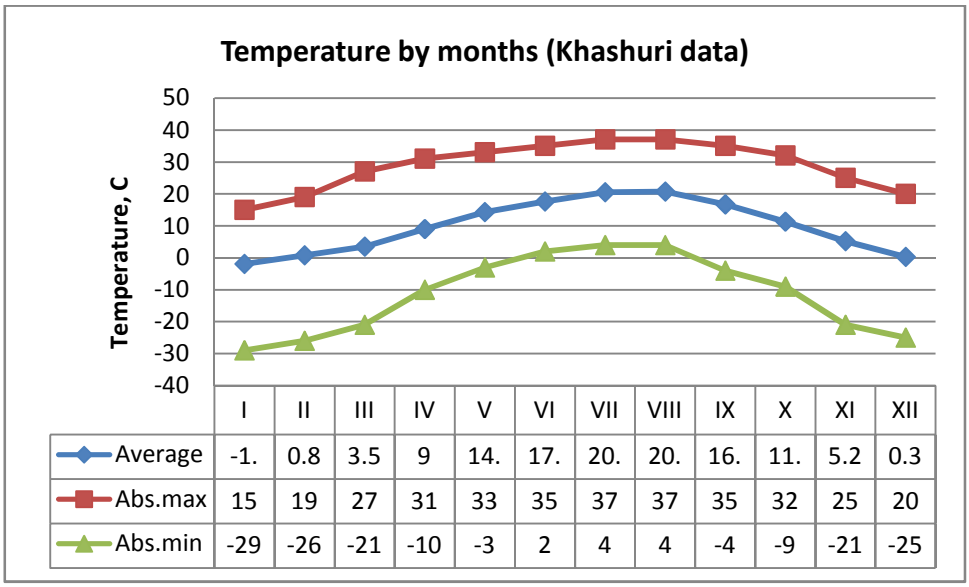
Eastern Georgia has a primarily subtropical climate, influenced mainly by dry air masses from the Caspian and Central Asia in the east, and humid air from the Black Sea in the west, and largely protected from the colder air in the north by the Greater Caucasus Mountains. According to construction-climatic characterizations the project region belongs to II-b climatic subregion.

The main characteristics are hot summers and relatively cold winters, and significantly less precipitation than in western Georgia. In the lower parts of the study area average air temperatures peak at around 23°C in July and August, when daytime temperatures often reach 33-35°C, but fall below 20 °C at night. In winter the average air temperature is around 1-2 °C between December and February, and regularly falls below -10 °C throughout this period.

Temperatures are significantly lower on the higher ground to the west of the study area, and around the Rikoti tunnel the average winter temperature is -1 to -3 °C between December and February and only rises to around 17 °C in summer. Precipitation is also much higher in this area, reaching 1100 mm per year, and the annual pattern is different as winter is much wetter than summer, and the average snow cover is between 80 and 100 days per year. Winds are also stronger than in the lowlands, averaging 8-10 m/sec in most months, blowing mainly from the east.



	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Average	-1.	0.8	3.5	9	14.	17.	20.	20.	16.	11.	5.2	0.3
Abs.max	15	19	27	31	33	35	37	37	35	32	25	20
Abs.min	-29	-26	-21	-10	-3	2	4	4	-4	-9	-21	-25



	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Average	-1.	0.8	3.5	9	14.	17.	20.	20.	16.	11.	5.2	0.3
Abs.max	15	19	27	31	33	35	37	37	35	32	25	20
Abs.min	-29	-26	-21	-10	-3	2	4	4	-4	-9	-21	-25

Figure 6.1 Average temperature (according to Khashuri meteorological observation posts, long term observation data averaged values)

Maximum daily precipitation level in the area totals 80mm. Annual precipitation on the plain is around 500-644 mm, and Figure 6.2 shows that spring and autumn are the wettest periods, and that winter is generally drier.

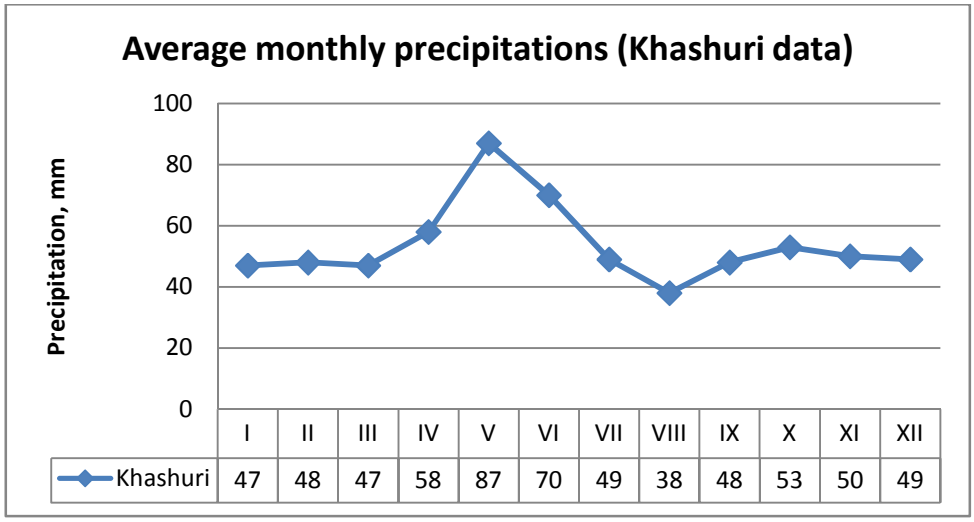


Figure 6.2 Precipitation (long term observation data averaged values)

Snowfall is moderate in most winters and the average snow cover on the plain is between 34 to 52 days. Wind speeds are generally quite low, averaging between 1.0 and 1.6 m/s in most months, and winds blow mainly from the north-east or south-west.

Relative air humidity is shown in Figure 6.3.

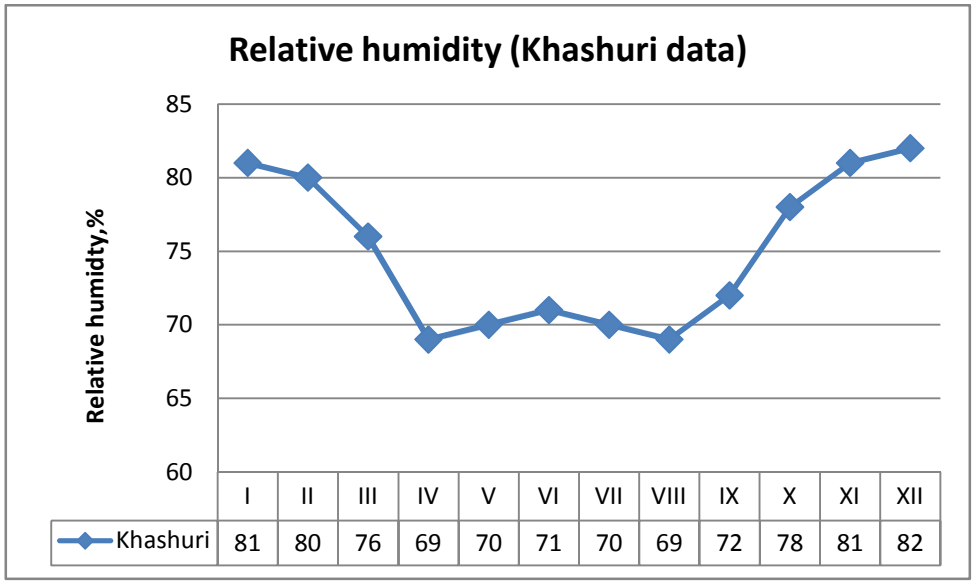


Figure 6.3 Relative air humidity

Prevailing wind direction and wind speed according to Khashuri observation post and wind speed data are shown below in Tables 6.1 and 6.2.

Table 6.1 Percent distribution of wind direction

	N	NE	E	SE	S	SW	W	NW	Calm
Khashuri	2	13	28	1	1	3	48	7	46

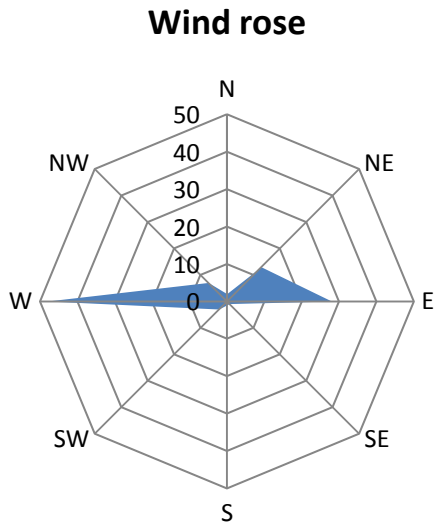
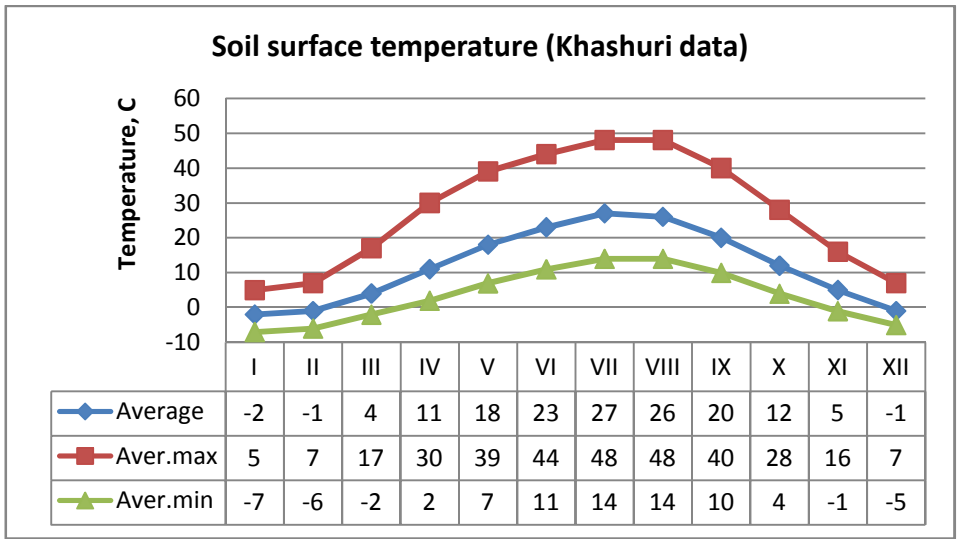


Figure 6.4 Wind rose (according to Khashuri meteorological observation posts, long term observation data averaged values)

Table 6.2 Wind speed

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Average
m/sec	3.2	4	4.9	5.1	4.6	4.3	4.6	4.3	4.2	3.5	3.4	2.9	4.1

Highest wind velocity, once in 1 year occurrence - 18 m/sec
Highest wind velocity, once in 5 year occurrence - 22 m/sec;
Highest wind velocity, once in 10 year occurrence - 24 m/sec;
Highest wind velocity, once in 15 year occurrence - 25 m/sec;
Highest wind velocity, once in 20 year occurrence - 26 m/sec



	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Average	-2	-1	4	11	18	23	27	26	20	12	5	-1
Aver.max	5	7	17	30	39	44	48	48	40	28	16	7
Aver.min	-7	-6	-2	2	7	11	14	14	10	4	-1	-5

Figure 6.5 Soil surface temperature (according to Khashuri observation posts, long term observation data averaged values)

Normative depth of soil seasonal freezing by fraction is:

clay and clayey soils	38 cm
fine grain sand, sandstones	46 cm
coarse and medium grain sand	49 cm
coarse fragmental soils	57 cm

6.1.2 Geomorphology and geology

The E-60 highway runs from north-west to southeast of Georgia, (Figure 6.6). The section under consideration is located 114 km to 126km north-west of the capital Tbilisi, in the River Mtkvari valley immediately east of the Likhi Ridge, which is the natural boundary between the eastern and western Georgia. The highway runs roughly parallel to the river on its northern side though the Khashuri-Doghlauri flat accumulative plain with undulating terraced surface in some places.

The geomorphologic peculiarity of the study territory, like its landscape and climatic peculiarity, is distinguished for two different characteristics. Most of the eastern part of the area is a plain-accumulative relief of Shida Kartli, formed under the influence of the erosive-accumulative processes of the river Mtkvari and its left tributaries.

Within the Upper Kartli flatlands the north and the south sections can be distinguished. The north is represented by Tiriphoni-Saguramo, the south - 'coincides' with the Mtkvari gorge. Tiriphoni-Saguramo is built of the Liakhvi, Lekhura, Ksani and Aragvi river sediments. The highest part, neat Tskhinvali is at 800m above sea level, the lowest, near Natakhtari – at 500m above sea level. The Tiriphony flatland from Tskhinvali to Gori is slanting southward. Other parts (Saamilakhvro, Mukhran-Saguramo) are flat.

The relief of the study territory clearly shows four terrace surfaces of the Mtkvari River with two inserted terrace steps developed under the influence of the Mtkvari tributaries forming a plain-accumulative hilly relief in the whole. The plain-accumulative surface is quite intensely crossed with the meridian oriented left tributaries of the river Mtkvari and channels of the irrigation system. The terrace is slanting in north to south direction.

In the ancient times the slopes were covered with riparian forest. Now remains of the forest can be found only near Khashuri (Osiauri area). On the slopes of Trialeti ridge vegetation is better preserved.

The section of interest is located between the Mtkvari River and the railway line, in the boundaries of the first river terrace, at 640-670m above sea level. The landform is accumulative, slightly undulated, developed, altered – some of the ravines are filled up, in some – irrigation canals are arranged.

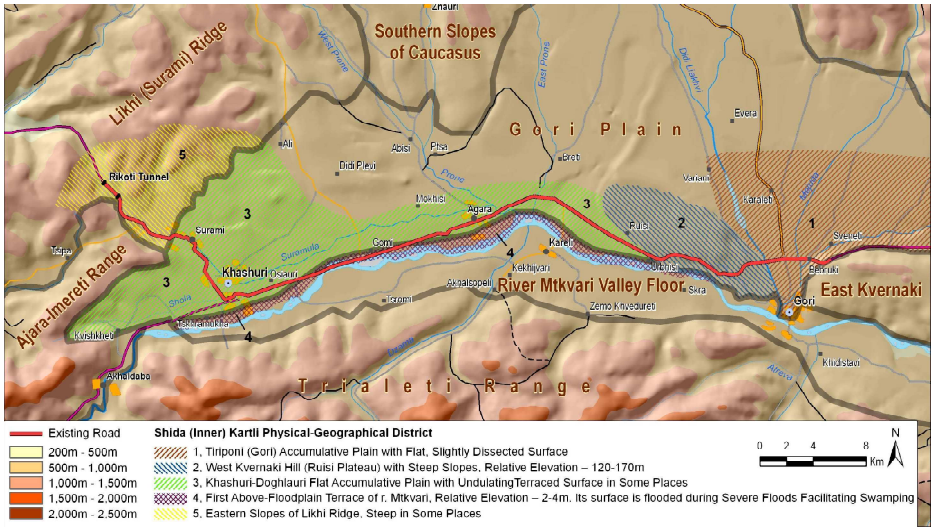
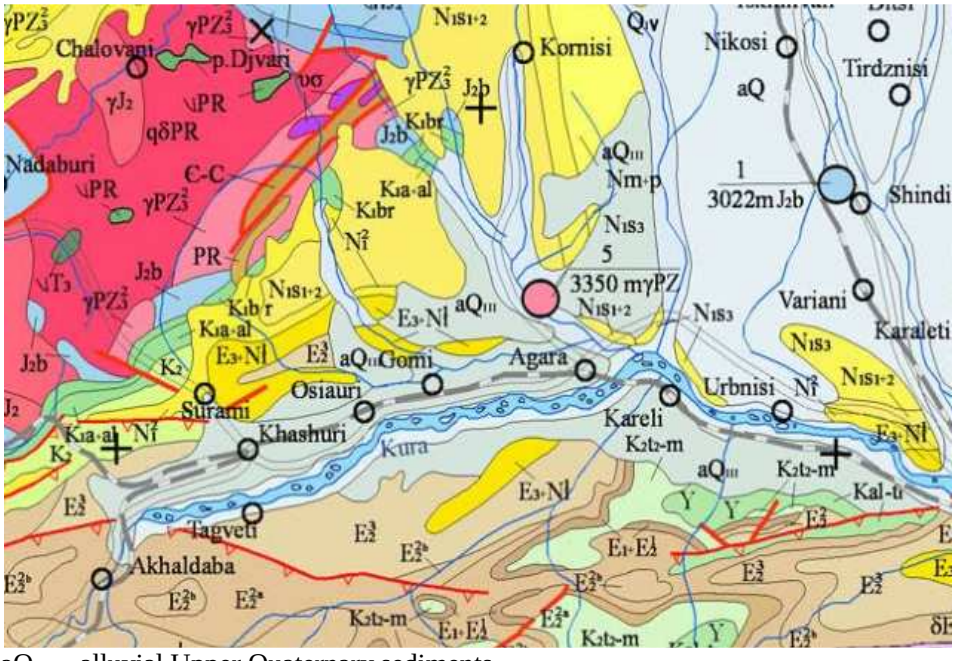


Figure 6.6 Main physical features of the study area (Source: Regional Environment Assessment, 2009, RD MRDIG)

According to tectonic zoning map the project region belongs to the east section of the central part of Adjara-Trialeti folded system. It is built of Upper Palaeogen (P_3) and Lower Neogene (N_1) sedimentary and volcanogenic rocks. The 'older' rocks are topped with 10-20m thick modern and Quaternary (Q_{3+4}) rocks represented by clay, sandstones, sand and cobbles.

The surface of the plain is composed of Quaternary fluvial alluvium (loosely cemented conglomerates, clays and sand) deposited by the rivers; and deluvial-proluvial material (coarse gravel, shingles, clay and sand), washed from the mountains by rainfall or ephemeral streams.



aQ_{III} – alluvial Upper Quaternary sediments

Figure 6.7 Fragment of geological map of the area

Engineering geological survey revealed that up to 10-15m depth the studied area is structured by deluvial, deluvial-proluvial clays and clayey formations, modern alluvial, alluvial-proluvial and proluvial cobbles and gravel (aQ_{IV}) with different matrix. Beneath the Quaternary sediments Palaeogene clays with sandstones interlayers are registered. The upper stratum of the Palaeogene formation is strongly weathered. Weathering level decreases by depth.

From km19 to km 26 significant geodynamic processes capable to affect construction are not registered. In vicinity to the Mtkvari riverbed, at km 26.71 low and medium intensity side erosion of the bank is observed. One of potential causes of that is damaged gabion. The problem has been taken into account during development of the road design.

6.1.3 Hydrogeology

The main hydro-geological region in the study area is Kartli Artesian Basin of porous, fissured and fissured-karst water, which underlies most of the Gori Plain. The Kartli artesian basin is formed in the depression between the Caucasus Mountains in the north, the Trialeti Range in the south and Likhi Ridge in the west (Figure 6.6).

Major geomorphologic units are the Tiriphoni and Mukhrani syncline depressions, overlain by the Quaternary formations and accumulative terraced terrain of river valleys. The depression is filled by a thick molassa series (up to 2 km) of the Miocene – Pliocene period, consisting of alternating conglomerates, sandstones and clays. This series underlies similarly thick (>200 m) non-dissected Early Quaternary and recent alluvial formations, composed of boulders, shingles and loams, with inter-layers of clay.

The groundwater associated with these formations is pressurized and frequently self-flowing in boreholes, and is classified as hydrocarbonate-sulphate calcic-sodium type with low mineralization up to 1 g/l. This complies with potable water requirements and the groundwater is widely used for supply of settlements. The deeper Miopliocene lagoon-continental sediments are only sporadically water-bearing, in layers of loose conglomerates. Here the majority of boreholes are sub-artesian, with water levels at 30-40 m below the ground. Consequently borehole yields are low and rarely exceed 1 l/s. The groundwater from this stratum is mainly of low mineralisation (0.4 – 1.0 g/l) and hydro carbonate calcic magnesium type, and is used for local decentralized water supply.

The Pressurised Water System of the Folded Zone of the southern slopes of the Caucasus Mountains underlies the northern and north-western part of the plain. The hilly/mountainous terrain is dissected, especially north-west of Chumateleti, where the E-60 crosses a complex series of exposed strata, comprising (from south to north) Neogene, Palaeogene, Upper and Lower Cretaceous, Bajocian (Middle Jurassic), Lias (Lower Jurassic), and Palaeozoic granites of Dzirula crystal massif around the Rikoti tunnel. Some of these have high water content, particularly the Bajocian porphyritic series of tuff breccias and sand-

stones with andesite layers, and the Cretaceous formations of limestone, sandstones, tuff breccias and dolomitised limestone. This area is characterized by abundant springs, which frequently appear during excavation work.

Survey implemented within the framework of engineering geological study revealed the following ground water levels in the project area:

- terrace I - 2-3.5m;
- terrace II – 7.3m-8.5m,
- farther - no ground water detected.

6.1.4 Hydrology

The main surface water body in the region under consideration is Mtkvari. The tributaries of the Mtkvari are the Suramula near Khashuri, the West and East Prone near Agara and Aradeti, and the Didi Liakhvi, Mejuda and West Tortla near Gori, Ksani, Aragvi, etc. Most of these flows roughly north to south into the Mtkvari, except the Suramula, which runs parallel with the Mtkvari on the northern side of the E-60 and drains into the Prone east of Agara. A total of 60 watercourses cross the E-60 between Sveneti and Rikoti, by means of bridges, drainage pipes, concrete culverts and other structures.

Mtkvari River. The Mtkvari is the largest river in the South Caucasus and is the dominant hydrological feature in the study area. It originates from springs at 2,720 m amsl on the northern slopes of Mount Kizil-Giadik in Turkey, and runs for 1,364 km through Turkey, Georgia and Azerbaijan, before discharging into the Caspian Sea south of Baku.

The Mtkvari basin covers 188,000 km^2 of mountains (mainly the Greater and Lesser Caucasus) and intermountain tectonic lowlands like the Gori Plain; and the river is recharged by glaciers, snow-melt, rain and groundwater. Around 50% of the annual discharge occurs in spring and 25% in summer, and flash floods can result when heavy rain coincides with the peak of the spring snow-melt.

The river system is polluted (organically and bacteriologically) by the discharge of poorly treated or untreated wastewater; irrigated agriculture and industry (however since 1990s industrial pollution decreased considerably).

Deforestation in the upper part of the basin has led to poor soil protection with damaging mudslides as a result. Moreover, deforestation and overgrazing have led to erosion causing high turbidity of river water.

In the area between Didi Akhalsopeli and Agara the floodplain is used by community as a pasture. In spring water in the floodplain may rise by 1- 1.8m. Flood width varies from 125m near Urbnisi to 650m near Didi Akhalsopeli. In the section from Kvishkheti to Tskhramukhe water may rise to 3.8 m. The river bed is meandering, branching.

Small islands within the riverbed are 30-60m long and 20-40m wide. Largest– width 0.4-2.2 km, 150-800m width – are located near Damchkhreula, Rbona, Didi Akhalsopeli, Agara, Kareli, Kvemo-Khvedureti and near Gori. The largest island is in 3 km downstream Khashuri, near Osiauri village (width 2.1km, length 1km, height 2m). Vegetation of the islands is deciduous, both trees and bushes are available.

The banks in the Kvishkheti-Khashuri section are low (0.1-0.3m), moderately washed away and covered with wetland and sparse bush vegetation.

There are a number of other rivers and streams in the study area, most of which drain into the Mtkvari.

Analogous method was used to find out the maximum outflows of the river Mtkvari at village Gomi. Information from Mtkvari- hydro power plant Likani long-term data was taken for the analogue, covering the period of 1933 – 1991. Based on the statistic processing with the method of the variation order of the observations of 59 years, we received high convenience results. In the process of analysis the coefficient of variation and asymmetry is defined with the use of a special monogram as a statistic λ_2 and λ_3 function, when $\lambda_2 = \frac{\Sigma \lg K}{n-1}$ and $\lambda_3 = \frac{\Sigma K \lg K}{n-1}$, we get the following parameters of the distribution curve:

- maximum water outflow average multiyear value $Q_0 = \frac{\Sigma Q_i}{n} = 549 m^3/sc$;
- variation coefficient Cv-0,41;
- Asymmetry coefficient Cs=4Cv.

The parameters of representative analysis of the variation order were defined, which fell in the acceptable range, since the average square error of average multiyear outflow and variation coefficient ratio is < 10%.

With the use of the received parameters and three-parameter gamma-distribution curve ordinates, the maximum outflow coefficient of different water supplies of the river Mtkvari at the HPP Likani was found.

Shift from analogue, i.e. HPP Likani intersection to project intersection is conducted with the help of the transformation coefficient, the values of which are received according to the ration of the drainage basin areas. From here, the value of the transformation coefficient at the village Gomi is equal to 1,081. The maximum outflow at the project sight is received via multiplication of maximum water outflows at HPP Likani intersection with transformation coefficient.

The maximum water outflow of the river Mtkvari at the Analogue and project intersections are given in Table below.

Table 6.3 Mtkvari – maximum flows (Q0Qm3/sec)

Section	F km^2	Q_0 m^3/sec	C_v	C_s	K	Assurance P%			
						1	2	5	10
Likani	10500	549	0.41	1.64	_	1310	1190	970	835
Agara	11400	596	_	_	1.086	1420	1290	1050	905
Gomi	11350	583	_	_	1.081	1415	1285	1045	900

Table 6.4 Maximum flows of the tributaries in the project area

Name	P%	Q m^3/sec
Mtkvari (near Agara)	1	1420
	2	1290
	5	1050
	10	905
Mtkvari (near Gomi)	1	1415
	2	1285
	5	1045
	10	900

The maximum water outflow of the River Mtkvari given in Table 6.3, are received with the help of the values gathered from the Urbnisi-Rikoti modernization section on the territory of the village Gomi.

Maximum water levels and hydraulic elements of river Mtkvari are given in Annex 8.

The tributaries of Mtkvari include:

1. East Prone and the West Prone (Ptsiula River) – in Ruisi and Aradeti section.

   The **East Prone** takes off the east slope of Likhi ridge at 1618 m asl elevation. It is 41 km long and has catchment area of 243 km^2; total fall – 996 m. Recharge – atmospheric water (rain, snow melt) and ground water. High water is observed in spring. Water is used for irrigation and water mills.

   Ptsiula (the West Prone) takes off the south slope of Lokhoni mountain of Surami ridge, at 1600 metres above sea level. The river is 38 km long; total fall - 962 m. Recharge area - 398 km2. High water is observed in spring. Water is used for water mills and irrigation.

   Other tributaries of the Mtkvari are the Suramula near Khashuri, the Didi Liakhvi, Mejuda and West Tortla near Gori. Most of these flows roughly north to south into the Mtkvari, except the Suramula, which runs parallel with the Mtkvari on the northern side of the E-60 and drains into the Prone east of Agara.

2. Surmaula – in Gomi bypass section

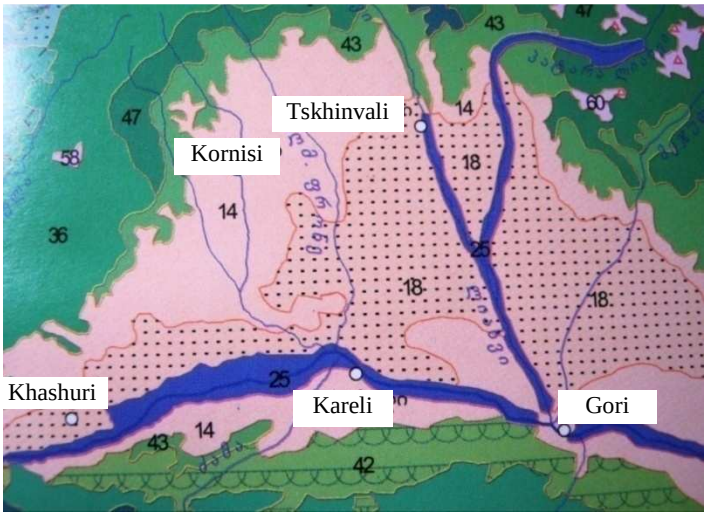
   Suramula takes off the eastern slope of Surami ridge at 1200 asl. The river flows into the Ptsa near the vil.Kvenatkotsa, while the latter flows into the

Mtkvari south to vil.Doglauri. The Suramula is 42 km long, total fall – 578 m, recharge area - 719 km^2. Recharge – snow, rain and ground water. Water regime is stable in summer. Unstable low water regime is typical for winter season. The river may freeze for 3-4 days, however this happens rather seldom. Water is used for irrigation. River network is distributed unevenly. The tributaries include: Shuagele (10km), Tiliana (17km), Choratkhevi (27km), west Prone (38km); Shola (18km). Density of the river network is about 0.73km/km^2. The width of a floodplain of Suramula varies from 20-25m (near vil.Itiria) to 200m (near Patara Sative). The floodplain is flat, depth is around 0.5m. During high water - the water level increases by 0.1-0.4m. Average head in 6-7 km from the source is 63^0. Downstream Surami to the confluence the head decreases. The character of the river changes from mountain to lowland stream. Width of the river is 3m, maximum – 25m, minimum -1m. Depth exceeds 0.3m. Flow ranges from 0.9-1.5 m/sec (near Khashuri) to 0.5-0.6 m/sec (downstream). The river bottom is flat. In the upper stream – stone-sandy, lower – stone-gravel. The banks merge into the lopes of the gorge, in some area fragmented terraces are observed. Flow used to be monitored at two stations: Surami (1926-1955) and Kvemo Tkotsa (1930-1935). High water is observed in spring and ends end of June. Maximum flow uses to be registered end of March. Low water is observed from end of June until October. Hazardous hydrological events are not observed. Flow near Surami varies from 0.002m^3/sec to 31.6 m^3/sec. Within-year distribution of the flow is not uniform. In spring, summer, autumn and winter the flow makes up 64.7, 16.2, 3.1 and 16% of annual value. Freezing is observed from December to the end of February. Water upstream Surami is clean and suitable for water supply. Downstream water is polluted with waste water, litter. Water is used for irrigation.

In the limits of the study area, north periphery of the terrace I, small seasonal (spring, autumn) impoundments have been registered. They are formed by excessive rainfall.

6.1.5 Landscape and land use

The landscape of this region is generally natural or semi-natural in the uplands of the north, south and west, and mainly anthropogenic in the lowlands of the centre and east, where most of the natural vegetation was removed many years ago to provide land for agriculture.



25	meadow accumulative and floodplain landscape with riparian and meadow vegetation
18	lowland-hillock accumulation landscape with yellow bluestem steppe. sibljak, seldom meadows
14	hilly foothills erosion-denudation landscape with Oriental hornbeam-oak derivates, sibljak, partly arid sparse forest, with yellow bluestem steppe, seldom badlands

Figure 6.8 Major types of landscape in the region

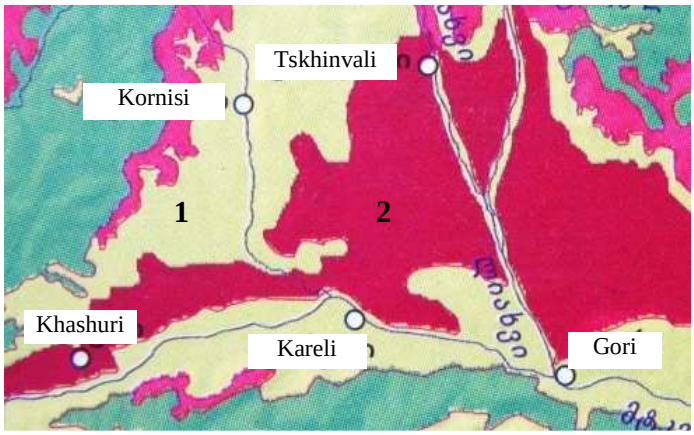


Figure 6.9 Status of the landscape in the region (1-slightly changed; 2-practically transformed)

Under the combined influence of geology and anthropogenic change, the Kartli plain today is a large, flat expanse of arable land, with few hedgerows and little natural vegetation. The land is mainly subdivided into small plots, which are primarily individually-owned and occupied by orchards, vineyards, vegetable gardens, corn fields, hay meadows and pastures. There are also small scattered settlements, and some overgrown secondary meadows in the places that are unfavourable for agriculture.

In the west the Likhi Ridge provides a more rugged and natural landscape, of steep hillsides dissected by narrow plunging gorges, covered by yellow brown soils, which support relatively large areas of mixed deciduous forest, mainly oak, beech and hornbeam.

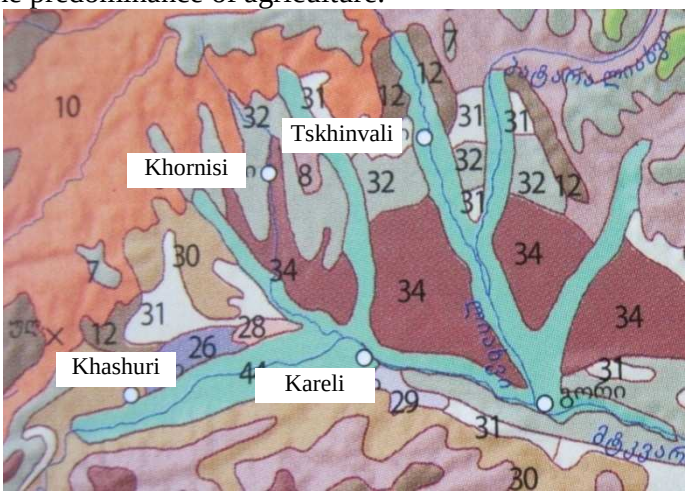
The landscape is modified near the towns and villages, where the forest is replaced by meadows and shrub-land, which has grown up after forest clearing. In such areas settlements the arable landscape predominates. In the east, West Kvernaki hill presents a semi-natural landscape, with steep slopes dissected by gorges and gullies through which runoff drains into the Didi Liakhvi River. These are interspersed with thorny shrubbery and areas of grassland on the mainly cinnamonic soils. There is little cultivation in this area, although the grassland is used quite extensively for grazing.

Figure 6.10 Typical landscape

The River Mtkvari floodplain has also been greatly altered by the activities of man, including flood protection, enterprise development (manufacture of building materials, fish ponds, etc), and agriculture. Some natural vegetation remains, but this is limited to isolated fragments of riparian forest, amongst thorny shrubbery and grassland (The land take data will be provided in the Land Acquisition and Resettlement Plan document. The EIA will present general overview of the issues.)

6.1.6 Soils

Soils in the project area belong to the Eastern Georgia forest-meadow soil zone. The soil is mostly cinnamonic, cinnamonic-calcareous and alluvial loamy, fertile, hence the predominance of agriculture.



44	alluvial carbonate
34	meadow cinnamonic soils
28	black carbonate
26	meadow black

Figure 6.11 Soil types in the area

Alluvial-carbonate soils are widespread along the banks of the rivers. This type of soil is rather diverse. Their basic mass, thickness of the profile, mechanical composition and concentration of carbonates, nitrogen and carbon as well as other characteristics often vary within a wide range. This is natural, since those parameters which determine the type of soil depend on river dynamics, the type of materials brought by rivers, lithilogical and mechanical (size, weight) composition of these materials and many other processes. These soils are characterized by the diversity of alluvial materials and high concentration of carbonates.

Figure 6.12 Alluvial soil

Cinnamonic soils are formed in conditions of relatively mild and humid climate with little influence of underground waters. Soils are characterized by high level of differentiation. The concentration of humus varies between 3-10%. Their geochemical potential is characterized by acid reaction which decreases with depth and ultimately becomes neutral. Therefore these soils are characterized by a rather high coefficient of washing.

Cinnamonic-calcareous soils occupy rather large areas within the corridor. Lithological composition of these soils is similar to those of brown soils, but with higher content of carbonate materials. These soils are formed mainly by deluvial sediments.

Figure 6.13 Cinnamonic soil

Alluvial-carbonate soils of young terraces have weak profile and are less stable, while old terraces are more stable because of fine and coarse fractions present.

Analysis of field lab data and reference material revealed presence of the following engineering-geological elements:

GE 1 Earth fill soil, represented by cobbles, gravel, construction material residuals;	GE 1 Earth fill soil is observed on the surface to 0.0-3.6m depth. It is represented by cobbles, gravel, construction material residuals. The layer is characterized by unequal thickness and content. During construction the mentioned layer should be removed. According to treatment complexity (mechanical treatment) soil belongs to category III (according to construction norms and rules CNR-IV-5-82). Calculated density - is 1.90 g/cm3. According to seismicity - earth fill soils belong to category III (pn 01.01-91). Conditional strength of earth fill soils (pn 02.01-08, Construction Norms and Rules) is 150 kpa. Average value of modulus of elasticity (Young's) is 19835kPa. Average value of modulus of subgrade reaction is 129.90kPa/mm resulted by the test.
GE 2 Lean clay, brown, hard and very stiff, with gravel inclusions to 10-15%;	GE 2 is observed as the first or second layer from the surface. Average thickness of lean clays is 1.9m within the studied site. Soils show no aggressivity to any grade concretes. According to treatment complexity (mechanical treatment) GE2 soil belongs to III category (CNR-IV-5-82). According to seismicity – to category II (pn 01.01-91). Conditional strength of lean clays (according to pn 02.01-08, Construction Norms and Rules) - is 250 kpa. Average value of modulus of elasticity (Young's) is 12457.5kPa.
GE 3 Clay, light brown, firm, carbonate, with gravel inclusions to 10-15%;	GE 3 is observed to 0.0-6.3m depth from the surface. Average thickness of their spreading is 2.5m. Category of GE 3 soil according to treatment complexity (mechanical treatment) - III category (CNR-IV-5-82). According to seismicity - category II (pn 01.01-91). Soils show no aggressivity to any grade concretes.
GE 3a Clay, light brown, stiff, carbonate, with gravel inclusions to 5%;(in almost all locations)	GE 3a is observed in most boreholes (22). Average thickness of their spreading is 5.8m. According to treatment complexity (mechanical treatment) GE3a belongs to category III (CNR-IV-5-82). According to seismicity – to category II (pn 01.01-91). Soils show no aggressivity to any grade concretes. Conditional strength of clays (pn 02.01-08, Construction

	Norms and Rules) - is 270 kpa.
GE 4 Silty sand, yellowish-brown, plastic, with gravel and cobble inclusions to 20-25%;	GE 4 is observed locally along the whole route. Average thickness of the layer is small and is 2.2m only. According to treatment complexity (mechanical treatment) - belongs to I category (CNR-IV-5-82). According to seismicity – to category II (pn 01.01-91). Soils show no aggressivity to any grade concretes. Conditional strength of silty sands (clay-sand) (pn 02.01-08, Construction Norms and Rules) - is 220 kpa.
GE 5 Cobbles, gravel, light brown, with lean clay–silty sand filling, with boulder inclusions;	GE 5 soil according to treatment complexity (mechanical treatment) belongs to category V (CNR-IV-5-82). According to seismicity – to category II (pn 01.01-91). Soils show no aggressivity to any grade concretes. Conditional strength of cobbles (according to pn 02.01-08, Construction Norms and Rules) - 450 kpa.
GE 6 Sandstones, extremely weathered, thin bedded, with clay interbeds and **GE 7** Sandstones, slightly weathered, thin bedded, with clay interbeds - have not been registered in the section of interest;	
GE 8 Clays, extremely weathered, with thin bedded sandstone interbeds;	GE 8. The observed basic clays represent Sarmatic deposits and are characterized by wide areal of spreading at the mentioned site, only below Quaternary deposits. GE 8, extremely weathered clays, according to treatment complexity while mechanical treatment belongs to category IV (CNR-IV-5-82), according to treatment complexity while drilling and blasting – to category IV. According to seismicity - category II (pn 01.01-91). Soils show no aggressivity to any grade concretes.
GE 9 Clays, slightly weathered, with thin bedded sandstone interbeds.	GE 9, according to treatment complexity while mechanical treatment belongs to category V (CNR-IV-5-82), while drilling and blasting – to category V. According to seismicity - category I (pn 01.01-91). Soils show no aggressivity to any grade concretes.

Physico-mechanical properties of the soil have been studied by GeoTechService Ltd., under the contract with Transport Ltd. Results are presented in report, submitted to EPTISA. (Summary table is given in Annex 9).

6.1.7 Air quality

The air quality is likely to be generally good in the study area, given its rural character, the predominance of agriculture as the major land use, and the absence of heavy industry. Vehicle emissions are comparatively low because of low traffic volumes, and air pollution is rapidly dispersed due to winds. However, the residents of the settlement closest to the highway may be exposed to elevated levels of pollutants from vehicle emissions.

During rehabilitated road operation it is expected to have increased traffic flow resulting in bigger vehicle emissions.

In the vicinity of the Agara – Zemo Osiauri road sub-section there has been no stationary point for observing the ambient air quality. For this reason ambient air background concentrations will be estimated according to methodological instructions given in “Background Concentrations for Towns and Settled Areas where no Ambient Air Quality Observations are Held“. According to this

document possible concentrations of harmful substances in the ambient air are linked to the population.

Table 6.5 Background concentration rate (Source: "Background Concentrations for Towns and Settled Areas where no Ambient Air Quality Observations are Held")

Population quantity in thousands	Background Concentration Rate, mg/m^3			
	Nitrogen dioxide, NO_2	Sulphur dioxide, SO_2	Carbon monoxide, CO	Dust, PM10
250-125	0,03	0,05	1,5	0,2
125-50	0,015	0,05	0,8	0,15
50-10	0,008	0,02	0,4	0,1
<10	0	0	0	0

The traffic on E-60 is probably the main source of air pollution, as traffic is assumed to be significant contributor to atmospheric levels of certain substances worldwide, mainly from the burning of fuel. These include carbon monoxide (CO), nitrous oxides (NO_x), volatile organic compounds (VOC) particulate matter (PM), and to a sulphur dioxide (SO_2).

In the study area the traffic is lighter and generally moves more freely, and winds blow throughout the year, so pollutants produced by vehicles on the E-60 and other roads should be rapidly dispersed in most circumstances. However people living alongside the road may be exposed to elevated levels of traffic pollutants given their proximity to the source, and overall air quality may decrease somewhat during the winter when many people burn wood to heat their houses.

6.1.8 Noise

The rural character of the study area also means that the noise environment is generally quiescent, and there are few sources of anthropogenic noise in and around most villages, apart from the relatively light road traffic, railway and occasional farm machinery. As was the case for air pollution, the E-60 is also likely to be the main source of noise in the study area, again produced by traffic.

Limited data have been collected in 2006 and 2009 (near Rikoti tunnel) during the Regional Environmental Assessment (see Table 6.6). Available data and forecast for the traffic growth enables to presume that statutory noise levels in the future may be exceeded quite regularly, and that people living near the E-60 may therefore be exposed to unacceptable levels of noise. Sound is attenuated rapidly by intervening buildings and vegetation, and levels generally decrease quite quickly with distance from the source, so exposure to elevated levels is probably limited to people living within a few hundred meters of the road.

Table 6.6. Noise and traffic flow on the E-60 in the study area in 2006 (Source: Regional Environment Assessment, 2009, RD MRDIG).

Location			**Urbnisi**	**Ruisi**
Date			Oct 2006	Oct 2006
Traffic flow (vehicles/h)	*Light vehicles,.mini-buses*		**653**	**732**
	Heavy good vehicles (HGVs),large buses		**61**	**70**
Equivalent level of sound L_{Aaq} (0,5 h) (dBA)			**76.5**	**77.5**
Acceptable day-time noise level in residential areas	*Houses, clinics, nursing homes, schools, etc*	Equivalent	**55**	**55**
		Maximum	**70**	**70**
	Hotels and hostels	Equivalent	**60**	**60**
		Maximum	**75**	**75**

6.1.9 Seismic conditions and hazardous processes

The area of Georgia represents a part of the active seismic zone of the Caucasus. It belongs to the Mediterranean seismic belt. Its architectonical movement and activity is connected with the movement of the neighbouring Eurasian and Afro-Arabic rocks.

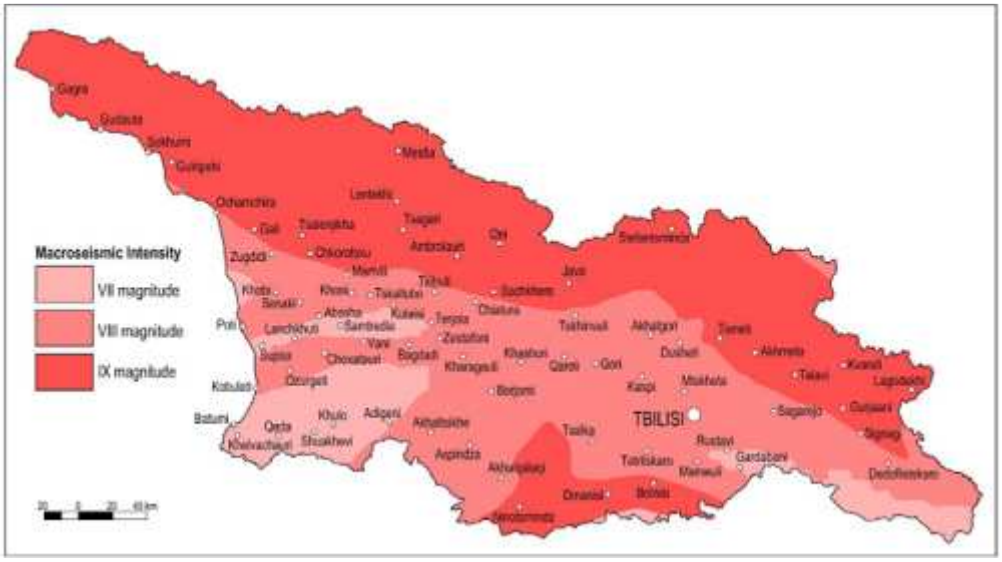


Figure 6.14. Seismic intensiveness map of Georgia (Source: Construction norms and rules – Asesismic stable construction, pn 36.0101-09)

The project is located in the high intensiveness seismic zone - the Richter scale (IX). Despite the mostly flat landform without complex topography or major geomorphological processes there are certain natural features that could be potential hazards for development in the region. These are related to physiography and climate, seismicity in the area, landslide, mudflows, flooding and snowfall. Hazardous processes show certain periodicity. Erosion is intense, in particular in the riverbeds of the Mtkvari and its tributaries. The landslides are observed in the areas with steep slopes, loose composition of some of the exposed strata, seismic activity and precipitation. Particular areas of concern are to Likhi and the South Caucasus ridges.

6.2 Biological environment

6.2.1 Flora

The Kartli plain is represented by several vegetation zones. Xerophilous plants, scrub and steppe vegetation are well developed. There are fruit orchards in the region within which the study area falls. The orchards are composed of apple, pear, peach, mulberry, plum and other drupaceous tree species. The rest of the area - in particular both sides of the river Liakhvi gorge and mount Malk-haziskedi - are used mainly for annual plants (wheat, corn, cabbage, potato, tomato, etc.) or pasture.

Phytogeographical description

In Shida Kartli three vertical zones of vegetation are known:

- lowland and flatland;
- middle mountain zone;
- high mountain zone.

Table 6.7. Typical vegetation species distribution in the project region

Elevation m above sea level	Description
500-600	Oak (*Quercus pedunculiflora*), grey poplar (*Populus hybrida*), elm tree (Elm *Ulmus sp.*), willow (*Salix sp.*), medlar (*Mespilus germanica*), hawthorn (*Crataegus sp.*). etc.
From 500-600 to 1000	Downy oak (*Quercus iberica*), European hornbeam (*Carpinus caucasica),* hornbeam (*Carpinus orientalis*), maple (*Acer camprestre*), European ash (*Fraxinus excelsior*), elm *Ulmus*, *Pyrus caucasica* etc. In underwood: Common hazel *(Corylus avelana),* rhododendron (*Rododendron ponticum),* cherry-laurel *(Laurocerasus officinalis),* holly (*Ilex colchica),* European cornel *(Cornus mas),* etc.
From 1000 to 1500-1600	Oriental beech forests, in some places Caucasian spruce (*Picea orientalis*), hornbeam (*Carpinus caucasica*), Norway maple (*Acer platanoides*), sycamore (*Acer pseudoplatanus*), etc.
From 1500-1600 to 2200	Fir-pine forests with oriental beech (*Fagus orientalis*), Caucasian linden (*Tilia caucasica*), European aspen *(Populus tremula*), European ash (*Fraxinus excelsior*), Caucasian oak (*Quercus macranthera*), Caucasian pear (*Pyrus caucasica*), etc. Underwood: Hazel nut tree (*Corilus avellana*), holly (*Ilex colchica*), cherry-laurel (*Laurocerasus officinalis*), rhododendron (*Rhododendron flavum*), etc.
Above 2200	Silver birch (*Betula verrucosa*), acer (*Acer trautvetteri*), European aspen (*Populus tremula*), mountain ash (*Sorbus caucasigena*), oriental beech (*Fagus orientalis)*

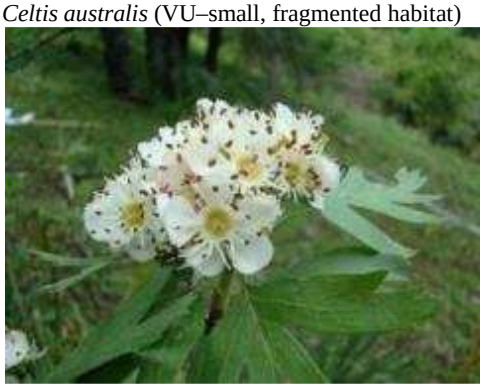
Amagdalus georgica (EN – very limited habitat)

Juglans regia (VU – tertiary relict, small, fragmented habitat)

Ulmus glabra (VU – small, fragmented habitat)

Celtis australis (VU–small, fragmented habitat)

Celtis glabrata (VU–small, fragmented habitat)



Crataegus pontica (VU–small, fragmented habitat)

Pyrus demetrii (EN– very limited habitat)

Figure 6.15. Endemic and protected species potentially occurring in the project zone

Above subalpine zone alpine meadows with typical high grasses are located. The survey did not reveal any endangered or protected species within the boundaries of the project area (200m both sides od alignment).

6.2.2 Fauna

Georgia belongs to the Palaearctic region and is characterized by rich biodiversity and a high level of endemism. Anthropogenic strain is very high in this region. For this reason it is one from twenty-five so called “hotspots” that are under attention of the major environmental protection organizations of the world. Due to its geographical characteristics there are a variety of climates in Georgia and this causes diversity of flora and fauna. Several species of fauna are at the edge of extinction, which means that relevant measures must be taken to preserve the existing environment.

Protected species known to be available generally in Shida Kartli are presented in the table below.

Table 6.8 Protected species in Shida Kartli

Latin Name	Georgian Name	Common Name (English)	Status
MAMMALS			
Mesocricetus brandti	ამიერკავკასიური ზაზუნა	Branst’s hamster	VU
Cricetulus migratorius	ნაცრისფერი ზაზუნელა	Grey hamster	CR
Lutra lutra	წავი	Common Otter	VU
BIRDS			
Podiceps grisegena	რუხლოყება მურტალა	Red-necked Grebe	VU
Tadorna ferruginea	წითელი იხვი	Ruddy Shelduck	VU
Melanita fusca	შავი გარიელი	Velvet Scoter	VU
Aquila chrysaetus	მთის არწივი	Imperial Eagle	VU
Aquila heliacal	ბეგობის არწივი	Golden Eagle	VU
Accipiter brevipes	ქორცქვიტა	Levant Sparrowhawk	VU
Falco cherrug	გავაზი	Saker Falcon	CR
Falco vespertinus	თვალშავი	Red-footed Falcon	EN
Buteo rufinus	ველის კაკაჩა	Long-legged Buzzard	VU
Neophron percnopterus	ფასკუნჯი	Egyptian Vulture	VU
Gyps fulvus	ორბი	Griffon Vulture	VU
REPTILE			
Testudo graeca	ხმელთაშუაზღვის კუ	Mediterranean tortoise	VU
Darevskia dahli	დარევსკის ხვლიკი	Dahl's Lizard	VU

VU – vulnerable; EN- endangered; CR- critical

The species protected under the Bonn convention available in the Shida Kartli region are given in the tables below.

Table 6.9 Bat species protected under the Bonn convention occurring in the Shida Kartli region

Latin Name	Georgian Name	English name
Rhinolophus ferrumequinum	დიდი ცხვირნალა	Greater Horseshoe Bat
Rhinolophus hipposideros	მცირე ცხვირნალა	Lesser Horseshoe Bat
Eptesicus serotinus	მეგვიანე ღამურა	Serotine Bat
Myotis blythii	წვეტყურა მღამიობი	Lesser Mouse-eared Bat
Myotis mystacinus	ულვაშა მღამიობი	Whiskered Bat
Myotis nattereri	ნატერერის მღამიობი	Natterer's Bat

Myotis emarginatus	სამფერი მღამიობი	Geoffroy's Bat
Myotis daubentonii	წყლის მღამიობი	Daubenton's Bat
Pipistrellus pipistrellus	ჯუჯა ღამორი	Common Pipistrelle
Pipistrellus pygmaeus	პაწია ღამორი	Soprano Pipistrelle
Pipistrellus nathusii	ტყის ღამორი	Nathusius's Pipistrelle
Plecotus auritus	რუხი ყურა	Brown Big-eared Bat

Table 6.10 Bird species protected under the Bonn convention occurring in the region

Latin Name	Georgian Name	English Name
	PODICIPITIFORMES	
Podiceps grisegena	რუხლოყება მურტალა	Red-necked Grebe
Podiceps auritus	რქოსანი მურტალა	Slavonian Grebe
Podiceps nigricollis	შავყელა მურტალა	Black-necked Grebe
PELECANIFORMES		
Phalacrocorax carbo	დიდი ჩავამა	Great Cormorant
CICONIIFORMES		
Botaurus stellaris	წყლის ბუღა	Great Bittern
Ixobrychus minutus	მცირე წყლის ბუღა	Little Bittern
Nycticorax nycticorax	ღამის ყანჩა	Black-crowned Night Heron
Ardeola ralloides	ყვითელი ყანჩა	Squacco Heron
Bubulcus ibis	ეგვიპტური ყანჩა	Cattle Egret
Egretta garzetta	მცირე თეთრი ყანჩა	Little Egret
Egretta alba	დიდი თეთრი ყანჩა	Great White Egret
Ardea cinerea	რუხი ყანჩა	Grey Heron
Ardea purpurea	ქარცი ყანჩა	Purple Heron
ANSERIFORMES		
Anser anser	რუხი ბატი	Greylag Goose
Tadorna ferruginea	წითელი იხვი	Ruddy Shelduck
Tadorna tadorna	ამლაყი იხვი	Common Shelduck
Anas strepera	რუხი იხვი	Gadwall
Anas crecca	ჭიკვარა	Common Teal
Anas platyrhynchos	გარეული იხვი	Mallard
Anas acuta	ბოლოსადგისა	Northern Pintail
Anas querquedula	იხვინჯა	Garganey
Anas clypeata	ფართოცხვირა იხვი	Nothern Shoveler
Netta rufina	წითელნისკარტა ყურყუმელა	Red-crested Pochard
Aythya ferina	წითელთვალა ყვინთია	Common Pochard
Aythya fuligula	ქოჩორა ყვინთია	Tufted Duck
Melanita nigra	შავი ყურყუმელა	Common Scoter
Melanita fusca	შავი გარიელი	Velvet Scoter
Mergus merganser	დიდი ბატასინი	Goosander
FALCONIFORMES		
Pernis apivorus	ჩვეულებრივი ბოლოკარკაზი	European Honey Buzzard
Milvus migrans	ძერა	Black Kite
Neophron percnopterus	ფასკუნჯი	Egyptian Vulture
Gyps fulvus	ორბი	Griffon Vulture
Aegypius monachus	სვავი	Black Vulture
Circaetus gallicus	ძერაბოტი	Short-toed Eagle

Circus aeruginosus	ჭაობის ბოლობეჭედა	Eurasian Marsh Harrier
Circus cyaneus	მინდვრის ბოლობეჭედა	Hen Harrier
Circus macrourus	ველის ბოლობეჭედა	Pallid Harrier
Circus pygargus	მდელოს ბოლობეჭედა	Montagu's Harrier
Accipiter nisus	მიმინო	Sparrow-hawk
Accipiter brevipes	ქორცქვიტა	Levant Sparrow-hawk
Buteo buteo	კაკაჩა	Common Buzzard
Buteo rufinus	ველის კაკაჩა	Long-legged Buzzard
Buteo lagopus	ფეხბანჯგვლიანი კაკაჩა	Rough-legged Buzzard
Aquila pomarina	მცირე არწივი	Lesser Spotted Eagle
Aquila heliaca	ბეგობის არწივი	Golden Eagle
Aquila chrysaetos	მთის არწივი	Imperial Eagle
Hieraaetus pennatus	ჩია არწივი	Booted Eagle
Falco tinnunculus	კირკიტა	Common Kestrel
Falco vespertinus	თვალშავი	Red-footed Falcon
Falco columbarius	ალალი	Merlin
Falco subbuteo	მარჯანი	Hobby
Falco peregrinus	შევარდენი	Peregrine Falcon
Falco cherrug	ბარი	Saker Falcon
GALLIFORMES		
Coturnix coturnix	მწყერი	Common Quail
GRUIFORMES		
Rallus aquaticus	ჩვეულებრივი ლაინა	Water Rail
Porzana porzana	ქათამურა	Spotted Crake
Porzana parva	მცირე ქათამურა	Little Crake
Porzana pusilla	პაწაწა ქათამურა	Baillon's Crake
Crex crex	ღალღა	Corncrake
Gallinula chloropus	წყლის ქათამი	Common Moorhen
Fulica atra	მელოტა	Coot
CHARADRIIFORMES		
Himantopus himantopus	ოჩოფეხა	Black-winged Stilt
Glareola nordmanni	ველის მერცხალა	Black-winged Pratincole
Charadrius dubius	მცირე წინტალა	Little Ringed Plover
Charadrius hiaticula	საყელოიანი წინტალა	Ringed Plover
Vanellus vanellus	პრანწია	Lapwing
Philomachus pugnax	ტურუხტანი	Ruff
Gallinago gallinago	ჩიბუხა	Common Snipe
Gallinago media	გოჭა	Great Snipe
Scolopax rusticola	ტყის ქათამი	Eurasian Woodcock
Tringa totanus	მსევანი	Common Redshank
Tringa stagnatilis	მერუე	Marsh Sandpiper
Tringa ochropus	შავი ჭოვილო	Green Sandpiper
Tringa glareola	ჭაობის ჭოვილო	Wood Sandpiper
Actitis hypoleucos	მებორნე	Common Sandpiper
Larus ichthyaetus	ხარხარა თოლია	Great Black-headed Gull
Larus melanocephalus	შავთავა თოლია	Mediterranean Gull
Larus minutus	მცირე თოლია	Little Gull
Larus ridibundus	ჩვეულებრივი თოლია	Black-headed Gull
Larus armenicus	სომხური თოლია	Armenian Gull
Larus cachinnans	ყვითელფეხა თოლია	Yellow-legged Gull
Sterna hirundo	მდინარის მეთოვლია	Common Tern
Sterna albifrons	მცირე მეთოვლია	Little Tern
Chlidonias niger	შავი თევზიყლაპია	Black Tern

Chlidonias leucopterus	ფრთათეთრა თევზიყლაპია	White-winged Black Tern
CORACIIFORMES		
Merops apiaster	კვირიონი	European Bee-eater
Coracias garrulus	ყაჭყაპი	European Roller
PASSERIFORMES		
Muscicapa striata	რუხი მემატლია	Spotted Flycatcher
Ficedula parva	მცირე მემატლია	Red-breasted Flycatcher
Ficedula albicollis	საყელოიანი მემატლია	Collared Flycatcher
Ficedula semitorquata	კავკასიური საყელოიანი მემატლია	Semi-collared Flycatcher

Table 6.11 Fish species of Shida Kartli

Latin name	Endemic	Endangered	Slow current species	Raid current species	In up and low streams of the rivers	Lake species
Rutilus rutilus			+			
Leuciscus cephalis			+			
Aspius aspius			+			
Chondrostoma cyri	+				+	
Chalcalburnus chalcoides			+			
Acanthalburnus microlepis	+				+	
Alburnoides bipunctatus			+		+	
Blicca bjorena			+			
Abramis brama			+			
Rhodeus sericeus			+			
Cyprinus carpio			+			
Carassius carassius						+
Hypophtalmichthys Molitrix						+
Aristichtys nobilis						+
Gobitis taenia		+			+	
Cobitis aurata					+	
Gobio gobio					+	
Gobio persa					+	
Barbus lacerta cyri						
Barbus capito			+			
Barbus mursa				+		
Varicorhinus capoeeta			+			
Silurus glanis			+			
Gambusia affinis					+	
Nemachilus brandti					+	
Gobius cephalarges	+				+	

The results of the field work confirmed the species' composition reported in the literature and showed extremely little occurrence of animals along the selected route. More evidence of their presence was found in more remote locations.

The survey did not reveal any endangered or protected species within the boundaries of the project impact area.

6.2.3 Protected areas

There are no protected areas in the project impact zone.

6.3 The socioeconomic and cultural environment

6.3.1 The human environment

Shida Kartli consists of six administrative districts: Gori, Kaspi, Kareli, Khashuri, Tskhinvali, Java, two of which (Tskhinvali, Java) at the moment are de facto out of the jurisdiction of Georgia. The economic and social situation in Shida Kartli deteriorated considerably as a result of the war, as local residents have had to cope with the loss of homes, transport, livestock, agricultural equipment and land.

Before the conflict in August 2008, the population of Shida Kartli was almost 313,000, and the majority is rural.

Table 6.12 Population of Shida Kartli (Gori, Kareli, Khashuri districts)

Location	2005	2006	2007	2008	2009	2010	2011	2012
Georgia	4 321.5	4 401.3	4 394.7	4 382.1	4 385.4	4 436.4	**4,469.2**	**4,497.6**
Shida Kartli	309.1	314.0	313.6	312.8	313.0	310.6	**313.0**	**314.6**
Gori municipality	146.9	135.9	135.8	135.6	135.8	144.1	145.3	146.1
Kaspi municipality	51.4	52.1	52.0	51.8	51.8	52.6	52.9	53.0
Kareli municipality	49.4	49.7	49.7	49.5	49.5	51.6	52.3	52.9
Khashuri municipality	61.4	61.8	61.6	61.4	61.4	62.3	62.5	62.6

Source: Department of Statistics of Georgia (2012)

Demography

Since 2003, the number of births has increased by about 6.7%. Overall death rates declined by around 10.6%. Since 2003, apart from the years of 2004 and 2005, there has been a net negative outflow of people in all municipalities of the region. By 2010 the population of the region reached 310,000, which accounted for 7% of the total population of Georgia. The majority are Georgians (91.1%). Shares of other ethnic groups are as follows: Osetians 5.1%, Azeri 1.9%, Armenians 0.6%, Russians 0.3%, Jews, Greeks, Abkhazians account for the rest.

The situation in the region deteriorated after the event of summer 2008. 18,000 of people had to leave their homesteads. The road to the Russian market, which, although illegal, still acted as one of the sources of income generation for the local residents, was closed.

General description

According to stakeholders, the study area contains some of most productive agricultural land in Georgia (Kocks, 2009). Agriculture is the basis of the econ-

omy. The main produce is cereal, fruit, grapes and cattle breeding (predominantly cattle and sheep).

Irrigation is widely used. Above-ground concrete conduits are often located near/in the vicinity of the highway (E-60). Technical maintenance status of the system is poor, however, some sections have been rehabilitated (Breti, Aradeti area, Mokhisi).

Settlements range in size and economic importance from Gori city to small rural villages. Gori has a population of ~50,000 and is an important administrative and economic centre.

Most dwellings and businesses along the E-60 are located on the north side of the road with the exception of certain businesses, such as filling stations, cafes/restaurants, small hotels and roadside vendors which can be found on both sides of the road.

The main source of income of the rural residents is agriculture related (51%), labour and businesses account for about 30%. Around 16.7% of residents' income is from pensions and social assistance payments. In the towns wage labour and business (about 70%) dominate with pensions/social assistance at the level of 15%.

Average monthly income varied from 100 GEL to around 800-1000 GEL.

Public health services in the region are provided by hospitals, dispensaries, ambulances. Along with the public health establishments, private medical hospitals and clinics also exist.

Shida Kartli is famous for its resorts such as Biisi; Gorijvari; Bazaleti Lake and Tkemlovani.

IDP and community oriented projects in the area. The region was affected by military actions in August 2008. Total number of IDPs following to this event is 9800. Since then various projects are implemented in the region in order to elevate economical and social situation in the area. Most of the projects focus on IDP. Most of the project have and are being implemented with international financial assistance. Projects in the regions have been implemented by CARE with the aid of ECHO, British Embassy Tbilisi Through the UK Conflict Prevention Pool (GCPP), The Food and Agriculture Organization of the United Nation (FAO), USAID, United Nations High Commissioner for Refugees (UNHCR), Embassy of the Federal Republic of Germany in Georgia, and others. Some of the projects supported by USAID for instance include:

Agriculture Mechanization Project - This project is establishing institutions and systems for a private sector-driven, sustainable small holder approach to the provision of mechanized agricultural services that are supportive of increased agricultural sector productivity, competitiveness, and profitability. Grants and limited technical assistance are being provided to private sector organizations to procure tractors and related equipment and deliver market-based mechanized

services to smallholder farmers. Farm services are made available to IDPs that received land from the Government of Georgia. In Shida Kartli, USAID supported centres in the Kareli District and Gori. The centres are expected to create a combined 26 new jobs and provide benefits to 1,800 farmers.

Sustainable Integration of the IDPs into the Value Creation Chains of the New Settlement Areas - The project provides technical assistance, training, and small grants for local micro-enterprises, including trade facilitation and market linkages with larger-scale firms and buyers, specifically focusing on IDP settlements in the Shida Kartli region, including Mtskheta, Gori and Kaspi districts (Tserovani, Tsilkani, Frezeti, Karaleti, Khurvaleti, Shavshvebi, Berbuki, Skra, Teliani, and Metekhi IDP settlements). In Shida Kartli, micro-enterprises include mushroom cultivation, bee-keeping, a small grocery store, poultry, livestock (cows, pigs, rabbits), greenhouse, and shoe repair.

Women's Economic Independence in the Post-Conflict Zone and Remote Regions of Georgia - The project aims to stimulate women entrepreneurs in Georgia by helping rural women develop business skills and start their own businesses. Innovative training courses and small grants are provided for women IDPs in the Shida Kartli region (Megvrekisi, Pkhvenisi, Nikozi, Tirdznisi, Brotsleti, Kvemo Khviti, Ergneti, Mereti, Verkhvebi, Sakhasheti, Kitsnisi, Shertuli, Arbo, Dvani, Ruisi, Gogeti, Plevi, Akhalsopeli, and Mokhisi) as well as for women residing in the remote regions of Georgia, including northern Kakheti and mountainous Imereti and Racha. In Shida Kartli, trainings were conducted in 2010 and will continue in 2011. Small grants have resulted in sustainable microenterprises including cheese and poultry processing, beekeeping, flower cultivation, dry goods grocery, guesthouse operations, and beauty salon businesses.

New Economic Opportunities (NEO) - The NEO project is designed to improve rural incomes; reduce poverty levels; improve food security; address critical, small-scale infrastructure priorities in targeted communities; enable targeted IDP communities (old and new) to sustainably maintain their households; and assist communities distressed by natural or other disasters. The project will target 10 municipalities and will benefit at least 70,000 households that are considered vulnerable. The project is expected to work in total of 35 communities, with an anticipated 30,000 beneficiaries in Shida Kartli.

Social Infrastructure Project - The Social Infrastructure Program provided enhanced learning and living conditions for orphans and vulnerable children. The project also improved the short-term economic status of ethnic minorities, IDPs, and graduates of the Vocational Education Programs by employing them in the rehabilitation of schools in Khashuri and Metekhi. It also renovated small group homes in Khashuri, Khtsisi, Metekhi, and Gori.

Strengthening Childcare Services and Systems - This activity focuses on the following areas: improving access to social benefits for vulnerable groups; improving alternative care and expansion of family support services; strengthening policy, oversight and accountability in the childcare system; and addressing the issue of domestic violence. The activity supports small group homes in

many areas of Shida Kartli, including Khashuri, Khtsisi, Metekhi, Tsilkani, and Gori.

Job Counselling and Referral Centre - This activity provided job counselling, referral, and placement of the unemployed in Georgia, with particular outreach to internally displaced persons (IDPs). The activity created job counselling and referral centres, facilitated outreach to employers, and placed beneficiaries in vocational education programs. This project supports a job counselling and referral centre located in Gori that provides training in job search and interview skills. Since 2010, the centre in Gori has provided job counselling to more than 1917 individuals and market-oriented vocational education to more than 303. The centre has helped more than 819 beneficiaries gain employment. In addition to the activities listed above, national Health and Social Development programs, including the Health System Strengthening Project, Tuberculosis Prevention Project, and Hepatitis B Catch-up Vaccination project, serve the region.

Khashuri municipality

The study area belongs to Khashuri municipality. The main settlements located along alignment under consideration include:

Left bank of the Mtkvari	Right bank of the Mtkvari
Mokhisi (Kareli municipality); Gomi, Vakha, Khidiskuri, Kvemo Adzvisi, Agarebi, Sative, Osiauri (Khashuri municipality)	Tsromi and Akhalsopeli (Khashuri municipality)

Population of the listed settlement according to the Khashuri municipality data (2010) is as follows:

Settlement	Population
Mokhisi (Kareli municipality)	1300
Gomi (Gomi community)	1307
Vaka (Gomi community)	1212
Khidiskuri (Gomi community)	82
Kvemo Adzvisi (Gomi community)	119
Zemo Osiauri (Gomi community)	335
Patara Sative (Gomi community)	77
Agarebi (Gomi community)	154
Tsromi (Tsromi community)	502
Akhalsopeli (Osiauri community)	160
Osiauri (Osiauri community)	1370 (Zemo); 930 (Kvemo)

Education. There are 39 schools and 12 kindergartens in Khashuri municipality, Schools are available in most of the villages in the region, 3 musical schools are in Khashuri. Total number of students in the schools of the municipality is 10473. 918 kids are attending kindergartens. Average number of students in school and kindergarten is 100-150 and 22-25 respectively. Number of teachers – 1200.

Part of the schools in the region has been rehabilitated within the framework of school aid projects. Some still require renovation and upgrading of technical base. Sanitary facilities and sport grounds have been arranged.

Vulnerable groups (individuals below poverty level, women led families (widows, single mothers), IDP). There are about 100 households below poverty line and 50 families led by women in Gomi. No IDP are registered.

Financial aid provided to the vulnerable groups include - breadwinner loss and disability pension was 50 GEL and 70 GEL respectively (January 2012 data); aid for socially unsecure - 30 GEL, retirement pension - 140 GEL (including 15 GEL insurance) .

Agriculture and business. Among economical activities in Khashuri municipality agriculture dominates. Trade and transport take up the same share, followed by industry and construction business. Processing accounts to 3% only, while administration, education, health care and services account for remaining 28%.

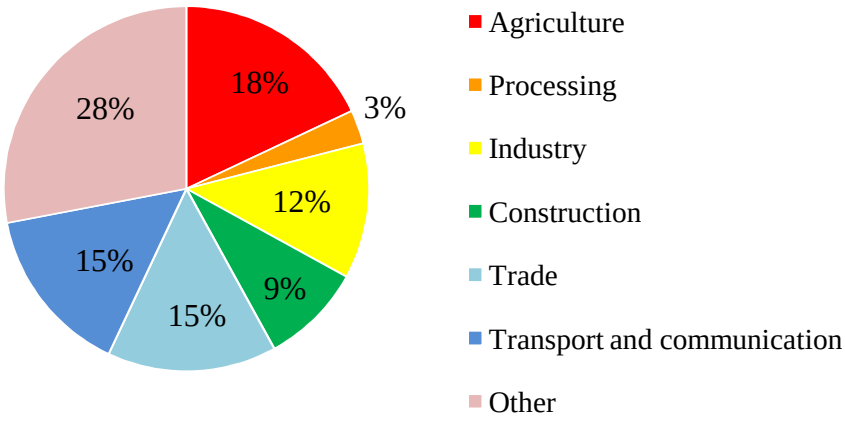


Figure 6.16. Main economical activities in Khashuri municipality

Main enterprises in Khashuri municipality include:

- Elita Ltd – fruit and vegetable processing factory in Surami
- Georgian Timber International – wood processing plant in Tskhramukha
- Gomi spirit and alcohol company – in village Gomi
- Magistrali Ltd – road construction, vil.Osiauri
- Georgian Railways division

Majority is employed in agriculture. Of active population 90% is self-employed, other 10% is engaged in trade (shop, fuelling station, pharmacy); education (school, pre-school); healthcare; administration; fish farming; inert material production; sugar production (vil.Agara); reinforced concrete production (Gori); mill (Ali, Nabakhtevi); restaurants. Employment in road construction, Hipp Georgia (Agara) and BTC (Didi Plevi) is worth to mentions.

Cattle farming is well developed. 95% of population is involved in stock-raising. Main varieties are – cow, buffalo, pig, sheep. Dairy products - cheese,

matsoni and meat are produced for sale and own use. Poultry farming is general practice. Poultry (chicken, turkey) is available in all households. Honey production is limited.

The main crops cultivated in the area are:

Annual crops	beans, corn, wheat, sainfoin, alfalfa
Fruit	apple, pear, quince, walnut, cherry, cherry-plum
Vegetable and greens	pumpkin, cucumbers, tomatoes, carrots, cabbage, beetroot, onion, garlic, pepper,

In Ali community, Khashuri municipality grapes are cultivated. The main varieties are: Pino, Goruli Mtsvane, Chinuri Tavkveri, Aligote.

Products are sold by subpurchaser at the farmers markets in the region (Khashuri, Gori) and in Tbilisi.

Access to technical facilities and machinery is limited. In regional centres microfinance organisations are available.

Local small businesses include: bakeries (tone), essential goods outlets, chemist's shop, fuelling and maintenance stations. Other possibilities of employment are administration offices, shops, Gomi spirit production, Agara sugar processing enterprise, etc.

Migration. Statistics of migration from the region is not available. This includes economical migration to other regions/towns and abroad, migration of youth for education. Main destinations for migrants are – Turkey, Greece, Spain, etc. Sometimes migration is seasonal.

Gender issues. In the study area women earn approximately 50% less than men. The households are headed predominantly males. On the other hand, in general in the region the number of female household heads is higher (16%) in the towns than in the villages (11.5%).

As mentioned above 50 households in Gomi are led by women. Women account for around 55% of population in Gomi. They are mainly employed in shops, education establishments, and administration office. Share of women in agriculture is also high.

Infrastructure In all villages in the region schools and kindergartens, shops, bakeries, pharmacies, fuelling stations, car maintenance shops, mills are available. Ambulance stations are operating in most of the villages.

Hospitals are in municipal centres – Kareli and Khashuri. There is a military hospital in Gori.

<u>Medical services in the project region include:</u>

- Khashuri Administrative District Hospital
- Polyclinic of Khashuri Station
- Khashuri Children's Polyclinic

- Khashuri Ambulance Station & Polyclinic
- Sanitary Supervision Service
- Khashuri Public Health Centre
- Khashuri Maternity Hospital
- Khashuri Women's Consultation Centre
- Surami Polyclinic
- Tezeri Ambulance Station
- Surami Psychiatric Hospital
- Kvishkheti Ambulance Station
- Surami Trauma Clinic
- Khashuri Clinic for Venereal Diseases
- Khashuri Ambulance Service

There is 1 theatre, 3 museums, 25 libraries in Khashuri municipality.

Sport grounds are available in Otarasheni, Kvenatkotsa, Ruisi, Didi Plevi and Tkotsi.

No clubs/community centres and libraries are accessible.

Water supply is mostly centralised. The system includes: boreholes, storage tanks and distribution system delivering water to the users. Disadvantage of the system is the need in pumping. This makes service rather expensive and unaffordable. Water supply is restricted.

For irrigation - river water is used. Irrigation infrastructure consists of above-ground concrete water conduits. Most of the sections are damaged. The network has been partly repaired in Breti and Mokhisi.

Sewerage system in the villages is not available.

The villages are connected to the national energy distribution grid. Individual, in some districts – cumulative meters are installed. High voltage electricity transmission line runs follows the E-60 alignment along the north bank of the Mtkvari River,

Gasification of the region is almost finished. Centralized gas supply is already provided to most of the villages in the area (Ruisi, Saglasheni, Aradeti, Kvenatkotsa, Vakha, Otarasheni, Tedotminda, etc) individual gas meters installed. In those villages where gas supply is not available firewood is used for cooking and heating.

In villages waste collection service is not available. There is no waste collection except for regional centres. The nearest landfills are in Agara and Khashuri.

The main roads in Gori, Khashuri and Kareli are is proper state of maintenance. Regular seasonal rehabilitation - after snow or heavy showers is required. The quality of internal roads in Aradeti, Sagolasheni, Kindzati, Mtskhetisjvari, Didi Plevi, Akhaldaba, Tedotsminda, Otarasheni is poor. Road to pastures are in particularly bad state of maintenance. These roads use to be completely de-

stroyed in winter and rearranged by own strength by local community after the snowmelt.

Railway line with stations in Khashuri, Kareli and Gori, connecting east and west Georgia runs through the region. The line runs west from Gori on the south bank of the Mtkvari and then crosses to the north bank between Kareli and Agara. It crosses below the E-60 immediately west of Agara and then proceeds to follow closely the alignment of the E-60 (just to the north) until Khashuri;

The nearest airports are in Kutaisi and Tbilisi.

Communication and information sources accessible in the area are the nationwide TV broadcasting channels and local TV companies Dia (coverage - Khashuri municipality), Trialeti (coverage – Shida Kartli region). Satellite antennas are widely available and not too expensive. Along with these sources of information radio channels are offered. Printed media is accessible.

The region is within the coverage area of the mobile operator companies – Magti, Geosell, Beeline.

Real estate and landuse

Agricultural land in Khashuri municipality account for 20.3 thousand hectares, of that 10.9 thousand ha are tillage plots. Split by crop variety is as follows: what 41%, barley 4%, vegetables (corn, beans, etc) 54%. 2800 ha is irrigated land, however because of significant fee for water use only 20% of these plots are used.

Majority of arable land is private. Land registration process finished in 2001, in 2002 relevant certificated were handed over to the owners. The pastures have not been privatized, they are under common ownership. Besides, farmers were allowed to lease or buy land from the state. Annual rental fee per hectare of pasture and arable land has been set as 15 GEL and 77 GEL respectively.

Land reform started in 1991, later on in 1992 resolution allowing privatization of land was enacted. In 1996 the Parliament of Georgia passes a low on the proprietary rights on agricultural land. Each household, permanent residents of the rural area, was allowed to privatise 1.25ha plot, while the quota for employees was set as 0.75ha. However, in some villages, because of the shortage of land households got less acreage plots (around 0.7ha). Information on registered plots can be obtained from the offices of the national agency of the state register.

Housing in the Shida Kartli region was affected by armed conflict in August 2008, but the villages in the project area can be considered as an exception. Though, many of the residential houses are rather old and need rehabilitation.

6.3.2 Historical and archaeological sites

Shida Kartli is known for its rich architectural heritage. In total of around 100 monuments of different historic periods is registered.

The main historic monuments close to the project area are Agarebi church, tower and the Virgin Mary church in village Gomi, remains of ancient settlement, Christ church and burial in Akhalsopeli, Trinity church and belfry in Zemo Osiauri; the Virgin Mary church complex, Somaneti church, St.George church in Vakha.

Shida Kartli is rich in archaeological heritage, most worth to include:

Gudabertka (Tsikhia-Gora) - a multilayered archaeological site where material typical of the Mtskheta-Arax culture was found, situated 7 km. east of the town of Gori, near the village of Sveneti. There is a big settlement with a mud-brick wall (III BC). Frame-type decorated buildings with clay figured hearths inside; public building and grain storage pits were revealed. The oldest artefacts found at the site were the clay signets with stylized images of a deer and a bird. Next to the remains of the settlement Early Bronze Age cemetery with burial mound in the centre was found. The upper layers of the site date back to the Early Iron Age.

Khizanaant Gora - multilayered archaeological monument situated in the village of Urbnisi (Kareli municipality) on the left bank of the River Mtkvari. The settlement (surface area - 340 square metre) borders with the ravine on both sides and enclosed by the artificial ditch on the north. Twelve cultural layers of the Early Medieval, Antiquity and Early Bronze Age had been revealed at the site. Three lower cultural layers of Khizanaant Gora date back to the second half of the 4th BC (early stage of the Kura-Arax culture).

On the left bank of the Mtkvari located is the ancient settlement **Urbnisi**. To the west - the remains of **Berikldeebi** (Eneolith Bronze Age settlement, and burial mounds) are registered. Archaeological excavations of 1979-1983 revealed remains of the Middle Bronze Age graves with black, light-colour, gray (Uzerliktepe type) ceramics. Two architectural horizons of the Bedenic settlements were revealed at the site. The rest of the findings included the Ruins of adobe buildings, rectangle sacrificial platforms plastered with clay, Bedenic black glazed ceramic of high quality, chestnut-colour and light-colour clay vessels, a fragment of a bronze axe with a pulled down haft, stone and bone tools. The ruins of a circular Early Bronze Age building with the disco shaped central heath (plastered with clay) were uncovered. The structure contained cylindrical vessels, platforms plastered with clay and typical Mtkvari-Arax and Uruk ceramic. The temple and the settlement dating to the Eneolithic Age, along with ceramics of similar to eneolithic age ceramics found in the west Georgian cave settlement (Samele Klde) and Urukian era ceramics were also discovered. South of the bridge over the East Prone River, on the right bank of the river, located are the remains of a medieval church (the so-called Erelaant Sakdari).

Dedoplis Mindori (Queen's field) on the second terrace of the Mtkvari is also worth to mention. In this area a large Eneolyth – bronze age settlement, burial

places and remains of the Kartli king's palace (II=I BC) as well as of an early medieval settlement have been found.

Sasiretis Gora - the Late Bronze – Early Iron Age archaeological site situated in the village of Kvemo Sasireti (Kaspi Municipality), on the right bank of the Mtkvari river. Bronze artefacts of the 13th century BC were found at the foot of the mound. The hoard included a Colchian axe, an axe of the Central Transcaucasian type, a chisel, a dagger, bits with a wheel-like chaplet; figurines of a swan and a Caucasian goat, a metal plate consisting of two parts, a lidded three-legs vessel in the centre of which there was a figurine of a bird.

Zguderi - west to village Zguderi (Kareli Municipality), on the left bank of the River Dzami, Gochaantkari several sites were excavated: a Late Bronze Age cemetery (10 pit-burials; 6 round stone mounds, dated end of 2 BC-1AD); a settlement (2nd – 4th AD), cemetery and early medieval settlement. Gold, silver and bronze objects found in the graves included a dish with Greek and Aramaic inscriptions, various utensils, jewellery, imported glass vessels, gold and silver Roman and Parthian coins. In 80m north of the cemetery the settlement of the 3-6AD was excavated. In about 150 m east of the above-mentioned settlement, remains of a medieval settlement were excavated.

Natsargora is located at the western limit of the Shida Kartli near the present village Natsargora in the hilly area to the north of the Mtkvari River, It comprises a small multiperiod mound and neighbouring cemetery. The mound is 20-25 m high, oval in shape. The area was occupied during the Early Bronze and the Late Bronze/Early Iron Age. The cemetery is located in the flat area to the South-East of the mound, and was in use, with interruptions, from the Early Bronze until the Classical Antiquity period. Natsargora is one of the few sites in the Shida Kartli region where Bedeni ceramics have been discovered. The site yielded both Mtkvari-Arax and Bedeni pottery which points to relation between the Mtkvari-Arax and the early kurgan cultures.

Nuli burial. Bronze Age burial on the right bank of the Prone River near vil.Nuli. Mtkvari-Arax pottery , bronze weapon, jewellery, other various objects of the same age and objects found in the area pointing to connection with Trialeti culture. Presence of Middle and Late Bronze Age has been revealed,

In total in Khashuri municipality about 146 sites have been identified (see Figure 6.19).

The closest to the project area sites are village ruins and vaulted church of the Late Medieval Period in 400m south-west of Akhalsopeli, left bank of the Suramula and a mound at the church graveyard south west to Akhalsopeli - Late Bronze Age pit-type tombs containing pottery and human remains.

Figure 6.17 Natsargora

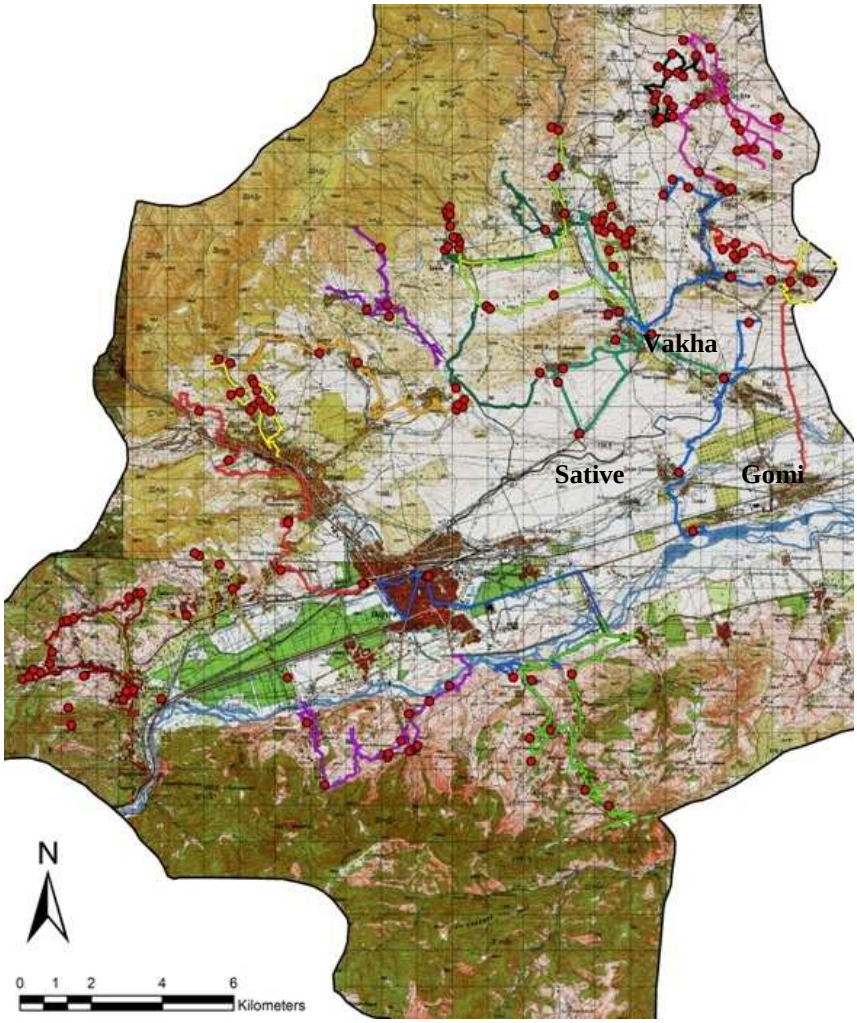


Figure 6.18. Archaeological sites considered by Georgian-Italian Shida Kartli archaeological survey team

Research implemented in the region revealed the presence of a considerable number of Late Chalcolithic and Early Bronze Age settlements in the alluvial plain of the Mtkvari River and on the surrounding hills.

Archaeological sites are generally located on high fluvial terraces or low natural hills in the flat alluvial plain formed by the braided river Mtkvari and its tributaries, with the exception of the Khashuri district, where some of them are situated in the neighbouring hilly zone.

There is opinion that during the last few thousand years the river basin has been under degradation rather than aggradation conditions, and therefore, except for very specific local conditions, ancient sites are rather unlikely to have been buried under thick deposit layers, and were more probably subjected to a certain amount of surface erosion.

Available evidence suggests, for instance, an overall stability of geomorphological conditions at least since the 3rd millennium BC, and probably even earlier, at both Okherakhevi and Tsikhiagora, as well as at Natsargora, whereas at Aradetis Orgora the presence of alluvial layers overlying the archaeological levels suggests that the bed of the Mtkvari River was located nearer to the site than in present times, in agreement with the results of aerial photos and satellite images interpretation.

The area in general is rich in archaeological heritage, which is to be taken into account during construction.

7 Expected environmental impacts and mitigation measures

7.1 Introduction

Environmental impacts of the proposed Agara- Zemo Osiauri section's upgrading show in three stages: pre-construction, construction and operation.

Pre-construction phase is mostly related with socio-economic issues, like acquisition of the land/property where the existing road is widened and the new route is built, and possible speculations gaining the compensations for the acquired land.

Construction phase. This is a large and complex development, involving major construction activities, so the construction phase is the period in which the greatest risk of negative impacts is present. However the work will involve basic techniques (excavation, earth-moving, concreting, etc) that are a component of the most construction projects, for which well developed mitigation methods are available. Some of the earthworks, particularly in embankments and during construction of bank protection structures in the Mtkvari floodplain are also needed. This will alter the topography and appearance of each site and location from which materials are obtained (note: use of existing licenced quarries is advisable, therefore impact on material abstraction site is not considered in the report in details) and where waste/soil is disposed. It could also change the flow patterns of surface and ground-water and affect its quality. Impact on water quality and aquatic life during construction of the bank protection structure and bridge over the Surmanula is also important. As for impact on community - nuisance factors such as noise, dust, emission traffic and restriction of free movement for people and cattle is worth to mention.

Operation. Once it is in operation, the upgraded road is expected to gradually carry more traffic, comprising light/medium vehicles and HGVs engaged in internal travel and transit between the surrounding countries. The road may fall into disrepair, compromising the investment and road safety, if it is not adequately inspected, maintained and repaired. The operating road may affect natural and human environments via traffic noise, air pollution, water pollution with liquid/powder cargo and/or fuel and lubricants from the cars as a result of traffic accidents on the road section passing near riverside and/or the accidents on the river crossings, visual impacts, disturbance, etc. Measures are included in the design to avoid some of these. Socio-economic effects will be more significant, particularly for individuals and communities that currently depend on the road and who will be excluded in the future by bypasses and safety measures.

Construction of the Gomi bypass will cut off the residents from the river, which can be considered as one of operation related impacts.

In the area covered by this EIA, the key environmental issues are likely to be:

- *Noise and air pollution impacts on closely located inhabited areas during construction and operation;*
- *Destruction of natural landscape (soil cover, vegetation, eco-systems, habitats, wildlife, relief) in the RoW, construction camp/equipment yards and permanent areas for spoil disposal;*
- *Landslips and other mass movements in road cuts during construction activities; erosion from fresh road cuts and fills, sedimentation of natural drainage ways;*
- *Declined water quality and increased sedimentation in the areas near surface water bodies;*
- *Impact of construction activities on aquatic ecosystems of the rivers/streams crossed by the highway;*
- *Soil contamination (RoW, equipment yards, cement/asphalt plants- in case used) during construction by oil/fuel, paint spills, waste;*
- *Impact on soil during operation;*
- *Waste disposal (construction camps and work sites), including waste water and waste alongside the RoW;*
- *Poaching by construction workers;*
- *Impact on cultural heritage - risks of uncovering archaeological material during excavation works;*
- *Heath hazards – noise, air emissions, dust – during construction and operation;*
- *Safety risks – hazardous driving conditions where construction interferes with pre-existing roads, accident risks associated with traffic and transport;*
- *Socioeconomic impacts - loss of business by roadside vendors; land acquisition/compensation (roadside commercial, orchards, non-motorized transport, etc).*

7.2 Impacts on water resources

Surface Water

Wastewater management, surface and underground water protection have been evaluated according to the Georgian laws and regulations (to the largest extent the law to be applied is the Georgian Law on Water, 1997, amended in 2003, 2004, 2005).

In Georgia surface water quality standards are defined according to the different categories of water use:

- Drinking-economic water use;
- Economic-household water use;
- Fish farming water use. This category is divided into three categories: the highest, the first and the second, according to fish species available and their sensitivity.

For the drinking-economic and economic-recreational water bodies categories quality standards are defined as maximum concentrations of polluting substances permissible for human health in the river waters (Sanitary Rules and Standards for the Protection of Surface Waters from Pollution[3]). The ecologic norms for pollutants in surface waters are established by "The Rules of Protection of Surface Waters of Georgia from the Pollution"[4]. This regulation defines maximum permissible concentrations of polluting substances in water bodies significant for human heath, as well as for fish farming purposes.

The standards imposed by these regulations broadly comply with the EU standards, defined by the Directives 2006/7/EC (bathing water quality), 2006/44/EC (on the quality of fresh waters needing protection or improvement in order to support fish life)

The surface water bodies potentially affected by the project (Agara – Zemo Osiauri section of the road) are Mtkvari and Suramula. The rivers belong to economic-household water category.

Groundwater

According to Georgian legislation, groundwater, in contrast to surface water is considered a mineral resource. Water quality is regulated by norms and rules "On sanitary protection of groundwater from pollution", "On sanitary protection zones for drinking and domestic water supply systems and Resorts" and "Sanitary-hygienic requirements of bottled water quality". The norms establish maximum allowable concentration (MAC) of pollutants in water.

The area belongs to Kartli artesian basin. One of the main fields of economy in the region is agriculture. Along with that sugar plant, cement production, abattoirs and meat processing plants and vehicle repair plants, etc used to be available. This led to deterioration of ground water quality. According to the survey carried out during the development of the State of Environment report 2007-2009, in 83 boreholes the maximum allowable concentrations of manganese, iron ions, nitrates, and nitrites turned out to be exceeded.

7.2.1 Water impact assessment: road construction

The causes of potential pollution of surface water include accidental fuel/oil spills from machinery/vehicles (including emergency situations), poorly man-

[3] approved by Order #297/m (August 16, 2001) of the Minister of Labour, Health and Social Protection of Georgia

[4] approved by Order #130 (September 17, 1996) of the Minister of Environment Protection and Natural Resources of Georgia

aged solid waste and construction materials, contaminated runoff, siltation of surface water during excavation/earthworks, cross contamination of ground water with pollution surface streams, pollution during construction in/close to the riverbed (bridge, bank protection structure).

Percolation of contaminated runoff, infiltration of polluted surface water and/or leakage of fuel during construction is generally assumed to be potential causes of ground water pollution. According to the engineering geological survey the ground water level in the project area varies from 2-3,5m (I terrace of the Mtkvari) to 7.3-8.5m (II terrace of the Mtkvari).

The risk of impact is usually higher for shallow aquifers which are more vulnerable. The impact probability in the bridge and protection structure construction area, where higher amount of excavation compared to that during the road construction works, is required.

Pollution of water may be observed during construction of the bridge over Suramula and arrangement of the Mtkvari bank protection structure.

The bridge over the Suramula is 37m wide. Construction of piers in the riverbed is not planned, however eathworks, drilling and other activities may have impact on the river water quality (increase of turbidity, pollution with liquid and solid waste, spilled fuel/oil). The impact can be mitigated by introduction of the measures set for disturbed soil areas (see below). Works must be scheduled for the period less sensitive for aquaitic life in the river (June-September). Keeping worksite in order and good waste management practices will also cotribute to aleviation of risk of impact.

The same applies to the bank protection riprap structure site. The 3.8km long structure will be arranged to provide addditional protection of the new embankment from flooding. The structure is being built next to existing bank protection facility to provide additional protection of the road. As any construction close to the water arrangement of the structure may have negative impact on the surface water body. Even though works are not implemented in water, to avoid impact on the river water quality before any work is begun, installetion of sift fencing barrier on the downslope side of construction is recommended. Construction is to be performed quickly and efficiently as delays during construction can lead to a major impact to the stream.

Attention is to be paid on the way in which the riprap is installed. Machinery should be parked in a flat area at the top of the slope and construction should be done by reaching out over the slope. This will help prevent damage to the top of the slope. Construction should start at the base and work upwards. If the job takes several days, the face of each section should be stabilized with stone and bare soil above the work area should be mulched before leaving for the day.

There will be no risk of pollution with sewage as bio-toilets will be provided.

In order to avoid or mitigate impact the operation of the site should be performed with due consideration to environmental safety measures:

- Should any temporary fuel tank be available, it must be located within at least 100m from the riverbed. The tank must be placed in covered areas with berms or dikes installed to intercept spills, if any. Any spill should be immediately intercepted and cleaned up with absorbent materials.
- Onsite repairs /maintenance and fuelling activities should be limited. Priority should be given to offsite commercial facilities. If impossible, a designated area and/or a secondary containment for possible spills for on-site repair or maintenance activities must be provided. These areas shall be located away from drainage channels surface water bodies. (distance between the maintenance site and the river should be at least 100m).
- On-site vehicles and equipment shall be inspected regularly for leaks and all leaks shall be immediately repaired. Incoming vehicles and equipment shall be checked for leaks. Leaking vehicles/equipment shall not be allowed on-site.
- Secondary containment devices (drop cloths, drain pans) shall be used to catch leaks or spills while removing or changing oils from vehicles or equipment. On small spills absorbent materials must be used.
- Tyre washing unit, if any,must be equipped with drainage an settling facilities.
- Washout pit must be cleaned not later than it is 75 % full.
- Usage of off-site vehicle wash racks or commercial washing facilities is preferable. If on-site cleaning is required, bermed wash areas for cleaning activities must be established. The wash area may be sloped to facilitate collection of wash water and evaporative drying.
- Discharge of untreated water into the surface water body must be strictly prohibited.
- Discharge of cement contaminated water must be avoided as cement pollution results in high alkalinity and raises the pH, which can be toxic to aquatic life.
- Materials and waste must be stockpiled so as to avoid erosion and washing off into the river. Drainage trenches must be established to divert surface runoff from the site.
- Waste collection area must be sited in order to avoid substantial amount of runoff from upland areas without draining directly to a water body.
- To prevent runoff contamination, paving should be performed only in dry weather.
- Do not let storm water runoff carry soil and other pollutants into storm drains or watercourses (streams, rivers, lakes, etc.).
- In disturbed soil areas silt fence, fiber rolls, gravel bags, or other approved sediment control must be ensured. At a minimum, all bare soil (whether it’s an abutment slope or a stockpile) must be protected before

it rains. Soil stabilization BMPs such as mulch, soil binders, plastic sheeting or erosion control blankets must be used to protect bare soil.

Responsibility for mitigation measures rests with the building contractor. Contractor is obliged to present erosion management plan prior to commencement of construction.

7.2.2 Water impact assessment: road operation

Operation of the road may lead to sedimentation and pollution of water with heavy metals and petroleum hydrocarbons. The values depend on vehicle maintenance, road conditions and loads carried. With consideration of location – close to the riverbed, impact of contaminated runoff is assumed to be significant factor capable to violate the quality of the stream.

Sensitivity of locations (minimum distance of embankment from the inner edge of the bank protection structure is less than 50m set as water protection strip width for rivers longer than 75km. The status of the river – state importance category is also to taken into account) protection and risk related to it have been considered in the design. The project envisages arrangement of drainage ditches equipped with filters. (Parameters of water management system have been calculated with consideration of rainfall and landform of the area.). This will enable to avoid contamination of surface water with runoff and/or spilled liquid in case of any accident in the sensitive section of alignment.

No water discharge into the surface water body will be the case.

As additional remedial measure maximum preservation of vegetation, leaving buffer zones of undisturbed vegetation between the road and the water body is recommended.

To reduce impact on water environment

- paving should be performed only in dry weather to prevent runoff contamination;
- proper staging techniques should be used 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;

Contamination of surface water with litter is more difficult to manage. (Waste management issues are described in Section 7.3 of the report.)

Maintenance during operation may be considered as another source of impact on operation stage. To deal with this impact, mitigation measures suggested for construction phase must apply. Proper planning of rehabilitation works can be effective measure for protection of water environment.

Direct/indirect impact on ground water quality during operation is less likely to happen.

Ranking of impact is given in Section 9.3.

Impact of bank protection structure on hydrology of the river and risk of flooding.

The bank protection structure is being arranged next to the existing one. This means that the bank is already regulated and the new construction will not change hydrology a lot.

Historic imagery of the site shows that the riverbed is dynamic. Changes include the sediment flow, and respectively - the shape of islands in the river and the river depth.

The river at given section flows to flood plain width of which is 250-500m. Here the river flow is dynamic and the riverbed is often changed (especially at the beginning and end of the proposed section), river is branching and unstable Irelands are created between the river branches. From the North-East it turns to the East direction and scours left bank, where land plots of the population and different industrial objects are located.

In 60-ies of the past century protective-regulative structure was constructed on ≈5.0-6.0 km long section in order to protect the territory from the impact of the river. The structure consists of embankment arranged along the river bank that is protected with 1.0×1.0×0.2m concrete slabs and regulative spur dikes comprising of concrete cubes that is constructed in front of it with a definite gradient angle towards the direction of the river flow. The distance between the spur dikes is different based on specification of their locations and varies between 200-400m.

50 years operation of existing bank protective structure proved its effectiveness, withstanding several inundations (e.g. 1968) without any reconstruction. Left bank was shaped in a manner that it became possible to grow vegetation cover (bushes, trees) on it.
At present, protective-regulative structure is in satisfactory condition. Embankment needs reinstatement on several places, only 5.0-6.0 m long sections need to be rehabilitated.
Reliability of existing protective-regulative structure needs to be increased along the whole length due to the designation of the highway, constant changeable climate conditions and intensive dynamic impact of the river .

In order to increase reliability of existing protective structure, project considers arrangement of riprap dike along the whole length in front of the embankment reinforced with concrete slabs so that the structure of existing protective wall shall be preserved.

Designed riprap is 1.0 m dimension structure with boulders located in two-layers that shall be constructed in front of the existing embankment with 1:1.5 m gradient and base of which will go deeper up to overall scour level of the

river bed received by calculations. Arrangement of so called "feeding tooth" of boulders is considered for the base of the riprap, that will respond to unpredictable scouring in case of necessity.

Utilization of boulders of more than 2.4 t/m3 volume weight is stipulated for riprap. Gaps between the boulders shall be filled with relatively smaller boulders and local gravel soil. Size of the riprap is determined by calculations and it requires 27.0÷30.0 m3 boulders for one longitudinal meter. Projected riprap dike is considered to be arranged on 4.0. km length.

Meadows and grasslands are dominating on the right bank of Mtkvari in the section where the embankment is to be constructed. According to the National Public Registry,there are no privately owned land parcels within the boundaries of the flood plan. The area is occasionally used for grazing, but according to the local residents -the areas is particularly valuable as a pasture and there is no much dependency on it.Distance from the right bank of the river to the cultivated plots (not registered properties) varies from 350 to 930 m. (see Figure 7.1).

Figure 7.1a View of the area

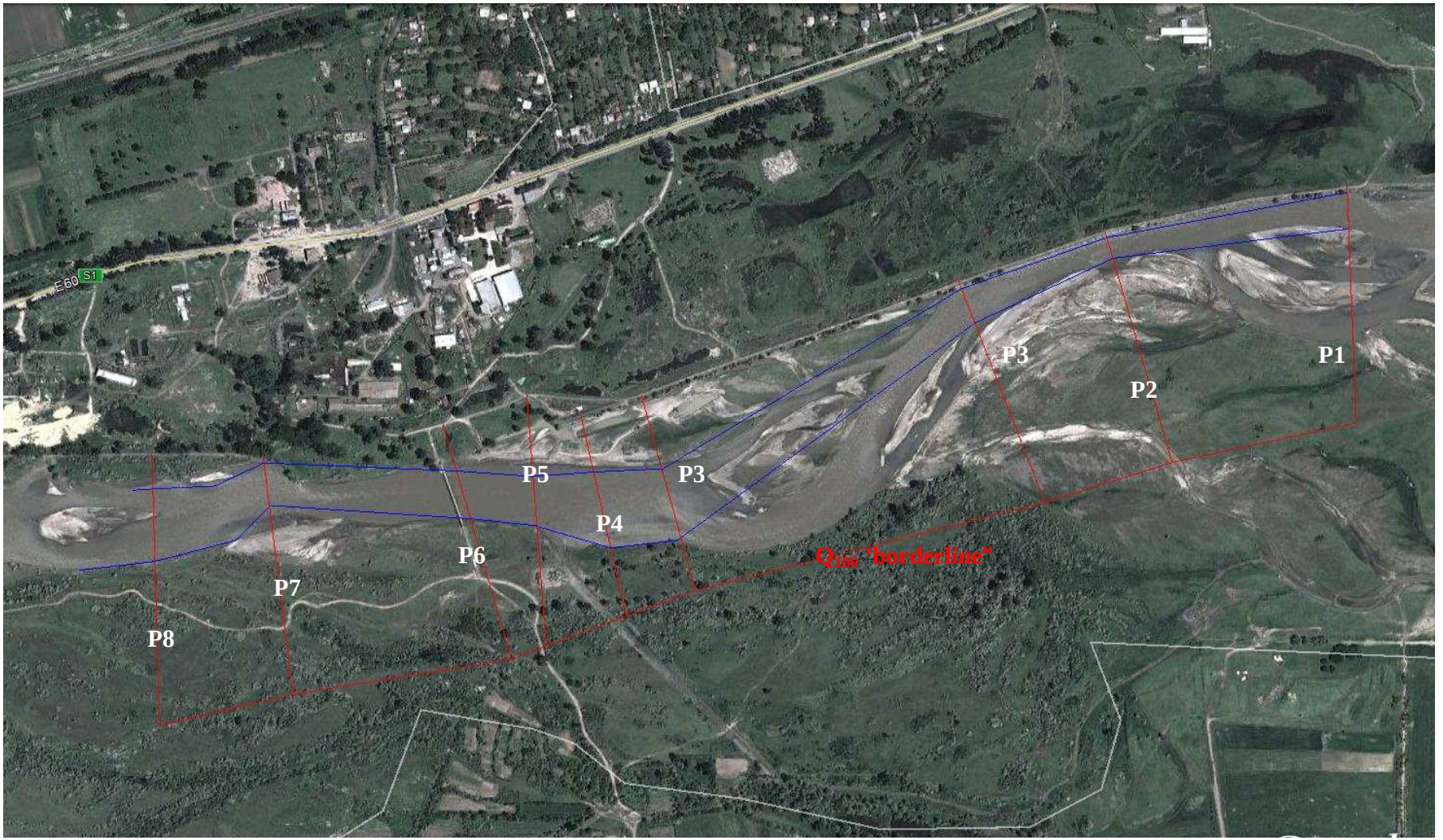


Figure 7.1b Mtkvari River (blue line); profiles (P1-P9) and Q100 tentative flooding line (red line)

7.3 Waste management

7.3.1 Waste: road construction

Waste streams generated during construction include: domestic waste, removed asphalt cover, inert construction waste, scrap metal, surplus soil, etc.

To prevent impact of the waste generated during construction on environment it must be collected and temporarily stored in the area selected with consideration of requirements listed below.

Until removal from the site, domestic waste (food waste, plastic bottles, packaging) must be collected in containers with fitted lid to avoid attraction of scavengers, propagation of odour and scattering by wind. The lids also protect waste from rain and snow. The containers must be placed in specially allocated area, in a distance from water bodies and traffic. Waste will be removed to the nearest landfill under agreement with local municipality.

Assuming that quantity of domestic waste generated per capita per year totals $0.7m^3$, in approximate total amount of the mentioned waste type produced during construction will equate $200x0.7=140\ m^3$/sec.

In Georgia municipalities are responsible for the collection and transportation of household waste. (However, regular waste collection service is only available in some of the central settlements.). Domestic waste generated during the construction will be collected and delivered to the nearest landfill under the contract.

Hazardous waste generated during construction will include:

- Used tires - 60-70 unit / year;
- Oil filters of construction equipment,vehicles and other machinery - 20-25 unit /year;
- Outdated and damaged accumulators 12-15 unit/year;
- Waste fuel - lubricants - 120-150 kg /year;
- Welding electrodes -50-60 kg /year;
- Amount of soil contaminated with accidentally spilled oil will depend on the scale of the spill

As so far Georgia does not have hazardous waste landfill, this type of waste will be disposed by licenced contractor authorised for handling/treatment of this kind of waste.

Area allocated for temporary disposal of hazardous waste must be arranged with stricter protection - in particular, containers must have secondary containment, hazardous waste must be stored separately from the inert one. Integrity of the hazardous waste containers must be controlled. Staff involved in hazardous waste management must be trained in waste management and safety issues. Waste must be removed every 3 day. Treatment, utilisation, disposal of waste must be done by authorised contractor.

Soil polluted with petroleum hydrocarbons because of accidental small scale fuel/oil spills (3-5m^3) can be remediated onsite (e.g. in situ bioremediation). Larger spills must be localized, contaminated soil/earth stripped, removed from the site and remediated. New, clean soil must be introduced, followed by recultivation. It is recommended to involve authorised company for this service.

Waste streams generated during construction of the road and demolition of the roadside structures/buildings will include inert waste from construction and demolition (road pavement, buildings/roadside structures) activities. Inert materials include earth, soil, rock, cured asphalt, brick, masonry, concrete. These materials do not decompose or produce leachate or other products harmful to the environment. Recyclable materials include but are not limited to: asphalt pavement, cardboard, concrete aggregate, excavated rock, soil (uncontaminated), green waste, wood/lumbers, scrap metal.

For temporary disposal of inert waste, the site within the camp/operation ground must be selected. The waste must be placed so as not to interfere with free movement of machinery and staff, away from surface water (within at least 100m). Waste must be source-separated in order to ensure proper management and enable reuse.

Any waste materials that may be used for the project must be reused on the site, residuals waste - should be disposed at the nearest landfill, as the case may be based on agreement with the municipal authorities or under agreement with local authorities used elsewhere for the needs of the region. For instance, wood/timber can be handed over to local municipality based on acceptance-submission certificate and subsequently, by decision of the local governance, distributed to the residents. Procedure is as follows: RD hands over material to the Ministry of Economy and Sustainable Development based on a formal certificate. After that material can be given to the local municipality following to takeover certificate .

The Regional Environmental Assessment recommends processing and reuse of removed asphalt pavement. The thickness of the existing asphalt pavement along the section under rehabilitation is from 170 to 200mm. Processing includes the following steps: removal; breaking down to maximum particle sizes of 32.5mm or smaller, depending on the intended use; blending with granular material to comply with the relevant requirements and use as levelling/capping layer or sub-base material. This will solve the problem of waste asphalt disposal. However, as the properties of existing material vary, frequent testing is required to verify compliance with the specifications. Temporary and final disposal of waste will be subject to formal permission from municipal authorities.

Surplus soil disposal site must be selected with consideration of the site selection requirements recommended for topsoil.

Excavated subsoil pile must have a natural angle of repose of up to 40° depending on texture and moisture content but, if stable stockpiles are to be formed, slope angles will normally need to be less than that. For stockpiles that

are to be grass seeded and maintained, a maximum side slope of 1 in 2 (25°) is appropriate.

If the soil is to be stockpiled for more than six months, the surface of the stockpiles should be seeded with a grass/clover mix to minimise soil erosion and to help reduce infestation by nuisance weeds that might spread seed onto adjacent land.

Permanent disposal site management and recultivation plan must be developed. Potential users of spoil must be identified to reduce amount of permanent storage. One of potential possibilities - using soil for covering waste at the nearest landfill (Agara or Khashuri).

Ranking of impact is given in Section 9.3.

7.3.2 Waste: road operation

The waste generated during operation will include roadside litter (unfortunate practice) and waste accumulated at rest/service facilities. The management of the waste generated at rest/service areas is of no great concern. The rest/service facilities shall be equipped with bins for waste collection. Management of roadside litter is more complicated. It is predominantly food waste, plastic and paper that people fly tip. The roadside litter is extremely unsightly and uncollected litter may attract vermin. It may impact animals that may get trapped or poisoned with litter in their habitats. Cigarette butts and filters threaten wildlife, as fish and birds often mistake this waste for food. Litter may end up in rivers and canals, polluting the water supply. And the last but not the least, the litter is also a road hazard that may occasionally contribute to accidents.

Recently a fine for littering has been introduced. However the littering along the highway is more difficult to manage. One way of its reduction is education. It is necessary to:

- ensure that the community is aware of the range of ways to dispose of their waste correctly;
- inform the community of the level of fines that littering incurs;
- may be an element of a roadside litter prevention program, educating the community that littering is illegal, fines apply and behaviours are monitored. The signs may be suitable for placement in a series of two to four signs at 10 km intervals to repeat the message in different ways.

Management of waste during operation will be responsibility of contractor identified by the Roads Department.

Ranking of impact is given in Section 9.3.

7.4 Impacts on air quality

7.4.1 Air pollution impact assessment: road construction

The major air quality issue during road construction is the production of dust during earthworks, storage and transportation of soil or other fine-grained materials (cement, sand, etc.), and vehicles moving across unpaved or dusty surfaces. Dust is also emitted during the production of concrete, especially if good production practice for dust emissions mitigation is not followed. It is very difficult to accurately quantify dust emissions arising from construction activities. It is thus not possible to easily predict changes to dust soiling rates or PM_{10} concentrations. Therefore it is necessary to determine the likelihood of a significant impact which should be combined with an assessment of the proposed mitigation measures, such as the following:

- *Spray all unpaved roads and significant areas of uncovered soil with water every four hours on working days, during dry and windy weather;*
- *Provide a wheel-washing facility and ensure that it is used by all vehicles before leaving all sites;*
- *Cover all loose material with tarpaulins when transported off-site on trucks;*
- *Keep at least 300 m distance from residences windward to reinforced concrete production plants.*

Air quality during road construction is reduced by emissions from construction machinery and heavy goods vehicles used for materials transportation, though it is strongly recommended to ensure appropriate technical service for the traffic fleet used in road construction.

Ranking of impact is given in Section 9.3.

7.4.2 Air pollution impact assessment: road operation

Amounts of vehicle emitted pollutants mainly depend on the technical condition of the vehicles, fuel quality and speed. Older vehicles usually have lower fuel consumption efficiency and cause higher emissions of combustion by-products. Increasing speed of the vehicle demands higher fuel supply and therefore results in larger amounts of emitted pollutants.

If the Agara- Zemo Osiauri road section will be upgraded (Project alternatives 1 and 2) the speed limit will be set to 120 km/h. The improved road capacity will result in an increased number of vehicles passing the route and in higher emission levels.

From the stand point of the "zero" alternative, the speed would remain the same (80 km/h and 60 km/h along settled areas), but the traffic flow would anyway increase due to economic needs. It would result in appearance of jams, especially near settlements. Lower speed results in lower emission levels but at the

same time it prolongs pollution dispersion. Increased traffic flow, low speed and low quality pavement would possibly impair ambient air quality along the route.

Ambient air quality is influenced by a number of factors, listed above. To evaluate and compare impacts of traffic induced air pollution the modelling of pollution dispersion along the Agara- Zemo Osiauri road section was performed, for "zero" and both Project alternatives 1 and 2.

Long-term pollution levels were calculated using modelling software *CAL-Roads View***.** It is an air dispersion modelling package for predicting air quality impacts of pollutants near roadways. Methodology is given in Chapter 5.

For Agara - Zemo Osiauri road section, three scenarios were modelled:

- *Pollutant dispersion calculations using forecasted traffic data (2025 year), assuming that the project was not implemented and the road was not upgraded (the "zero" alternative);*
- *Pollutant dispersion calculations using the same forecasted traffic flow (2025 year), assuming that the Project alternative 1 was implemented and road upgrading included southern bypass.*
- *Pollutant dispersion calculations using the same forecasted traffic flow (2025 year), assuming that the Project alternative 2 was implemented and road upgrading included northern bypass.*

Table 7.1 Modelled pollutant concentrations* in different subsections of the road for the "zero" and for the both Project alternatives

		Modelled concentrations (30 min onetime maximum)					
		CO, mg/m^3		**NO_2, µg/m^3**		**PM_{10}, µg/m^3**	
		Distance from road		Distance from road		Distance from road	
		5 m	50 m	5 m	50 m	5 m	50 m
Road sub-section from 114 to 120 km (of designed road)	*"Zero alternative"*	0.01 - 0.019	0.003 - 0.007	18.0 - 24.0	4.0 - 6.0	1.0	0
	Project alternative 1	0.036 - 0.041	0.007 - 0.014	25.0 - 30.0	6.0 - 10.0	1.0	0
	Project alternative 2	0.036 - 0.041	0.007 - 0.014	25.0 - 30.0	6.0 - 10.0	1.0	0
Road sub-section from 120 to 124,8 km (of the designed road)	*"Zero alternative"*	0.026 - 0.032	0.007 - 0.01	18.0 - 21.0	5.0 - 7.0	1.0	0
	Project alternative 1	0.032 - 0.045	0.010 - 0.013	33.0 - 41.0	7.0 - 14.0	2.0	0
	Project alternative 2	0.032 - 0.045	0.010 - 0.013	33.0 - 41.0	7.0 - 14.0	2.0	0

CONCLUSIONS:

- *Negative impacts of air pollution by NO_2, CO and PM_{10} are negligible for the "zero" and for the both Project alternatives 1 and 2;*
- *Modelled concentrations of CO and NO_2 were lowest for the "zero" alternative.*
- *Concentrations of CO and NO_2 were higher for Project alternative 1 as compared to the "zero" alternative, but it would bypass the settlement of Gomi and town of Khashuri ensuring better conditions for pollutant dispersion and less impacts on the residents.*

No specific air pollution mitigation measures are recommended for Agara - Zemo Osiauri road section; however it is advised to keep proper planning of greenery near settled areas.

7.4.3 Impacts on climate

Usually automobiles and light trucks produce well over 60 % of CO_2 emissions within road transport. In developing countries like Georgia freight trucks (and in some cases even buses) consume more fuel and emit even more CO_2 than light duty vehicles. Transport related CO_2 emissions in Georgia contribute about 40 % of total CO_2 emissions; from this amount only 8 % of CO_2 emissions are related with other than road traffic sources (Source: World Bank, World Development Indicators - Last updated March 2, 2011). Georgia has one of the fastest growing economies in the region, and favorable geographical position. It is expected to have continual increase in goods transit and upgraded roads should serve for this purpose. Increased traffic flows will inevitably result in bigger CO_2 emissions.

Upgrading of Agara - Zemo Osiauri road section will result in continual increase of vehicles passing the route therefore it is necessary to calculate amounts of emitted CO_2 along the roads section under study, and to compare "zero" and both upgrading alternatives. CO_2 emissions were calculated relying on forecasted traffic flow and emission factors for relevant fleet composition. Detailed information on initial calculation data is given in Table 7.4.

Table 7.2 Initial data for CO2 emissions calculation

		"Zero" alternative	**Project alternative 1**	**Project alternative 2**
Year		2025	2025	2025
Composition of traffic flow	Cars, vehicles/day	22446	22446	22446
	HGV*, vehicles/day	2040	2040	2040
	% of heavy transport in flow	8.3	8.3	8.3
	Total number of vehicles/day	24485	24485	24485
Speed limit, km/h	Cars (in settlements)	80 (60)	120**	120**
	HGV (in settlements)	80 (60)	100**	100**
Emissions of CO_2, kt/year		**5.1**	**6.12**	**6.12**

*Heavy Goods Vehicles

**If Project alternative 1 or 2 will be implemented all settlements will be bypassed therefore speed limit restrictions are not actual.

The comparison of the "zero" and both Project alternatives with regard to CO_2 emissions reveals that the "zero" alternative would ensure smaller amounts of emitted pollutants. It is mainly because of the fact that emissions of CO_2 are dependent on speed: at very low and very high speeds emissions reaches maximum values. If the road wouldn't be upgraded ("zero" alternative) speed limit would remain 80 km/h (except of 60 km/h near Agara and Gomi settlements), which is almost moderate speed for CO_2 emissions. However a number of small off-roads would connect settlements or individual dwellings with the main route. Numbers of vehicles travelling at a very low speed or queuing with working engines would concentrate near these junctions. Very low average speeds generally represent stop-and-go driving, and vehicles do not travel far. Therefore, the emission rates per mile are quite high (when a car's engine is running but it is not moving, its emission rate per mile reaches the maximum). Conversely, when vehicles travel at much higher speeds, they demand very high engine loads, which require more fuel, and therefore lead to high CO_2 emission rates. Low emission rates are obtained at moderate speeds of about 65 - 95 km/h.

For the both Project alternatives the speed limit would be 120 km/h. Increased speed along the route would result in larger amounts of emitted CO_2 gases, but on the other hand would help to avoid emissions due to vehicles travelling at very low speed or queuing. One of the measures for CO_2 emissions reduction is proper management of vehicle speed, but it cannot be properly applied for the case under the study, because one of the main reasons for Agara - Zemo Osiauri roads section upgrading is to ensure higher speed and better road capacity.

To reduce CO_2 emissions from the transportation sector, attention should be given to more efficient vehicles, alternative fuels, and reducing vehicle mileage. In terms of the perspective of Agara - Zemo Osiauri road section upgrading, all factors influencing CO_2 emissions are hard to foresee. For example, it is possible that in 2025 the consumption of low-carbon fuel (such as biofuel and synthetic fuel) will considerably increase resulting in lower emissions than predicted. However, consistent policy on the topic should be obtained considering all the influencing factors and development of the state.

7.5 Impacts on the noise environment

7.5.1 Noise and vibration impact assessment: road construction

Road construction will introduce additional noise sources to the local area. Road construction noise is caused by construction equipment and operations, i. e., there are two main sources of noise during the construction: noise resulting from road upgrading works, and noise from additional activities, such as transport of materials by HGV along the route. The dominant source of noise from most construction equipment is the engine, usually a diesel, without sufficient muffling. Only in a few cases noise generated by the process dominates (for

example, impact pile driving, pavement breaking, etc.). Noise levels during the construction will vary depending on the construction activity and schedule. Noise levels from the main road construction equipment and operations are presented in Table 7.3.

Table 7.3 Construction equipment noise emission levels

Equipment	Typical noise level (dBA) approximately 15 m from source
Air compressor	81
Backhoe	80
Compactor	82
Concrete mixer	85
Derrick crane	88
Bulldozer	85
Grader	85
Jack hammer	88
Paver	89
Pile-driver (impact)	101
Pile-driver (sonic)	96
Pneumatic tool	85
Truck	88

The upgrading of the Agara - Zemo Osiauri road section will involve building two bypasses near Gomi settlement and Khashuri town. Reconstruction works in this road section will involve usage of some specific machinery (backhoe, bulldozer, trucks, heavy roller and etc.). Noise and vibrations will be inevitable from such activities as digging trenches, soil compaction, breaking of the old road pavement by hydraulic hammer and other. According to the data presented in Table 7.5, frequent exceedances of acceptable noise levels resulting from construction activities are anticipated. Increased HGV movement along the route during the construction will be low as compared to the existing traffic flows and will cause no noise-related disturbance.

The Decree # 234n (Ministry of Health and Social Welfare of Georgia, Oct. 6, 2003) defines minimum distances for various construction related activities from „sanitation zones, to protect human health from the impacts of noise and vibration:

- Borrow pits (Art. 32) > 100 m;
- Asphalt plants (Art. 34) > 500 m;
- Reinforced concrete production (art. 35) > 300 m;

Noise limits for various working environments are estimated in General EHS Guidelines "Occupational health and safety" (issued by International Finance Corporation, 2007) which is the main document to rely on for noise and vibration issues. For heavy industry (with no demand for oral communication) limit equivalent noise level is set to 85 dBA; maximum - 110 dBA.

Noise impact assessment was performed identifying sensitive receptors (settlements, dwellings) within minimum distances from realignment boundaries as

indicated in the Georgian standards for various construction related activities as it is described above. It is expected to have adverse noise impacts during road construction, but they are not considered to be of high importance. Settlement patterns along the Agara - Zemo Osiauri road section imply that only few people will be exposed to elevated noise levels during the road construction (most likely the ones working in the fields near the construction sites), with exception of Gomi settlement. However construction noise impact will be temporary and of medium significance, if environmental and safety requirements will be followed.

Vibration impacts are expected to be felt only locally near construction sites and should not have any negative impacts on residents.

There are dwellings which could fall into the restricted zone established for asphalt plants or reinforced concrete production (300 m and 500 m respectively). Thus, to protect human health from the impacts of noise and vibration the following is recommended:

- to keep the requested distances from appropriate activities to the closest dwellings and residential areas;
- to keep restrictions on working hours on week days, weekends or public holidays, no night-time working.

People working at the construction sites will be exposed to elevated noise and vibration levels. According to the data presented in Table 7.7, most of the road construction activities will result in noise levels exceeding 85 dBA. Therefore it is recommended:

- To enforce the use of hearing protection by using hearing protective devices capable of reducing sound levels at the ear to at least 85 dBA;
- Exposure to hand-arm vibration from equipment such as hand and power tools, or whole-body vibrations from surfaces on which the worker stands or sits, should be controlled through the choice of equipment, installation of vibration dampening pads or devices, and limiting the duration of exposure (EHS Guidelines, 2007).

7.5.2 Modeling of long-term noise levels: road operation

There are two types of noise caused by the road operation: the noise generated by vehicle engines and the noise generated by tyre-road friction. Noise levels increase with the speed. After upgrading the Agara - Zemo Osiauri road section, the speed limit will be set to 120 km/h. It will result in increased number of vehicles passing the route because of better road capacity, and higher levels of noise. From the stand point of "zero" alternative, the speed would remain the same (80 km/h and 60 km/h along settled areas), but the traffic flow would anyway increase because of economic needs. Modeling of long term noise dispersion was performed for both project alternatives 1 and 2, and "zero" alternative. It targeted quantitative evaluation of increased noise levels and possible negative impacts on residents near the EWH-60.

Long-term noise levels were calculated using the modelling software *CadnaA* (*Computer Aided Noise Abatement*). Methodology is given in Chapter 5.

For Agara - Zemo Osiauri road section three scenarios were evaluated according to the project alternatives:

- *Noise dispersion calculations using forecasted traffic data (2025 year), assuming that the project was not implemented and the road was not upgraded (the "zero" alternative);*

- *Noise dispersion calculations using the same forecasted traffic flow (2025 year), assuming that the Project alternative 1 was implemented and road upgrading included southern bypass.*

- *Noise dispersion calculations using the same forecasted traffic flow (2025 year), assuming that the Project alternative 2 was implemented and road upgrading included northern bypass.*

The existing Agara - Zemo Osiauri road section (114 km to 124 km) runs through agricultural landscape, passing along Gomi settlement situated from 116.2 km to 120.8 km. This is the only road section where residential houses fall into the area of unacceptable noise levels for all analyzed alternatives (for Project alternative 1 Gomi settlements would be situated from 117.2 km to 120.9 km).

According to the modelling results for the "zero" alternative and for the both project alternatives acceptable daytime noise level ($L_d \leq 65$ dBA) would be exceeded in a distance of respectively 25 and 85 m from the road boundaries and acceptable night time noise level ($L_d \leq 55$ dBA) would be exceeded in a distance of respectively 55 and 165 m from the road boundaries. These distances reflect the situation when there are no obstacles on the way. An increased speed after the implementation of both the project alternatives would result in the exceedance of the acceptable noise levels at three times bigger distance from the road as compared with the "zero" alternative.

Near Gomi the present road alignment is situated almost parallel to the railway line, at about 340 m distance (railway line crosses Gomi settlement almost in the middle, while the existing road surrounds it from the southern part). There's a railway station in Gomi, and the speed on the railway is restricted to 25 km/h. Near Agarebi settlement trains reach the speed of about 80 km/h and noise levels increase affecting bigger territories on both sides of the railway. In case of "zero" alternative 19 dwellings near Gomi and 18 near Agarebi would be exposed to unacceptable noise levels, induced by road operation.

Project alternative 1 would go south of Gomi settlement, reaching a maximum distance of 315 m from the current road alignment, and therefore keeping a bigger distance from the railway line. Primary noise dispersion calculations revealed that in case of Project alternative 1 implementation near Gomi 4 dwellings would be situated within the zone of unacceptable noise limits. Additional

cross sections proved acceptable noise limits are not exceeded in the living environment.

The comparison of data in Table 7.8 reveals that project Alternative 1 would result in double distances from the road, where acceptable noise levels are exceeded, comparing with the "zero" alternative. Implementation of Project alternative 1 near Gomi would have a negative impact on approximately 4 dwellings which would be exposed to unacceptable noise levels. In case of "zero" alternative number of houses situated in the zone of unacceptable noise limits would be 19.

Near Agarebi approximately 23 dwellings are falling into the zone of unacceptable noise levels in case of Project alternative 1, and 41 in case of "zero" alternative.

It is worth pointing out that long-term prognosis for noise dispersion might be inaccurate in the way that all impact factors are difficult to foresee. For example, calculations are made using noise emission factors reflecting current traffic fleet. It is obvious that such a long-time period will bring positive changes to the economy of Georgia, resulting in higher percentage of new cars in the traffic fleet and respectively lower noise levels.

Table 7.4 Results of noise dispersion modelling for three analyzed alternatives ("Zero" alternative, Project alternatives 1 and 2)

Alternative	Location (km of EWH)	Approximate number of residential houses under impact*	Modelled noise levels, dB(A)**		Acceptable noise levels are exceeded in a distance of, m (in a territory with no obstacles, excluding impact of the railway)	
			Daytime 7 am - 10 pm	Night time 10 pm - 7am	Day time	Night time
"Zero" alternative	116.2 km to 120.8 km of the existing road: Gomi Agarebi				25	85
		19	65 - **69**	55 - **63**		
		41	61 - **70**	55 - **64**		
Project alternative1	117.2 km to 120.9 km of the designed road: Gomi Agarebi				55	165
		4	62 - 63	**56 - 57**		
		23	61 - **70**	**56 - 64**		
Project alternative 2	Zemo Osiauri	4	59 - 64	54 - **56**	55	165

**Number of houses under impact is calculated excluding impact of railway noise*

*** Noise levels exceeding acceptable ones are in bold text*

CONCLUSIONS:

- *Upgrading of the Agara - Zemo Osiauri road section would result in increased noise levels due to a better road capacity, increased traffic flow and speed.*

- *As a result of the both Project alternatives implementation, acceptable daytime and night time noise levels would be exceeded respectively in a distance of 85 m and 165 m from the road boundaries;*

- *Comparison of modelling results revealed that implementation of Project alternative 1 would result in less impact on residents along the road section under study comparing to zero alternative and it should be chosen as preffered alternative;*

- *To protect residents of Gomi and Agarebi settlements from negative noise impacts after road upgrading noise mitigation measures should be applied.*

7.5.3 Recommended measures for noise level reduction

According to the findings described in Chapter 7.5.2, implementation of the Project alternative 1 would result in unacceptable day and night time noise levels next to the closest dwellings along the Agara - Zemo Osiauri road section, therefore noise mitigation measures should be applied. Results of noise dispersion calculation were evaluated in 3 subsections of the road, where residential houses fall into the zone of unacceptable noise levels, as described in Chapter 7.5.2 and Annex 2.3.

Near residential houses situated along the road section under study acceptable noise levels are exceeded by 3 - 4 dBA at night (Table 7.9), except of those in Agarebi, where some dwelings are falling within the zone where acceptable noise levels during night time are exceeded by 9 dBA.

To protect residents along the road section under study from unacceptable noise impact, it is recommended to reduce speed in sub-sections of the road where acceptable noise levels are exceeded.

Summary of the recommended noise mitigation measures are given inTable 7.9 below. Noise dispesion maps with noise reduction measures applied are given in Annex 2.3.

Table 7.5 Recommended noise mitigation measures

Location (km of the designed road)	Approximate number of the residential houses under unacceptable noise impact	Acceptable noise limits are exceeded by, dBA**		Recommended solution
		Daytime 7 am - 10 pm	Night time 10 pm - 7am	
117.2 - 118	43	-	+3	Limit seed to 90 km/h*
121.1 - 121.6	16	-	+4	Limit speed to 80 km/h*
121.6 - 122.1	8	+5	+9	Limit speed to 50 km/h

* Speed limit restrictions are only applicable during night time, because L_d is not exceeded

**Only influence of the designed road was estimated (influence of the railway was excluded)

7.6 Impacts on flora and fauna

Negative impacts of road construction and operation was evaluated according to the main principles indicated in the Law on the Wildlife (1997, amended in 2001, 2003 and 2004), the Law on the Red List and the Red Book of Georgia (2005, amended in 2006) etc. Along with the national legislation/regulations, international requirements (the EBRD policy and the World Bank operation procedures), and the EU Directives to which Georgia is a party were taken into account.

The Flora

The area has a long history of development. Ancient forests covered the area (*Quercus iberica, Carpinus caucasica* and *Fagus orientalis)*, but were destroyed in the course of time. In some places secondary vegetation represented by hemixerophyle and xerophyle shrubs developed.

The main shrub varieties observed within the area are as follows:
Jerusalem Thorn (*Paliurus spina christi)*,
Iberian Spirea (*Spiraea hypericifolia)*,
Buckthorn (*Rhamnus pallasii)*,
Juniper (*Juniperus oblonga)*,
Dog Rose (*Rosa canina)*,
Hawthorns (*Crataegus kyrtostyla)*,
Honeysuckle (*Lonicera caucasica)*,
Blackthorn Hedge (*Prunus spinosa)*,
European Smoketree (*Cotinus coggygria)*,
Cotoneaster (*Cotoneaster racemiflora)*, etc.

Along with hemixerophytes steppe grasses such as *Botriochloa ischaemum* are present.

The landscape along the road is modified. The area is used for cultivation and orchards. Within the plots, along the irrigation ditches, fragments of wetland

vegetation (reed (*Phragmites sp*) and Common Cattail *(Typha latifolia*)) are found. The species' composition in the area under consideration is poor in terms of diversity. Only common plants are registered. The following habitats may be pointed out: agricultural land (cereal); agricultural land (vegetables); orchards; fragments of secondary forests and shrubs; grasslands; ornamental plants /windbreak along the road.

Vegetation within the area under consideration is altered and degraded. Most of the land plots are cultivated. No protected species were revealed. Special attention is to be paid to the area south to Gomi plant where remains of riparian poplar (*Populus hybrida*) forest are observed.

The poplar used to be widely met in forests of East Georgia, in particular along the Mtkvari and its tributaries. The trees registered in the project impact zone are about 30m high, root neck diameter – 2-3 metres. This is about 500m long strip with plant density 0.3. Along with the poplar in the underwood willow (*Salix sp)* and oleaster (*Eleagnus angustifolia)* shrubs are present.

Description of the route by sections is presented in Table 7.10 below.

Table 7.6 Description of the route by sections:

X-0399922; Y- 4654067; H-655 m	Section 'connects' to existing road in 200m from the overpass bridge. Road and railway line run parallel towards Khashuri. Vegetation in the strip between the road and the railway line – shrubs. None of the species have ornamental or commercial values. Farther on both sides of the road are planted with one row of coniferous trees, and Eastern cottonwood (*Populus deltoides*) in row/rows. In some sections black locust (*Robinia pseudoacacia*), willow (*Salix sp,*), poplar (*Populus gracilis*), plum (*Prunus divaricata*), blackthorn (*Prunus spinosa*), buckthorn (*Rhamnus pallasii*), oleaster (*Eleagnus angustifolia*), raspberry (*Rubus sp.*), etc. Plants are cultivated, in some places natural. Existing road borders with corn fields. Natural vegetation is strongly altered because of development. Of other plants: Gramineae, Leguminosae, Compositae, Gruciferae, etc. The meadows are used as pastures even in winter. Mentioned to be is that of cultivated plants European black pine (*Pinus nigra*) and poplar (*Populus deltoides*) dominate.
X-0398031; Y- 4653559; H-657 m	On both sides of the road there are 2-3 rows of pine trees and Italian poplar. Other plant (deciduous trees and shrubs) species are: oleaster (*Eleagnus angustifolia*), willow (*Salix sp,*), blackthorn (*Prunus spinosa*), plum (*Prunus divaricata*), raspberry (*Rubus spp.*). On the right side of the road residential houses are located, on the left side – corn fields and undeveloped plots. From this point the road moves away from the existing alignment to the south.
X-0395586; Y- 4652757; H-660m	The new road moves away from the existing alignment towards the south-west. The road crosses cultivated land, strip of vegetation and undeveloped areas with herbaceous plants typical for the area. There is sand quarry Excavate areas are waterlogged. The area is xerophilous. Fragments of hemixerophilous shrubs and trees are also observed. The road bypasses Gomi from the south running through riparian forest.
X-0394312; Y- 4652192; H-663 m	The road runs through the area between the riverbed and Gomi alcohol factory premises. Vegetation is presented by poplar (*Populus hybrida*) and willow (*Salix spp.*) – forming 500m long stand. In the area adjacent to Gomi factory 30-40 m high poplar trees are available. Such riparian forests in the Mtkvari riverbed are met only in Gardabani area. In biogegraphic references this forests are referred to as intrazone

	(amonalic) phytocenosis. The new alignment runs along the quarry area towards vil.Agarebi and turning to Sative. On both sides of the road corn and gourds are cultivated.

Poplar (*Populus hybrida*)

Oleaster (*Eleagnus angustifolia)*

Black locust (*Pina nigra*)

Eastern cottonwood (*Populus deltoides*)

Figure 7.2 Tree species in the studied area

The following habitats are located in the project area:

- agricultural (tillage) land
- secondary forest (bushes, mainly fragmented)
- uncultivated land (grasses and shrubs)
- windbreaks and roadside ornamental plants.

Most of the route crosses tillage land, meadows and undeveloped land in the areas close to the Mtkvari riverbed. Along the Gomi bypass construction will affect the roadside vegetation. Area to the north of existing road (the last sections of the new alignment under consideration) runs through cultivated land.

The Fauna

The area is rural, main field of economy – farming and fruit growing. Main fauna species presented in the area of interest are not diverse. During the walkover similar species were observed along both sections of the design road. Birds are prevailing. White wagtail (*Motacilla alba*), blackbird (*Turdus merula*), whitethroat (*Sylvia communis*), magpie (*Pica pica*) and carrion crow (*Corvus corone*) dominate. Buzzard (*Buteo buteo*), hoopoe (*Upupa epops*), nightingale (*Luscinia megarhynchos*), red-backed shrike (*Lanius collurio*), black-headed bunting (*Emberiza melanocephala*), corn bunting (*Miliaria calandra*), quail (*Coturnix coturnix*) have also been registered.

Near the residential areas house sparrows (*Passer domesticus*), common redstart (*Phoenicurus phoenicurus)*, goldfinch (*Carduelis carduelis* and *Carduelis chloris*) is met.

White wagtail (*Motacilla alba*)

Blackbird (*Turdus merula*)

Magpie (*Pica pica*)

Whitethroat (*Sylvia communis*)

Carrion crow (*Corvus corone*)

House sparrows (*Passer domesticus*)

Figure 7.3 Bird species in the area

The survey detected some amphibians and reptiles, such as marsh frog (*Rana ridibunda*) and Caucasus emerald lizard (*Lacerta strigata*).

Marsh frog (*Rana ridibunda*)

Caucasus emerald lizard (*Lacerta strigata*).

Figure 7.4 Amphibian and reptile species in the area

None of protected mammal species (Branst's hamster, grey hamster, common otter) known to be available in the region was met.

However, it must be taken into account that the floodplain of the River Mtkvari is an important site that supports a rich fauna, including marsh turtle, and is an aggregation area for migrating birds. Floodplains are also important spawning areas for many species of fish. Because this option brings traffic close to the river it increases the risk of ecological damage from the spillage of toxic materials (fuels, oil, etc) following accidents.

Main fish species observed in the river are: khramuli (*Varicorhinus capoeta*); Mtkvari barbel (*Barbus lacerta*). barbel (*Babrnus mursa*), Mtkvari under-mouth (*Chondrostoma*), black brow (*Acanthalburnus microlepis*), Mtkvari bleak (*Alburnus filippi*), spiny loach (*Cobitis taenia*), golden spiny loach (*Cobitis aurata*), Mtkvari gudgeon (Gobio *kurii*), Ginger gobi (*Neogobius cephalarges*), amur bitterling (*Rhodeus sericeus*), mosquito fish (*Gambusia affinis*).

7.6.1 Flora and fauna impact assessment: road construction

General impacts of roads and other linear structures on flora and fauna include the following:

- Removal of roadside vegetation;
- Soil compaction, sealing of soil surface;
- Death of animals caused by road mortality;
- Higher levels of disturbance and stress, including that related to noise;
- Reduction or loss of habitat;
- Barrier effect, reduced connectivity;
- Subdivision and isolation of habitats and resources, breaking up of populations;
- Reduction of habitat below required minimal areas, loss of species, reduction of biodiversity;
- Indirect impact from dust, particles; oil, fuel, etc.
- Impact of water pollution on aquatic life;
- Impact on aquatic life caused by construction of bank protection structures – loss of established habitat.

Spoil material from road cutting can kill vegetation on disposal site and add to slope stability/erosion processes leading to additional damage of productive soil and vegetation next to disposal sites if not managed properly.

Loss of the slope stability may entail further loss of vegetation through continuous loss of soil substrate, which again may negatively affect the river habitats.

The project will affect farmland, vegetation in the ROW of the bypass section and trees along the road. In the RoW of the Gomi bypass section 760 Pine trees, 350 Poplars and 380 units of other mature trees including willow, etc

have been registered , In total - 1490 trees (girth diameter >0.08m) and bushes (girth diameter <0.008m)[5]. Of these vegetation worth to mention are 20 centennial Poplar trees next to the Gomi spirit and alcohol factory.

The impact may be mitigated by replanting (planting 3 tree [the same species as the cut ones] to compensate the loss of one), but first of all unjustified damage to vegetation must be avoided. Access roads, the equipment/machinery stationing yard, and the camp must be established with maximum caution so as to preserve the vegetation/trees.

Safety requirements must be taken into account while planting, so that the trees do not block the view, have acceptable diameter when mature while they are planted in certain locations and their canopies do not reach over the road.

An effective windbreak should have at least two rows of evergreen trees, but using more rows may be even more effective. Depending on the tree species, the trees may be planted at least 2.4 metres apart; planting closer together may require cutting down the trees after 5-10 years to allow natural growth of the others . To maximize efficiency and minimize wind damage to the trees, the outer rows should be trees or shrubs that grow lower to the ground, with the tallest plants in the middle. To provide a windbreak year-round, the tallest row must be of coniferous trees. The rest may be a mixture of deciduous and coniferous trees. The space between deciduous trees must be 2.4 to 3.6 metres, while evergreens may be spaced by 1.8 to 4.3 m. The shrubs may be between 0.9 to 1.8 m apart within a row. If several rows are planted, 3.6 m may be left between the rows, except when planting large deciduous trees, which require 6 metres between rows.

The roadside vegetation zones and roadside plants which act as shelter for birds and small mammals are also attributed to sensitive areas. In the ‘edges’ of the road hamsters and turtles may be encountered.

Generally speaking the roads are considered as a barrier for some mammals, reptilians and amphibians, both during construction and operation. Other impacts associated with roads/highways are noise and vibration having potential to disturb land and avian species.

Dust is generally considered as an impact worth mentioning. It is assumed that dust deposited on the plants in the road impact zone affects food base of the vertebrate and invertebrate species.

[5] Uprooted and cut trees less than 0.08 m diameter in girth, bushes, roots, shall be disposed at appropriate locations. Trees more than 0.08 m diameter in girth shall be cut, twigs removed, trees shall be transported at locations appointed by the Engineer and stored. Treesare proberty of the Employer. Roots and stumps shall be disposed at appropriate locations. Cut trees handling procedure – to be followed.

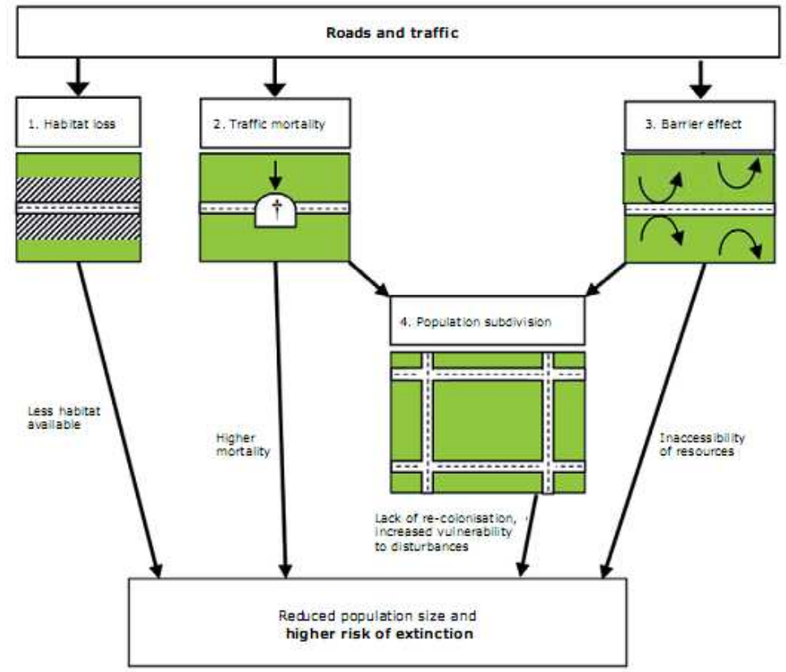


Figure 7.5 Four main impacts of transportation infrastructure on fauna
Note: Both traffic mortality and barrier effect contribute to population subdivision and isolation.
Source: From Jaeger et al., 2005b. Reproduced by permission of Elsevier.

An immediate impact related to the construction and operation of roads is noise from construction equipment, and heavy traffic. Animals respond to noise pollution by altering activity patterns, and with an increase in heartbeat and production of stress hormones. Birds and other wildlife that communicate by auditory signals may be confused near the road construction sites.

Heavy metals, carbon dioxide, carbon monoxide and dust emitted during earthworks may all have cumulative effects. The contaminants may be carried far from roads by wind and runoff and add to the negative impact related to construction near/in the riverbed.

Works within wet areas or on watercourses may negatively affect fish habitats and disturb riparian vegetation and soils that are essential to support aquatic habitats. The impact of construction activities in the riverbed or in immediate vicinity to it on aquatic ecosystems of the rivers/streams close to the highway, such as water pollution and increase of water turbidity will occur. Pollution with spilled fuel/oil, poorly managed waste or contaminated wastewater can be a problem. The site survey did not reveal any burrows in the section of the river bank where arrangement of protection structure is planned.

Construction activities adjacent to unstable slopes may cause landslides and mudflow affecting water environment. Similar impact may have spoil if not handled properly.

The following measures for mitigation of impact on the flora and fauna are suggested:

- Boundaries of RoW and operation area, including traffic routes during construction must be strictly kept to avoid impact on 'adjacent'vegetation;
- Vegetation must be preserved as far as feasible;
- Lost vegetation must be 'replaced' by triple amount of the same species replanted in the area;
- Stockpiles of excavated soil must be properly designed and managed;
- Special attention should be given to the avian fauna in the spring-summer (April to July), the season most sensitive for birds;
- Construction in/near the riverbed should be avoided in the fish spawning season (June-September); Noise and vibration level should be reduced by means of securing proper technical maintenance of machinery/vehicles, adherence to no horn policy, strictly keeping to the stationing/operation ground during the construction and operation;
- Dust reduction measures should apply, such as covering materials, removed topsoil and waste to avoid wind erosion and spreading around; restriction of the speed of trucks delivering materials to the construction ground, covering friable material with tarpaulin during transportation, avoiding high dumping of materials during unloading. If required, the ground (machinery stationing, camp site) should be watered to avoid generation of dust;
- Spoil disposal sites must be arranged not closer that 50m from the active riverbed;
- Boundaries of RoW and operation area, including traffic routes during construction must be strictly kept to avoid impact on vegetation;
- Stockpiles of excavated soil must be properly designed and managed;
- Special attention should be given to environmental safety during the construction in and near the riverbed. Hazard incurring operations (fuelling, servicing of cars/machinery) should be carried out in not least than 100m from the surface water body;
- Proper management of waste, including domestic, should be followed, waste dumping into the river or scattering around should be excluded. The site for temporary storage of waste should be selected in not least than 100m from the surface water body;
- The fuel/oil storage should be equipped with adequate secondary containment (impermeable cover of the area, and the containment of suf-

ficient capacity to avoid pollution of soil/water outside the berm and/or washing it off by the runoff);

- Spills should be immediately cleaned up to avoid spreading of pollution;
- Trenches or pits, if made, should be fenced or protected to avoid entrapping and injuries of the fauna species. Bright coloured ribbons may be used for big animals (e.g. cattle), while metal plastic and other shields/fences may be used for small animals. If, despite of the mentioned precautions, small animals turn to be entrapped, upon completion of the shift, planks or medium size twigs must be made available for the animals to escape from the pits/trenches after the night. Pits and trenches must be checked prior to filling up.

The construction impact will be temporary. The scale of impact may be reduced by means of organizing the works with due consideration of environmental safety requirements and mitigation measures recommended above.

Ranking of impact is given in Section 9.3.

7.6.2 Flora and fauna impact assessment: road operation

No direct impact on flora is expected during operation of the highway. Indirect impact can be related to dust and exhaust emissions from traffic and contamination via contaminated runoff from the road. Pollutants washed off from the road can impair growth of vegetation and affect soil organisms.

Main impacts on fauna during operation in general may include:

- Death of animals caused by road mortality;
- Higher levels of disturbance and stress, including that related to noise;
- Barrier effect, filter effect to animal, including fish, movement (reduced connectivity);
- Modifications of food availability and diet composition (e.g. reduced food availability for bats due to the air temperature change along the road embankments at night);
- Modification of humidity conditions (e.g. lower moisture content in the air due to higher solar radiation, stagnant moisture on road shoulders due to soil compaction);
- Modification of light conditions;
- Modification of wind conditions;
- Indirect impact from dust, particles (abrasion from tyres and brake linings); oil, fuel, etc. (e.g. in case of traffic accidents), including chronic contamination because of bioaccumulation;
- Impact on aquatic habitats along the bank protection structure;

- Impact on aquatic life as a result of siltation during construction;
- Alternation of flood cycle and water level which in its turn affects on water biodiversity;
- Impact of bank protection structures on hydrology resulting in flooding of unprotected areas (impact on soil and vegetation) on another bank of the regulated stream.

As mentioned above, immediate impact related to operation of roads is noise from heavy traffic. The birds and other wildlife that communicate by auditory signals may be particularly confused near roads. In general animals may adapt to increased noise levels, and apparently resume normal activity.

Pollutants such as heavy metals, carbon dioxide, and carbon monoxide, emitted by vehicles, may all have serious cumulative effects. Combustion of petrol containing tetraethyl lead, and wear of tyres containing lead oxide, result in lead contamination of roadsides. Many studies documented increasing levels of lead in plants with proximity to roads, and with increases in traffic volume. Plant roots take up lead from the soil, and leaves take it up from contaminated air or from particulate matter on the leaf surface. The lead then moves up the food chain, with sometimes toxic effects on animals, including reproductive impairment, renal abnormalities, and increased mortality rates.

The impacts of other heavy metals, such as zinc, cadmium, and nickel are less known. Motor oil and tyres contain zinc and cadmium; motor oil and gasoline contain nickel. These metals, like lead, were found to increase with proximity to roads, with increasing traffic volume and decreasing soil depth. Earthworms were found to accumulate all these metals, in concentrations high enough to kill earthworm-eating animals. These roadside contaminants may be carried far from roads by wind and water.

Impact of roadside litter is also to be mentioned. Poorly managed waste may attract and entrap small animals, while cigarette butts and filters are often mistaken for food by fish and birds.

Part of the new alignment will practically follow the existing one. The Gomi bypass section will run next to the residential area, which enabled to assume that the fauna to some extend has already adapted to presence of people and noise. Widening of the road will not affect the established balance significantly.

No significant habitats have been registered within the new alignment area. Construction of the bypass will cut off the village from the river. This may have some impact on cattle which used to move freely in the area. To reduce impact cattle passage, undercrossings, will be installed. These structures may be used by other animal species as well. To reduce a risk of road kills in critical locations barriers must be installed. Providing long sight limits can be considered as another mitigation measure for collision risk.

The design of the bank protection structure - riprap - is less 'stressful' for aquatic life compared to the concrete. The 'texture' provide natural environment and favourable conditions for aquatic biodiversity.

The roadside vegetation will be re-established after completion of the construction, so within a few years animals/birds and bats may return to familiar surroundings.

Preserved, planted vegetation , in addition to creating attractive groundcover, will serve various functions, such as:

- *Screen headlight glare*. Vegetation may shield headlight glare of oncoming traffic.
- *Buffer noise*. Vegetation may be used in combination with berms and barriers to block road noise from the surrounding environment. Very dense, wide and high plants will offer some noise reduction, but will not approach the sound blocking capacity of a built wall. Obscuring the source of the noise from view may often reduce awareness of the problem, providing some psychological benefit even though actual noise levels may not be affected.
- *Indicate change in direction.* From a distance, the trees will be viewed as a solid mass helping the driver to anticipate a turn in the road.
- *Control drifting snow*. Mass plantings of trees and/or shrubs are very effective for controlling drifting snow.
- *Integrate the roadside landscape into the surroundings.* Plants may mitigate the impression of the landscape disturbance.
- *Contribute to the health and diversity of the regional environment.* Plants may enrich the value of roadsides to the wildlife.

Ranking of impact is given in Section 9.3.

7.7 Impacts on geology

7.7.1 Geology impact assessment: road construction

Road is located in earthquake zone, no other geo-hazards known. Construction is related to a certain amount of earthworks (the construction of road embankments, underpasses, bridges and intersection), the probability of landslides and other mass movements in road cuts, erosion from fresh road cuts and fills, and sedimentation of natural drainage channels must be taken into account. Special attention should be given to the river crossing areas (bridges). The bypass is next to the floodplain of the River Mtkvari – must to be considered.

The principle impact that highway development projects have on the natural geologic erosion process includes temporary exposure of disturbed soils to precipitation and to surface runoff. The soil exposure and the resulting reshaping of the topography may create situations when detrimental erosion and sedimentation temporarily occur.

The two factors that have the greatest impact on the slope stability are the slope gradient and the groundwater. Generally, the greater is the slope gradient and the presence of the groundwater, the lower is the stability of a certain slope regardless of the geologic material or the soil type.

The erosion of embankments and river terrace slopes as a result of highway construction activity may have serious environmental impacts, including:

- pollution of surface water,
- damage to adjacent land, and
- degradation of streams and of the aquatic habitat.

In general the process may be controlled by:

- selection of a reasonable embankment height and stabilization of the slopes;
- establishment of temporary berms, slope drains, temporary pipes, contour ditches, ditch checks, diversions, sediment traps etc.

Culverts used in the road, bridge and berm construction are to prevent flooding and washing out of roads. They also minimize erosion, build-up of standing water, and provide pathways for run-off.

Some of the problems and solutions are listed below:

Problem	**Solution**
When the runoff is allowed to flow down an excavated slope, the risk of erosion is high.	A combination of diversion ditches and slope blankets may be considered.
The outer surface of a fill is usually less compact than the rest of it. In wet weather, the moisture content of the outer layer will increase and the slope of adequate stability may fail in dry conditions.	Compaction, use of temporary shields
Bridge end fill slopes often suffer from the effects of concentrated flow, either running off the deck or from the deck drains.	Blocking the surface drains on the bridge temporarily, until vegetation becomes established, in the meantime collecting the water in a controlled manner at the end of the deck or placing water impact protection such as sufficiently large pads of rockfill under the drains.

Cut slopes can be stabilized by hydroseeding,

Ranking of impact is given in Section 9.3.

7.7.2 Geology impact assessment: road operation

The operation impact is less likely to occur, as the design is developed based on results of extensive geotechnical and engineering geological surveys implemented under design stage of the project.

Bank protection structure will ensure safety of the road structure and favour to bank protection.

Ranking of impact is given in Section 9.3.

7.8 Impacts on soils

Evaluation of adverse impacts on soil and soil pollution was performed according to the Georgian laws and regulations (the law applicable to the largest extent is the Law on the Soil Protection, 1994 (amended in 1997 and 2002).

The road section from Agara – Zemo Osiauri section of the highway lies on the Kartli Plain. Influenced by both, geologic and anthropogenic changes, the plain predominantly consists of arable land with little natural vegetation. The soils in this region are relatively fertile. Most of the land is subdivided into small plots, which are primarily individually-owned and occupied by orchards, vineyards, vegetable gardens, corn fields, hay and some overgrown secondary meadows.

The sample analysis revealed that concentration of all metals is below relevant maximum allowable concentrations adopted in the EU.

7.8.1 Soil impact assessment: road construction

Loss of the vegetative soil layer along the road section will inevitably occur, and soil properties will be changed to form sub-grades along the route, resulting in the loss of soil productivity.

The road construction impact on the soil will mainly relate to organizing and operating the camps/machinery stationing and operation grounds, spoil disposal site, risk of fuel/oil spills from vehicles and/or fuel storage (if available on the camp site/building ground), erosion due to modification of natural conditions.

The primary effect of roads is that on the topsoil. Amount of topsoil removed for construction always amount to significant value. In addition to the loss of the topsoil if is not stripped prior to construction, impact on soil productivity outside the RoW can be affected by excessive ramming.

In order to avoid or mitigate impact (accidental fuel/oil spills, poor management of waste, polluted runoff.), the operation ground must be established with consideration of environmental safety measure, as presented below:

- Ground clearance must be minimized;
- To avoid loss of the productive soil layer, all suitable topsoil and other material shall be saved and stockpiled separately for the future reculti-vation of the area ;
- To preserve the quality of the topsoil it must be removed so not to mix with the subsoil;
- Topsoil and subsoil must be stored separately until reuse. (The topsoil removed from the new road alignment and from the area used for wid-ening of the road may be handed over to the local municipality for soil quality improvement);
- To ensure stability, the soil piles shall not be higher than 2 metres. The piles must be placed and managed so to avoid erosion and wash-ing off. Drainage trenches around the piles must be provided.
- Soil compaction may be reduced by strictly keeping to temporary roads, camp/operation ground boundaries;
- Disturbed vegetation must be replanted immediately after construc-tion/disturbance stops;
- Any temporary fuel tank shall be located within not less than 100 m from the riverbed. The tank shall be placed in a covered area with berms or dikes to contain any spills. Any spill shall be immediately contained and cleaned up with absorbent materials;
- Onsite repairs /maintenance activities shall be limited. Priority shall be given to offsite commercial facilities. If impossible, a designated area and/or secondary containment for the on-site repair or maintenance activities must be provided. These areas shall be located away from drainage channels and surface water bodies (the maintenance/fuelling site shall be within not less than 100 m from the river);
- On-site vehicles and equipment shall be inspected regularly for leaks and all leaks shall be immediately repaired. Incoming vehicles and equipment shall be checked for leaks. Leaking vehicles/equipment shall not be allowed on-site;
- Secondary containment devices (drop cloths, drain pans) shall be used to catch leaks or spills while removing or changing fluids from vehi-cles or equipment. Drip pans or absorbent materials shall be provided. On small spills absorbent materials shall be used;
- Fuelling off-site shall be encouraged. If required, designated areas for on-site fuelling shall be located away from drainage courses and sur-face water bodies; (the maintenance/fuelling site shall be within not less than 100 m from the river)

- Use off-site vehicle wash racks (commercial washing facilities) are preferable. If on-site cleaning is necessary, bermed wash areas for cleaning activities shall be established. The wash area may be sloped to facilitate collection of wash water and evaporative drying;
- Materials and waste shall be stockpiled so as to avoid erosion and washing off into the river. Drainage trenches shall be arranged to divert surface runoff from the site;
- Waste collection area must be sited so as not to receive a substantial amount of runoff from upland areas and not to drain directly to a water body;
- In case of the fuel/oil spills risk, an oil trap shall be additionally provided;
- Adequate training on environmental protection and safety shall be provided to the staff;
- No fly tipping policy shall be followed;
- Education/awareness rising of the community shall be provided.
- Only waste water cleaned up to established norms (TPH 0.3 mg/l and suspended particles 30 mg/l) can be discharged on the relief.
- Receiving area must not be prone to erosion. It is advisable not to drain water to the area where crops are cultivated.

To reduce amount of surplus subsoil and impact of the permanent stockpiles on environment, ways for beneficial use of this material must be found. Use of the surplus subsoil as a ballast by the nearest landfills (Agara, Khashuri) can be an option.

In the construction stage the responsibility for soil protection from pollution rests with the contractor.

Ranking of impact is given in Section 9.3.

7.8.2 Soil impact assessment: road operation

The road operation is usually related to soil pollution by heavy metals in a narrow band on either side of the road. Pollutants settling in soil within the RoW can impair vegetation growth increasing risk of erosion. Impact on soil may result from blockage of the drainage system which can cause flooding and/or erosion of soil.

Another impact – is pollution with litter.

The impact on soil during operation is more difficult to manage as the sources of impact in this stage are the “users” of the highway.

Impacts may be partly mitigated by awareness raising and education of the community. The establishment of the rest/service facilities with consideration

of environmental requirements may also contribute to the reduction of soil pollution with waste.

To avoid impact on erosive flow on the soil or flooding - blockage of drainage system must be avoided.

Phytoremediation may be considered as a measure for reduction of soil contamination.

Ranking of impact is given in Section 9.3.

7.9 Impacts on the landscape

The road will have impact on the local landscape. The new section will 'deviate' from existing alignment and bypass the residential area (Gomi). The new road corridor will cross some agricultural land and run along the Mtkvari riverbed with limited expected impact on flora and fauna Construction works will require certain amount of clearing within the RoW. The impact may be rated a medium impact on the landscape.

The overall impact on the new road section on the landscape will be adverse and permanent, but not significant.

With due consideration of the background status and the view and prior to the development, the roadside revegetation options, wherever appropriate, should be provided to reduce the landscape impact.

Planting and landscaping of the roadsides is generally considered as an efficient way of restoring, sometimes improving aesthetic views of the area. At the same time plants along the roadside may act as windbreaks providing protection of farmland in the impact area. Planting with vegetation will also support wildlife by creating habitats. (Planting with native plants is preferable).

The following aspects must be taken into account:

The minimum clear zone (an area for drivers of errant vehicles to regain control after running off the road) distance for high speed highways is estimated as 9m. Clear zone distances larger than 9 m must be provided at other locations such as the outside of horizontal curves, near ramp intersections, at points of congestion or where evasive manoeuvres may be required.

Large trees may be planted within 9 m distance where they will not constitute a fixed object[6]; for example, on cut slopes above a retaining wall, behind the existing barrier curbs (0.6m behind) or in areas behind the existing guardrails (0.4m behind). Trees may be planted behind barrier curbs if the road speed is sufficiently low so as to prevent cars from mounting the curbing. Design exceptions may include:

[6] A single tree with a trunk diameter larger than 0.1m is considered a fixed obstacle.

- locations where the cumulative loss of trees would result in a significant adverse change in character of the roadside landscape;
- landscape, park, recreation, horticultural, residential or similar areas where trees and other forms of vegetation provide significant functional and/or aesthetic value;
- where absence or removal of trees would adversely affect rare/endangered/threatened species (plant or animal), wetlands, water quality or result in serious erosion/sedimentation effects.

For planting trees closer along roadways, other considerations should include potential maintenance problems of roadway shading, leaf or other tree debris litter, etc. In areas of the right of way that are not impacted by limitations of the clear zone, naturalistic plant growth shall be encouraged.

Lines of sight - Plants should not interfere with the effective sight distance limits for stopping, passing or making manoeuvres at intersections. Low-growing plants of 5.5 m or lower may be planted in the sight line area as long as other requirements for sight distance are met. Taller growing plants are to be placed beyond these calculated sight line setbacks.

In the cases where an existing facility does not already provide adequate sight distance because of geometric restrictions, no further reduction will be allowed. Locations, such as the inside of curves, inside interchange loops and median shoulders shall be kept clear and the designed sight distance shall be kept.

During the construction visual landscape impacts will be temporary and low.

Impact from permanent structure (road) during operation will have no impact within the section where the road is being widened. In the new section the change can be ranked as low to medium.

Ranking of impact is given in Section 9.3.

7.10 Socio-economic impacts

7.10.1 Socio-economic impact assessment: road construction

Road construction will have both, negative (such as dust, noise, loss of roadside businesses and land/harvest) and positive impact (temporary employment) from social-economic standpoint.

Issues related to the involuntary resettlement, including land take, are covered under the Resettlement Action Plan (RAP) developed by EPTISA – a consultant to the RD.

Construction activities for the road section under consideration will entail land acquisition and resettlement (LAR). To satisfy WB OP 4.12 requirements related to resettlement/land acquisition issues the RAP

document has been developed by Eptisa Servicios de Ingenieria, S.L.team. Due considerations have been given during the design of the road widening alignment and intersections layout to minimize the adverse impacts of land acquisition and involuntary resettlement. Efforts have been put to incorporate best engineering solution in avoiding large scale land acquisition and resettlement.

Due to the variability of the embankment and median zone width, effective width of the impacts corridor was assumed to vary between 22 and 29 m along the RoW and from 50 to 138 at the intersection sites. For the subsections where entirely new road is constructed -53 to 70m impact corridor of the RoW was considered.

The survey revealed that impacts along these road sections will entail acquisition of 933,906 sq.m of land from 445 plots divided in terms of tenure type as follows:

- **Category 1**. 56 titled private land plots with full registration 113,021 sq.m;
- **Category 2.** 199 titled private land plots 259,341 sq.m rightfully owned and requiring legalization through 1 stage process of registration in NAPR (legalizable land plots). These land plots have been transferred to the owners during the land reform but the formal procedures needed for registration in NAPR have not been completed.
- **Category 3.** 190 State owned land plots of 561,544 sqm not used by private users. Most of these land plots belong to the existing road infrastructure and the rest part constitutes adjacent wind belt zone. Category 3 land parcels are not subject for compensation. There are no public land plots in the affected area used by leaseholders or illegally ocupied by squatters.

Given the magnitude of impacts (there are 259 AHs, 188 severely affected APs and one relocated resident) the project under this RAP is classified as “A” for resettlement. .

Table E.1 Summary Impact on Land Acquisition and Resettlement

No.	**Impacts**	**Unit**	
Land Tenure Patterns			
1	**Total Land parcels affected**	**No.**	445 plots
2	**Total land Area to be acquired**	**Sqm**	933,906
3	**Category 1**. Private Registered Plots	No.	56
		sq.m	113,021
4	**Category 2.** Private (Rightfully owned) Legalizable through NAPR (1 stage legalization)	No.	199
		sq.m	259,341
5	**Category 5.** State Owned Not Used by Private Users	**No.**	190
		Sqm	561,544
Land Use and Compensation Categories			
6	**Type 1**; Private agricultural (**remote from the existing section of highway**) (3 Gel/sq.m)	No.	132
		sq.m	144,488

7	**Type 2**; Private agricultural (**located along the existing section of highway)** (4 Gel/sq.m)	No.	118
		sq.m	185,325
8	**Type 3**; Private non-agricultural land used for commercial needs (4 Gel sq.m)	No.	5
		sq.m	42,549
9	**Type 4; Non-agricultural State Owned (not used by private users)**; not compensable	**No.**	190
		Sqm	561,544
Agricultural Patterns			
10	Area under wheat cultivation	sq.m	262,588
11	Area under maize cultivation	sq.m	57,390
12	Area under vegetables cultivation	sq.m	8,835
13	Affected Trees [636 apple (27 AH); 13 walnut trees (4 AH)]	No	**649**
Affected Structures			
14	Compelx of Gas Filling Stations (7 buildings, 1 dead-end railway track and 1 fence)	No.	1
15	Old Farm	No.	1
16	Residential House (with 3 ancillary buildings)		1
17	Fencing/Walls	No.	2
		sq.m	600
Affected Businesses			
19	Gas Filling Station (operation income)	No.	1
Affected Households			
21	Severely affected Households	No.	188
22	Vulnerable Households	No	57
23	Resettled households	No.	1
24	AH with registered plots	No.	56
25	AH with legalizable plots (rightful owners, 1 stage registration through NAPR)	No.	196
26	AH with agricultural land plots	No	247
27	AH with non-agricultural (commercial) land plots	No.	5
28	AH losing Jobs	No	7
	Total AH		259
29	Total Affected Persons	No	1011

Type of Loss	Application	Definition of APs	Compensation Entitlements
Land			
Permanent loss of agricultural land	AF losing agricultural land regardless of impact severity	Owner with full registration	Cash compensation in cash at full replacement cost or replacement land of same value of land lost and at location acceptable to APs where feasible. The option selected for the Program is cash compensation. If residual plots becomes unusable the project will acquire it in full if so the AP desires.
		Legalizable Owner	These AP will be legalized and provided with cash compensation at full replacement cost.
		Informal Settlers/ APs with no registration/valid documentation	One time self-relocation allowance in cash equal to 12 months at minimum subsistence income[7] .297GEL per 1 month x 12 months=3564 GEL x AH).
Non-Agricultural Land	AF losing their commercial/ residential land	Owner with full registration	Cash compensation at full replacement cost or replacement land of same value of land lost and at location acceptable to APs where feasible.
		Legalizable Owner	APs will be legalized and provided with cash compensation at full replacement cost..
		Renter/Leaseholder	Rental allowances in cash for 3 months
		Informal Settlers/ APs with no registration/valid documentation	One time self-relocation allowance in cash equal to 1 year at minimum subsistence income 297GEL per 1 month x 12 months=3564 GEL x AH.
Buildings and Structures			
Residential and non residential structures/assets		All AFs regardless of legal ownership/ registration status (including legalizable and Informal Settlers)	All impacts will be considered as full impacts disregarding the actual impact percentage. Impacts will be compensated in cash at full replacement costs free of depreciation and transaction costs.
Loss Of Community Infrastructure/Common Property Resources			
Loss of common property resources	Community/Public Assets	Community/Government	Reconstruction of the lost structure in consultation with community and restoration of their functions
Loss of Income and Livelihood			
Crops	Standing crops affected or loss of planned crop incomes**	All AFs regardless of legal status (including legalizable and Informal Settlers)	Crop compensation in cash at gross market value of actual or expected harvest. Compensation for this item will be provided by default both if the crops was harvested or not at time of impact
Trees	Trees affected	All AFs regardless of legal status (including legalizable and Informal Settlers)	Cash compensation at market rate on the basis of type, age and productive value of the trees.
Business/Employment	Business/employment loss	All AFs regardless of legal status (including legalizable and Informal Settlers)	Owner: (i). (permanent impact) cash indemnity of 1 year net income; (ii) (temporary impact) cash indemnity of net income for months of business stoppage. Assessment to be based on tax declara-

[7] Minimum subsistence income to be calculated based on a 5 people family and the monthly-updated benchmarks indicated by the National Statistics Office of Georgia at time of RAP approval

			tion or, in its absence, minimum subsistence income. Permanent worker/employees: indemnity for lost wages equal to 3 months of minimum subsistence income.
Allowances			
Severe Impacts	>10% income loss	All severely affected AFs including informal settlers	Agricultural income: 2 additional crop compensation covering 1 year yield from affected land. Other income: 1 additional compensation for 3 months of minimum subsistence income. 297 GEL per month x 3 months=891 GEL per AH)
Relocation/Shifting	Transport/transition costs	All AFs to be relocated	Provision of allowance covering transport expenses and a livelihood expenses for the transitional period for 3 months equal to 3 months of minimum subsistence income. 200 GEL as vehicle hire charge + 297GEL as minimum subsistence income x 3 months = 1,091 GEL per AH
Vulnerable People Allowances		AFs below poverty line, headed by Women, disabled or elderly	Allowance equivalent to 3 months of minimum subsistence income[8] and employment priority in project-related jobs 297 GEL as minimum subsistence income per month for 3months= 891 GEL per AH)
Temporary Loss			
Temporary impact during construction			
Unforeseen resettlement impacts, if any			

Road construction will not affect any community or public property.

The project impact extends to 1011peoples comprising 53% male and 47% females: 521 male and 462 females. Further, 10 of the 252 AHs are headed by women. 57 households indetified as vulnerable include

Category of vulnerability	**No. of AHs**
Extremely Poor AHs (rating below 57000 receiving subsistence allowance)	50
Poor AHs (rating more than 57000 and below 70000 receiving insurance policy)	7
Female headed AHs with low income and dependents	10[9]
Total	57

[8] Income expected from crops on affected agricultural land permanently used for crop cultivation during the recent years. In case if the land was permanently used for crop cultivation, but for the year, when the inventory of losses was conducted, no crops have been planted (due to need of rest to this land or illness of the farmer or any justifiable reason), the land parcel still will be considered as designed for crop cultivation and relevant compensations will be paid

[9] 7 of the female headed AH is extremely poor (subsistence allowance) and 3 are poor (insurance policy). These 10 AHs are already counted as vulnerable

The project will primarily affect Georgian people which are almost 99.9% of the total affected population. Some insignificant in number ethnic minority groups is also present in the program area. These groups are fully integrated into the Country institutional, cultural, and economic processes, and they do not fit the Indigeneous people definition of WB. Expropriation of land through eminent domain will not be applied unless approach for acquisition through negotiated settlement fails. Compensation eligibility is limited by a cut-off date as set for this project on the day of the beginning of the AP Census which is 15 December 2012.

APs will be entitled for compensation or at least rehabilitation assistance under the Project are (i) all persons losing land irrespective of their title, (ii) tenants and sharecroppers irrespective of formal registration, (iii) owners of buildings, crops, plants, or other objects attached to the land; and (iv) persons losing business, income, and salaries. A summary entitlements matrix is included in Table E-2.

Table E-2. Compensation Entitlement Matrix

RD has responsibility implementation of the RAP through the Resettlement Unit (RU) under the Roads Development and Resettlement Division in RDMRDI. A Land Acquisition and Resettlement (LAR) Commission (LARC) will be assisting RU in all LAR activities and RU will be represented at the field by a Working Group comprising the legal, economics and engineering expertise from other departments of RDMRDI. In addition, RU will be assisted by LAR Team in the rayon level involving also the local self-government bodies. Transport Reform and Rehabilitation Centre (TRRC) has been formed as an independent body for financial management of World Bank financed projects. In addition, a number of other government departments will play an instrumental in the updating and implementation of RAP-I. The National Agency of Public Registry (NAPR) within the Ministry of Justice will be assisting the Project through registration of land ownership and its transfer through purchase agreement from landowners to the RDMRDI. The local government at Rayon and village level will also be involved.

The designated official from RU was also an active member in leading role during the census survey. RU staff and local level LAR Team members were informally trained during the feasibility study. Members of LAR institutions will be trained prior to the implementation of RAP-II under the ADB RETA or similar WB programs for capacity building of RU staff and its field operatives.[10]

A grievance mechanism will be available to allow a AP appealing any disagreeable decision, practice or activity arising from land or other assets compensation. Grievance redress committees (GRCs) at local level involving

[10] Regional Technical Assistance Project RETA-7433 REG: Mainstreaming Land Acquisition and Resettlement Safeguards in the Central and West Asia.

the local government officials, representative of APs, representative of local NGOs and consultant. APs will be fully informed of their rights and of the procedures for addressing complaints whether verbally or in writing during consultation, survey, and time of compensation. Care will always be taken to prevent grievances rather than going through a redress process.

Consultation with likely APs in the project affected areas was conducted during the feasibility study of the Project (tranche 1) and preparation of draft RAP for section 2 in 2009. Specific to the section 2 of the project road in Khashuri Rayon, people were consulted through individual contact during the census survey under the feasibility study for identification of APs. At the preparation of RAP-II in detail design stage, all likely APs (available on site) are consulted through community level meetings and through individual contact at the time of census, socioeconomic survey and detail measurement survey. The consultation process is currently ongoing and will be finsihed befor the apdate of the Final Draft RAP.

RAP-II requires legalization of the 199 land parcels for 196 legalizable owners of land parcels under acquisition which is in progress and negotiation with all legalized land owners and APs will take from mid April till first week of June of 2013.

Payment of compensation and cash allowances will be completed by end of June 2013. All activities related to the land acquisition and resettlement have been scheduled to ensure that compensation is paid prior to displacement and commencement of civil works. Public consultation, internal monitoring and grievance redress will be undertaken intermittently throughout the project duration. The resettlement cost estimate under this RAP is **7,089,014 GEL (USD 4,296,372).**

Land acquisition and resettlement tasks under the project will be subject to monitoring. Monitoring will be the responsibility of RDMRDI. Internal monitoring will be carried out routinely by RU/RDMRDI. The results will be communicated to the WB through the quarterly project implementation reports. External monitoring will be carried out on a regular basis, and its results communicated to RU/RDMRDI and Financing WB through quarterly reports. The RDMRDI (through external help) will carry out a post-implementation evaluation of the RAP-I Iabout a year after completion of its implementation.

Gender issues. The civil works contracts will include provisions to encourage employment of women during the implementation. Additionally, women headed households will be considered vulnerable and special assistance is provided in the land acquisition and resettlement plan.

Impact on socio-economical impact during construction is ranked as low,

7.10.2 Socio-economic impact assessment: road operation

Operation of the road will have both, negative and positive impact on community in the project area.

After shifting the traffic from existing road in the section crossing Gomi to the bypass - dust, noise and emission impact on the residents of the settlement will reduce. For the same reason – pedestrian safety in Gomi will improve. On the other hand, diversion of the traffic will affect businesses along existing alignment and roadside associated social activities. The main businesses along the current route which will be bypassed after diversion of the traffic from the settlement are two shops, two fuelling stations (most likely only one of the will be affected) and hotel/restaurant for transit truck drivers from Turkey. Another impact of the new alignment (bypass section) will be restriction of free access to the river for people and cattle. According to interviews with the local community potential restriction of access to the river in some locations will not be considered as significant impact as population is not using river resources a lot,

Faster traffic on the highway and median barriers will 'disconnect' the right and the left side properties in the section where the road is being widened. Even though construction of underpasses is envisaged, distance and time required to move from one side of the highway to another will increase.

High traffic on the highway will affect users of non-motorised transport (e.g. bicycles, bullock-carts). Increased traffic volumes and speed may result in a growing number of accidents and more serious injuries.

Two key health risks in relation to roads and traffic are accidents and air quality changes. Along with exposure to emissions from the traffic, health risk is also related to potential contamination of crops cultivated adjacent to the road.

Gender issues. Women will be affected by redirection of the traffic and slowdown of the businesses in Gomi as they account for majority of employed in these businesses (shops, hotel service, canteen). However, the project will equally impact the male employees.

Measures to reduce/mitigate impact on socio-economical environment during operation of the road include:

- arrangement of underpasses for people and animals;
- signs, barriers to reduce access of pedestrians to the carriageway;
- arrangement of alternative routes for non-motorized transport and pedestrians;
- arrangement of leisure zones along the route to support development of local businesses and businesses affected by diversion of the traffic from existing road;
- implementation of air quality deterioration mitigation measures – e.g. arrangement of plant barrier, preservation of existing vegetation.

Ranking of impact is given in Section 9.3.

7.11 Historical-cultural impacts

With consideration of potential sensitivity of the area chance find procedure must be put in place (see Annex 6). The works in the area should be supervised by an archaeologist.

There is no risk of operation impacts.

7.12 Protected territories

There are no protected areas in the project impact zone. This issue are not considered in the EIA.

8 Comparative evaluation of alternatives and identification of the preferred option

For the section of interest Feasibility study by Kocks Consult GmbH and regional environmental assessment by Nippon Koei UK considered alternatives (see Figure 8.1) which included:

- ***Widening the existing road*** (from Agara – Zemo Osiauri)
- ***Gomi Bypass North***.
- ***Gomi- Bypass South 1*** (Gomi Area)
- ***Gomi- Bypass South 2*** (Gomi Area)

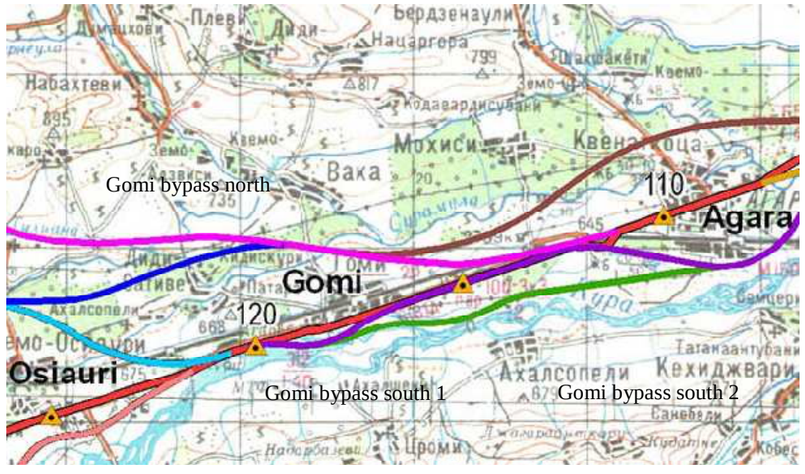


Figure 8.1 Alternatives – Gomi bypass of E-60 Highway.

Gomi Bypass North would start from existing road west to Agara bypass and continue north westwards in direction of village Vakha bypassing Gomi. Considering the impact of the northern alternative on the agricultural (private) land and the negative attitude of the regional stakeholders on land needs of the most productive soils alternative was recommended to be excluded from further evaluation.

A Gomi Bypass South 1 alternative to bypass Gomi was developed to avoid impacts on the agricultural land north of the existing road. The southern alternative would branch off from the west of Agara, bypass Gomi from the south

and join again the existing road. The section runs parallel the Mtkvari River and needs arrangement of bank protection.

Gomi Bypass South 2 was developed in order to straighten the south alternatives for bypassing Agara and Gomi by connecting directly the proposed southern bypass of Agara with the proposed southern bypass of Gomi. This alternative would shorten the south alternatives by about 0.5 km and would minimise land acquisition, since most part of the alignment is located within the Mtkvari river basin. Alternative runs close to the Mtkvari River and would require additional measures to protect the road from flooding. This option is less attractive than the south alternative 1, as the section running close to the river is longer. Alternative was therefore not recommended for further evaluation.

Widening of the road without bypass. The option is not feasible because of the safety and need of resettlement.

Relying on the information given above the EIA report includes analysis and comparison of three options: **”zero" alternative (**assuming that the project is not implemented); **Gomi Bypass North, Gomi Bypass South 1 and Gomi Bypass South 2**.

Zero alternative means no impact on biophysical and social environment at all, however, with consideration of the fact that the section is a part of the East-West Highway E-60 which is being upgraded, consideration of this alternative is not reasonable.

Brief evaluation of alternatives is given overleaf (Table 8.1).

Table 8.1 Comparison of alternatives – Gomi bypass section

Criteria	Alt 0 Zero Alternative	Alt N Gomi bypass North	Alt S1 Gomi Bypass South1	Alt S2 Gomi Bypass South 2	Comparison			
					Alt 0	Alt N	Alt S1	Alt S2
Potential flood risk	No impact	No impact	Part of the road - Gomi bypass - is located in the Mtkvari floodplain. Measures against flooding of the roads /bank protection is required	Part of the road - Gomi bypass - is located in the Mtkvari floodplain. Measures against flooding of the roads /bank protection is required			-	-
Impact on traffic	Existing infrastructure will not be of sufficient capacity. Impact on traffic flows and safety	No impact on existing road and traffic – new alignment is being constructed	Temporary impact on traffic during widening of the road	No impact on existing road and traffic– new alignment is being constructed	-		-	
Earthworks volume	No impact	Alternative follows existing terrain with limited earthworks	Alternative follows existing terrain with limited earthworks	Alternative follows existing terrain with limited earthworks		-	-	-
Impact on agricultural opportunities and businesses	No impact	Significant impact north to Kvenadkotsa, Gomi, Khidiskuri and Zemo Osiauri	Limited impact on agricultural land since the road is located in the Mtkvari river basin	Limited impact on agricultural land since the road is located in the Mtkvari river basin		-	-	-
Land acquisition	No impact	Large private land plots will be affected	Limited impact on the private land. No resettlement require	Section is slightly longer than Slt2. Limited impact on the private land. No resettlement require		-	-	-
Natural environment	Increase of traffic will cause increase of noise, dust, emissions in the boundaries of the settlement	The new road crosses mainly agricultural land , impact on fauna, impact on landscape, loss of productive land	The new road corridor crosses some agricultural land and run close to the Mtkvari though developed area. Land clearance is required – i.e. impact on flora and fauna	The new road corridor crosses some agricultural land and run close to the Mtkvari though developed area. Land clearance is required – i.e. impact on flora and fauna. The section is longer than the Alt2, which means that impacted area is larger	-	-	-	-
Social environment	Increase of traffic will cause increase of noise, dust, emissions in the limits of the settlement., safety risks	Impact on the main source of income in the area – agriculture; fragmentation of land	Restriction of free accessibility of the river,	Restriction of free accessibility of the river - longer section compared to Alt 2	-	-	-	-
Impact in archaeologically sensitive areas		No archaeological sites within the direct impact zone of the project area known. Possibility of chance find is not excluded.	No archaeological sites within the direct impact zone of the project area known. Possibility of chance find is not excluded.	No archaeological sites within the direct impact zone of the project area known. Possibility of chance find is not excluded.				

Note:

negative impact

less strong negative impact

Taking into account the mentioned above and allowing for the mitigation measures suggested, widening of the section from Agara to Gomi bypass, by-pass and the section running north to existing road between Akhalsopeli and Osiauri (Gomi bypass South 1) is considered as preferable alternative.

9 Environmental Management Plan (EMP)

Information included in the EMP is synthesized from the main findings outlined in every chapter of the EIA report, i.e., all proposed mitigation and monitoring actions set to a timeline, specific responsibility assigned and follow up actions defined.

The EMP for the preferred alternative is presented in a table format and divided into three main parts, dealing with the physical environment, with the biological environment, and with the socio-economic and cultural environment. Each part is organized by development stages, i.e. pre-construction, construction and road operation.

The overall objective of the EMP is to bring the project into compliance with national environmental and social requirements and environmental and social policies of the lender.

The EMP links the mitigation measures into a comprehensive implementation scheme, designed to ensure action. It describes institutional responsibilities, compliance monitoring and reporting requirements, and cost for implementing the EMP, all in order to answer the “who?”, “how?” and “how much?” questions.

A set of mitigation measures, monitoring indicators and estimated costs of main mitigation activities is listed in Section 9.4 of this document.

The EIA and EMP will be made available for the bidders so that they can consider and incorporate their environmental responsibilities into their bid proposals.

9.1 Environmental management framework and policy

The Georgian environmental impact assessment (EIA) system is based on environmental legislation of Georgia. The laws Environmental Impact Permit and Ecological Expertise provide the framework for EIA in Georgia. The process is similar to that in European Union and on the whole meets requirements set in the International Financial Institutions’ (EBRD, World Bank, IFC) environmental and social safeguards.

Environmental impact permit is issued by the Ministry of Environmental Protection (MoE) following to consideration of application for an Environmental Impact Permit (EIP) submitted by the proponent. According to the national regulations the application includes Environmental Impact Assessment report, technical summary and other information. The application is subjected to review by experts. Conclusion of the review forms the basis of the permit decision.

World Bank Environmental Assessment policy (OP/BP 4.01) incorporates environmental impact assessment of projects, strategic environmental assessment of plans and policies, etc. The process involves screening to define the type and level of study/assessment and specifies approach. The OP4.01 is "supported" by other guidance given in variety of the guidelines.

The guiding principles on the environmental safeguards applicable to every stage of a project include: commitment to comply with all applicable environmental laws and regulations; commitment to the sustainable management/use of natural resources; commitment to manage the business activities so that any adverse effects on the local environment is avoided, remedied or mitigated.

9.2 Institutional framework

Roads Department of the Ministry of Regional Development and Infrastructure of Georgia (RD) is responsible for general oversight on environmental compliance of works through ensuring quality performance of the technical supervisor and of the contractor Presently general oversight on environmental compliance is a responsibility of Technical Policy Department of RD, however RD has prepared plan of reorganization that will be finalized and approved by the 1st of April 2013. The plan aims to establish new Environmental and Social Department that will consist of: Head of department, Deputy Head of Department, Head of Social Unit, Head of Environmental Unit, 6 Resettlement Specialists and 2 En-vironmental Specialists. (Additionaly, Environmental Consultant for World Bank Projects) the Environmental and Social Department is supposed to be more active addressing the issues deploying more effective control/monitor system.

Supervisor of works commissioned by RD is charged with responsibility to establish strong field presence in the project area and supervise the works. Along with ensuring consistency with the design and quality of works, the supervisor is mandated to track implementation of EMP by the contractor, reveal any deviations from the prescribed actions, and identify any environmental/social issues should they emerge at any stage of works.

Construction contractor is obligated to follow the EMP and good construction practice. Contractor must have one relevant specialist in the team in order to ensure compliance with the EMP, who is able to fully understand recommendations and professionally apply prescribed mitigation measures to the contractor’s daily operations.

The Contractor shall comply with the requirements of the Environmental Management Plan, the Health and Safety Plan, and the Traffic Management Plan developed by him for the Contract. After the contract is awarded, the Contractor is required to use the mobilization period to finalize in detail all his EMPs based on a detailed preconstruction survey and the EIA documents handed to him by the Employer. The EMPs have to be in accordance with the Contractor's finalized work/method statements and schedules.

According to the Technical Specifications, before commencement of works the Contractor shall develop and submit for approval by the Engineer a range of documents:

1. Dust management plan
2. Sewage management plan
3. Waste management plan
4. Soil Management Plan
5. Emergency response plan (in case of spills, accidents, fires and the like) prior to operation of the asphalt plant
6. Grievances mechanism
7. Method statement or plan for the execution of bridge construction works
8. Health and Safety Plan

9.3 Summary of anticipated environmental impacts

Issues to be considered on design and pre-construction phase

#	Description	Comments
1	Route selection	Risks/impacts related to geohazards prone sites; sensitive ecosystems; archaeology; landuse can be avoided by proper selection of the route.
2	Sitting alternatives for borrow pits, waste disposal areas, asphalt and concrete mixing sites, fuelling sites, camps, storage places and equipment yards.	Impact on air/water and landscape depends on proper sitting of the sites and facilities. This is to be considered by constructing contractor at the mobilization stage.
3	Interchanges and interception sites	Are considered in design in order to avoid interference on local transportation and access; and ensure safety of traffic.
4	Compliance with international design standards	Safety; efficiency of operations and maintenance
5	Nuisance	Noise and emissions related to traffic are tangible only in densely populated areas where the residential houses are located close to the road.

6	Bridges, viaducts and flood protection installations; drainage facilities, anti-erosion measures	Proper design ensures safety and reduces the risks of road destruction related to flooding, landslides, rock falls etc. Implementation of drainage systems is important for the maintenance and safety Temporary and permanent drainage systems, retaining walls, berms and embankments, design of anti-erosion engineering measures and reinstatement plan are important for minimizing erosion and secondary impacts: landscape degradation and increased sedimentation of watercourses, slow destruction of the highway pavement
8	Infrastructure elements.	At the design stage it is important to consider protection and reinstatement of infrastructure -electric power transmission systems, water supply and irrigation pipeline systems and channels.

Environmental and social impacts - construction

#	Potential Impacts	Severity	Sites
1	Destruction of natural landscape (relief, soil cover, vegetation, eco-systems, habitats and wildlife) in the right-of-way occupied by the highway.	Minor to medium	Whole alignment
2	Destruction of natural landscape (relief, soil cover, vegetation, eco-systems, habitats and wildlife) on the access roads, in the borrow pit sites, waste dumps, construction camps and equipment yards.	Medium	Borrow pit sites Waste dumps, Construction camps Equipment yards – to be defined at the preconstruction stage by the constructing contractor.
3	Erosion stimulated from fresh road cuts and fills and temporary sedimentation of natural drainage ways. Erosion of lands below the road bed receiving concentrated outflow from covered or open drains.	Minor to medium	Part of alignment, which passes hilly and mountainous landscape.
4	Increased suspended sediment in streams affected by erosion at construction sites and fresh road cuts, fills and waste dumps. Declined water quality and increased sedimentation	Medium	Bridge construction area, road section next to the river, bank protection area
5	Impact of construction activities on aquatic ecosystems of the river	Minor to medium	MkvariSuramula
6	Soil and water contamination during construction – spilled oil, grease, fuel, paint.	Minor	Water –Mtkvari, Suramula Soil – along the whole alignment; camps, equipment yards /concrete mixing sites
7	Poor sanitation/solid waste disposal in construction camps and work sites (sewerage, sanitation, waste management)	Minor to medium	Location to be defined by constructing contractor.

8	Construction wastes alongside the RoW, spoil; roadside litter.	Medium	Along alignment; at work-sites; spoil disposal areas
9	Air pollution from vehicle operations, dust.	Minor	Near the settlement
10	Air pollution from asphalt/concrete plants.	Medium	Supplier site
11	Noise from machinery/vehicle – traffic, local	Minor	Near the settlements
12	Poaching by construction workers	No to very mi-nor	Rivers, along the route
13	Creation of stagnant water bodies in borrows pits, quarries, etc. suited to mosquito breeding and other disease vectors.	Minor	Borrow pits, quarries
14	Recontamination by infectious biologi-cal materials during earth works near the pest holes (i.e. not registered An-thrax sites)	No to very mi-nor	Whole the new alignment
15	Health hazards by noise, air emis-sions/dust (vehicles, construction works)	Minor	Near the settlements
16	Impacts on archaeological sites	Minor to medium	Along the RoW
17	Hazardous driving conditions where construction interferes with existing roads.	Minor	Whole alignment Near the settlements
18	Impact on existing infrastructure	Medium	Near the settlements Section between Gomi and the river (transmis-sion line, water pipes, op-tical fibre cable replace-ment)
19	Traffic related accident risks	Minor	Whole alignment; Most sensitive sites are near the settlements
20	Economical displacement of people liv-ing on the right of way	Medium	Compensation

Environmental and social impacts - Operation

#	**Potential impacts**	**Severity**	**Sites**
20	Impact on landscape	Medium	Whole alignment
21	Impact on the access roads, borrow pit sites, waste dumps	Minor	During repair
22	Roadside litter	Minor	Along alignment, land-fills
23	Erosion from road cuts and fills and temporary sedimentation of natural drainage ways. Erosion of lands be-low the road bed receiving concen-trated outflow from covered or open drains.	Medium	Within the RoW. Most part of alignment, in particular the section running close to the riv-erbed

24	Alteration of land/subsoil drainage patterns	Negligible	The existing culverts and drainage systems are re-habilitated
25	Increased suspended sediment in streams affected by erosion, fresh road cuts, fills and waste dumps. de-clined water quality and increased sedimentation	Minor	Along alignment near the rivers
26	Soil and water contamination by oil, grease, fuel and paint alongside the highway	Minor	Most part of alignment
27	Air pollution from machinery during maintenance works.	Minor	Most part of alignment
28	Air pollution from traffic	Minor	Near the settlements, Most part of alignment
29	Noise pollution from traffic	High	Near the settlements, Most part of alignment
30	Roadside litter.	Medium	Most part of alignment
31	Creation of a transmission corridor for pests, weeds, etc	Medium	Most part of alignment
32	Health hazards - dust and exhaust emissions	Minor	Near the settlements:
33	Obstruction of routes from homes to farms, etc, increasing travel time.	Minor	Near the settlement
34	Impairment of non-motored transpor-tation and pedestrians in the highway corridor due to reduced or impeded rights-of-way.	No	No
#	**Emergency Related Impacts**	**Severity**	
35	Accident risks associated with traffic that may result in spills injuries or loss of life	Medium	Near the settlements Most part of alignment

Impact matrix - Construction Stage

Activity	Impact	Character of impact							
		Direct	Indirect	Positive	Negative	Reversible	Irreversible	Temporary	Residual
Land clearance and grading in the RoW	Impact on landscape, flora/fauna, habitats	+			+		+		+
	Erosion	+			+		+		
	Emissions	+			+	+		+	
	Noise, vibration	+			+	+		+	
	Soil pollution		+		+	+		+	
	Waste generation		+		+	+		+	
	Ground and surface water pollu-tion		+		+	+		+	

Construction; pavement	Emissions	+			+	+		+	
	Noise, vibration	+			+	+		+	
	Soil pollution		+		+	+		+	
	Waste generation		+		+	+		+	
	Ground and surface water pollution		+		+	+		+	
Exploration of borrow pits	Impact on landscape, flora/fauna, habitats	+			+		+		+
	Erosion	+			+		+		+
	Emissions	+			+	+		+	
	Noise, vibration	+			+	+		+	
	Soil pollution		+		+	+		+	
	Waste generation		+		+	+		+	
	Ground and surface water pollution	+			+	+		+	
Transportation of material from borrow pits.	Emissions	+			+	+		+	
	Noise, vibration	+			+	+		+	
	Soil pollution		+		+	+		+	
	Waste generation		+		+	+		+	
	Ground and surface water pollution		+		+	+		+	
Demolition of part of the road-side structures and part of existing pavement	Emissions	+			+	+		+	
	Noise, vibration	+			+	+		+	
	Soil pollution		+		+	+		+	
	Waste generation		+		+	+		+	
	Ground and surface water pollution		+		+	+		+	
Disposal of spoil and wastes	Impact on landscape, habitats	+			+	+		+	
	Emissions	+			+	+		+	
	Noise, vibration	+			+	+		+	
	Soil pollution		+		+	+		+	
	Waste generation		+		+	+		+	
	Ground and surface water pollution		+		+	+		+	

Character of Main of the Anticipated Impacts - Operation Stage

Activity/ Factor	Impact	Character of impact							
		Direct	Indirect	Positive	Negative	Reversible	Irreversible	Temporary	Residual/long-term

Physical existence	Impact on landscape	+					+		+
Traffic	Impact on landscape, flora/fauna, habitats	+	+		+				
	Emissions	+			+				+
	Noise, vibration	+			+				+
	Soil pollution		+		+	+		+	
	Waste generation		+		+	+		+	
	Ground and surface water pollution		+		+	+		+	
Maintenance works	Impact on landscape, flora/fauna, habitats	+		+					
	Erosion	+		+	+			+	
	Emissions	+			+				+
	Noise, vibration	+			+				+
	Soil pollution		+		+	+		+	
	Waste generation		+		+	+		+	
	Ground and surface water pollution		+		+	+		+	
Accidents	Impact on landscape, flora/fauna, habitats		+		+	+		+	
	Erosion								
	Emissions		+		+	+		+	
	Noise, vibration								
	Soil pollution		+		+	+		+	
	Waste generation		+		+	+		+	
	Ground and surface water pollution		+		+	+		+	

9.4 Environmental management and monitoring

A. Design phase

Issue	Measures taken or to be taken	Implementing Organization	Responsible Organization - supervisor
Dust/air pollution	• Placement of earth borrowing sites, waste disposal sites and concrete mixing sites is identified with consideration of environmental issues (to avoid negative impacts on humans and wildlife).	EPTISA/Contractor	RD
Noise	• Planning of auxiliary and haulage routes away from densely settled areas avoiding increased noise levels.	EPTISA/Contractor	RD
Surface water pollution	• Identification of the need for arrangement of drainage system. Identification of surface water protection measures for facilities/works near or in the riverbed	EPTISA	RD
Loss of land/harvest Loss of a source of income/business	• Development and implementation of Land acquisition and resettlement plan • Compensation	EPTISA	RD

B. Construction phase

Activity	Location	Issue	Mitigation measure	Responsible authority	Approx. Cost (GEL)	Monitoring			
						Monitoring measure	Frequency	Approx. Cost (GEL)	Responsible agency
Site clearance	RoW, support infrastructure	Cutting of grass and other herbaceous vegetation, cutting and removal of shrubs and tree felling activities.	• Identification of trees to be cut or replanted. During the construction of the bridges special attention shall be paid to the protection of the plant species along rivers. • Avoidance of cutting and damaging of the trees without any special need. Preservation of vegetation as far as feasible. • Each removed tree shall be compensated by planting and maintaining 3 trees of the same species nearby or after completion of works and recultivation of temporarily used sites .	Contractor	The cost will be determined on case by case basis with consideration of the type of the plant species removed.	Inspection	Permanent monitoring during construction After completion of recovery works	No cost	Contractor, supervision by RD
Offsite traffic	Access roads	Impact on vegetation and soil	• Strict keeping to the boundaries of the traffic route to avoid 'extra' damage of vegetation (if any) and soil ramming	Contractor	No cost	Inspection	Occasionally	No cost	Contractor, supervision by RD
Establishment and operation of contractor's work camps, equipment yard	Camps, equipment yard	Impact on vegetation and inadequate use of land resources	• Keeping to the boundaries of plots allocated for the project. • Arranging camp facilities with consideration of environmental safety requirements • After completing the works rehabilitation measures shall be taken to restore the access roads and other units (construction camps, storage territories, etc) to the state that they were in before launching the project. By approbation of the local authorities the temporary roads can be left for the use of the local communities.	Contractor	Cost of revegetation – will depend on location of site allocated for the camp and auxiliary facilities. The cost for planting and maintenance of a tree is estimated as 7$ per unit	Inspection during the whole phase of construction process.	Once a week. during construction. Monitoring of implementation/ efficiency of recovery plan	No extra costs	Contractor, supervision by RD

Establishment and operation of contractor's work camps	Camps, equipment yard	Water and soil pollution, uncontrolled spillage of the waste water and waters polluted with mineral oils.	• Control the waste water of the temporary construction units to avoid their possible impacts upon the surface water. The waste water shall be collected in the septic tanks/pits. The tanks/pits emptied – waste disposed under agreement of local municipality. • Fuel/oil tanks shall be ricked around with watertight material (it is possible to use clay for the purpose). Storage site arranged at least 100 m distance from the riverbed. The area under the reservoirs/inside the ricks shall also be covered with waterproof material. Any spill should be immediately isolated and cleaned up with absorbent materials. • Onsite fuelling must be avoided. If onsite fuelling is required, this is to be done in the area arranged according to the requirements of pollution prevention plan. The designated areas for on-site fuelling must be located away from drainage channels. • Regularly checking of vehicles/machinery for leaks. All leaks shall be immediately repaired. Incoming vehicles and equipment shall be checked for leaks. Leaking vehicles/ equipment shall not be allowed on-site. • Secondary containment devices drip pans or absorbent materials shall be provided. On small spills absorbent materials must be used. • Materials and waste must be stockpiled so as to avoid erosion and washing off into the river. Drainage trenches must be established to divert surface runoff from the site. • Waste collection area must be sited in order to avoid substantial amount of runoff from upland areas without draining directly to a water body. • If there is a risk of fuel/oil spills, an oil trap should be additionally provided. • To prevent runoff contamination, paving should be performed only in dry weather. • Staff should be briefed in sound material/fuel/waste management	Contractor	The costs will be estimated by contractor identified through tendering.	Inspection during construction Monitoring of compliance with requirements of "Plan of avoidance of accidental spills and spills response"	Permanent monitoring during construction works	No extra cost	Contractor, supervision by RD
Earthworks and various construction activities	Road alignment	Soil stability and quality degradation, deterioration of the soil structure and reducing its productivity.	• Removal of topsoil prior to construction • Maintaining the humus topsoil deposited along the RoW corridor in a stable state prior to reuse. • Separate stockpiling of top and subsoil. • Strict keeping to the boundaries of the access roads and operation grounds to avoid pollution, ramming of soil. • Preservation of vegetation as far as feasible to avoid the risk of erosion • Avoidance of fuel/oil spills • Briefing staff in good practice • Hydroseeding	Contractor	No extra costs required. Will be done within the budget of construction works.	Inspection Periodical check up with the purpose of estimation of state of the soil storage layer.	Once a week during construction Monitoring after completion of works	No extra costs	Contractor, supervision by RD
Establishment and operation of contractor's work camps and various construction activities	Camp, operation ground	Safety of workers, operators and drivers.	• Providing detailed information to the personnel about the activities foreseen in the project. • Holding trainings upon the safety of activities carried out by specialists in different fields • Briefing of new staff • Safety briefing prior to the shift start • Providing the personnel with personal protective equipment. • Checking the safety skills of the technical staff (drivers, etc.). • Preparation of a health and safety plan governing all activities on site.	Contractor	No extra costs required. Will be done within the budget of construction works	Incident records Training records Safety briefing records	Inspection	No extra costs	Contractor, supervision by RD

Bridge, culvert and drainage system construction; construction of bank protection facility	Bridge , bank protection facility construction site and culver, bank protection structure construction sites	Possible deterioration of water quality, impacts upon water habitats caused by the works carried out in the river-beds. Impacts on the banks caused by activating erosion processes	• Earthworks necessary for the construction of the bridge piers and abutments shall be kept to the minimum practicable according to the design in order to avoid erosion. • Building temporary access roads having taken into consideration existing extent of erosion. • Examining the river banks and their neighbouring slopes for potential sliding of soils. The aim of the examination is to rehabilitate and consolidate the banks in time. • Reducing the time necessary for the construction of the bridge piers and abutments to its optimal minimum. • Avoidance of stockpiling the material removed from the trenches into the river-beds. • Prohibition of vehicle/car maintenance, onsite fuelling near the river-bed. • Proper management of waste • Stabilisation of slopes • Timing construction works in the riverbed with consideration of periods sensitive for aquatic life. Construction works in the rivers shall not coincide with the spawning season (preferably in autumn). • Prohibition of direct discharge of waste water into the rivers. • Arranging water-ways and canals for fish-passes during temporary shifts of the natural river-beds necessary for the construction works carried out in the river-beds. • Briefing staff in good practice	Contractor	No extra costs required	Inspection Briefing records	During construction Daily	No extra costs required	Contractor, supervision by RD
Operation of equipment maintenance and fuel storage areas	Workshops fuelling area	Deterioration of water/soil quality in the rivers caused by possible spillage of polluted waters, mineral oils or other contaminants.	• Establishing control to avoid re-fuelling the vehicles and technical equipment in the river-beds, on the terraces and in their immediate vicinity and hence uncontrolled emergency spillage. • Control of the proper status of technical maintenance of vehicles/building machinery (pipes for hydraulic fluid, fuel tanks, etc shall be daily checked before the machinery comes into the rivers). • Usage of off-site vehicle wash racks or commercial washing facilities is preferable. If on-site cleaning is required, bermed wash areas for cleaning activities must be established. The wash area may be sloped to facilitate collection of wash water and evaporative drying. • Onsite repairs /maintenance activities should be limited. Priority should be given to offsite commercial facilities. If impossible, a designated area and/or a secondary containment for possible spills for on-site repair or maintenance activities must be provided. These areas shall be located away from drainage channels. • Machinery/vehicles must not be fuelled or maintained near the river-bed (distance between the maintenance site and the river should be at least 100 m). • Briefing staff in good practice	Contractor	No extra costs required. The costs for arrangement of wash area (as appropriate) will be estimated by contractor	Inspection during construction Daily control of technical status of vehicles/machinery records. Briefing records	During construction Daily	No extra costs required.	Contractor, supervision by RD
Earthworks and various construction activities	Construction ground	Landscape disturbance.	• Before launching the works with regard to possible changes of the landscape a landscape harmonization plan shall be worked out and approved by Employer.	Contractor	No extra costs required.	Monitoring of implementation of the plan -records	During construction	No extra costs required.	Contractor, supervision by RD
Earthworks and various construction activities	Construction ground	Archaeological chance finds	• Supervision by an archaeologist to avoid impact • In the event of unexpected discovery of archaeological objects during construction operations the Contractor shall follow the chance find procedure (See Annex 6) • Works would resume only after measures have been taken as requested by the Ministry and confirmation has been received that works may continue. • Briefing staff in good practice	Contractor	Cost of archaeological examination	Availability of chance find procedure Control records	During construction	No extra costs required.	Contractor, supervision by RD

Earthworks and various construction activities	RoW and adjacent	Air pollution from improper maintenance of equipment	• Maintain construction equipment to good standard; improper functioning machinery that causes excessive pollution will be banned from the construction sites. • Speed limit for offsite traffic.	Contractor	No extra costs required	Permanent control	During construction	No extra costs required.	Contractor, supervision by RD
Reinforced concrete mixing	Concrete mixing unit area	Dust/air pollution from concrete mixing	• Mixing equipment should be well sealed; vibrating equipment should be equipped with dust-remove device. Keep at least 300 m distance from residences windward wind direction to reinforced concrete production plants.	Contractor	No extra costs required.	Permanent control	During construction	No extra costs required.	Contractor, supervision by RD
Earthworks, storage and transportation of soil or other fine-grained materials (cement, sand, etc.), vehicles moving across unpaved or dusty surfaces.	Storage, roads	Dust/air pollution	• Spray all unpaved roads and significant areas of uncovered soil with water every four hours on working days, during dry and windy weather; • Provide a wheel-washing facility and ensure that it is used by all vehicles before leaving all sites. • Cover all loose material with tarpaulins when transported off-site on trucks; • Cover all material stockpiled on site with securely-held tarpaulins at all times;	Contractor	The costs for arrangement of wheel-washing facility will be estimated by Contractor. No other costs required.	Permanent control	During construction	No extra costs required	Contractor, supervision by RD
Earthworks and various construction activities	Settlements	Impacts upon the human beings and natural receptors caused by increased noise levels.	• In the vicinity of settlements material transport and working hours will be restricted to between 07 to 21 hours within a 500 m distance of the adjoining settlements. • Speed limit set for the offsite traffic. • Implementation of regular technical check-ups of mobile and stationary devices.	Contractor	No extra costs required.	Permanent control,	During construction	No extra costs required	Contractor, supervision by RD
Construction of the road and structures, , demolition of the roadside facilities	Waste dumping area	Non-hazardous waste production from construction and demolition Hazardous waste	• Development and implementation of waste management plan • For temporary disposal of inert waste the site within the camp/operation ground must be selected. The waste must be placed so as not to interfere with free movement of machinery and staff, away from surface water (within at least 100 m). Waste must be source-separated in order to ensure efficient management and enable reuse. • Any waste materials that may be used for the project must be reused on the site, or for the needs of municipality based on agreement, the rest should be disposed at the nearest landfill, as the case may be, under agreement of local authorities. • Briefing staff in good practice • Briefing of the staff in hazardous waste management	Contractor	No extra costs other than that related to removal of the waste from the site by waste removal service (under the contract) - required.	Monitoring of compliance with the waste management plan - records	During construction	No extra costs required	Contractor, supervision by RD
Operation of equipment maintenance, fuel storage areas, various construction activities	Operation ground	Hazardous waste production from accidental spills, maintenance of the machinery, etc. (oils, solvents, oily rugs, used filters, etc.)	• Development and implementation of waste management plan • As Georgia has no hazardous waste landfill yet, the hazardous waste will be disposed off under agreement with local authorities. However, the site for temporary disposal of hazardous waste must follow stricter requirements, namely, hazardous waste containers shall have secondary containment and the waste shall not be mixed with recyclable inert material. • Hazardous waste must be handled separately from inert one. • Disposal must be done with consideration of the waste type with relevant safety measures in place. • Temporary disposal site must be agreed with relevant authorities • Waste oil to be carried to the closes recycling facility under the contract • The staff involved in waste handling, in particular in hazardous waste management, should receive adequate training in waste management and safety. • Used tires can be transferred to Heidelberg Cement enterprise, for use as fuel, based on agreement with the company's leadership	Contractor	No extra costs other than that related to removal of the waste from the site by waste removal service (under the contract) - required.	Monitoring of compliance with the waste management plan- records	During construction	No extra costs required	Contractor, supervision by RD

Establishment and operation of construction sites/camps	Camp	Production of non-hazardous domestic waste (food waste, packaging, plastic bottles, etc.)	• Development and implementation of waste management plan • Waste must be collected in waste containers fitted with lids to prevent scattering by wind, odour pollution and attraction of scavengers. The lid will also protect the waste from rain/snow. The containers should be located in a predefined area, remote from water bodies and away from traffic. • Briefing staff in good practice	Contractor	No extra costs other than that related to removal of the waste from the site by waste removal service (under the contract) - required.	Monitoring of compliance with the waste management plan - records	During construction	No extra costs required	Contractor, supervision by RD
Various construction activities	Along the RoW	Impacts on fauna (accidental deaths, reduction, loss or isolation of habitats, etc.)	• Trenches or pits, if made, should be fenced or protected to avoid entrapping and injuries of the fauna species. Bright coloured ribbons (for big animals - e.g. cattle); metal plastic and other shields/fences (for small animals) may be used. If, despite of the mentioned precautions, small animals turn to be entrapped, upon completion of the shift, planks or medium size twigs must be made available for the animals to escape from the pits/trenches after the night. Pits and trenches must be checked prior to filling up; • Special attention should be given to the avian fauna in the spring-summer (April to July), the season most sensitive for birds; • Construction in/near the riverbed should be avoided in the fish spawning season. • Arrangement of barriers to ensure safety of fauna. • Monitoring of fauna on the new road section construction site. • Briefing staff in good practice	Contractor	No extra costs required	Monitoring of impact – casualties report	During construction	No extra costs required	Contractor, supervision by RD
Earthworks and various construction activities	Along alignment	Erosion, etc.	• Selection of a reasonable embankment height and stabilization of the slopes by hydroseeding; • Use of wooden shields for pits if they are very deep to preserve stability, as the case may be during the bridge construction; • Establishment of temporary berms, slope drains, temporary pipes, contour ditches, ditch checks, diversions, sediment traps etc. • Briefing staff in good practice	Contractor	No extra costs required. Will be covered by construction works budget.	Visual monitoring	During construction	No extra costs required	Contractor, supervision by RD
Mobilization, construction	Settlement	Loss of land, loss of businesses/income, restriction of access to the river; impact on safety, noise and dust impact.	• Development and implementation of Land acquisition and resettlement plan • Implementation of noise, emission mitigation measures, • Temporary employment	Contractor	Land acquisition costs	Site visits, interviews, documents control	Throughout acquisition process	No extra costs, other than traffic costs envisaged	RD

C. Operation phase

Activity	**Location**	**Issue**	**Mitigation measure**	**Responsible authority**	**Approx. Cost (GEL)**	**Monitoring**			
						Monitoring measure	**Frequency**	**Approx. Cost (GEL)**	**Responsible agency**
Accidental fuel/oil spill and/or roadside litter washed off/blown off into the river	Surface water	Water pollution	• More frequent surface sweeping and the development of better cleaning methods; • Better control over truck traffic to minimize spills; • Culverts must be cleaned routinely, and repaired as far as required.	Contractor, supervision by RD	No extra costs – covered by maintenance budget	Visual Instrumental measuring – TSP and oil in water samples	12 months after commissioning (quarterly)	Cost of analysis by authorised laboratory	RD
Road resurfacing	Road/bridge	Water bodies pollution by heavy metals, hydrocarbons and debris	• Maintenance paving should be performed only in dry weather to prevent runoff contamination. • Proper staging techniques should be used 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. • Resurfacing operations could include porous asphalt for potholes and shoulder repair to reduce the amount of storm water runoff from road systems.	Contractor, supervision by RD	No extra costs	Instrumental measuring Inspection Keeping records	During maintenance	No extra costs	RD

Transport emissions	RoW, settlements	Air pollution by transport emissions	• To keep greenery near settled areas;	Contractor, supervision by RD		Visual observation of the status of greenery	Quarterly instrumental measuring	Low cost	y RD
Noise	Residential area	Impacts upon the human beings and natural receptors caused by increased noise levels.	• To protect residents along the 114 km to 126 km road section from negative noise impacts noise mitigation measures should be applied- traffic velocity decrease in those sections where the noise limits are exceeded (see EIA report). In the long run – in case of the traffic volume increase arrangement of barriers (plant barrier, engineering constructions) in sensitive locations can be recommended.	Contractor, supervision by RD	No extra cost	Instrumental measuring - day and night times (Within 750 m from the highway)	12 months after commissioning (quarterly) - Quarterly instrumental measuring of noise levels by day and night time	Low cost	RD
Littering	Along the new road	Possible negative impact on wildlife, water pollution	• Ensure that the community is aware of the range of ways to dispose of their waste correctly; • Inform the community of the level of fines that littering incurs; • Signage may be an element of a roadside litter prevention program, educating the community that littering is illegal, fines apply and behaviours are monitored. The signs may be suitable for placement in a series of two to four signs at 10 km intervals to repeat the message in different ways. • Cleaning up	Contractor, supervision by RD	No extra costs, the costs will be set in the terms of the contract agreement with the relative company	Visual	Throughout the year	No extra costs	by RD
Condition of green buffers	Along the new road	Impact on vegetation Road kills of animals	• Removal of faded plants and re-plating. • Status of plants • Keep records of accidents. • If accident hot spots with large mammals are identified, appropriate protective measures shall be elaborated (e.g. reflectors /local fencing, warning signs, speed reduction etc.)	Contractor, supervision by RD	No extra costs – covered by maintenance budget	Visual observation Keep records of accidents.	Throughout the year Monthly drive through the highway section	No extra costs required	RD
Traffic	Along all road sections	Incidence of accidents due to winter typical hazards (snow, ice, fog)	Installation of warning signs Informing	Contractor, supervision by RD	Low cost	Keep records of accidents.	Winter period	No extra costs	RD

Presence of the road structure, traffic redirection	Along all road section	Restricted access because of the presence of the road, restricted access to the river; safety issues, impact on non-motorized transport	Underpasses and bridges built according to the project. Preservation of existing roads	Contractor, supervision by RD	Costs of civil engineering structures – included in the budget;	Status of the structures	Periodically	No extra costs	RD
Traffic redirection	Settlement	Impact on businesses along exiting road after redirection of the traffic	Arrangement of alternative workplaces/ employment possibilities; Attraction of funds and support of business development		Attracted funds case by case				

9.5 Monitoring, implementation

Objective of the monitoring is to control the impacts estimated during environmental assessment; evaluate efficiency of mitigation measures set in the EIA statement; detect unpredicted impacts and define measures to minimize, avoid or mitigate them.

Monitoring shall be done by supervisor. Construction and operation stages of the project - covered. The monitoring shall be provided at sensitive receptors. The monitoring data shall be submitted to the Roads Department. Any impact or failure of mitigation measures shall be identified, relevant remedial actions defined.

Monitoring shall include visual observation and measurements as appropriate. Field testers and hand-held equipment shall be used to monitor short- term impact. Calibrated equipment and approved methods of monitoring must be used. Calibration must be done regularly, all calibration records and monitoring results, along with the copies of the site records, certificates, permits and documents - submitted and kept by the Roads Department.

The list of records must include:

- Work program and schedule;
- Environmental permits and licences;
- List of equipment;
- List of mitigation measures;
- Route/program of construction material transportation;
- Inspection records – noise, water quality monitoring data;
- Copies of correspondence related to environmental issues;
- Site drainage plan;
- Records of maintenance and cleaning schedules for sediment and oil/grease traps;
- Records of sewage disposal;
- Records of quantity of discharged wastewater and concentration of pollutants;
- Waste disposal records
- Written designation of waste disposal sites and instructions for waste transportation from local authorities;
- Air quality monitoring results;
- Log of material inventories and consumption;
- Chance find records (if any);
- Complaints register;
- Incidence register (environmental limits excedence forms, injuries records, etc);
- Records on remedial actions taken;
- Equipment control and maintenance log;
- Corrective and preventive action request records;
- Training records.

The preset frequency of monitoring can be revised based on results of the observation data. In case of non-compliance with environmental quality performance criteria additional monitoring must be carried out.

9.6 Reporting

Contractor shall prepare monthly EMP status reports for submission to supervisor/ Roads Department. Based on the contractor's reports the supervisor prepares monthly reports on the status of EMP implementation and environmental/social performance of the contractor. Technical supervisor assess accuracy of information given in the contractor's reports, identifies gaps, evaluates adequacy of mitigation measures applied by contractor; highlights incompliance with EMPs, inform on any acute issues, and proposes corrective actions. Technical supervisor fills out monthly field monitoring checklists and to provides narrative analysis of environmental safeguards application as a part of the general supervision reporting to the RD. Safeguards team of the RD keeps these reports and furnish to the World Bank upon demand.

As part of the project progress reporting to the World Bank, the RD should include comprehensive information on the application of safeguards under the project, providing quantitative and qualitative data generated through monitoring of EMP implementation. Such reporting should include summary of the work undertaken by RD's own staff with the purpose of reality-checks and quality control of the supervisor's performance, and summary of remedial actions taken to address any issues flagged in the process of environmental supervision of works.

9.7 Remedies for EMP violation

Any violations identified through monitoring shall be remediated. Responsibility for enforcement of compliance and adherence of contractor to the EMP rests with Roads Department of the Ministry of Regional Development and Infrastructure. For minor infringements, the contractor will be given 48 hours to remedy the problem. In case restoration fails RD will arrange for another contractor to do provide restoration. The cost of works will be deduced from the offending contractor's payment. For infringements causing a long-term/irreversible damage financial penalty up to 1% of the contract value in addition to the cost for restoration activities will be set.

10 Stakeholders' consultation and disclosure

Stakeholder's consultation and disclosure will be conducted according to the World Bank policy, the Georgian laws and reasonable international practice. The framework for the EIA in Georgia is established by the legislation (see Chapter 2). The specific requirements are prescribed by three statutory acts: *On Environmental Impact Assessment (2009), On Carrying Out Ecological Expertise (2008),* and *Rules for Special Council of Environmental Impact of the Ministry of Environment Protection (2008)*.

Two series of the meetings with community are scheduled:

- *at the beginning of project during the EIA scoping process* to inform stakeholders about the project and seek their input in determining the scope of the EIA and design studies; The meetings was held on September 25, 2012 in Gomi
- at the *Draft Final Report stage*, to inform people about the likely impacts of the project and the way in which they will be mitigated, and to obtain their support to the measures as far as possible.

During the EIA process, the Roads Department will be responsible for arrangement of the meetings including invitation to the participants, the venue and presentation equipment. Representatives from the Roads Department will participating in the meetings and discussions.

The consultant (COWI Lietuva and GAMMA) will be responsible for the development of a presentation in Georgian at each meeting; writing up leaflets in Georgian to be distributed at each meeting; preparation of the minutes of each meeting; incorporation of an account of the consultation process in the EIA report, identifying how each point was addressed in the EIA and/or engineering design, and providing valid reasons why any points were not addressed.

The final report prepared taking into account the commentaries and remarks received from the stakeholders and the minutes of the meetings with responses to the comments received from the stakeholders, the Ministry of Environment of Georgia inclusive, will be handed over to the Roads Department. for submission to the World Bank and the Ministry of Environment of Georgia.

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