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Environmental Impact Assessment Approval Sheet

Reference IEE: DCN: 2010-GEO-033
Country: GEORGIA
Project Name: Municipal Infrastructure Rehabilitation Project, Roads Rehabilitation

Type of document(s):
☒ **Environmental Impact Assessment Addendum**

Document Prepared by: Tetra Tech EM, INC.
Document Preparation Date: Aug 2012

Location(s) Covered by this document: Georgia

Environmental Media and/or Human Health Potentially Impacted (check all that applies):
☒ Air ☒ Water ☒ Land ☒ Biodiversity

Introduction:
This document records Mission clearance and Bureau Environmental Officer (BEO) approval of the Addendum to the Environmental Impact Assessment (EIA) for USAID/Caucasus's Municipal Infrastructure Activity, Roads Rehabilitation (Component 1), rehabilitation of the access road of the village of Gorijvari, and Pushkin Street in the town of Gori. A draft version of this addendum was vetted with BEO (attached email).

Background:
USAID's environmental regulation (22 CFR part 216 or Reg. 216) establishes the conditions and procedures for environmental review of new projects, programs, or activities authorized by USAID. It includes a process for the review of environmental and social impacts to ensure that projects funded by USAID are environmentally sound, designed to operate in compliance with applicable regulatory requirements, and not likely to cause a significant environmental, health or safety hazard.

The Initial Environmental Examination (IEE) for the Municipal Infrastructure Rehabilitation Project was approved by the Europe and Eurasia BEO on July 23, 2010, DCN: 2010-GEO-033. The IEE established the requirement for an EIA. As per the IEE and Regulation 22 CFR part 216, a Scoping Statement for the EIA was prepared and approved on December 22, 2011. The EIA was approved by BEO on March 14, 2012.

After EIA approval, the project acquired additional work: the rehabilitation of the access road of the village of Gorijvari, and Pushkin Street in the town of Gori. In order to environmentally address these add-ons, an addendum was developed to the already approved EIA, attached.

Action:
We request your approval of the Addendum to the Environmental Impact Assessment for the Municipal Infrastructure Rehabilitation Project, Roads Rehabilitation Activity (Component 1).

Clearance:
Mission Director: _____ Date: 8/21/12
Stephen M. Haykin

Project COTR: _____ Date: 21 Aug 12
Brad Carr

Mission Environmental Officer: _____ Date: 8/21/2012
Mariam Ubilava

Approval:
Bureau Environmental Officer: _____ Date: Aug 22, 2012
William Gibson

Approved: X Disapproved: _____

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DCN: 2012-GEO-063

ADDENDUM TO ENVIRONMENTAL ASSESSMENT

MUNICIPAL ROAD REHABILITATION
GORIJVARI ROAD AND PUSHKIN STREET IN GORI MUNICIPALITY

MUNICIPAL INFRASTRUCTURE AND IDP HOUSING REHABILITATION PROJECT

CONTRACT: AID-EDH-I-00-08-00027-00, TASK ORDER: AID-114-TO-11-00002

DCN: 2010-GEO-033

JUNE 2012; Revised 17 August 2012

This document was produced for review by the United States Agency for International Development. It was prepared by Tetra Tech for the Municipal Infrastructure and IDP Housing Rehabilitation Project, Task Order number AID-114-TO-11-00002 under the USAID Architectural and Engineering (A&E IQC).

DISCLAIMER
The author's views expressed in this publication do not necessarily reflect the views of the United States Agency for International Development or the United States Government

TETRA TECH

18 August 2012

Mr. Bradley Carr
Water Irrigation and Infrastructure Advisor
Office of Economic Growth
US Agency for International Development
11 George Balanchine Street
Tbilisi, 0131
Georgia

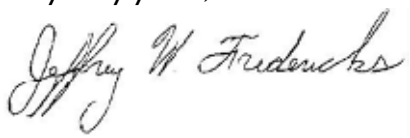
Re: Addendum to Environmental Assessment for Municipal Road Rehabilitation

Dear Mr. Carr:

This report is being submitted to you in accordance with the requirements of task order no. AID-114-TO-11-00002 of contract AID-EDH-I-00-08-00027-00. It provides Tetra Tech's revised Addendum to the Environmental Assessment for Municipal Road Rehabilitation, specifically covering Gorijvari Road and Pushkin Street in Gori Municipality based on BEO comments.

We look forward to your review and welcome your comments and suggestions.

Very truly yours,



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CC: USAID (George Kokochashvili); MDF (Kartlos Gviniashvili); Tetra Tech (Firouz Rooyani, Dean White, Brian Potvin, Ilia Eloshvili)

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ABBREVIATIONS AND ACRONYMS

ARWR	Actual Renewable Water Resources
BEO	USAID Europe and Eurasia Bureau Environmental Officer
CFR	Code of Federal Regulations
EA	Environmental Assessment
EIA	Environmental Impact Assessment
EMMP	Environmental Mitigation and Monitoring Plan
EPI	Economic Prosperity Initiative (USAID Project)
ESS	Environmental Scoping Statement
Geo	Geo Ltd
GMIP	Municipal Infrastructure And IDP Housing Rehabilitation Project (the project)
GoG	Government of Georgia
IDP	Internally Displaced Persons
IRWR	Internal Renewable Water Resources
KAV	Kavgiprotransi-Mg Ltd
M&E	Monitoring and Evaluation
M&M	Mitigation and Monitoring
MDF	Municipal Development Fund
MEO	USAID/Georgia Mission Environmental Officer
MLHSA	Ministry of Labor Health and Social Affairs
MRA	Ministry of Refugee Affairs
MRDI	Ministry of Regional Development and Infrastructure
NEO	New Economic Opportunities (USAID Project)
NGO	Non-Government Organization
PMP	Performance Monitoring Plan
SOW	Scope of Work
TBD	To Be Determined
TOCOTR	USAID Task Order Cognizant Technical Officer
Tt	Tetra Tech EM Inc.
USAID	United States Agency For International Development
USG	U.S. Government
WB	World Bank

1. Summary

The Government of Georgia (GoG) identified municipal roads as a priority target for USAID technical assistance. Five municipalities impacted by the 2008 conflict were initially identified by the GoG as priority targets for USAID technical assistance under GMIP Component 1. The municipalities - Gori, Mtskheta, Oni, Kareli, and Dusheti – submitted up to three infrastructure rehabilitation proposals for GMIP financial assistance. The Environmental Assessment (EA) for Municipal Road Rehabilitation (January 2012, Revised February 2012) addressed environmental concerns related to these projects. After approval of the Roads EA by the USAID Bureau Environmental Officer (BEO), GoG and the Gori Municipality replaced 26 Gori roads with Gorijvari Road (in Didi Gorijvari, Gori District) and Pushkin Street in Gori. This EA Addendum covers these two new road projects.

1.1 Description of the Project

The five selected municipalities identified road segments for rehabilitation based on costs and benefits, selecting the highest priority road segments within individual road projects that would meet performance targets. Only existing roads will be rehabilitated; no new roads will be constructed. Projects are summarized for each municipality as follows:

- Mtskheta Municipality selected 32 roads with a total length of 10.3 kilometers for road rehabilitation.
- Oni Municipality selected 8 streets with a total length of 3.2 kilometers for rehabilitation.
- Kareli Municipality selected 12.3 kilometers of internal roads at Sagolasheni-Dvani for rehabilitation.
- Dusheti Municipality selected 3.1 kilometers along eight internal road segments for rehabilitation.
- **Gori Municipality** originally selected 26 streets with a total length of 8.7 kilometers for road rehabilitation. Later, GoG and Gori Municipality replaced these roads with two new roads, **Gorijvari Road** (in Didi Gorijvari, Gori District) and **Pushkin Street** in Gori.

This EA Addendum covers these two new roads in Gori Municipality. The projects include new pavement and/or cobblestones, curbs, new sidewalks and stairs, and improved drainage systems. Curbs will be concrete with the base course arranged using macadam and the pavement will be an asphalt-concrete hot mix. Drainage improvements include rehabilitation of open channels or closed collectors, and/or replacement of damaged concrete reinforcement pipes or culverts.

1.2 Project Context

GMIP addresses needs resulting from Georgia's August 2008 conflict with Russia and the global economic downturn that has challenged Georgia's economic stability. These needs

have placed a severe strain on Georgia's national budget and its ability to finance core investments in critical regional development initiatives like municipal roads. Many years of decline in the quality, coverage and maintenance of roads have dramatically reduced Georgia's quality of life in rural areas and constrained private sector growth. Such degradation and instances of conflict-related damage have resulted in significant constraints to the productive capacity and quality of life of thousands of Georgians.

1.3 Major Conclusions

This EA Addendum used the potential significant concerns identified in the original EA. The concerns evaluated in detail in this EA Addendum are shown below:

- Impacts to Threatened, Endangered & Protected Species (TES), disruption of sensitive habitats and other sites along roads where protected birds, bats, amphibians and reptiles may use habitats.
- Disturbance or threat to important ecological habitats.
- Impacts to Cultural and Historic Resources including cultural or historic chance finds.
- Impacts of changes in water quality, sediment loads; deterioration of downstream water and impacts on downstream users.
- Cumulative impacts of road rehabilitation activities.
- Temporary or permanent land expropriation.

In addition to these significant effects, the EA included best practices for a range of potential concerns, including soil erosion and damage to roads and road foundations. These concerns were eliminated from further consideration in the EA Addendum because they did not require any further assessment; best practices exist to mitigate impacts. The EA Addendum also includes mitigations (including best practices) to address impacts associated with construction activities, disposal of old/damaged asphalt and road subsurface materials, disposal of damaged sidewalks and drainage collectors/pipes. Mitigations also address socio-economic and public health and safety concerns, road operation and maintenance including erosion, road ruts, potholes and clogged drains, impacts to TES and cultural/historic resources and municipal road maintenance programs.

Environmental Mitigation and Monitoring Plans (EMMPs) were developed for road rehabilitation (Table 6.1) and operation and maintenance of municipal roads (Table 6.2). EMMPs include the identified environmental impacts, individual mitigation measures, monitoring indicators, monitoring/reporting frequency and responsible party for oversight of EMMP implementation. EMMPs mitigate the following identified environmental impacts during construction and road rehabilitation.

2. Introduction and Background

GMIP addresses needs resulting from Georgia's August 2008 conflict with Russia and the global economic downturn that has challenged Georgia's economic stability. These needs have placed a severe strain on Georgia's national budget and its ability to finance core investments in critical regional development initiatives such as road rehabilitation. Many years of decline in the maintenance of roads have dramatically reduced Georgia's quality of life and constrained private sector growth. This degradation has constrained productive capacity and quality of life of thousands of Georgians. GMIP Component 1, Rehabilitation of Municipal Roads, will repair infrastructure that Georgians rely on for jobs and income generation.

The major purpose of this project is to improve the infrastructure in five selected municipalities - Mtskheta, Oni, Kareli, Dusheti and Gori. Gori originally selected 26 streets for rehabilitation and later replaced these roads with two new roads, Gorijvari Road and Pushkin Street. Projects were chosen based on potential for high impact and benefits. USAID and GMIP expect infrastructure rehabilitation projects will contribute to economic growth and improve the social condition of the local population including IDPs.

The target roads need to be rehabilitated because asphalt-concrete pavement of the streets is damaged (pits and settlement are common); the road pavement is fragmented, and in many places the sand and gravel layers are exposed. Roads do not have needed drainage systems and during precipitation events the water flows on the carriageway and washes out the asphalt-concrete layer to the sand and gravel layers. Collectors and drainage pipes and culverts need to be rehabilitated.

2.1 Why Addendum is Needed

This Addendum has been prepared to address the possible environmental concerns of two new road rehabilitation projects in Gori Municipality. These new roads (Gorijvari Road and Pushkin Street) are described in this Addendum. The alternatives considered in the original EA are the same reasonable alternatives considered for these new roads. Alternative 1 (Proposed Action) is preferred to the Restructured Roads Program (Alternative 2) and the No Action Alternative. New Affected Environment and Environmental Consequences discussions are included in this Addendum for these new roads and new Environmental Mitigation and Monitoring Plans (EMMPs) are developed to address environmental concerns related to these new roads.

2.2 Description of the Project

There are two new roads in the GMIP municipal road rehabilitation project in Gori Municipality: Gorijvari Road and Pushkin Street. These projects are summarized as follows:

- Gorijvari Road: The length of this rehabilitation project is 1,445 m. Rehabilitation includes improvement of the paved section in Didi Gorijvari, upgrade of gravel sections of the Gorijvari Monastery access road, some realignment requiring about 170 m of new roadway, new concrete drainage culverts/furrows, parking lots, sidewalks and a 92 m section of cobblestone pavement. Gorijvari Road in Gori

Municipality is very steep and the existing road shows severe erosion needing recontouring, revegetation and stabilization. This road rehabilitation involves Road Improvement Type III (cobblestone) and Road Improvement Type IV (two layers of asphalt-concrete pavement). The alignment of Gorijvari Road is shown in Figure 2.1.

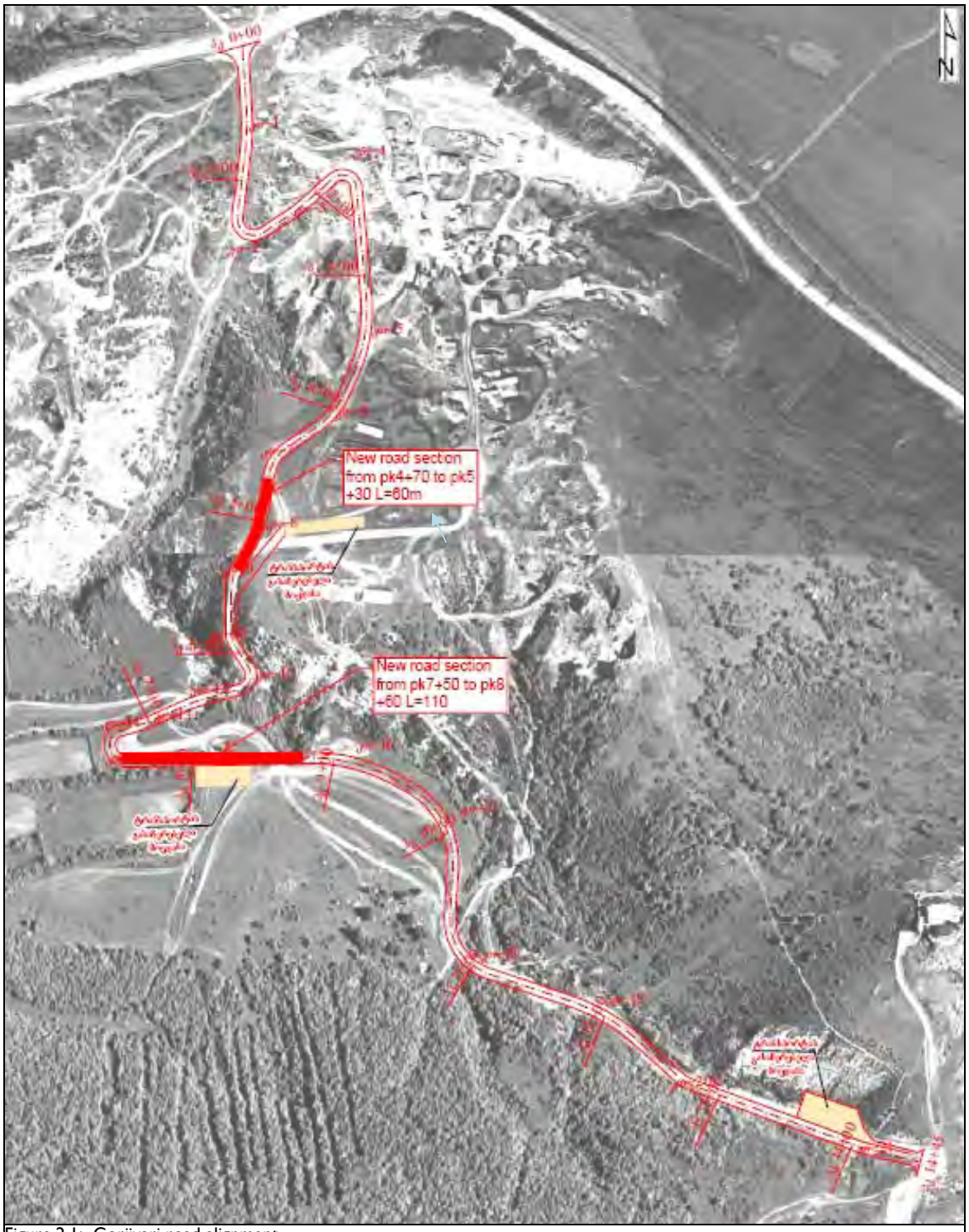


Figure 2.1: Gorijvari road alignment

- Pushkin Street in Gori Municipality: The length of this rehabilitation project is 915 m. The existing roadbed (12 – 20 m wide) is in satisfactory condition, but the roadway pavement (7.9 – 10.5 m wide) has various kinds of damage, waves, small and large pits, linear and lateral cracks and poor slopes. The existing reinforced-concrete bridge is in good condition, but there is some damage where the bridge connects to the roadway. Existing drainage pipe is in good shape but some additional pipe is needed. Also, new concrete curbs are needed and sidewalks need to be raised and replaced, including new stairs. This project involves Road Improvement Type IV. The damaged roadway will be milled totally and rehabilitated with two layers of asphalt-concrete pavement. The location of Pushkin Street is shown in Figure 2.2.

Figure 2.2: Pushkin street location

These road projects address needs from Georgia's August 2008 conflict with Russia. This conflict and the global economic downturn have placed a severe strain on Georgia's national budget and its ability to finance core investments like these municipal roads. Many years of decline in the quality, coverage and maintenance of roads have dramatically reduced Georgia's quality of life and constrained private sector growth.

2.3 Other Project Alternatives

Two other alternatives to the proposed action were considered: restructured roads program and no action. Under the restructured roads program, fewer road segments are improved and road improvements will meet higher standards. This alternative emphasizes quality of road improvement over quantity. Municipalities would use the highest quality

pavement types, sidewalks that fully meet pedestrian needs, and drainage systems that address higher rainfall event projections.

This alternative was reviewed with the GMIP Steering Committee. The Committee indicated that the municipalities had flexibility during initial the project development period and that their priority road segments took road quality standards into consideration along with local needs, number of beneficiaries and costs. They thought that if municipalities were offered this alternative, there would be little difference in the road segments recommended for GMIP funding.

The no action alternative was also considered. Under this alternative, the target road rehabilitation projects would not be implemented. The expectation that improved roads would bring tourists and other investment would not materialize. The employment opportunities that are expected as an indirect effect of road rehabilitation are intended to significantly benefit IDPs near the municipalities. Without road rehabilitation, these employment opportunities will be lost, and IDPs will continue to find it difficult to improve their living conditions. This alternative provides a benchmark against which the proposed action alternative may be evaluated.

2.4 22 CFR 216 Requirements, IEE Summary, Scoping Process

USAID's environmental regulations (22 Code of Federal Regulations 216 or Reg. 216) establish the conditions and procedures for environmental review. These procedures apply to new projects, programs, or activities authorized by USAID. Reg. 216 establishes a process for the review of environmental and social impacts; and ensures that projects that are undertaken as part of programs funded under USAID are environmentally sound, are designed to operate in compliance with applicable regulatory requirements, and as required by the legislation are not likely to cause a significant environmental, health or safety hazard.

The Initial Environmental Examination (IEE) for GMIP was drafted and approved by the Europe and Eurasia Bureau Environmental Officer (BEO) on June 23, 2010 (DCN: 2010-GEO-033). Pursuant to Reg. 216 and the IEE's Positive Determination for Component 2, an Environmental Assessment (EA) is required. This EA was prepared to comply with the Positive Determination and is meant to ensure that environmental consequences and their significance are known and clearly identified prior to the approval of the final design and start of construction [216.3 (a) (4)].

LTD KAV and Tetra Tech led the scoping process for the municipal road rehabilitation EA. The team identified, reviewed, and prioritized environmental issues. The Scoping Statement was approved by the USAID/Europe & Eurasia Bureau Environmental Officer (BEO).

2.5 Plan for Addendum

The potential significant social and environmental concerns considered for these new roads are the same concerns identified in the Scoping Statement (SS) and analyzed in the original EA for Road Rehabilitation. Mitigations (including best practices) address impacts associated with soil erosion and damage to road foundations, construction activities, disposal of old/damaged asphalt and road subsurface materials, disposal of damaged sidewalks and

drainage collectors/pipes. Mitigations also address socio-economic and public health and safety concerns, road operation and maintenance including erosion, road ruts, potholes and clogged drains, impacts to TES and cultural/historic resources and municipal road maintenance programs.

EMMPs were developed for road rehabilitation (Table 6.1) and operation and maintenance of municipal roads (Table 6.2). EMMPs include the identified environmental impacts, individual mitigation measures, monitoring indicators, monitoring/reporting frequency and responsible party for oversight of EMMP implementation.

3. Description of New Road Rehabilitation Projects

Gori Municipality replaced their original list of 26 roads that were addressed in the original EA with two new municipal road projects (Gorijvari Road and Pushkin Street). Appendix 8.1 provides the detailed list of rehabilitation activities for Gorijvari Road. At the end of this appendix are notes that describe the construction site, project description, engineering, road pavement specifications and additional project notes. A similar description of rehabilitation activities for Pushkin Street is provided as Appendix 8.2 Summary information on each road project is provided below:

Gorijvari Road

- The length of this rehabilitation project is 1,445 m.
- Rehabilitation includes improvement of the paved section in Didi Gorijvari, upgrade of gravel sections of the Gorijvari Monastery access road, some realignment requiring about 170 m of new roadway, new concrete drainage culverts/furrows, parking lots, sidewalks and a 92 m section of cobblestone pavement.
- The road is very steep and the existing road shows severe erosion needing recontouring, revegetation and stabilization.
- This project involves Road Improvement Type III (cobblestone) and Road Improvement Type IV (two layers of asphalt-concrete pavement).

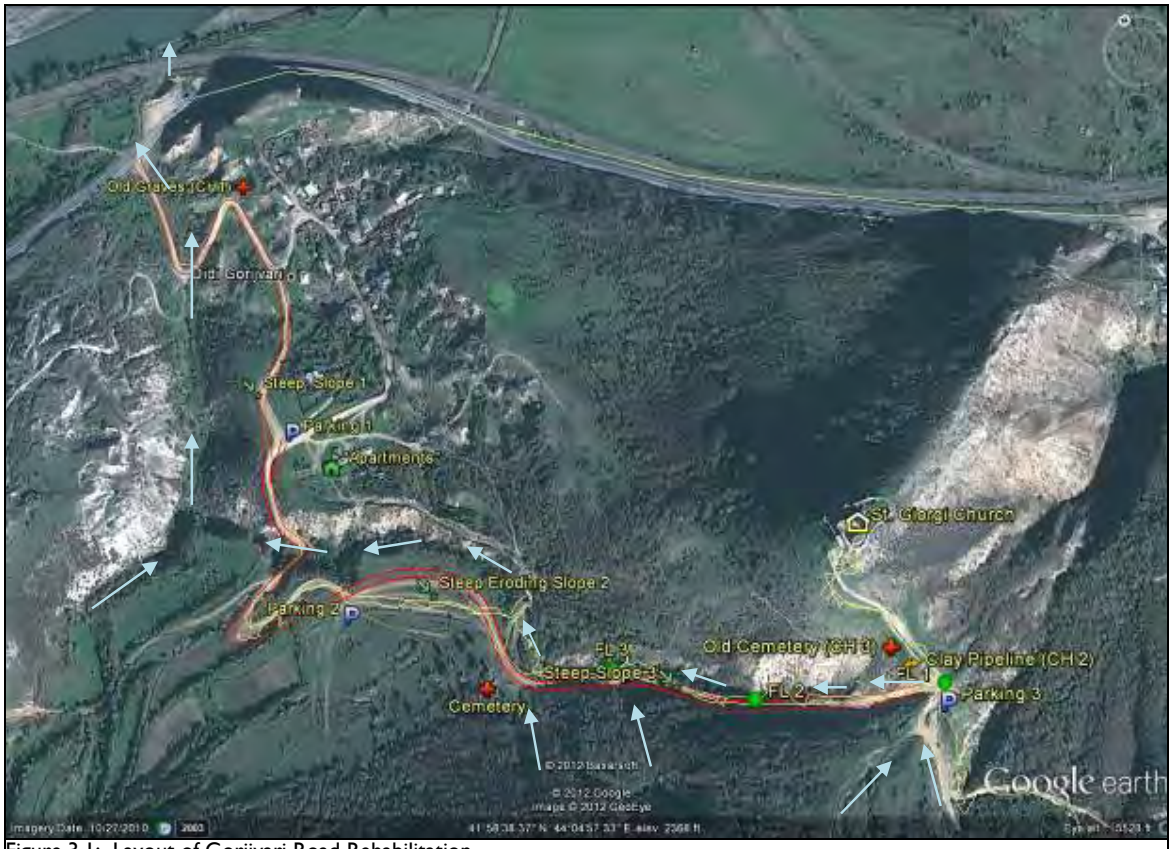


Figure 3.1: Layout of Gorijvari Road Rehabilitation

Pushkin Street/Gori

- The length of this rehabilitation project is 915 m.
- The existing roadbed (12 – 20 m wide) is in satisfactory condition, but the roadway pavement (7.9 – 10.5 m wide) has various kinds of damage, waves, small and large pits, linear and lateral cracks and poor slopes.
- The existing reinforced-concrete bridge is in good condition, but there is some damage where the bridge connects to the roadway. Existing drainage pipe is in good shape but some additional pipe is needed. Also, new concrete curbs are needed and sidewalks need to be raised and replaced, including new stairs.
- This project involves Road Improvement Type IV. The damaged roadway will be milled totally and rehabilitated with two layers of asphalt-concrete pavement.

The EA road projects involved four types of road pavement improvements (alternative road materials will be considered as well). Each road type is described below:

Road Improvement Type I

- Damaged asphalt-concrete pavement is fully removed;
- Removed asphalt-concrete pavement will be crushed and recycled for relaying as an aggregate base;
- Leveling layer of sand and gravel mix, thickness 8 cm on hard base (stone base or compacted), leveling layer of sand, thickness 15 cm on sandy base;
- Base course - crushed aggregates 0-40 mm, thickness 8 cm;
- Road Pavement – fine-grained asphalt-concrete hot mix – thickness 5 cm.

Road Improvement Type II

- 6-7 cm of asphalt-concrete pavement;
- Milling of the damaged asphalt-concrete pavement, mixing the milled materials with fractional macadam and providing a leveling layer 5 cm thick;
- Add binder course – coarse grained porous asphalt-concrete Mark II hot mix – 6 cm;
- Add wearing course – fine- grained dense asphalt-concrete hot mix – 4 cm;
- All roads will have improved drainage channels and/or raised curbs for sidewalks to ensure proper drainage.

Road Improvement Type III

- Add sub-base layer of clean sand and gravel (non-silty) mix, thickness 15 cm;
- Add base course – clean sand (non-silty) and cement (5%) mix, thickness 15 cm;
- Add pavement using local cobble-stone – average size 15 cm.
- Pavement structure includes arrangement of a concrete reinforcement belt.

Road Improvement Type IV

- Pit-hole repair of asphalt-concrete layers using pneumatic hammers and Bitumen;
- Filling pits with fine-grained dense asphalt-concrete hot mix;
- Arrangement of leveling layer with fine-grained porous asphalt-concrete hot mix – thickness 2 cm;
- Add wearing course – fine-grained dense asphalt-concrete hot mix - thickness 4 cm.

4. Affected Environment

This chapter provides a brief description of the human and natural environment associated with the two new municipal road rehabilitation projects (Gorijvari Road and Pushkin Street in Gori). It focuses on the *affected environment* in these two project areas, including population characteristics, economy and geology and soils. Baseline descriptions of the affected environment provide the benchmark for the evaluation of the environmental consequences of the proposed projects in Section 5.

4.1 Population Characteristics

The population of Gori Municipality (the entire district) as of January 1, 2010 was 143,100, including 51,200 living in Gori (town) and 91,900 living in rural areas. The share of the urban/rural population is therefore 35.5% / 64.7%. Average density of population is 62 persons per sq. km. Population of Gori Municipality is distributed among 21 Territorial Units, which include 96 villages. The largest territorial unit is the town of Gori.

4.2 Economy

Gori Municipality provides a representative profile of the economic sectors of the two project areas: agriculture (20.2%), processing (4.8%), industry (14.8%), construction (5.6%), trade (12.1%), transport and communications (12.4%), public/governance (16.6%), education (5.0%), health (2.7%), and other services (5.8%). The Gross Domestic Product (GDP) of Gori Municipality is 1.68% of the GDP of Georgia, a small fraction of the national GDP; the annual per capita income is 2080 GEL.

4.3 Geology and Soils

There are four main morphological parts in Gori: 1) Gori plain, occupying 39.7% of the territory with the inclination towards southeast. 2) The valley of Shua Mtkvari with wide terrace plains. 3) Kvernaki ridge, which is located 100-120 meters above the plain. 4) The northern slope of Trialeti Ridge, which is very close to Mtkvari Plain. Alluvial meadow carbonate and brown carbonate soils are found throughout the Gori plain.

The geographic distribution of soils in Georgia is shown on Figure 4.1 below. As can be seen, two main types of soil are present in the project area:

- Meadow-cinnamonic: these soils can be found in Kvemo and Zemo Kartli, in Kakheti and Meskheti regions. Their combined area is some 1180 hectares (1.7% of Georgia). These soils are characterized by poorly differentiated profile, with more profound profiles on cinnamon soils. They are distinguished by weak alkaline or alkaline reaction, a low content of humus, carbonate, a loamy to clayey texture, accumulation of clay, high content of hygroscopic water, bulk density between 1.22 to 1.31 g / cc, a high to medium absorption capacity. The soils have moderate (0-10cm) to poor (10-20cm) content of hydrolysable nitrogen, have low content of mobile phosphorus and exchangeable potassium, and they are prone to water and wind erosion.

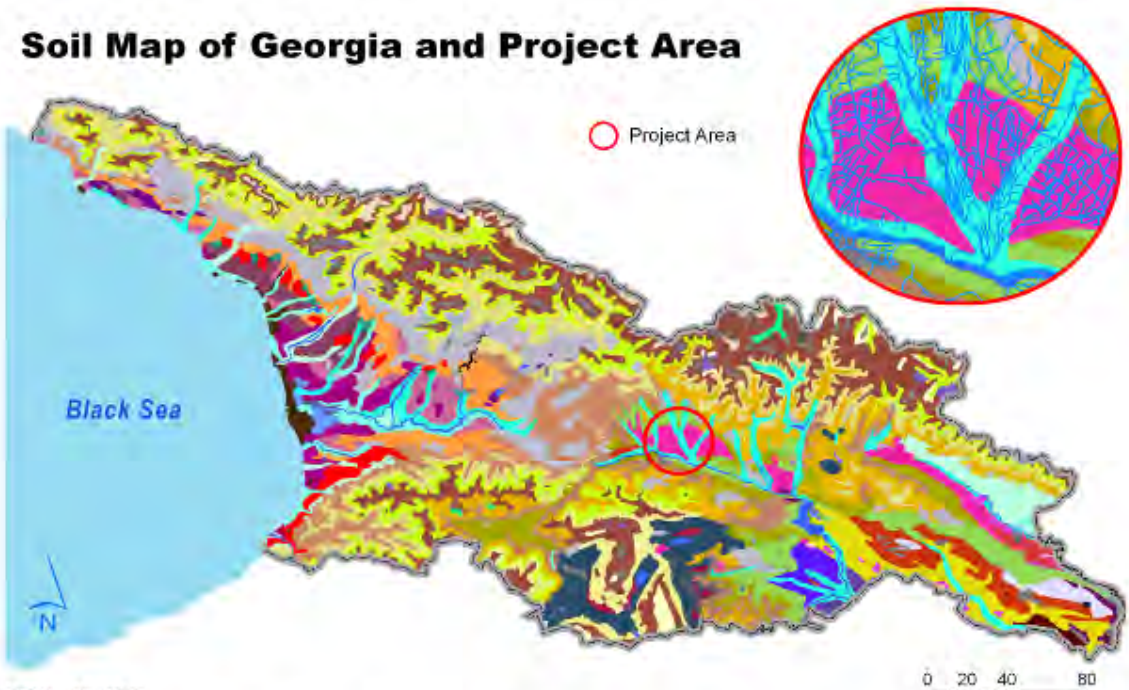
- Alluvial calcareous (calcaric fluvisols): these soils occupy some 2720 sq km (4.0% of Georgia). These soils are characterized by neutral or alkaline reaction,

low humus content, high content of hygroscopic water, high absorption capacity, loamy or clay texture. The soils have medium (0-10cm) to poor (10-20cm) content of hydrolysable nitrogen, have slight to moderate content of total phosphorus, low or medium content of total potassium, and medium to low content of exchangeable potassium. They are prone to wind erosion.

Gori belongs to the fold system of the Lesser Caucasus Mountains and is characterized by plain relief constructed from Quaternary Age conglomerates, pebbles, sand, and loamy sand. The south part is constructed from paleogenic limestone and loam, while the northern part is constructed from neogenic loam and limestone. In the valley of Mtkvari river, brown soils and gray forest soils (of medium and thin thickness) are found. The land is productive and is typically used for agriculture.

Alluvial soils are found in the gorges of the rivers Didi Liakhvi, Patara Liakhvi, Mejuda, Ksani, Aragvi, Iori, Alazani, and others. In most of these gorges, alluvial carbonate soils are at the initial stage of development to the field soil. The alluvial soils of this type and old alluvial soils contain thick and medium-thick loam and are characterized by a low percent of humus.

The soils in the Gori project area are thought to have normal soil erosion activities with average sediment transport behavior. Their normal erosion/transport behavior is influenced by the soil consistency and content of yellow clay, macro-porous/rough particle sand, crushed rock and pebbles, break-stone and conglomerates.



SOIL TYPES

Source: Urushadze, T., available at http://www.moa.gov.ge/images/mica/niadag_map.jpg

1	Primitive mountain-meadow	26	Black calcareus
2	mountain-meadow soddy (andic cambisols)	27	Black alkalized and halomorphic
3	Mountain-meadow soddy-peat	28	Meadow-black
4	Mountain-meadow bog	29	Meadow-black alkalized and halomorphic
5	Mountain-meadow chernozem-like	30	Cinnamonic leached
6	Mountain-forest-meadow	31	Cinnamonic (chromic cambisols)
7	Brown forest acid (umbric cambisols)	32	Cinnamonic calcareus
8	Brown forest weakly unsaturated (eutric cambisols)	33	Cinnamonic light
9	Brown forest podzolized	34	Meadow-cinnamonic
10	Yellow-brown forest	35	Meadow grey-cinnamonic
11	Brown forest-black	36	Grey-cinnamonic dark
12	Raw-humus calcareus (calcaric) - (rendizans)	37	Grey-cinnamonic (ermic cambisols)
13	Waterbodies	38	Grey-cinnamonic light
14	Terra-Rossa	39	Humus sulphate
15	Red soils	40	Solonetz
16	Red podzolized soils	41	Solonchak
17	Yellow soils (haplic alisoils)	42	Alluvial acid (dystric fluvisols)
18	Yellow podzolized soils	43	Alluvial saturated (eutric fluvisols)
19	Subtropical podzol (haplic acrisols	44	Alluvial calcareous (calcaric fluvisoils)
20	Subtropical orstein podzol	45	Sitly-bog (haplic gleysols)
21	Subtropical grey podzol (Gleic acrisols)	46	Peat-bog (haplic gleysols)
22	Leached chernozem (luvic chernozem)	47	Antropogenis soils (urbic anthrosols)
23	Chernozem (haplic chernozem)	48	Strongly eroded soils and bare rocks (dystric/eutric lithosols)
24	Vertic chernozem	49	Glaciers
25	Vertisols		

Figure 4.1: Soil Map of Georgia (source: Ministry of Agriculture of Georgia)

4.4 Water Resources, Hydrology and Fisheries

The sources of water that feed rivers and streams in the Gori and Gorijvari project area are the Didi Liakhvi River, Patara Liakhvi River and the Mejuda River. These river systems are described below.

Didi Liakhvi River: The Didi Liakhvi River originates at Goluata village, at 2337.7 m altitude and falls into Mtkvari/Kura River from the left side, at 972 m above sea level at Gori. The length of the river is 98 km; the total fall – 1755 m; average slope – 17.9%; area of the catchments basin – 2440 km^2; and average altitude of the basin – 1590 m. The river system includes numerous tributaries totaling 1800 km in length, including Patara Liakhvi (63 km length) and Mejuda (46 km length).

The river regime is characterized by spring floods and low flows in winter. The river is fed from rain, snow, glacier and groundwater. Thirty to 39% of the annual flow is provided in spring, 37-42%; in summer, 14-16%; in autumn and 8-9% in winter. For calculation of the average annual flow of Didi Liakhvi River, at Ergneti village (near village Kvemo Nikozi), 47 years of data (1942-1990) from the hydro power station Kekhvi was used. Average annual flows at Kekhvi varied from a minimum in 1951 of 17.9 m^3/sec to a maximum of 53.3 m^3/sec (1987) with an average of 27.3 m^3/sec. Downstream, there are four to five villages with a combined population of up to 1000 households. These water users/villages divert Didi Liakhvi waters for irrigation. Total downstream use of Didi Liakhvi water is estimated at 2.5 m^3/sec. There is no Didi Liakhvi water diverted for use in Gori city. Groundwater and irrigation return flow contribute to recharging the river. Even in the low summer flow period, 3-4 m^3/sec flow is maintained in Didi Liakhvi where it joins Mtkvari/Kura.

Patara Liakhvi River: The Patara Liakhvi River originates from the springs located on the northwest slope of Cheparukhi Mountain, in the western part of Lomisi Mountain Ridge, and falls into the River Didi Liakhvi at the village of Shertuli. The length of the river is 63 km; total downgrade is 1960 m with an average slope of 31.1%; the catchments basin is 513 km^3; and the average altitude of the basin is 1850 m. The Patara Liakhvi River is fed basically by rain and snow waters. The role of groundwater feeding is secondary. Its regime is characterized by spring floods and summer to autumn high waters and relatively stable low flow in winter. 44.7% of the annual flow is in spring, 33.5% in summer, 21.1% in autumn and 9.7% in winter. Average annual flow, based on data from Vanati hydro-power station, located ten km below the Zonkari reservoir varies from 5.19 m^3/sec to 18.0 m^3/sec

Mejuda River: The Mejuda River originates on the southern slope of Dzirisi Mountain (2994.6 m) and falls to the Didi Liakhvi River at Gori. The length of the river is 46 km with an average slope of 30%. There are 79 tributaries of 278 km total length which flow into the river. Among them, the most significant are Adzula (26 km length) and River Western Tortla (31 km length). The Mejuda River is fed from rain, snow, and groundwater. Its regime is characterized by spring floods and variable low flows during other seasons. About 53.7% of the annual flow occurs in spring, 20.7% in summer, 11.6% in autumn, and 14% in winter.

Groundwater: Renewable groundwater resources at the national level are estimated at 17.23 km^3/year, of which 16 km^3/year are drained by the surface water network. This gives a total of 58.13 km^3/year for internal renewable water resources (IRWR). The total actual

renewable water resources (ARWR) are 63.33 km^3/year. In 1990, the total water abstraction was estimated at three km^3/year from some 1,700 tube-wells. According to a recent assessment, another seven km^3/year could be sustainably abstracted in the future. Groundwater use was not greatly developed during the Soviet period, due to the emphasis on large-scale, state-run surface irrigation schemes.

Fisheries: The Red List of Georgia is part of the International Union for Conservation of Nature (IUCN) Red List of Threatened Species that was founded in 1963. The Red List is the world's most comprehensive inventory of the global conservation status of biological species. The IUCN is the world's main authority on the conservation status of species. A series of Regional Red Lists are produced by countries or organizations, which assess the risk of extinction to species within a political management unit.

Three fish species on the Red List of Georgia (Golden spined loach- *Sabanejewia aurata,* brook trout- *Salmo fario,* and Kura undermouth- *Chondrostoma cyri* may occur in ecosystems that feed rivers and streams in the Gori project area. Out of 14 fish species inhabiting River Liakhvi (all protected under the Bonn Convention), ten species can be encountered with variable frequency and abundance in the project area's sections of rivers, namely:

1. *Capoeta capoeta* (Khramulya)
2. *Chondrostoma cyri* (Kura Undermouth)
3. *Barbus lacerta cyri* (Kura Barbel)
4. *Barbus mursa* (Barbel - Mursa)
5. *Acanthalburnus microlepis* (Blackbrow bleak)
6. *Alburnoides bipunctatus eichwaldi* (Bystryanka)
7. *Neogobius cephalarges constructor* (Ginger Goby)
8. *Noemacheilus brandti* (Kura Stone Loach)
9. *Sabanejewia aurata* (Golden Spain Loach)
10. *Ponticola constructor* (Caucasian Goby)

Of these species, Nos. 4 and 5 are endemics of the Caucasus and No. 2 is included on the Red List of Georgia. While these fish species may be in regional ecosystems, none of these species are expected to occur in the Gori and Gorijvari project areas.

4.5 Environmental Baseline of Project Sites

The following sections provide information about the current environmental setting in the areas around Gorijvari Road and Pushkin Street in Gori. Road rehabilitation is proposed for these two existing roads within this urban and peri-urban environment of already disturbed area. Below, the biodiversity (fauna/flora), ecosystems and cultural resources are described for each road project. The information below was gathered from the site reports, from other documentation as noted, and from field visits during the scoping process and the EA phase.

4.5.1 Affected Environment: Gorijvari Road

Gorijvari Road is southwest of Gori Municipality on the right bank side of Mtkvari River. The Gorijvari Road rehabilitation begins in Village Did Gorijvari near the Trialeti mountain range and continues to Gorijvari Monastery. Appendix 8.3 provides a detailed site visit report that begins with an environmental characterization of the site followed by

descriptions and findings for terrestrial biology (fauna, by Mr. Andrei Kandaurov from the Institute of Zoology, flora by Dr. Mirian Gvritishvili from Tbilisi Botanical Garden) and cultural heritage and archaeology (by Dr. Gogi Mindiashvili). The site inspection was conducted by these experts on April 7, 2012.
Summary findings on biodiversity and cultural resources are described below.

BIODIVERSITY. This section includes an assessment of fauna and flora based on review of published scientific data, available collections, experience of experts and field survey findings. The **Red List of Georgia** is referenced in this section. It is part of the International Union for Conservation of Nature (IUCN) Red List of Threatened Species that was founded in 1963. The Red List is the world's most comprehensive inventory of the global conservation status of biological species. The IUCN is the world's main authority on the conservation status of species. A series of Regional Red Lists are produced by countries or organizations, which assess the risk of extinction to species within a political management unit.

All sensitive receptors which might be affected by the Gorijvari Road rehabilitation were identified. All possible impacts on identified populations of protected species and key plant communities, habitats, and ecosystems were considered. The general principle for species selection was that each species is protected by law (listed in the national Red Data List, 2006). Rehabilitation of the road should not lead to the harm to species that occur in Georgia, especially endangered species.

Fauna: In total, 108 mammal species occur in Georgia. The Red Data List of Georgia includes 33 mammals. All bat species, 28 in total, recorded in Georgia are protected under the EUROBATS agreement. About 35-40 species of mammals are recorded in the region, most of them occur in habitats lying outside the Project area. 390 bird species are recorded in Georgia. The Red Data List of Georgia includes 35 birds. Over 220 species nest in Georgia, others are observed during migration and wintering. No less than 215 species are migrating forms. Georgia is part of important Euro-African and Euro-Asian migration routes for birds. No less than 230 bird species are recorded in the country during spring and autumn migration. The bird migration takes place from west to east along r. Mtkvari valley (from Khashuri to Tbilisi) from early March to mid-May. In late August - late November the birds migrate from east to west. Up to 120 bird species and 1 million individuals migrate through r. Mtkvari valley (in both directions) in Georgia. The most abundant migrating groups are *Passeriformes, Charadriiformes, Falconiformes* and *Anseriformes*. About 240 bird species are recorded within the Gori administrative district. Near 150 of them are local breeders (nesting species), 57 regular migrants, 28 species are wintering here, and 8 species are vagrant or occasional visitors. One can observe not more than 60 bird species within the considered area. Among them 15-18 species – prefer urban and rural habitats, 13 species related with riparian habitats and about 30 species prefer bushes and forest edges.

Fifty-four reptile species occur in Georgia. 11 species are included in the Red Data List of Georgia. About 10 species could be expected within the Project area. Majority of the reptile species are not likely to be affected by construction. 12 amphibians are found in Georgia, 2 are included in the Red Data List of Georgia. No one of the red listed species occurs within the area of Project. Thousands of invertebrate species inhabit Georgia. The status of "Data Deficient" can be applied to the majority of the species. The Red Data List of Georgia includes 44 invertebrates. The Red data List of Georgia is an only legal issue to protect

species according to law. The species listed in the Red Data List of Georgia, which can be seen within the area of the Project of the Gori-Gorijvari road rehabilitation, are presented in the Table 4.1.

Table 4.1. Georgian Red List Species in the Project Area

Ref.	Scientific Name	Common Name	National Status	Kind of occurrence within area
		Mammals		
1	*Myotis emarginatus*	Geoffroy's bat	VU	?
2	*Cricetulus migratorius*	Grey dwarf hamster	VU	Open landscape
3	*Ursus arctos*	Brown bear	EN	Vagrant from forest south from area
		Birds		
1	*Buteo rufinus rufinus*	Long-legged buzzard	VU	Possibly breeding
2	*Aquila heliacal*	Imperial eagle	VU	Migrant, vagrant
3	*Aquila chrysaetos*	Golden eagle	VU	Vagrant
4	*Neophron percnopterus*	Egyptian vulture	VU	Feeding area
5	*Aegypius monachus*	Eurasian black vulture	EN	Vagrant
6	*Gyps fulvus*	Eurasian griffon vulture	VU	Vagrant
7	*Falco cherrug*	Saker falcon	CR	Migrant
8	*Falco vespertinus*	Red-footed falcon	EN	Migrant
9	*Aegolius funereus*	Boreal owl	VU	Possibly breeding
		Reptiles		
1	*Testudo graeca*	Mediterranean tortoise	VU	Open areas, forest edges
		Invertebrates		
		Butterflies		
1	*Manduca atropos*	Death's head sphinx	EN	Forest edges
2	*Callimorpha dominula*	Tiger moth	VU	Forest edges
3	*Polyommatus daphnis*	Meleager's blue	VU	Open areas, forest edges
		Bumble bees		
2	*Bombus persicus*	Persian humble-bee	VU	Open areas, forest edges
3	*Xylocopa violacea*	Violet carpenter bee	VU	Open areas, forest edges

Endemic Species: Among vertebrates, there are four species endemic to the Caucasus that can be found in the project area. Table 4.2 provides the species names (scientific and common), assessment of extent of possibility that these species would be impacted during construction works or during the normal operation of the road and preferred biotopes for these species.

Table 4.2. Species Endemic to the Caucasus in the Project Area

	Common name	Latin name	Possibility of impact on the species	Biotopes and range of occurrence
		MAMMALS		
1	Caucasian mole	*Talpa caucasica*	Low	Forest
2	Radde's shrew	*Sorex raddei*	Low	Forest
3	Caucasian mouse	*Apodemus ponticus*	Low	Forest
		REPTILES		
1	Kura lizard	*Darevskia portschinskii*	Low	Gorijvari monastery, along road

Species Protected by Law: Three mammal species included in the Red Data List of Georgia occur in the project area. Construction activities may affect individual range (home range) of the grey dwarf hamster (*Cricetulus migratorius*). It is possible that the brown bear (*Ursus arctos*) could penetrate into the project area in winter from neighbor forests. However, it is unlikely that this bear will be affected by road construction.

Available data on distribution of bats indicates that eight bat species occur in the project area. One out of these eight bat species, namely Geoffroy's bat (*Myotis emarginatus*) is included in the Red Data List of Georgia as Vulnerable. It should be emphasized that structures colonized by bats are extremely important for their survival. Table 4.3 below provides a list of the bat species, status and preferred shelter type for colonies (tree hollows or structures / buildings).

Table 4.3. Bat Species Found in the Project Area

Ref.	Scientific Name	Common Name	Status	Inhabiting	
				Tree Hollows	Buildings
1	*Rhinolophus ferrumequinum*	Greater horseshoe bat	LC	+	+
2	*Rhinolophus hipposideros*	Lesser horseshoe bat	LC	+	+
3	*Myotis mystacinus*	Whiskered bat	LC	+	+
4	*Myotis emarginatus*	Geoffroy's bat	**VU**		+
5	*Eptesicus serotinus*	Serotine bat	LC	+	+
6	*Pipistrellus pipistrellus*	Pipistrelle bat	LC	+	+
7	*Plecotus auritus*	Brown long-eared bat	LC	+	
8	*Miniopterus schreibersii*	Common Bent-wing Bat	LC		+
	Total = 8 species			6	7
	Included in the Red Data List of Georgia	1 species		1	1

Bats are strongly dependent on existing shelters and areas for propagation and wintering. Their disturbance in May-June or December-February may result in high mortality of these animals. The strong negative impact can be caused by cutting down mature trees with hollows along the existing road.

Nine bird species out of thirty-five included in the Red Data List of Georgia may occur in the project area. Two species could be nesting; others are migratory (3) or vagrant (3) visitors to area. One species (Egyptian vulture) regularly feeds on the area, but nearest known to us nest is out of the Project area on Kvernaki Ridge. For the migratory birds, the part of r. Mtkvari valley between Tbilisi and Khashuri is important as it provides route for migration, while the rivers floodplain provides shelters and feeding areas, as well as bushes and forest in the Project area provides shelters.

Bushes and deciduous forest on foothills along the road are the breeding bird habitat.

One reptile species (Mediterranean tortoise), included in the Red Data List of Georgia, may occur in the construction impact zone. Destroying of places where the tortoises lay eggs can reduce number of population in the vicinities of the construction area. Often such

places are on the edges of the roads and on the slopes of gullies. Among reptiles are one regional endemic of the Caucasus – the Kura lizard (*Darevskia portschinskii)*. Generally, the rock lizards are very much depended on specific places of dwelling – rocks, rich with insects. Therefore, they meet in a plenty on a few sites removed from each other. Destruction of such sites can strongly reduce a population or even to threaten to population of the species. It can happen, during the construction, if rocks, on which they today live, will be blown up during the construction.

Sites important for reptiles should be defined during the pre-construction survey, including:

- Edge of the dirt road where there is a risk of destruction of Mediterranean tortoise (*Testudo graeca*) egg-laying sites.
- Exposure of rocks along the upper part of existing roads inhabited by rock lizards (*Darevskia* sp.).

No amphibian species included on the Red Data List of Georgia are recorded within the project area. Available scientific data indicates that five invertebrate species protected by law may occur in the project area. These species include three butterflies, one bumblebee, and one carpenter-bee. However, it is unlikely that rehabilitation of roads will harm these species on a population level. It should be noted that the work area lies within the ranges of four mammals. These are listed in Table 4.4.

Table 4.4. Mammal Species Occurring Within the Project Area

#	Latin name	English name
1	*Canis lupus*	Wolf
2	*Canis aureus*	Jackal
3	*Vulpes vulpes*	Fox
4	*Marten sp.* Not defined on species level	Marten

Wolf, jackal and fox are attracted to the construction area by the dump near the monastery containing bones, leather and entrails of sacrificial animals, mainly sheep. The feeding strategy of these species (picking up food from the road) leads in mortality of the carnivores on roads.

Ecosystems: Major ecosystems found along the existing road are briefly described below:

- Agricultural landscapes. Part of the project area is represented by Village Didi Gorijvari, which includes cultivated land and pastures. The existing pasture land does not support rich fauna. However, the pasture land represents habitat for protected species (Grey dwarf hamsters and Mediterranean tortoise).

- Foothill deciduous forests and xerophytic shrubbery occupy the slopes of hills and ridges. Negative impacts on these ecosystems could occur only if large areas of shrubbery are destroyed. The planned rehabilitation of the existing road will not substantially increase the current results. However, it might be good to consider construction of some type of "underpass" for small animals to cross the road safely.

Flora: Vegetation in the area of rehabilitation of Gorijvari Road can be botanically characterized as a derivative of degraded oak-oriental hornbeam forests. There are a few noteworthy plants including Georgian Red List species, viz. elm (*Ulmus minor Mill.*) as well as

a number of economic (edible, medicinal) and amenity plants that should be used during vegetation restoration after road construction. See Table 4.5 for species of trees and shrubs along Gorijvari Road near Gorijvari Monastery.

Table 4.5. List of Species of Trees/Shrubs Growing Near Gorijvari Monastery.

Acer campestre L.	Field maple	ჩვეულებრივი ნეკერჩხალი
Armeniaca vulgaris Lam.	Apricot	გარგარი, ჭერამი
Astragalus microcephalus Willd.	Millk vetch, Tragant	გლერძი
Atraphaxis caucasica (Hoffm.) Pavl.	Caucasian goat's wheat	ხორციფერა
AABBerberis vulgaris L .	European Barberry	კოწახური
Carpinus orientalis Mill.	Oriental hornbeam	ჯაგრცხილა
Cornus mas L.	Cornelian cherry	შინდი
Cotinus coggygria Scop.	Smoke tree	თრიმლი
Cotoneaster sp.	Cotoneaster	ჩიტაკომშა
Crataegus spp.	Hawthorn species	კუნლის სახეობები
Elaeagnus angustifolia	Oleaster	ფშატი, ჭალაფშატა
Ephedra procera Fisch. et C.A.Mey.	Ephedra	ჯორის ძუა, ცხენისმუხლა
Fraxinus excelsior L.	Common ash	იფანი
Juniperus oxycedrus L.	Juniper	ღვია
Lonicera caprifolium L.	Garden woodbine	ჯიქა
LLonicera iberica Bieb.	Georgian Honeysuckle, Woodbine	ცხრატყავა
Paliurus spina –christi Mill.	Christ's thorn	ძეძვი
Prunus divaricate Ledeb.	Bush cherry plum	ტყემალი
Pyrus caucasica Fed.	Caucasian wild pear	პანტა
Pyrus salicifolia Pall.	Willow-leaved pear	ტირიფფოთოლა ბერყენა
Rhamnus pallasii Fisch. et C.A.Mey.	Pallas's buckthorn	შავჯაგა, ჯღარდალა
Rosa canina L.	Dog-Rose	ასკილი
Spartium junceum L.	Spanish broom	ესპანური კურდღლისცოცხა
Spiraea hypericifolia L.	Spirea	გრაკლა
Tilia begoniifolia Stev.	Caucasian linden	კავკასიური ცაცხვი
Ulmus minor Mill.	Smoothleaf elm	თელა

Local plants for areas rehabilitated along Gorijvari Road include Cornelian cherry, Wild plum (ტყემალი in Georgian) and Dog-rose.

CULTURAL RESOURCES. The Gorijvari Road rehabilitation site consists of the fortification stone fence and a two story building that was destroyed during the 1920 earthquake. The fortification is of double wall type, with gun ports (see Annals of Historic and Cultural Heritage Monuments of Georgia, v. 5, 1990). Small size St. Giorgi Church, single hall type, with bell tower and fortification walls was built and restored in 1980s. Medieval settlements of various periods are near the project site. Settlement ruins are evident from the cliff located almost at the edge of the road, where signs of the old church can be identified along with damaged graves exposed in the cliff (which were fabricated using tile shaped stones). These graves were apparently serving as multiple use family vaults (as revealed by the skeleton bones) and could date to the VIII-X period. This site is located near the beginning of Gorijvari Road.

There are also small fragments of the clay pipeline for water supply. The pipeline was identified at the end of the proposed road, near the bottom of the old graveyard. Clay pipe

is considered to be not later than of XVIII century. The pipe is exposed in the left side of the road. A cemetery with memorial grave stones encrypted in Georgian Mkhedruli alphabet is located between the end point of the road and the St. Giorgi Church (XIX period). The grave stones of 1830 and 1901 were documented. Other grave stones were removed but could still be found during construction.

	
Gorijvari Monastery	Grave used as family vault
	
Tombs from graves	Georgian Mkhedruli encryption

4.5.2 Affected Environment: Pushkin Street

Gori, at 700 meters above sea level (masl), is located in eastern Georgia on the Shida Kartli Plain. The Mtkvari river divides Gori into two parts. The main part of the city is located on the east side. Gori is bordered by Kaspi region in the east, Tsalka region in the south, Kareli region in the west and Samachablo in the north. Pushkin Street is located in already disturbed areas of Gori, most of which are urban and peri-urban.

BIODIVERSITY. In Gori, agriculture is the most common land use in the plain area. Since only existing roads will be rehabilitated, only vegetation next to the roads will be disturbed. However, because of the dense human population in the project area, there is little fauna. Existing roads are in urban areas that do not support rich fauna. Some common bird and bat species can still be found in the project area.

Gori Municipality is ecologically important. For example, the Mtkvari Valley between Tbilisi and Khashuri is important for bird migration because the valley provides migration routes and the river floodplains provide shelters and feeding areas for waterfowl and waders.

However, in this urban/peri-urban environment, wildlife is rarely found. No threatened or endangered species or other protected species are found in the affected environment. There are no wetlands or sensitive habitats, including critical habitat of TES along and adjacent to the road segments. No protected areas are located in the "affected environment."

In the wider region, various mammals may be found: chamois, bear, mole, marten, badger, forest cat, jackal, fox, marten, squirrel, and rabbit. But of these, only species adapted to living near human populations are found in the affected environment (i.e., squirrels and rabbits).

CULTURAL RESOURCES. In accordance with the Ministry of Culture and Monuments of Georgia, there are 136 registered monuments of cultural heritage in Gori Municipality, out of which 53 are located in the town of Gori. Of particular importance are the ancient rock-hewn town Uplistsikhe, Goris Tsikhe Castle, Gorijvari, and Erekles Baths. Most of the heritage assets are churches and monasteries and therefore are owned by the Patriarchy of Georgia in accordance with the Constitutional Concordat between the Georgian Orthodox Church and the State.

Goris Tsikhe Fortress

The following sites and monuments of cultural heritage are located in Gori:

- Saint Mary Church;
- Khareba (Annunciation) Church;
- Holy Trinity Church;
- Iveria Holly Temple;
- Father Giorgi Mtatsmindeli Temple;
- Saint Nikolozi Church;
- Saint Nino Church.

The Pushkin Street rehabilitation site is located in a Gori district outside of where these cultural heritage monuments are located.

5. Environmental Consequences

The original EA provides a framework for analyzing the potentially significant social and environmental impacts associated with Gorijvari Road and Pushkin Street in Gori Municipality. These concerns were generated from document review, meetings, and site visits. The concerns were categorized into potentially significant social and environmental issues for further analysis. This section evaluates the potentially significant social and environmental issues with these new roads (Gorijvari Road and Pushkin Street).

5.1 Direct & Indirect Effects and their Significance

Social & Environmental Concern	Potentially significant issue	EA Requirements/ Work Tasks
1. Impacts to Threatened, Endangered & Protected Species (TES), disruption of sensitive habitats and other sites along roads where protected birds, bats, amphibians and reptiles may use habitats.	Rehabilitation, including construction and operation phases, could impact TES and sensitive ecological habitats. This could occur through direct impacts (workers may disrupt habitats without oversight) or it may occur indirectly through habitat alterations due to road rehabilitation. Short and long -term impacts are possible.	Identify presence of TES and/or habitat; identify other important habitats; determine possible short and long-term habitat alterations.

As discussed in Section 4, the affected environment associated with Gorijvari Road and Pushkin Street is located in already disturbed areas, most of which are urban/peri-urban. Pushkin Street in Gori is considered highly disturbed, providing poor quality and very little wildlife habitat. No sensitive habitats are located in the vicinity of Gorijvari Road or Pushkin Street.

Vegetation is not extensive along either of the proposed roads. Where vegetation exists, it is highly disturbed and provides little of its original ecosystem functions. TES, endemics, and other protected and sensitive species are not expected to be affected by the Pushkin Street rehabilitation project in Gori.

Gorijvari Road was surveyed on April 7, 2012. Tracks of 4 species of mammals, 14 bird species and 2 species of reptiles (2 lizards) were observed. No amphibian species or invertebrate species protected by law were observed. Based on the survey and other reviews of available data, it is unlikely that there will be any problems related to conservation of animal biodiversity that cannot be mitigated. There were no species expected to be impacted on a population level. There are no important animal breeding or nesting places, feeding sites, stop-over sites during migration, wintering or hibernation places. The summary of the field observations during the April survey is presented in Table 5.1.

Table 5.1. Observation Points Along Gorijvari Road

#	Label	Longitude	Latitude	Elevation	Time	Comment
1	132	44.08479	41.97432	810	11:51	Upper end of the road near the Gorijvari monastery. Landslide area and dump attracting carnivores to the

						road. Voles colony. Habitat of Caucasian agama.
2	133	44.08292	41.97482	781	13:14	Dense bushes in dry gully on right (northern) side of the road. Scat of Marten and Hedgehog.
3	134	44.08165	41.97545	756	13:24	Covered with bushes dry channel of watercourse on the left (southern) side of the road. Border between home ranges of two foxes. The scat marks on the stone.

The April survey did identify a few Gorijvari Road concerns that should be addressed. A pre-construction survey is recommended for possible sitings of Georgian Red-Listed species, endemic species and other species protected by law. The survey should also cover mature trees planned to be removed to verify presence of bat roosts. (Note that the April survey did not identify any such trees.) If found, bat boxes could be used to compensate for felled trees with nursing colonies and/or wintering associations of bats. The pre-construction survey can also identify whether there are any egg laying sites of Mediterranean tortoise on the construction site.

Best practices should be considered for both road rehabilitation projects to reduce dust emissions and noise levels during construction. Also, construction culverts can be modified as underground passages for small mammals and reptiles to reduce the possibility of animal mortality on roads. Landscape improvements could be planned along terraced steep slopes and local plants such as Cornelian cherry, Wild plum (ტყემალი in Georgian) and Dog-rose could be planted.

Mitigation for construction camp impacts is described in the EMMP (Section 6). Given the extent of already built up areas near these roads, potential impacts from construction camp siting can be easily mitigated. Construction camp operations (solid and liquid waste, hunting and fishing, and social impacts) are also easily mitigated with best practices, as proposed in the EMMP.

Significance: In general, habitats are already degraded along the proposed roads. Where there are exceptions, mitigation such as retention of valuable/important trees, use of signs, use of adequate erosion control measures and other best practices are available to avoid most impacts. The team considered an alternative Gorijvari road going southward from Gorijvari Monastery. It was unfavorable from the biodiversity conservation standpoint because it impacted forest much more than the existing road rehabilitation plan. A pre-construction survey is recommended for possible sitings of Georgian Red-Listed species, endemic species and other species protected by law. The survey should also cover mature trees planned to be removed to verify presence of bat roosts. The survey should also identify whether there are any egg laying sites of Mediterranean tortoise on the construction site. Overall, mitigations and best practices are available for Gorijvari Road and Pushkin Street to minimize potential significant impacts.

Social & Environmental Concern	Potentially significant issue	EA Requirements/ Work Tasks
2. Impacts to wetlands and other natural resources. Disturbance or threat to important ecological habitats.	Rehabilitation, including construction and operation phases, could impact wetlands or other ecological habitats. There may be direct and indirect impacts. Short and long-term impacts are possible.	Determine existence and importance (function and quality) of key natural resources/vegetation types (wetlands or habitats of ecological importance); determine possible short and long-term habitat alterations and effects on the habitat.

The "Affected Environment" section did not identify any important ecological habitats in the areas of road rehabilitation. Site visits confirmed that there were no wetlands crossed by the existing Gorijvari Road or Pushkin Street; no direct effects on wetlands are expected.

Some disturbance of animals may take place, but this is not expected to be significant. Mortality of mammals and reptiles on the roads could be a problem and should be monitored. Increased erosion is likely to have direct and indirect adverse affects on habitats in construction areas. Best practices during construction should mitigate these concerns. Soil contamination by the oil or fuel (diesel) and waste products during construction and operation can also be monitored and mitigated with best practices. Noise pollution during construction will be temporary.

Significance: Wetlands and important ecological habitats are not an issue for Gorijvari Road or Pushkin Street. Best practices are needed to mitigate habitat affects of increased erosion during construction. Also, since a few mature trees might be impacted during construction, pre-construction surveys are recommended for all mature trees planned to be removed to verify presence of bat roosts and ecological habitats. Mitigation measures (tree retention, minimizing brush cutting) are needed to minimize concerns.

Social & Environmental Concern	Potentially significant issue	EA Requirements/ Work Tasks
3. Impacts to cultural and historic resources including cultural or historic chance finds.	During the construction phase, cultural resources may be found, disturbed, and/or destroyed.	Identify cultural resources of importance in the vicinity of the projects and as appropriate for the specific resources, measures to remove or protect.

Pushkin Street in Gori is outside the area where cultural heritage monuments are located; Rehabilitation of Pushkin Street will not directly affect cultural or historic monuments. Activities that could possibly indirectly impact monuments, such as noise, detours, vibration, and air quality, are expected to be minimal.

Gorijvari Road ends at Gorijvari Monastery. During rehabilitation of Gorijvari Road, mitigations should insure protection of ruins of medieval settlements, the old fortification stone fence, damaged graves and family vaults, old clay pipeline fragments and churches/monastery. Road grading and excavation should not disturb these resources. If

graves or remnants of family burial vaults are impacted, they should be excavated and relocated by archeologists. Wheelchair access to the monastery should be considered along with appropriate (bilingual) road signs at the beginning of the road, at the turning point from the main road, and at suitable locations along Gorijvari Road. Potential adverse effects on artifacts are easily mitigated. (See Section 6 EMMPs for mitigations.)

Significance: Rehabilitation of Pushkin Street should not directly affect any cultural or historic monuments. During rehabilitation of Gorijvari Road, mitigations should insure protection of ruins of medieval settlements, the old fortification stone fence, damaged graves and family vaults, old clay pipeline fragments and churches/monastery. If artifacts are unearthed during the construction phase, mitigation/best practices can mitigate any concerns.

Social & Environmental Concern	Potentially significant issue	EA Requirements/ Work Tasks
4. Impacts of changes in water quality, sediment loads; deterioration of downstream water and impacts on downstream users.	Roads and drainage runoff may carry contaminants downstream to areas where they may concentrate (if flushing is in adequate) and/or to areas where they may cause significant damage to natural resources. This is mainly a long-term impact that is of concern during the operation phase.	Determine points of possible contamination (i.e., where changes to water quality or sediments impact downstream users).

While road rehabilitation does not involve water crossings, rain and snow runoff have already caused erosion along Gorijvari Road. Damaged areas need to be stabilized. Best practices (erosion control, care with heavy machinery so that no fuel spills occur, etc.) are needed to protect local rivers and streams. Erosion on the foot trail slope toward Gorijvari Monastery should be controlled. Stone tiling should be considered for the Monastery access trail and a landscape-friendly natural barrier would prevent cars from entering the old cemetery.

Road rehabilitation will improve drainage on the roadways and it may also improve water quality of the streams by decreasing erosion, sedimentation, and cleaning the slopes. Special focus should be given to using aggregate fill on steep road segments, cobblestones as pavement on steep slope road segments and engineering designs that provide proper drainage and protection of offsite hydrology. Natural drainage patterns should be maintained as much as possible, provide for a range of erosion control measures to minimize loss of vegetation cover and road damage. Realistic estimate should be made of the cut spoil and its reuse as fill, minimizing disposal of non-reusable spoil. Asphalt cover should be provided for the main road of Didi Gorijvari village, so that negative social impact of traffic is mitigated (many visitors of Gorijvari are known to deviate from main route and pass vehicles through Didi Gorijvari).

Significance: Parts of Gorijvari Road already damaged by erosion should be stabilized. Best practices (erosion control, care with heavy machinery so that no fuel spills occur, etc.) are needed to protect local rivers and streams. With appropriate erosion control and other safeguards, impacts can be managed effectively. Requirements for site specific erosion and sediment control plans are included in the Section 6 EMMPs. Site specific stormwater

management plans and spill prevention and control plans are also part of the appropriate EMMP mitigations.

Social & Environmental Concern	Potentially significant issue	EA Requirements/ Work Tasks
5. Cumulative impacts of road rehabilitation activities.	Cumulative impacts may result from the combination of past, present, proposed, and reasonably foreseeable actions. A cumulative effects analysis is part of this EA.	Identify the space, time, and assumptions to predict cumulative impacts.

Cumulative impact is defined by the US Council on Environmental Quality as:
…the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7).

The municipalities have few if any new developments; most buildings are several decades old, and while some of the important historical sites have been restored they are reconstructed in line with their historical nature. Other developments planned for the municipalities are included in the Municipal Infrastructure Development Plans and they are mainly sewage, water lines, power lines, and communication lines.

The new road rehabilitation may encourage investment in the municipalities—that is one of the aims of USAID support. Tourism investment is likely along Gorijvari Road. All investments should be required to comply with the infrastructure development plans for each municipality and with local norms for cultural and historical integrity. Given that cultural and historical tourism is one of the key drivers of the economy, these norms should be implemented carefully. The other key economic driver, agriculture, is also expected to benefit. Tourism investment would bring in more tourists who would help raise income of agricultural producers in the municipalities.

Significance: Cumulative impacts are not expected to be significant.

Social & Environmental	Potentially significant issue	EA Requirements/ Work Tasks
6. Temporary or permanent land expropriation.	During construction, private land may be temporarily expropriated during construction, or in some places, roads may be slightly widened and private land expropriated.	Identify locations where expropriation may occur.

There are many areas along the road segments that back up to private property, including houses and shops. During construction, noise, dust and other air pollutants would be increased temporarily. The amount of traffic on most of these roads may slightly increase, but long-term impacts of noise and air pollution would be minor.

Construction waste may be temporarily stored on private property that is located adjacent to the roads or private property may be directly affected by the need to excavate beyond

the current footprint. Both of these situations would involve temporary expropriation. Construction waste would be removed once the construction crew is finished with the road segment (as required by best practices which are included in the EMMP and which will be included in the Bill of Quantities (BOQ).) Excavations will be backfilled to original contour once construction is complete.

GMIP will comply with Georgia's *Law on Rules for Expropriation of Ownership for Necessary Public Needs,* in which the expropriator (USAID-GMIP) has to make every reasonable effort to acquire property by negotiation and is required to value the property in accordance with the fair market value before negotiations.

Significance: As long as there is compliance with the GoG law on expropriation, impacts of road rehabilitation are expected to be minor.

5.2 Issues Eliminated from Further Evaluation

As provided for in the original EA, there were several concerns that require mitigation, but no additional investigation and analysis was needed in the EA. Best practices are widely available and can be easily applied to the GMIP Proposed Action; they are included in Section 5 EMMPs and they will be included in the Bill of Quantities (BOQ) as well. Table 5.2 includes the concerns eliminated and the reason for elimination.

Table 5.2 Concerns Eliminated from Further Evaluation

Social & Environmental Concern	Reason for Elimination
1. Erosion and sedimentation, excavation, removal of pavement, trenching, grading; removal of damaged drainage systems; offsite disposal of damaged pavement, sidewalk and drainage pipes/culverts; management of any contaminated concrete/waste arising from the road sites during construction needs careful, appropriate and well-defined planning and execution; disposal of excavated material; disposal of construction waste.	Information is sufficient to provide best practices to minimize this concern; BPs to be included in the bidding document. No additional investigation is needed.
2. Vegetation growth and sedimentation in drainage systems.	Information is sufficient to provide best practices to minimize this concern; BPs to be included in the bidding document. No additional investigation is needed.
3. Dust generation; pedestrian and traffic safety; health and safety	Sufficient information is available to develop BPs for inclusion in the bidding document. No additional investigation is needed.
4. Increased erosion and sedimentation during operation	Sufficient information is available to develop BPs to minimize this concern; BPs to be included in the bidding document. No additional investigation is needed.
5. Rehabilitation activities could degrade air quality, cause noise pollution, and leaks from machinery could pollute water and soils.	Sufficient information is available to develop best practices to minimize this concern; these to be included in the bidding document. No additional investigation is needed.
6. Construction camps could result in pollution	Sufficient information is available to develop BPs

of surface and groundwater if inadequate sanitary facilities are not provided; damage to habitats; cutting of trees if alternative fuel and building material is not provided; alter landscapes if the site is not returned to previous conditions; introduce alcohol and socially destructive practices via construction crews.	to minimize this concern; these to be included in the bidding document. No additional investigation is needed.
7. Added by the EA Team: Quarrying, gravel pits and borrow pits for road materials and fill may result in impacts, and if mitigation measures are not implemented, erosion, sedimentation, aesthetic impacts as well as landslides and loss of human life are possible. Transportation of new road materials, concrete and asphalt, drainage collectors/pipes and impacts from transporting waste materials for disposal may cause impacts to existing roads.	Sufficient information is available to develop BPs, and no additional investigation is needed.

5.3 Possible Conflicts between Proposed Action and Land Use

The Gorijvari Road and Pushkin Street rehabilitation projects will comply with Municipal Infrastructure Development Plans. This will help ensure that there are no conflicts between the proposed action and land use in the municipalities. The municipalities are peri-urban/rural and they are economically focused on tourism and agriculture. The proposed action is in line with this—road rehabilitation is designed to encourage tourism, and by increasing job opportunities in the tourism sector and increasing revenue of those involved in related sectors, the general characteristics of these municipalities are expected to remain rural/peri-urban and agricultural.

5.4 Possible Conflicts between Proposed Action and Policies and Controls

GMIP will coordinate with local authorities to ensure that the upgrades and rehabilitation comply with local concerns such as zoning, water use, agricultural land conversion, and others provisions and local government requirements.

5.5 Energy Requirements

Most of the energy requirements occur during construction since heavy machinery will be used during the construction phase. The maintenance phase will also require energy, but this is expected to be minimal since most maintenance will occur manually with workers cleaning drainage systems.

5.6 Irreversible and Irretrievable Commitment of Resources

Rehabilitation of Gorijvari Road and Pushkin Street/Gori may involve irreversible or irretrievable commitment of resources. GMIP will implement all reasonable measures as recommended as a result of the pre-construction survey to minimize impacts. No other irreversible or irretrievable commitment of resources is expected.

5.7 Means to Mitigate Adverse Environmental Impacts

Construction phase impacts can be mitigated by best practices (using erosion control measures; ensuring stockpiled fill and equipment and material storage sites are located in areas away from ecologically important areas; protecting against fuel spills; retaining brush and trees; and implementation and monitoring of other practices described in the EMMP, Section 5.

Construction camp impacts are easily mitigated given the already disturbed nature of the general locations. Worker training can be used to identify and protect cultural or historic chance finds.

Best practices are available to address impacts from improper extraction of road materials as well as impacts from transporting new road materials, concrete and asphalt, drainage collectors/pipes and transporting waste materials for disposal.

Operation and maintenance phase impacts (other than those below) can be mitigated by commonly used best practices: erosion control measures, signs, speed bumps, retention of brush and trees (unless they cause a human safety hazard or if mowing is needed to minimize vehicle collisions with wildlife).

GMIP will implement all reasonable measures as recommended as a result of the pre-construction survey to minimize impacts. GMIP compliance with the *Law on Rules for Expropriation* and with municipal land use plans should ensure that significant social and cultural impacts do not result.

6. Environmental Mitigation and Monitoring Plans

This chapter includes the EMMPs for road rehabilitation activities. Table 6.1 covers mitigation and monitoring measures for construction and rehabilitation of roads and Table 6.2 covers operation and maintenance of these roads.

6.1 Environmental Mitigation and Monitoring Plans

The Table 6.1 EMMP addresses erosion and road damage, impacts associated with construction and road rehabilitation, disposal of old/damaged asphalt and road subsurface materials, disposal of damaged sidewalks and drainage collectors/pipes, extraction of road materials, socio-economic and public health and safety. The EMMP addresses impacts to TES and cultural and historic resources. The Table 6.2 EMMP covers road operation and maintenance including road ruts, potholes and erosion/clogged drains, increased traffic, impacts to TES and cultural/historic resources and municipal road maintenance programs.

Tables 6.1 and 6.2 provide the monitoring indicator(s), monitoring and reporting frequency and GMIP party responsible for monitoring. Monitoring is provided to ensure the effectiveness of mitigation measures. For TES and cultural/historic impacts monitoring, a report is included at the end of the construction period that recommends mitigation measures for use during the irrigation operational period to protect TES and cultural and historic resources.

For the activity, Rehabilitation of Gorijvari Road and Pushkin Street, mitigations in Table 6.1 address the following identified environmental impacts:

- Soil erosion and damage to road foundations, especially along steep sections of Gorijvari Road.
- Impacts to Threatened, Endangered & Protected Species (TES), disruption of sensitive habitats and other sites along roads where protected birds, bats, amphibians and reptiles may use habitats.
- Impacts to wetlands and other natural resources. Disturbance or threat to important ecological habitats
- Impacts to cultural and historic resources including cultural or historic chance finds.
- Impacts of changes in water quality, sediment loads; deterioration of downstream water and impacts on downstream users.
- Construction Camp damage to local habitats and depletion of local fauna/flora.
- Impacts from Lack of Environmentally Sound Facilities or Poor Sanitation at Construction Camp Facilities.

- Impacts from Lack of Management of Construction Areas, Equipment and Materials Storage.
- Community Impacts from Introduction of Alcohol and Other Socially Destructive Substances via Construction Crews.
- Impacts from Lack of Control of Stormwater runoff during Road Rehabilitation.
- Impacts on Roads from Transporting New Road Materials, Concrete and Asphalt, Drainage Collectors/Pipes and Impacts from Transporting Waste Materials for Disposal.
- Impacts from Removal and Disposal of Old/Damaged Asphalt, Road Subsurface Materials, Sidewalks, Drainage Collectors/Pipes.
- Impacts from Improper Extraction of Road Materials (Quarry and Gravel Pits and Barrow Pits).
- Impacts from Road Rehabilitation including Compaction of Roadbed and Addition of Materials for Subsurface Layers and Pavement.
- Impacts from Rehabilitation of Sidewalks and Drainage Collectors/Pipes
- Noise, Odor and Visual Quality Impacts.
- Socio-economic Impacts.
- Public Health and Safety Impacts.

For the activity, Strengthening Operation and Maintenance of Municipal Roads, mitigations in Table 6.2 address the following identified environmental impacts:

- Soil Erosion and Damage to Road Foundations, Especially Along Steep Sections of Gorijvari Road.
- Impacts to Threatened, Endangered & Protected Species (TES) and Habitats.
- Impacts from Road Ruts, Potholes, Mud-holes and Washboarding.
- Impacts from Clogged Drainage Collectors/Pipes, Standing Water and Water Pools.
- Road Improvements Increase Traffic and Vehicle Speed, Higher Accident Rates.
- Water, Soil and Other Environmental Impacts due to Weak Municipal Road Maintenance Programs.

TABLE 6.1: Environmental Mitigation and Monitoring Plan for Road Rehabilitation

Activity	Identified Environmental Impacts	Are Impacts Potentially Significant?	Mitigation Measure(s)	Monitoring Indicator(s)	Monitoring and Reporting Frequency	Responsible Party(ies)
Rehabilitation of Gorijvari Road and Pushkin Street/Gori	Soil erosion and damage to road foundations, especially along steep parts of Gorijvari Road.	N	Engineering designs use best practices to prevent/reduce erosion, especially on steep parts of Gorijvari Road. Prepare Site Specific Plan for Erosion and Sediment Prevention and Control. Stabilize erosion-damaged sections of Gorijvari Road. Provide a range of erosion control measures to minimize loss of vegetation cover and road damage. Use high quality aggregate fill on steep road segments, use cobblestones as pavement on steep road segments and provide special designs for proper drainage, protection of offsite hydrology. Maintain natural drainage patterns as much as possible. Use realistic estimates of cut spoil and its reuse as fill, minimizing disposal of non-reusable spoil. Use asphalt cover for the main road of Didi Gorijvari village. If possible, add	Conformance with erosion control design standards Conformance with site specific erosion and sediment control plan. Complaints from nearby residents Photo logs	Inspection at the start of the activity and at least monthly thereafter during construction Erosion control report at end of construction, including mitigation measures for road operation & maintenance (O&M) period.	Requirements specified in contracts Periodic inspections by MDF and GMIP.

Activity	Identified Environmental Impacts	Are Impacts Potentially Significant?	Mitigation Measure(s)	Monitoring Indicator(s)	Monitoring and Reporting Frequency	Responsible Party(ies)
			energy dissipaters, crown road, grade control, ditch lining and outlets, proper culvert design, etc.			

Activity	Identified Environmental Impacts	Are Impacts Potentially Significant?	Mitigation Measure(s)	Monitoring Indicator(s)	Monitoring and Reporting Frequency	Responsible Party(ies)
	Impact to Threatened, Endangered & Protected Species (TES), disruption of sensitive habitats and other sites along roads where protected birds, bats, amphibians and reptiles may use habitats.	N	Use biologist experienced with TES and their habitat. Conduct pre-construction survey for possible sitings of Georgian Red-Listed species, endemic species and other species protected by law. Survey should cover mature trees planned to be removed to verify presence of bat roosts and ecological habitats. Survey should identify any egg laying sites of the Mediterranean tortoise. If eggs or tortoises are encountered during construction, activities in the vicinity shall cease until the TES biologist can visit the site to provide recommendations for avoiding impacts to the tortoise population. Establish and maintain a chance finds procedure for TES protection. If needed, develop TES program to protect TES and their habitats. Implement TES protection programs including worker training to identify and	Conformance with TES Program Survey by TES biologist. Inspections by TES biologist. Number of TES identified Number of trees protected and TES habitats protected. Number of employees trained. Records from implementation of the chance find procedure.	Survey report for TES/habitat identification and protection Inspection at the start of the activity and at least monthly thereafter during construction TES protection report at end of construction, including mitigation measures for road operation & maintenance (O&M) period. Gorijvari Tourism Report with recommendations for minimizing impacts of	Requirements specified in contracts Periodic inspections by MDF and GMIP

Activity	Identified Environmental Impacts	Are Impacts Potentially Significant?	Mitigation Measure(s)	Monitoring Indicator(s)	Monitoring and Reporting Frequency	Responsible Party(ies)
			protect TES and habitats. Conduct Gorijvari Tourism Study of possible impacts of increased traffic on air quality, flora, fauna and cultural sites.		increased traffic and visitors on air, quality, flora, fauna and cultural sites.	
	Impacts to wetlands and other natural resources. Disturbance or threat to important ecological habitats.	N	Use biologist experienced with ecological habitats to design habitat protection programs, if needed. Use worker training to identify and protect habitats. (Note: field survey confirmed that wetlands and important ecological habitats were not	Number of habitats protected Number of employees trained Photo logs	Inspections monthly during construction. Habitat protection report at end of construction, including	Requirements specified in contracts Periodic inspections by MDF and GMIP

Activity	Identified Environmental Impacts	Are Impacts Potentially Significant?	Mitigation Measure(s)	Monitoring Indicator(s)	Monitoring and Reporting Frequency	Responsible Party(ies)
			concerns for Gorijvari Road or Pushkin Street.)		mitigation measures for road O&M	
	Impacts to Cultural and Historic Resources including Cultural or Historic Chance Finds.	N	For rehabilitation of Gorijvari Road, insure protection of ruins of medieval settlements, the fortification stone fence, damaged graves/family vaults old clay pipeline fragments and churches/monastery. Establish and maintain a documented chance finds procedure and provide regular worker training to identify and protect cultural or historic chance finds. Remove & dispose of old road materials to offsite disposal site that protects cultural and historic sites. Revegetate to protect cultural/historic sites.	Complaints by residents or members of cultural or historic site. Photo logs	Inspection at the start of the activity and at least monthly thereafter during construction	Requirements specified in contracts Periodic inspections by MDF and GMIP
	Impacts of changes in water quality, sediment loads; deterioration of downstream water and impacts on downstream users.	N	Choose or develop design standards for road surface drainage, culvert installation, erosion control, revegetation, Mejuda River crossing, sensitive areas, steep slopes, etc. Develop site specific storm	Conformance with design standards and stormwater and erosion control plans Complaints from	Monthly during construction	Requirements specified in contracts Inspections by MDF and GMIP

Activity	Identified Environmental Impacts	Are Impacts Potentially Significant?	Mitigation Measure(s)	Monitoring Indicator(s)	Monitoring and Reporting Frequency	Responsible Party(ies)
			water management plans. Install stormwater control barriers (silt fences, hay bales, filters) to prevent and control erosion Restore site through replanting, reseeding and soil erosion measures (especially after old road materials removed)	nearby residents Photo logs		
	Dust and Air Pollution Impacts	N	Use water sprays, covers and containment to control dust and air emissions during construction. Use low emission heaters for construction camps. Prevent burning, minimize visible smoke/emissions Use environmentally acceptable fuels (natural gas if available) for construction equipment.	Monitor dust and particulates Complaints from nearby residents Photo logs	Monthly monitoring during construction	Requirements specified in contracts Inspections by MDF and GMIP
	Construction camp damage to local habitats and depletion of local fauna/flora.	N	Choose or develop design standards for construction camps Analyze area for possible habitat or fauna/flora damage, select proper site for construction camp Keep camp size to minimum	Conformance with design standards Complaints from nearby residents. Photo logs	Inspection at the start of the activity and at least monthly thereafter during construction phase; once	Requirements specified in contracts Inspections by MDF and GMIP.

Activity	Identified Environmental Impacts	Are Impacts Potentially Significant?	Mitigation Measure(s)	Monitoring Indicator(s)	Monitoring and Reporting Frequency	Responsible Party(ies)
			Explore off-site accommodation for crews Provide adequate quantity of food and cooking fuels Train workers to protect local habitat and local fauna/flora, create defined footpaths Comply with site specific spill prevention and control plan		during demobilization	
	Impacts from lack of environmentally sound facilities or poor sanitation at construction camp facilities (Soil and Water Contamination)	N	Choose or develop design standards for construction camps Provide sound temporary sanitation facilities (e.g., dry toilets or pit latrines, cleanup of food services, trash/waste collection bins Provide off-site housing for workers Use minimum camp size Remove and restore site after construction is completed	Conformance with design standards Complaints from nearby residents. Photo logs	Inspection at the start of the activity and at least monthly thereafter during construction phase; once during demobilization	Requirements specified in contracts Inspections by MDF and GMIP.
	Impacts from lack of management of construction areas, equipment and materials storage areas (Soil and Water Contamination)	N	Develop mobilization and de-mobilization plans Install fence and signs Set protocols for storage of materials and wastes Set protocols for equipment storage and maintenance	Conformance with mobilization and de-mobilization plans, fuels and lubricant storage, and waste	Inspection at the start of the activity and at least monthly thereafter during construction	Requirements specified in contracts Inspections by MDF and GMIP.

Activity	Identified Environmental Impacts	Are Impacts Potentially Significant?	Mitigation Measure(s)	Monitoring Indicator(s)	Monitoring and Reporting Frequency	Responsible Party(ies)
			Limit onsite equipment maintenance, require most maintenance offsite Store fuels and lubricants in safe place. Protect River Mejuda and provide site specific spill protection and control plans and stormwater management plans. Establish emergency response procedures Prevent dumping of hazardous materials Prevent dumping of other non-construction waste Remove and restore site after construction is completed.	management protocols. Inspection of shipping manifests, landfill receipts, and photo logs Compliance with site specific spill prevention and control plans and stormwater management plans Complaints from nearby residents Photo logs		
	Community impacts from introduction of alcohol and other socially destructive substances via construction crews.	N	Prohibit alcohol and socially destructive substances in construction camps. Use local or regional labor if possible. Install signs and reminders that alcohol or substances are prohibited	Camp inspections Complaints from nearby residents	Monthly during construction	Requirements specified in contracts Inspections by MDF and GMIP
	Impacts on roads from transporting new road materials, concrete and asphalt, drainage collectors/pipes and	N	Choose or develop design standards for material transport and storage Select transportation routes (change routes) to minimize	Conformance with design standards including road, transportation	Monthly during construction	Requirements specified in contracts Inspections by

Activity	Identified Environmental Impacts	Are Impacts Potentially Significant?	Mitigation Measure(s)	Monitoring Indicator(s)	Monitoring and Reporting Frequency	Responsible Party(ies)
	transporting waste materials for disposal.		impacts on roads and local residents. Inspect roads along transportation routes. Restore damaged roads to original condition.	routes. Complaints from nearby residents.		MDF and GMIP
	Impacts from removal and disposal of old/damaged asphalt, road subsurface materials, sidewalks, drainage collectors/pipes (Soil and Water Contamination)	N	Protect area next to channel berm. Use construction lines to mark construction zone. Provide dust control during extraction and disposal of spoil and sediment. Train workers to protect surrounding environment Materials stored onsite, protected from stormwater runoff or wind until transport for disposal Prevent soil erosion	Monitor waste quantity (kg(m3) Inspection of roads Complaints from nearby residents Percentage of workers and supervisors with up-to-date training records Photo logs	Monthly during construction	Requirements specified in contracts Inspections by MDF and GMIP.
	Impacts from improper extraction of road materials (quarry and gravel pits and barrow pits)	N	Choose or develop design standards for material extraction Contractor prohibited from operating their own quarry or gravel pit Construction materials purchased from quarry providers with proven environmental protection programs and closure plans, no violations of	Certifications of selected quarries and gravel providers Inspection of suppliers Complaints from residents near quarries, gravel pits or barrow pits.	Once before contracting with quarries, gravel or earthen fill suppliers and monthly during construction	Requirements specified in contracts Inspections by MDF and GMIP

Activity	Identified Environmental Impacts	Are Impacts Potentially Significant?	Mitigation Measure(s)	Monitoring Indicator(s)	Monitoring and Reporting Frequency	Responsible Party(ies)
			environmental regulations Quarries, gravel pit and/or barrow pit operators have permits and stormwater management programs			
	Impacts from road rehabilitation (Add compaction of roadbed and addition of materials for subsurface layers and pavement)	N	Protect area next to road. Use construction lines to mark construction zone. Train workers to protect surrounding environment Minimize use of heavy machinery Restore site through replanting, reseeding and soil erosion measures Adhere to road design and engineering specs and follow best practices Use BMPs for maintenance and storage of equipment	Conformance with plans and BMPs Complaints from nearby residents. Percentage of workers and supervisors with up-to-date training records Photo logs	Monthly during construction	Requirements specified in contracts Periodic inspections by MDF and GMIP
	Impacts from rehabilitation of sidewalks and drainage collectors/pipes (Soil and Water Contamination)	N	Protect area next to area being improved Train workers to protect surrounding environment Prevent erosion and changes to existing waterways Minimize use of heavy machinery	Camp inspections Complaints from nearby residents Percentage of workers and supervisors with up-to-date training records Photo logs	Monthly during construction	Requirements specified in contracts Periodic inspections by MDF and GMIP

Activity	Identified Environmental Impacts	Are Impacts Potentially Significant?	Mitigation Measure(s)	Monitoring Indicator(s)	Monitoring and Reporting Frequency	Responsible Party(ies)
	Noise, Odor and Visual Quality Impacts	N	Schedule trucks carrying waste/construction materials to minimize local impacts. Minimize use of heavy equipment during early morning and nights	Visual inspections Complaints from users and nearby residents.	Monthly during construction	Requirements specified in contracts Periodic inspections by MDF and GMIP
	SocioEconomic Impacts	N	Hire local workers. Community public meetings to share mitigation information. Traffic detours, if needed, should minimize impacts (especially transport of hazardous goods) on affected neighborhoods and other affected areas	Number of local workers Number of public meetings.	One time during construction phase	Requirements specified in contracts Periodic inspections by MDF and GMIP
	Public Health and Safety Impacts	N	Documented safety procedures. Maintain regular worker safety training Provide workers with protective equipment (e.g., gloves, boots, eyewear). Manage construction traffic to protect children and the community. Signs clearly displayed Protect public from stored waste/construction materials	Conformance with safety procedures Percentage of workers and supervisors with up-to-date training records Number of accidents and injuries. Complaints from nearby residents	Inspection at the start of the activity and at least monthly thereafter during construction	Requirements specified in contracts Periodic inspections by MDF and GMIP

Activity	Identified Environmental Impacts	Are Impacts Potentially Significant?	Mitigation Measure(s)	Monitoring Indicator(s)	Monitoring and Reporting Frequency	Responsible Party(ies)
			or abandoned structures Document underground and surface utilities/structures			

TABLE 6.2 Environmental Mitigation and Monitoring Plan for Road Operation and Maintenance

Activity	Identified Environmental Impacts	Are Impacts Potentially Significant?	Mitigation Measure(s)	Monitoring Indicator(s)	Monitoring and Reporting Frequency	Responsible Party(ies)
2) Strengthening operation and maintenance of municipal roads	Soil erosion and damage to road foundations, especially along steep parts of Gorijvari Road and Pushkin Street cross at Mejuda River .	N	Implement mitigations in erosion control report prepared at end of construction period.	Number of erosion control mitigations for O&M period.	Quarterly in first year and annually after first year.	Requirements specified in contracts Periodic inspections by MDF
	Impacts to Threatened, Endangered & Protected Species (TES)	N	Implement mitigations in TES protection report prepared at end of construction period.	Number of TES identified Number of habitats protected Number of harmed/dead TES along rehabilitated roads	Quarterly in first year and annually after first year.	Requirements specified in contracts Periodic inspections by MDF
	Impacts to habitats along Gorijvari Road and Pushkin Street	N	Implement mitigations in habitat protection report at end of construction period (if report needed).	Number of wetlands and habitats protected. Number of habitat inspections.	Quarterly in first year and annually after first year.	Requirements specified in contracts Periodic inspections by MDF

Activity	Identified Environmental Impacts	Are Impacts Potentially Significant?	Mitigation Measure(s)	Monitoring Indicator(s)	Monitoring and Reporting Frequency	Responsible Party(ies)
	Impacts from road ruts, potholes, mud-holes, washboarding (Soil and water contamination)	N	Better routine maintenance of roads using high quality gravel and asphalt materials. Inspect roads for early identification of problems Provide worker training for improved maintenance and early identification of problems	Number of maintenance measures implemented Number of road inspections	Quarterly in first year and annually after first year.	Requirements specified in contracts Periodic inspections by MDF
	Impacts from clogged drainage systems, standing water and water pools (potential disease vectors)	N	Better routine maintenance of culverts, drainage pipes, collectors, side channels, runoff ditches. Remove materials blocking drainage systems Inspect drainage systems to identify problems early Provide worker training for improved maintenance and early identification of drainage problems	Number of maintenance measures implemented Number of drainage inspections	Quarterly in first year and annually after first year.	Requirements specified in contracts Periodic inspections by MDF and GMIP
	Road improvements increase visitors, traffic and vehicle speed, higher accident rates (Socioeconomic Impact)	N	Implement tourism/traffic recommendations in Gorijvari Tourism Report for minimizing impacts of increased traffic and visitors on air quality, flora, fauna and cultural sites. Plan for, procure and equip rehabilitated roads with	Number of recommendations in Gorijvari Tourism Report implemented. Number of accidents Complaints from nearly residents.	Quarterly in first year and annually after first year.	Requirements specified in contracts Periodic inspections by MDF

Activity	Identified Environmental Impacts	Are Impacts Potentially Significant?	Mitigation Measure(s)	Monitoring Indicator(s)	Monitoring and Reporting Frequency	Responsible Party(ies)
			adequate traffic control signs Integrate safety features into engineering design (speed control signs, streetlights, pedestrian crossings, proper road markings			
	Soil, Water and other Environmental Impacts due to weak Municipal Road Maintenance Programs	N	Strengthen municipal road maintenance programs (organize data collection, identify O&M problems throughout the municipal roads network and design solutions including better road operating guidance, preventive maintenance, program schedules and activities, training for stronger management systems for maintenance workers including use of "how-to" guides and information on best practices.	Number of municipalities participating in municipal maintenance strengthening Number of requests for assistance to improve road maintenance Number of inspections Number of complaints from nearby residents	Quarterly in first year and annually after first year.	Leadership and periodic inspections by MDF with initial start-up support from GMIP

4. LIST OF PREPARERS

Baseline data collection, field studies, alternatives analyses, impact assessment and development of EMMPs and completion of this EA was conducted by a specialized team of scientists and engineers from Tetra Tech. Backgrounds of principal members of the EA Team are highlighted below:

James Gallup, Ph.D., P.E., Team Leader and Environmental Engineer. Dr. Gallup is a senior environmental engineer with over 40 years of international experience, including projects in Georgia. He led a team that prepared a Programmatic Environmental Assessment (PEA) for the USAID AgVANTAGE Project implemented by ACDI/VOCA. He has provided direct technical support to the Europe and Eurasia Bureau Environmental Officer and he designed and implemented USAID's Global Environmental Pollution Prevention Project (EP3). Dr. Gallup, a registered professional engineer, earned his Ph.D. in Environmental Engineering from the University of Oklahoma. He holds a BS in Microbiology and MS in Environmental Engineering.

Mamuka Gvilava, Ph.D., Environmental Specialist. Dr. Gvilava is an environmental specialist with fifteen years experience in field work, project management, policy and regional cooperation. He has experience with environmental and social impact assessment, remote sensing and green design. He served as national focal point to the Black Sea Commission and project director of the World Bank and GEF Coastal Zone Management Project. He has a Ph.D. in physics and math.

Mamuka Shaorshadze, Environmental Specialist. Mr. Shaorshadze has 12 years relevant experience, most recently as an environmental supervisor on two Millennium Challenge Georgia (MCG) fund infrastructure programs. He also served as an Environmental Field Officer for the Georgian Oil and Gas Corporation initiatives funded by the MCG. Mr. Shaorshadze earned his Bachelor's Degree in International Economics from Georgian Technical University.

5. APPENDICES

Appendix 8.1: List of Rehabilitation Activities for Gorijvari Road

Appendix 8.2: List of Rehabilitation Activities for Pushkin Street/Gori

Appendix 8.3: Site Visit Report for Gorijvari Road (April 7, 2012)

Appendix 8.1

List of Rehabilitation Activities for Gorijvari Road

Work Activities: Rehabilitation of Gorijvari Road

#	WORKS	DIMEN	QUANT	NOTE
1	2	3	4	5
	I. Preparatory Works			
1	Rehabilitation and Laying of the Roadway	km	1.445	
2	Dismantling of the existing wooden triangular high voltage pole	unit	1	
	II miwis vakisi			
1	Excavation of the existing damaged asphalt paving and base by using bulldozer	m^3	446	
2	Loading the demolished asphalt paving on the dump trucks by using excavator	m^3	446	
3	Transporting demolished asphalt paving to 5km distance to the dump	tn	802.8	
4	Excavation of the IV category soil and loading on the dump trucks	m^3	20686	
5	Transporting IV category excavated soil to 1,5 km distance to the dump	tn	37235	
6	Arrangement of the Road Bed	m^3	20686	
7	Excavation of the III category soil, by using bulldozer	m^3	707	
8	Loading excavated soil on the dump trucks	m^3	707	
9	Transporting III category excavated soil to 5 km distance (to the area assigned by the Municipality)	tn	1202	
10	Excavation of III category soil by using excavator, loading on the dump trucks	m^3	4554	
11	Transporting III category excavated soil to 5 km distance (to the area assigned by the Municipality)	tn	7742	
	III Engineering Structures			
1	Removal of the metal d-1200 mm pipe	meter	11.5	

2	Cleaning of the pipe body by hand	m^3	6	
3	Loading on the dump trucks by excavator	m^3	6	
4	Transporting to the dump to 5 km distance	tn	10.2	
5	Manual excavation of soil in the III cat. soil	m^3	156	
6	Sand-gravel bedding 20 cm thick	m^3	30.9	
	Arrangement of the culvert head with cast-in-situ concrete			
1	Arrangement of the base with cast-in-situ concrete m-200	m^3	22.52	
2	Arrangement of the furrow with cast-in-situ concrete m-250	m^3	19.88	
3	Arrangement of the body with cast-in-situ concrete m-250	m^3	11	
4	Arrangement of the toe with cast-in-situ concrete m-250	m^3	17.52	
5	Arrangement of the stone downstream apron	m^3	68.00	
6	Backfilling of soil by hand	m^3	32.00	
7	Loading of surplus soil on the dump trucks manually and transporting to the dump to 5 km distance	tn	223.20	
8	Supply and installation of the d-1500mm steel pipe	meter	45.00	
9	Installation of the pipe existing on-site d-1200 mm	meter	11.50	
10	Treatment of the pipe with corrosion preventing agent	m^2	264.0	
	Installation of the precast concrete furrow and metal lattice (at two places)			
1	Excavation of the trench in the III cat. soil manually	m^3	16.00	
2	Loading of surplus soil on the dump trucks manually and transporting to the dump to 5 km distance	tn	28.80	
3	Crushed stone bed under the furrow,10 cm thick	m^3	1.60	
4	Arrangement of the precast concrete furrow with section 0.4X0.4m, length - 22m.	m^3	3.52	
5	Arrangement of the metal cover lattice on the water intake cross furrow angle bar 100X100X8mm - 44,88 lin.m iron square 20X20mm - 392,5 lin.m	meter	22.00	
6	Arrangement of the cast-in-situ concrete coupling furrow m-250	m^3	2.00	

	Arrangement of precast structural concrete furrows with section 0.4X0.4m			
1	Excavation of the III category soil manually	m^3	42.00	
2	Loading of surplus soil on the dump trucks manually and transporting to the dump to 5 km distance	tn	75.60	
3	Arrangement of the crushed stone bed under the furrow,10 cm thick	m^3	6.00	
4	Supply and installation of the precast structural concrete furrows with 0.4X0.4m section 0.4X0.4m-98m.	m^3	15.68	
5	Backfilling of soil by hand	m^3	13.00	
6	Loading of the remaining soil and transporting to the dump to 5 km distance2	tn	52.20	
	IV Road paving			
1	Installation of the bottom layer of the base course with sand-gravel, 30 cm thick (2593X1.22)	m^3	3163.00	
2	Installation of the top layer of the base course with crushed stone, 15 cm thick (1149X1.2)	m^3	1448.0	
4	Installation of the bottom layer of the paving with coarse grained porous stone a/c hot mix, type B, mark II, thickness 5 cm. Placing liquid bitumen (0.600 gr/m2)	m^2	1981.0	
5	Installation of the top layer of the paving with fine grained compact stone a/c hot mix, type B, mark II, thickness 4 cm . Placing liquid bitumen (0.00035 gr/m2)	m^2	1981.0	
6	Installation of concrete-asphalt layer (18cm thick, m-400)	m^2	5344.0	
7	Arrangement of the roadside ditches in the III category soils, manually	m^3	1538.0	
8	Transporting surplus soil to the dump, to 5 km distance	tn	2768.4	
9	Arrangement of shoulders with sand-gravel mixture	m^3	2860.0	
	V Connections			
1	**Number of connections**	**Unit**	**5.0**	
2	Excavation of topsoil with bulldozer, 20 cm thick.	m^3	11.0	

3	Loading of the excavated topsoil on the dump trucks	m^3	11.0	
4	Transporting excavated humus soil to 1 km distance 1	tn	17.6	
5	Excavation of the III category soil, 10 cm thick, loading on the dump trucks	m^3	547.0	
6	Transporting III cat. excavated soil to the dump, to 5 km distance	tn	929.9	
7	Arrangement of embankment with sand-gravel	m^3	39.0	
8	Installation of the bottom layer of the base course with sand-gravel, 20 cm thick	m^3	93.0	
9	Installation of the base course with crushed stone 10 cm	m^3	37.00	
10	Supply and installation of the metal pipe d-530mm	meter	16.00	
11	Installation of the paving with one layer of fine grained a/c hot mix, thickness 5 cm . Placing liquid bitumen - 0,144tn	m^2	410.00	
12	Arrangement of shoulders with sand-gravel, 15 cm thick	m^3	27.80	
13	Treatment of the pipe with corrosion preventing agent	m^2	26.63	
	Arrangement of Transport Parking Lots			
1	Excavation of topsoil with bulldozer, 20 cm thick.	m^3	120	
2	Loading of the excavated topsoil on the dump trucks	m^3	120	
3	Transporting excavated humus soil to 1 km distance 1	tn	192	
4	Excavation of the III category soil, loading on the dump trucks	m^3	525	
5	Transporting III cat. excavated soil to the dump, to 5 km distance	tn	893	
6	Arrangement of embankment with sand-gravel	m^3	1726.00	
7	Installation of the bottom layer of the base course with sand-gravel, 20 cm thick	m^3	383.00	
8	Arrangement of gravel base, 15 cm thick.	m^3	309.00	
9	Installation of the paving with one layer of fine grained a/c, thickness 5 cm . Placing liquid bitumen	m^2	2063.00	

10	Curb holding concrete	m^3	6.00	
11	Arrangement of basalt curbs, 30X15 cm supply, placement	meter	335.00	
	VI Road Furniture and Signs			
1	Arrangement of reinforced concrete curvilinear parapets on the shoulder	meter	1101.00	
2	Installation of standard warning signs	Unit	23.00	
3	Installation of plastic signal columns	Unit	222.00	
4	Installation of vision mirrors	Unit	3.00	
	VII Improvement of Gorijvari Monastery Access Road			
1	Lining concrete on the existing damaged concrete roadway, 5 cm thick concrete m-250	m^3	12.00	
2	Rehabilitation and broadening of the existing damaged stairs by using cast-in-situ concrete m-250	m^3	1.00	
3	Excavation of the III category soil manually	m^3	27.00	
4	Loading of surplus soil on the dump trucks and transporting to the dump to 5 km distance	tn	48.60	
5	Arrangement of the concrete pedestrian path m-250 (3X45X0,3)	m^3	40.50	
6	Excavation of pits in the III category soil manually	m^3	2.00	
7	Installation of metal poles d-100mm 15X1,4	meter	21.00	
8	Filling pits with concrete m-150	m^3	1.89	
9	Hanging metal decorative chain on the poles	meter	53.00	
	Arrangement of the cobblestone pavement from the asphalt road to the door and to the rise on the right side			
1	Installation of basalt curbs around the cobblestone pavement, size (30X15cm)	meter	92.00	
2	Installation of curbs holding concrete (0.018X92)	m^3	1.66	

3	Excavation of the existing III category soil with bulldozer and loading on the dump trucks	m^3	214.00	
4	Transporting III category excavated soil to 5 km distance	tn	363.80	
5	Installation of the bottom layer of the base course with sand-gravel mixture, 30 cm thick	m^3	128.00	
6	Installation of the base with sand-cement 10% mix, 15 cm thick	m^3	64.00	
7	Arrangement of the cobblestone pavement with stone block	m^2	426.00	
	Arrangement of the metal railing, 40,5 meter long			
1	Excavation of pits in the III category soil manually	m^3	1.00	
2	Installation of metal poles d-100mm	meter	9.60	
3	Arrangement of the metal railing with steel square pipes Steel rectangular pipe, size 100X50X3 Steel rectangular pipe, size 60X30X2	meter	40.50	
4	Painting metal elements with oil paint, twice	m^2	347.00	

Gorijvari Road: Explanatory Note

1. General

Rehabilitation of Gorijvari Access Road is envisaged in accordance with Gori Municipality agreement #238, dated December 2, 2011. The design was prepared based on survey and research carried out by GEO Ltd in December 2011. The design is prepared in accordance with current norms and regulations.

2. Short Description of the Project District

The project district is located in mountainous climate area of East Georgia situated in the North of East Trialeti range. This zone is characterized by mild continental climate. Average annual temperature is $+10^0$C . The highest average monthly temperature is observed in August, $+22^0$C and the lowest in January, 1^0C. Locally provided construction materials are taken from a licensed quarry adjacent to River Liakhvi bed.

3. Description and Length of the Project Road

Study was conducted on Gorijvari Access Road, which starts at Gori-Skra highway and ends at a square located below the church (KP 14+45). The length of the project road is 1,445 meters. Road curve angels are fixed with wooden pickets.

4. Preparatory Works

Preparatory period comprises the following: reconditioning and fixing of route, dismantling of the existing unused wooden pillar and preparation of the site, transfer and fixing of parapets.

5. Subgrade

The width of the project road's bed is 8 meter and the one of the roadway makes up 5 meter.
The project road goes through the low dumps of up to pk 3+00 followed by low section that increases gradually and achieves its maximum at pk 5+20 the height of the section of which is 6.35 m., then it decreases again and at pk 5+88 it comes to zero. The dump begins from pk 8+36 and achieves its culmination at pk 12+41 the height of the dump of which is 5.65 m., from which it begins decreasing again to pk 13+40, achieves 0 and with small sections it completes at pk 14+45. Dump is arranged by transportation of excavated soil in dump. Excess excavated soil is loaded and removed to the dump at the site defined by the municipality.

6. Engineering Structures

At the beginning of the project road at pk0+02 there is the metal pipe of D-600 mm which is in good condition and will be kept unchanged. At pk3+13 there is envisaged placing of precast concrete furrow of 0.4X0.4 m with holing of 11 m length that is covered from above with the metal lattice that is arranged on the angle of 100X100X8

mm with iron square of 20X20 mm. The sizes and scheme of the cover lattice are given on the Drawing #6.

At pk6+19 exists the steel pipe of D-1200 mm that is buried in soil. The project envisages removal, cleaning of this pipe, arranging of the heads and placing.

At pk 8+64; pk 11+20 and pk11+88 the project road is crossed by existing deep ravines on intersections of which there are envisaged to be placed the steel pipes of D-1500mm, arranging of heads and downstream aprons the scheme of which are given on the Drawing #7 and the quantities in the Register #8.

At pk 14+45 there is envisaged to be placed the precast concrete furrow of 0.4X0.4 m holing including arranging of cover lattice.

From pk13+47 to pk 14+45 alongside the transport parking lot site at the bottom of the mountain on the left side there is envisaged arranging of precast concrete furrows of 0.4X0.4 m holing for avoidance of runoff water.

7. Road Bed

The width of the project road's bed is 8 meter and the one of the roadway makes up 5 m. The width of the laterals is 1.5 m. On the road there is envisaged to be arranged the through of the road bed. The road bed structure is as follows: from pk0+00 to pk 2+00 and from pk5+70 to pk 7+51. Arranging of the lower layer of the base with sand gravel mixture of 30 cm thickness. Upper layer of the base with fractional crushed rock of 15 cm thickness. After arranging of the crushed rock base there is to be placed liquid bitumen as follows: 600 gram per 1 sq. m. Lower layer of the cover – coarse grained, porous, crushed rock asphalt concrete hot mixture of 5 cm thickness, type "B", Mark II. Liquid bitumen placing 350 g/m^2. Upper layer of the cover – small- grained, dense, crushed rock asphalt concrete hot mixture of 4 cm thickness, type "B", Mark II from pk 2+00 to pk5+70 and from pk 7+51 to pk14+45. The road bed structure is as follows:

- Lower layer of the base – sand-gravel mixture of 30 cm thickness
- Upper layer of the base – fractional crushed rock of 15 cm thickness
- Roadway - monolith cement concrete of 18 cm thickness, lateral section of which is given on the Drawing #10.

After arranging of the cover there are arranged the filling laterals out of sand gravel mixture. On transport parking lot sites there are arranged small-grained asphalt concrete cover of one layer at 5 cm thickness on the crushed rock base at 15 cm thickness and the lower layer of the base with sand gravel mixture at 20 cm thickness.

Vehicle operational indicators of the road should meet the requirement of the main normative documents as follows:

- Correctness of the roadway according to 3.06.03.85 of Building Regulations (СНиП)
- Friction coefficient of the cover with the car wheels in accordance with 2.05.02-85 of Building Regulations (СНиП)
- Slope of the roadway in accordance with 3.06.03.85 of Building Regulations (СНиП)

At the vehicle joints there are envisaged as well arranging of one-layer small-grained asphalt concrete of 5 cm thickness on the crushed rock base at 10 cm thickness and arranging of the lower layer of the base out of the sand gravel mixture of 20 cm thickness.
Filling laterals are to be arranged from sand gravel mixture at 15 cm thickness.

8. Improvement of Gorijvari Monastery Access Road

At the end of the project road starts the monastery access road that is destroyed in some sections. The project envisages repairs of existing damaged stairs and broadening with in-situ concrete of m-250. Lining concrete on the existing concrete roadway, 5 cm thick concrete m-250. Arrangement of the concrete pedestrian path m-250. Hanging metal decorative chain on the poles. From the end of the project road pk17+48 till the door of the monastery and on the right till the ascending road to be arranged the paving with granite paving blocks on sand cement 10% mixture of 15 thickness and by arranging of lower layer of the base from the sand gravel mixture of 30 cm thickness.
Arrangement of metal railing at 40.5 m length with the sections of 8.1 m, by fastening of metal pipes, mounted on the square pipe of 100X50X3 mm by welding of the square pipes of 60X30X2 mm structure and sizes of which are given on the Drawing #8.

9. Road Ownership and Equipment

On road joints on two sections pk5+70 and pk10+42 there are envisaged placing of metal pipes of D=530 mm of 8 m length without heads. The types and structure of the joints are given on the Drawing #5. Pickets of joints and parameters are given on the Register #5.
Alongside the high dumps and steep ravines at the laterals are envisaged to be placed curvilinear parapets (royals). Along the road there is envisaged to be placed the signal poles taking the standards into consideration. The works are to be carried out by the specialized teams consisting of qualified workers. During implementation of works the safety, equipment operating, industrial sanitary and fire fighting rules should be met.

10. Labor protection and Safety Technique

Keeping of safety methods and sanitary standards in the process of construction are obligatory. At the standards of the norms of technical safety (II-4-89) there are considered all those issues knowing of which are obligatory. Before construction starting the existing road needs to be regulated in order to be provided free movement of the construction vehicle at the site. At the movement dangerous zones there are to be placed the special warning signs.
The working places should be provided with safe inventory essential for conducting of works. Before starting of works the workers should be provided with protecting special helmets, cloth and shoes. All sub-divisions of construction should be provided with medicaments of primary assistance.

Appendix 8.2

List of Rehabilitation Activities for Pushkin Street

Work Activities: Rehabilitation of Pushkin Street

#	WORKS	DIMEN	QUANT	PRICE PER UNIT	TOTAL Cost, GEL
1	2	3	4	5	6
	I Preparatory Works				
1	Road restoring and fastening	km	0.915	150	137.25
2	Removal of the bottoms of cut trees	Pc	1	7.8	7.8
3	Loading of existing reinforced concrete (royal) curvilinear parapets with autocrane, removal to 2 km distance and bringing down with autocrane including placing	Pc	6	168	1008
4	Lifting of existing wells to the project marks	Pc	12	80	960
	II Road bed				
1	Milling of existing asphalt pavement of 8 cm thick	m^2	7259	6.24	45296.16
2	Loading of the milled material on the dump trucks with excavator and removal to 5 km distance to the side assigned by the Municipality, including leveling in fill	m^3	580	4.42	2563.6
3	Demolishing of existing asphalt pavement and base on the sidewalk with pneumatic hammers	m^3	316	25	7900
4	Loading it with excavator on dump trucks and removal to 5 km distance including leveling in the fill	m^3	316	4.42	1396.72
5	Dismantling of existing damaged curbs with pneumatic hammers	Lin. M	692	1.2	830.4
6	Loading it with excavator and removal to the bulk to 5 km distance	m^3	31.34	4.42	138.5228
7	Arrangement of concrete curbs around existing vines (50X30X15) 43 vines	Lin. M	86	16.1	1384.6
	III Engineering Structures				

1	Lengthening of existing drainage pipes at pk 5+66 pk 6+13 and pk 6+20 with respective lengths 5+4+6=15 lin. M and metal pipes of d-325 mm	Lin. M	15	106	1590
2	Concreting of lengthened pipes in the furrow	m^3	1	160	160
3	Plastering of gaps existing on the bridge with sand-cement mortar	m^3	0.05	160	8
4	On existing bridge the toe coupling Concrete m-200	m^3	0.1	160	16
	IV Arrangement of reinforced concrete belt wall				
1	Processing of III category soil by hand including accumulation on site	m^3	34	7.2	244.8
2	Arrangement of crushed rock base of 10 cm thickness	m^3	7	23.34	163.38
3	Arrangement of reinforced concrete belt wall of the size (0.7X0.3) m "m-250" with prefabricated concrete	m^3	47	204.9	9630.3
4	Reinforcement bar A-I d-6 mm	Lin. M	855	0.5	427.5
5	Reinforcement bar A-III d-8 mm	Lin. M	900	0.68	612
6	Loading of surplus soil on dump trucks with hand and removal to the bulk to 5 km distance	m^3	34	9.98	339.32
	V Arrangement of curbs				
1	Preparation of crushed rock under the layer at 5 cm thickness 1743X0.25X0.05	m^3	22	23.34	513.48
2	Curb holding concrete m-200 1743X0.018	m^3	31.4	160	5024
3	Purchasing of concrete curbs of the size 30X15 cm acquiring, bringing, installation 1002+741+7	Lin. M	1750	16.1	28175
	VI Road Pavement				
1	Processing of destroyed asphalt pits and breaking down the edges with pneumatic hammers	m^3	9	25.00	225
2	Loading of broken parts on dump trucks and transporting to the bulk to 5 km distance	m^3	9	4.42	39.78
3	Processing of pits and edges with liquid bitumen	t	0.036	1195.00	43.02

4	Restoring of pits and edges with fine grained, dense, crushed-rocky asphalt-concrete hot mixture of Type B, Mark II of 5 cm thick	m^2	170	17.80	3026
5	Arrangement of crushed rock base of 5 cm thick	m^3	8	23.34	186.72
6	Liquid bitumen placing (8509X0.00035)	t	2.978	1195.00	3558.71
7	Arrangement of the bottom layer of the pavement with coarse grained, porous, crushed-rocky asphalt concrete hot mixture of Type B, Mark II, of 4 cm thick	m^2	7259	13.13	95310.67
8	Arrangement of leveling layer with fine grained dense asphalt concrete hot mixture of Type B, II with average thickness of 4 cm	m^2	1250	14.24	17800
9	Liquid bitumen placing (8509X0.00035)	t	2.978	1195.00	3558.71
10	Arrangement of the top layer of the pavement with fine grained dense porous crushed rocky asphalt concrete hot mixture of Type B, Mark II of 4 cm thick	m^2	8509	14.24	121168.16
	VII Arrangement of asphalt pavement on sidewalk				
1	Arrangement of the fill with sand=gravel mixture of 12 cm thickness 1638+1525=3163X0.12X1.24	m^3	471.00	15.39	7248.69
2	Arrangement of crushed rock base on the sidewalk of 5 cm thickness (78+47=125)X1.26	m^3	158.00	23.34	3687.72
3	Placing of liquid bitumen on sidewalk 3163X0.0006	Pc	18.00	2.40	43.2
4	Raising of existing windowsills by 20 cm with pumice-block	t	1.898	1195.00	2268.11
5	Pavement arrangement of sidewalk with fine grained dense crushed rocky asphalt concrete hot mixture of Type B Mark II of 4 cm thickness	m^2	3018	14.24	42976.32
6	Pavement arrangement of sidewalk with fine grained dense crushed rocky asphalt concrete hot mixture of Type B Mark II of 5 cm thickness	m^2	145	17.8	2581
	VIII Arrangement of vehicle connections				
1	Milling of existing pavement of 5 cm thick	m^2	574	3.9	2238.6
2	Loading with excavator on dump trucks and removal to the bulk to 5 km distance	m^3	29	4.42	128.18

3	Dismantling of existing pavement with grader at 12 cm thickness	m^2	91.67	0.25	22.9175
4	Loading it with excavator and transporting to the bulk to 5 km distance	m^3	11	4.42	48.62
5	Base arrangement with crushed rock of fraction 0-20 mm of 5 cm thickness (4.55+1.26)	m^3	6	23.34	140.04
6	Placing of the liquid bitumen on roadway 0.00035 t/m^2	t	0.220	1195	262.9
7	Arrangement of the bottom layer of the pavement with coarse grained, porous, crushed-rocky asphalt concrete hot mixture of Type B, Mark II, of 4 cm thick	m^2	635	13.13	8337.55
8	Liquid bitumen placing 0.00035 t/m^2	t	0.220	1195	262.9
9	Arrangement of the top layer of the pavement with fine grained crushed rocky asphalt concrete hot mixture of Type B, Mark II of 4 cm thick	m^2	635	14.24	9042.4
	IX Arrangement of yard entries				
1	Dismantling of existing pavement with pneumatic hammers	m^3	49	25	1225
2	Loading it by hand on dump trucks and transporting to the bulk to 5 km distance (39.4X1.24)	m^3	49	9.98	489.02
3	Arrangement of crushed rock base of 5 cm thickness (19.7X1.26)	m^3	25	23.34	583.5
4	Liquid bitumen placing 0.0006 t/m^2	t	0.300	1195	358.5
5	Arrangement of one-layer pavement with fine grained asphalt concrete hot mixture of 5 cm thick	m^2	484	17.8	8615.2
	Rehabilitation of Stairs Ascending from Pushkin Street to Sukhishvili St.				
1	Demolishing the top of the existing damaged wall with pneumatic hammers at 20 cm thick	m^3	1.50	30	45
2	Loading of demolished mass on dump truck transporting to the bulk to 5 km distance	m^3	1.5	4.42	6.63
3	Arrangement of concrete girdle on existing destroyed wall and project walls at the height 30cm m-200	m^3	4.8	160	768

	Schedule of volumes for arrangement of reinforced concrete retaining wall to the left and to the right from pk0+00 pk0+07.33 (length - 14.66 m.)				
1	Excavation of III category soil by hand (4+4)	m^3	8	8	64
2	Loading of excavated soil on dump trucks and transporting to the bulk to 5 km distance	m^3	8	4.42	35.36
3	Arrangement of concrete base m-200	m^3	4.8	140	672
4	Arrangement of concrete wall m-200	m^3	8.2	160	1312
5	Vertical reinforcement bar d-12mm a-III	Lin. M	205.9	1.5	308.85
	Schedule of volumes for arrangement of reinforced concrete retaining wall at connection of Sukhishvili Street to the left and to the right (length - 6.2 m.)				
1	Excavation of III category soil by hand (2.2+1)	m^3	3.2	8	25.6
2	Loading of excavated soil on dump trucks and transporting to the bulk to 5 km distance	m^3	3.2	4.42	14.144
3	Arrangement of concrete of the base m-200 (1.26+0.6)	m^3	1.86	140	260.4
4	Arrangement of concrete wall m-200 (1.68+0.8)	m^3	2.48	160	396.8
5	Vertical reinforcement bar d-12mm a-III (30.8+15.4)	Lin. M	95.00	1.5	142.5
	Schedule of volumes for arrangement of cast-in-situ concrete stairs at the connection of Sukhishvili Street				
1	Excavation of III category soil by hand	m^3	1.4	8	11.2
2	Loading of excavated soil on dump trucks and transporting to the bulk to 5 km distance	m^3	1.4	4.42	6.188
3	Preparation of crushed rock of 10 cm thick	m^3	0.55	23.34	12.837
4	Arrangement of three steps of the staircase (30X15 cm) with cast-in-situ concrete m-200 length 4.8m	m^3	1.30	140	182
	Arrangement of the yard entry pk 9+12 to the left				
1	Excavation of III category soil of 30 cm thick	m^2	21.3	8	170.4
2	Loading of excavated soil to the bulk at 5 km distance	m^3	6.4	4.42	28.288
3	Arrangement of the bottom layer of the base with sand gravel mixture of 20 cm thick	m^3	8.00	16	128
4	Arrangement of the top layer of the base with fractional crushed rock of 10 cm thick	m^3	3.00	23.34	70.02
5	Liquid bitumen placing 0.0006 t/m^2	t	0.01	1195	15.296
6	Arrangement of the pavement with fine grained dense asphalt concrete hot mixture of Type B, Mark II of 5 cm thick	m^2	21.30	17.8	379.14

7	Curb holding concrete	m^3	0.34	140	47.6
8	Concrete curb purchasing, bringing, arranging	Lin. M	19.00	18	342
	Railing arrangement				
1	Steel pipe d=65mm of 4mm thick	Lin. M	72.18	17.8	1284.804
2	Steel pipe d=25mm of 3.2mm thick	Lin. M	54.60	5.8	316.68
3	Painting of the railing with oil paint two times	m^2	19.02	7.5	142.65
	Facing of the stairs and platforms				
1	Reinforcing of staircase platforms with reinforcement bar d-12 a-III	Lin. M	214.00	1.5	321
2	Correcting of stairs and platforms' profile with sand cement mortar of the following proportion: 1:3	m^3	9.18	6.5	59.67
3	Arrangement of basalt slabs on stairs, platforms and staircase foreheads at 3 cm thickness	m^2	120.00	55	6600
4	Sand cement mortar of 1 cm thick	m^3	1.20	120	144
	X Street Furniture and Signs				
1	Warning traffic signs' installation on standard supports 76mm	Pc	11	127	1397
2	Painting of existing bridge's railing with oil paint	m^2	142	4.13	586.46
3	Installation of vision mirror	Pc	1	480	480

Pushkin Street: Explanatory Note

1. General part

The project task envisages rehabilitation of Pushkin Street in Gori Town in accordance with #101 "Contract on State Procurement" of Gamgeoba of Gori Municipality dated April 11, 2012
The project was based on the material of survey conducted by "Geo" Ltd. In April, 2012,
The project is prepared in accordance with valid regulations.

2. Brief Description of Construction Site

The site of survey belongs to mountainous climate district of East Georgia that is located to the North of Trialeti mountainous ridge. This zone is characterized with moderately continental climate with average annual temperature of +100C . High average temperature a moth is +220C in August and low temperature in January: 10C - At the construction site the construction material is received from licensed quarry existing in riverbed of Liakhvi river.

3. Length and description of the project road

Based on the project task the survey was conducted on Pushkin St. in Gori Town . The streets begins at Tskhinvali highway and finished at the stairs descending from Sukhishvili St. At the project sections there are noted various kind of damages, waves, small and big size pits, linear as well as lateral cracks, linear and lateral slops are out of order. The mentioned deformations obstacles normal and safe movement of vehicles, reduces its carrying capacity causes emission of toxic gas in big quantity. For rehabilitation works the project envisages conducting of respective arrangements. Existing observing wells are envisaged to be brought to the project marks. The length of the project street makes up 915 m. The curve angles of the road to be designed are fastened on site with steel sticks. The reference points are fastened on solid points existing on site, fastening scheme and description of which are provided in the schedule of reference points.

4. Preparatory Works

Preparatory works envisage the following: restoration, fastening of the road, eradication of the bottom of existing tree, bringing of reference points and fastening. Loading of existing curvilinear parapets (royals) on dump trucks and transporting to 2 km distance.

5. Roadbed

The roadbed of existing street is in satisfactorily condition, width of the roadbed fluctuated from 12 to 20 meter, width of the roadway fluctuates from 7.9 to 10.5 m. At the site in the vicinity of the sidewalk there are met the green lawns around which concrete curbs are to be arranged from all four sides. Scheme for arrangement of the curb is provided on the drawing. The sidewalks existing on the street are partially and in some places totally destroyed; The project envisages
restoration of the sidewalks with the new curbs, by arranging of the fill with sand-gravel mixture, arrangement of crushed rock base at the sidewalk of 5 cm thickness.

6. Engineering Structures

At the designed street from pk3+41 to pk 3+70exists reinforced-concrete bridge that as engineering structure is in good condition. The bridge need the gap between the curb stones to be plastered with mortar. Existing damaged toe to be coupled needs to be restored with concrete. The stones of railings

and curb stones are to be painted with oil paint. At crossings of Shartava and Ninoshvili Streets there exist the drainage pipes that are in good condition but need only lengthening as it is envisaged under the project. Removal-placing of curvilinear parapets (royals) are envisaged at the connection of Tbilisi Street. At all connections and yard entries there is envisaged to be arranged the plinths with sloped curb arrangement scheme of which is given on Drawing #10.

7. Road Pavement

The width of the mentioned project street's roadway fluctuates from 5 to 10.5 m, and the width of sidewalks fluctuates from 1.0 to 5.3 m. In some places between the roadway and sidewalk there are the green lawns around which the curbs' stones are mainly damaged and destroyed. The project envisages replacement of these damaged curbs with the new concrete curbs quantity and location of which is provided in respective schedule and on situation plans. From pk3+70 on both sides at the streets the sidewalks are not arisen what for water of rain accumulates on the sidewalk. The project envisages raising of all sidewalks to 15-20 cm height in such a way the water not to penetrate into the windows in existing houses. From pk8+60 to pk 8+70 at the left side of the street there are the air mines of the basement toward the wall. In the project for these air mines we are doing insulation at the sidewalks with the curb stones and the sidewalk is raised in such a way that the water of the sidewalk not to enter the air mine. At the end of the street to the right side from pk 8+98 to pk 9+15 there are the areas of small size that is covered with garbage and rough grass. The project envisages on this site too small lawns to be arranged and the sidewalks to be asphalted.

The structure of the roadway of the project street is as follows: from pk 0+00 to pk 6+79 and from pk8+04 to pk 9+15, The damaged roadway is to be milled totally including loading of the milled material on dump trucks and transporting to the bulk to 5 km distance.

- After milling of the roadway in sections where milled material did not penetrate deeply due to pits, there is to be arranged the crushed rock base.
- Liquid bitumen placing 0.00035 t/m2.
- Bottom layer of the pavement with coarse-grained, porous, crushed-rock asphalt concrete hot mixture, Type B, Mark II of 4 cm thick.
- Liquid bitumen placing 0.00035 t/m2.
- Arrangement of the top layer of the pavement with fine-grained dense crushed-rock asphalt-concrete hot mixture of Type B, Mark II, thick – 4 cm.

Existing asphalt linear slope from pk 6+76 to pk 8+04 is too small, 1-1.2% what for the water quantity is practically impossible. This site is envisaged under the project.

- Pit repairs of existing heavily damaged asphalt pavement.
- Arrangement of leveling layer with fine-grained, dense crushed-rocky asphalt hot mixture of Type B, Mark II with average thickness of 4 cm.
- Pavement arrangement with fine grained dense crushed-rocky asphalt concrete hot mixture of Type B, Mark II of 4 cm thick.
- The existing sidewalks at the right side of the street from pk8+15 is fallen and water stands.

The project envisages raising of existing sidewalks with fine-grained dense crushed-rocky asphalt concrete hot mixture of Type B, Mark II of 5 cm thick.

- On all remained sidewalks after arrangement of the fill with sand-gravel mixture of 12 cm thickness there is arranged the crushed rock base of 5 cm thickness (fraction 0-20 mm).

- Liquid bitumen placing 0.0006 t/m2.
- Arrangement of the pedestrian part with fined grained dense crushed-rocky asphalt concrete hot mixture of Type B, Mark II of 4 cm thick.

The road vehicle operating indicators should meet the requirement of the following main normative documents:

- Correctness of the roadway according to SNIP 3.06.03.85.
- Friction coefficient of the pavement with regard to the car wheels according to SNIP 2.05.02
- Slope of the roadway according to SNIP 3.06.03.85.

8. Road Signs

- At all road connections there is envisaged to be installed the warning standard traffic signs.
- To the left of the street pk 4+05 there is to be installed the vision mirror that will assist to provision of vehicle movement ascending from Gogebashvili Street without any obstacles.

9. Labor protection and Safety Technique

Keeping of safety methods and sanitary standards in the process of construction are obligatory. At the standards of the norms of technical safety (II-4-89) there are considered all those issues knowing of which are obligatory. Before construction starting the existing road needs to be regulated in order to be provided free movement of the construction vehicle at the site. At the movement dangerous zones there are to be placed the special warning signs. The working places should be provided with safe inventory essential for conducting of works. Before starting of works the workers should be provided with protecting special helmets, cloth and shoes. All sub-divisions of construction should be provided with medicaments of primary assistance. For the workers work of which are connected with technical material the supervision of permanent staff needs to be conducted. Working of the crane machinery during the road movement should be conducted gradually without pushes. At the zones of cranes' operation, presence of the people is not allowed. At the construction the special attention should be paid to safety rules regarding fire fighting.

Appendix 8.3

Site Visit Report for Gorijvari Road
(April 7, 2012)

Site Visit Report for Gorijvari Road (April 7, 2012)

This report starts with the rapid environmental characterization of the site (including some potential impacts and mitigation needs, as well as observations with regard to engineering design requirements), followed by the affected environment descriptions and findings for terrestrial biology (fauna, by Mr. Andrei Kandaurov from the Institute of zoology, flora by Dr. Mirian Gvritishvili from Tbilisi Botanical Garden) as well as cultural heritage and archaeology (by Dr. Gogi Mindiashvili). The visual site inspection was performed by this team of experts on 07 April 2012. Findings of respective specialist studies are accompanied by mitigation measures, suggested by the experts.

5.1 GENERAL SITE INSPECTION (compiled by Mamuka Gvilava)

Map below lays out the Gorijvari road and sensitivities identified during the ecological and cultural heritage inspection (red line indicates road routing, as proposed by GEO). These sensitivities (and potential mitigations) are described below in the captions to photo illustrations, summarized in this section as well as expanded in further sections. (Explanations are given starting from the highest point and going downward along the rehabilitation road.)

Goggle Earth file can be accessed by clicking here: Goriivari_Road

Figure 1. Layout of the proposed Gorijvari road and results of the site inspection.

Brief discussion meeting at GEO office.

End point of the road to Gorijvari. Land cover shows signs of erosion despite very small 'catchment' of the concrete trail to the Church.

Bell tower of Gorijvari St. Giorgi Church.

View over Gori from the Church.

Scars in the landscape are essentially the Gorijvari road. Erosion is significant across the entire section and locals inform (and is evident from site inspection), that downhill movement of the water during storm events should be a significant factor in completing the road design.

View over the 'eastern' alternative (rejected due to potential impact on St. Barbare ruins). It is also visible that forestry roads contribute to significant sediment and water runoff.

Cars should be blocked from accessing the cemetery. No excavations allowed between two separated sections of the old cemetery.

International visitors (apparently from German Embassy) were encountered during site visit.

Animal sacrificing (sheep) seems unavoidable, but it is recommended to 'hide' these features.

If feasible, wheelchair accessibility to be provided. Stone tiling preferred to concrete.

Erosion is a typical pattern all along the route.

This natural drainage shape should be maintained with due erosion control to divert excess water

Upward and downward panoramas show severe erosion due to vehicle movement damage in the middle section of the road (see steep slope 2 mark on the Figure 1). All damaged area outside the road route should be recontoured to natural shape, ripped, revegatated and stabilized.

		
Didi Gorijvari should be proud of its ancient graves, which deserve removal of unsightly structures and better preservation.		Locals were delighted to hear about the road rehabilitation. Strong advice given was to take due account of catchment waters and their impact road drainage. Kindly asked for simple renewal of asphalt cover in the road passing through their village as well.

5.2 To summarize some of the mitigations suggested as a result of the field reconnaissance (other mitigations are proposed in thematic reports provided below) the following is proposed:

5.3

- Detailed pre-construction survey and photographic inventory to document all pre-construction concerns and conditions.

5.4 - Address erosion on the foot trail slope towards the Church.

- Stone sheet tiling preferred landscape friendly option for Church access trail (versus concrete cover, which is least desirable solution).
- Establish landscape friendly natural barrier to prevent cars entering the old cemetery.
- Minimize landscape and other environmental impact of the parking areas installing green parking solutions such as perforated surface concrete pavement.
- Consider other solutions for areas subjected to significant aggregate filling with the intention to mitigate steep road sections (e.g. by providing for stone payments on steep slope sections).

5.5 - Adequate erosion control all along the road (including full remediation and stabilization of all currently damaged areas along the entire route).

5.6 - Engineer in charge of design to investigate site hydrology, take full account of drainage needs.

- Maintain natural drainage patterns as much as possible, provide for a range of erosion control measures so that vegetation cover loss and gullying is prevented from emerging.

5.7 - As part of the design work GEO to come up with realistic estimate of the cut spoil and reuse volumes through fills, as well as to identify closest sources of aggregates and site(s) for disposal of non-reusable spoil.

5.8 - Provide for asphalt cover in the main road of Didi Gorijvari village, so that negative social impact of traffic is mitigated (many visitors of Gorijvari are known to deviate from main route and pass vehicles through Didi Gorijvari).

1.2 FAUNISTIC ASSESSMENT (compiled by Andrei Kandaurov)

Key objective of this report is to describe potential impact zone of Gori-Gorijvari road rehabilitation within the Inner (Shida) Kartli Region in terms of conservation of animal diversity. The report is based on review of published scientific data, available collections, experience of an author and findings of field survey conducted on the territory under consideration in 07 April 2012.

1.2.1 Approaches and Methods

In preparing this report we are using as a basic principle - necessity of protecting biodiversity of the fauna of Georgia, as our national heritage and source of income and free services for a significant part of the local population (pharmacy, tourism, recreation etc).

For the evaluation of the consequences of the realization of the project and estimation of the impacts on the environmental receptors - all sensitive receptors, which might be affected, should be identified. In the report should be identified ecosystems and habitats, populations of animals that could be, directly or indirectly, affected by the construction and operation of the road. Therefore, during the environmental assessment, the possible impacts of the project on all the identified populations of the protected species and all key biotopes and ecosystems, which might be affected by the project, should be considered.

The general principle for species selection is that each species, considered in the report, must have an argument, which allows to include it in the list for consideration, e.g. to be a species that is already protected by law (listed in the national Red Data List, 2006). Rehabilitation of the road should not lead to the harm to animals that occur in Georgia, especially, to the endangered species. The extinction of even one species is inadmissible. We have to prevent any harm for these species on Georgian territory pursuant to our international obligations and national interests.

However, all species, which can be included in the list for consideration in this report, should be presumed as the species impacted by the project, especially if a part of population, significant for surviving of a species as a whole on the territory of Georgia, could be adversely affected by the impact factors of the construction and/or operation of the road.

Key-site selection has two aspects. From one hand, should be selected area which is important for the animals as a key-site. That maybe breeding or nesting place, feeding (foraging) site, stop-over site during migration, wintering or hibernation place, etc. From another hand, we should select sites within the area of the Project activity, where an impact of the construction, operation, and repair works will result in harm to fauna.

We need to identify all the influence factors of the Project to evaluate its impact on the fauna. These factors are:

1. Direct and indirect losses of habitats due to unexpected or long-term consequences of construction (e.g. erosion increasing, habitat fragmentation, because of the cutting trees, etc.)
2. Pollution: the soil and the water - by the oil or fuel (diesel) and waste products during construction and operation
3. Noise pollution – both, disturbance during construction, and residual background noise, during operation of road
4. Animals disturbance on the key-sites e.g. on breeding (nesting) places during breeding season, on foraging sites and on wintering areas, on migration routes and stopover sites during migration. That will cause number decreasing of a population
5. Mortality of mammals and reptiles on the road

All "sensitive" habitats and ecosystems should be noted in the report. All sites, that are requiring extra cares during constructions and/or operations, and all sites, where can arise problems with the

biodiversity preservation, and thus mitigation measures are required - must be noted before the construction work will begin.

The report is prepared using the World Bank's Environmental Source book, Operational Directives 4.01 (Environmental Assessment), Operational Polices on Forestry (OP 4.36) and Natural Habitats (OP 4.04); EU EIA Directive 85/337/EEC as amended by 97/11/EC, EU – Guidance on Scoping, 1996 and latter EBRD guidelines.

National Legal framework

Existing nature conservation legislation in Georgia partly corresponds to internationally accepted principles and criteria in the sphere of nature conservation and biodiversity protection and consequently provides an acceptable framework for EIA. The Georgian legislation and international obligations of Georgia, resulting from the signed International Conventions in the field of the Nature Protection, form a legal side of a framework of our examination.

The main laws on nature conservation relevant to this report are:

- the Environmental Protection Law of Georgia (the Frame Law for nature conservation)
- the Wildlife Law of Georgia
- the Law on Red Data List of Georgia
- Decree #303 of May 2, 2006 of the President of Georgia, "On Approval of the Red List of Georgia" (Endangered Species List)

Pursuant to the Georgian legislation, 135 species and 4 sub-species of animals are protected (Red Data list of Georgia, 2006). Taking into consideration the species, which are protected by the International Agreements, the whole number of protected species can reach up to 250. Most of these species are listed in the Red Data List of Georgia, Red Data List of IUCN, and in Attachments to different Conventions.

International Conventions

The following list gives an overview on Multilateral International Conventions, related to nature conservation and biodiversity protection, enforced in Georgia, which are relevant to this report:

- Convention on Biological Diversity (CBD), 1992, - accepted at 02/06/1994.
- Convention on the Conservation of Natural Habitats and of Wild Fauna and Flora (the Bern Convention) - ratified in 30/12/2008.
- Convention on the Conservation of Migratory Species of Wild Animals (CMS), Bonn, 1979, date of entry into force 01/06/2000.
- Agreement on the Conservation of Bats in Europe (EUROBATS) – ratified at 21/12/2001. This Agreement protects 28 bat species occurring in Georgia.

1.2.2 General Description of Georgian Fauna

A. Zoogeographical Aspects of Study Area, Brief Overview

Physical-geographic regions of Caucasus

Geographically, the Caucasus isthmus is recognized as a land from the southern borders of Armenia, Azerbaijan, and Georgia in the south to the Kuma-Manych depression in the north. It borders upon the Black and Azov Seas in the west and the Caspian Sea in the east. Close neighborhood of areas with different natural conditions is typical for the Caucasus. Distances between high mountains and coastal lowland, as well as between humid or arid subtropics and coniferous forests, are rarely more than several tens of kilometers, and sometimes less than ten kilometers. The isthmus has historically served as the area of transit for many species in the process of exploring new areas and as a migration corridor for many animals.

The territory of Georgia, lying in the western-central part of Caucasus, is the most uneven from the climatic and landscape point of view, among Caucasian countries. Georgia covers both Caucasian mountain systems (southern slopes of Great Caucasus as well as northern part of Lesser Caucasus). At the same time, all types of Caucasian landscapes are represented here. Humid sub-tropic landscapes with predominance of autochthonous Caucasian (or Colchic) fauna and flora are in the western part of the country. The alpine landscapes with plenty of East-European elements are spread in the northern and north-eastern part. The typical Middle East treeless uplands are presented in the southern Georgia and, at last, semi-deserts of Turanian type in the south-east.

From the physical-geographic point of view, the Gorijvari road is situated on the right bank of the Mtkvari (Kura) River within the middle part of the Transcaucasian depression. This depression is located between mountain ridges of the Great Caucasus and the Lesser Caucasus that are bordering from the North the large region of Middle East Uplands.

Western part of the Transcaucasian depression covers the Colchic province (Kolkheti), including two sub-provinces - of Colchic (Kolkheti) lowland and Colchic (Kolkheti) foothills. All rivers and streams here belong to the basin of the river Rioni and to the basin of the Black Sea.

Central part of the Transcaucasian depression, situated in the eastern and central parts of Georgia, belong to the Kura physical-geographic province, Kura-Alazani sub-province (another sub-province of this province - Kura-Arax lowland, is located in Azerbaijan). All rivers and streams in this region belong to the basin of the river Mtkvari (Kura) and, thus, to the basin of the Caspian Sea. The construction area lies outside of the Kura physical-geographic province.

The Middle East physical-geographic province situated to the south from the Transcaucasian depression and consists of the Lesser Caucasus and Javakheti Plateau (Upland). One can divide Lesser Caucasus in three sections. Western part - Meskheti ridge and western slopes of Trialeti ridge are quite humid and high, covered with broad-leaved forest. Hard rocks form mountain relief. Eastern part – Trialeti ridge is more arid and low, than western part, covered with deciduous forest. The south part consists of the Javakheti Plateau (Upland), Javakheti, Samsari and Erusheti ridges. Relief is leveled (smoothed), rocks volcanic and diluvium. This part mainly is covered with tree-less, open grassy landscape. Only on the Erusheti ridge one can see forest. All rivers and streams, located on this territory, except rivers on northern slopes of Meskheti ridge, belong to the basin of the river Mtkvari and, thus, to the basin of the Caspian Sea. Rivers on northern slopes of Meskheti ridge belong to the basin of the river Rioni and Black Sea.

The Gori-Gorijvari road is situated on lower foothills of the northern slopes of the Trialeti Ridge of the Lesser Caucasus. There are no open permanent watercourse within the Project area, just dry channels of the gullies. The territory is covered with South-East Caucasian sub-Mediterranean foothill landscape with hornbeam-oak forest and secondary dry scrubland.

Zoogeographic Characteristics of the Caucasus

From the viewpoint of zoogeography, the entire Caucasus is located in the Holarctic or Palearctic kingdom or zone, depending on the terminology used by experts in zoogeographic zoning. The zoning of the World Geographic Atlas of 1964 published in Moscow[1] is used in the report. According to Vereshchagins map (1964), the Caucasus includes several zoogeographic sub-zones. In the north of the region there are two districts of the Kazakhstan-Mongolian province of the Central Asian sub-zone. The middle of the Caucasus is mountains of the Greater and Lesser Caucasus and Talish that belong to the Caucasus district of the Circumboreal sub-zone, and are isolated from the main part of the sub-zone by steppes. The Circumboreal sub-zone is sometimes referred to as the sub-zone of Western Eurasia, which in principle does not change its characteristics and boundaries in the Caucasus (World of Geography 1984). Southern boundaries of the Caucasus lie within the Anterior Asia district of the Mediterranean province and Kura district (almost entire Azerbaijan) of the Iran-Turan province. Both these provinces belong to the Mediterranean sub-zone. Thus, three zoogeographic sub-zones and four zoogeographic provinces neighbor in the Caucasus.

The Caucasus is a home of the species typical for all the three sub-zones, and is rich in the diversity of flora and fauna.

Territory of Georgia spreads on the almost all biogeographic regions represented throughout Caucasus isthmus. It is rather difficult to outline correct border between faunistic regions represented throughout Georgia because of the mutual penetration of species between them. Complicated, sometimes mosaic, spatial structure of biological communities representing different biogeographic regions is specific to Caucasus, from the biodiversity point of view.

One can outline, throughout territory of Georgia two areas with important landscape differences. The first - Caucasus district, including Colchic and Caucasus regions, unify forest landscapes with plenty of autochthonous animals and representatives of European fauna. The second - the Mediterranean sub-zone is composed with two other types of biological communities. There are Anterior Asia district with highlands of Lesser Caucasus (landscapes very similar to those in Turkey and the most part of Middle East) and arid, semi-dessert landscapes in Kura district with many elements of Turanian fauna (this region, also is genetically connected with biological communities typical for countries of Central Asia). Significant part of Georgian territory (northern slopes of Trialeti ridge and part of southern slopes of Great Caucasus in East Georgia) are covered with forest areas with communities including elements of Colchic, East-European, Middle East and Turanian fauna.

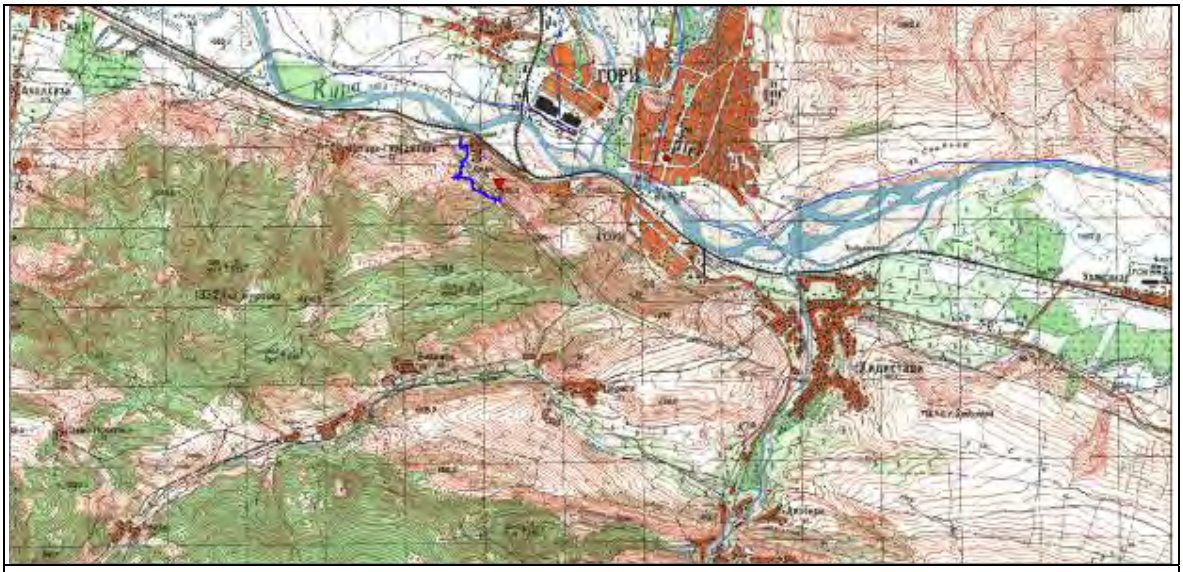
In difference from other Caucasian countries, significant part of Georgia is occupied with communities of mixed origin, which could not be unified with any enumerated districts. Relief causes relatively clear borders between some biogeographic districts, but these borders remain conditional. E.g., the Colchic district as a whole is situated in the basin of the Black Sea, whereas most other districts (except western part of Caucasian) - in the basin of the river Kura, entering Caspian Sea. However, Colchic elements are found along southern slopes of Great Caucasus up to the eastern border of Georgia and in Borjomi Gorge, which belongs to the basin of Kura; Turanian elements are found in the valley of Alazani, which belongs, in general, to the Caucasian district etc.

[1] We refer to the zoning presented in the World Physical-Geographic Atlas (1964) first of all because one of the map authors was N.K. Vereshchagin, author of *The Mammals of the Caucasus; a History of the Evolution of the Fauna* (1959), a fundamental monograph also including a detailed map of the Caucasus zoogeographic zoning based on theriology data.

Caucasian agama - *Laudakia caucasia*

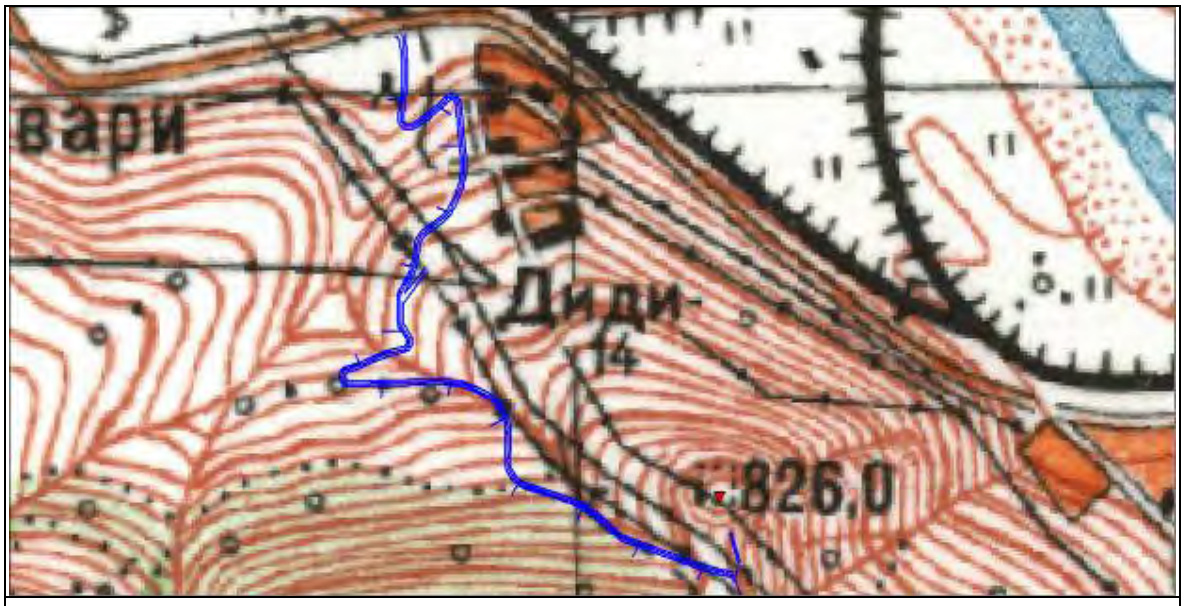
Turanian fauna element on the Gorijvari monastery wall - Caucasian agama - *Laudakia caucasia*. Observation point #132

The Gorijvari road rehabilitation area is situated within the territory occupied with communities of mixed origin, with a considerable admixture of East-European and Turanian species. But, animals' communities of the Project area are quite degraded in result of usage of this territory by local human population for pasture and harvesting of fuel wood for a long time. The area of the Project is very small. It is limited by the width of the existing parochial dirt road (less than 10 m) and with total length of about 1,5 km. This territory is, actually, on lesser importance from the standpoint of the animal biodiversity conservation, because of long and hard transformation of the natural landscapes and dense human population in the area.



Map 1. General view on the Project area

Blue line – the line of the project of the road rehabilitation
Red triangle – Gorijvari monastery



Map 2. Detailed view on the Project area

B. General Description of Georgian Fauna by Taxonomic Classification

In total, 108 mammal species occur in Georgia. The Red Data List of Georgia includes 33 mammals. All bat species, 28 in total, recorded in Georgia are protected under the EUROBATS agreement. About 35-40 species of mammals are recorded in the region, most of them occur in habitats lying outside the Project area.

390 bird species are recorded in Georgia. The Red Data List of Georgia includes 35 birds. Over 220 species nest in Georgia, others are observed during migration and wintering. No less than 215 species are migrating forms. Georgia is part of important Euro-African and Euro-Asian migration routes for birds. No less than 230 bird species are recorded in the country during spring and autumn migration. The bird migration takes place from west to east along r. Mtkvari valley (from Khashuri to Tbilisi) from early March to mid-May. In late August - late November the birds migrate from east to west. Up to 120 bird species and 1 million individuals migrate through r. Mtkvari valley (in both directions) in Georgia. The most abundant migrating groups are *Passeriformes, Charadriiformes, Falconiformes* and *Anseriformes*. About 240 bird species are recorded within the Gori administrative district. Near 150 of them are local breeders (nesting species), 57 regular migrants, 28 species are wintering here, and 8 species are vagrant or occasional visitors. One can observe not more than 60 bird species within the considered area. Among them 15-18 species – prefer urban and rural habitats, 13 species related with riparian habitats and about 30 species prefer bushes and forest edges.

54 reptile species occur in Georgia. 11 species are included in the Red Data List of Georgia. About 10 species could be expected within the Project area. Majority of the reptile species are not likely to be affected by construction.

12 amphibians are found in Georgia, 2 are included in the Red Data List of Georgia. No one of the red listed species occurs within the area of Project.

Thousands of invertebrate species inhabit Georgia. The status of "Data Deficient" can be applied to the majority of the species. The Red Data List of Georgia includes 44 invertebrates.

The Red data List of Georgia is an only legal issue to protect species according to law. The species listed in the Red Data List of Georgia, which can be seen within the area of the Project of the Gori-Gorijvari road rehabilitation, are presented in the Table 1.

Table 1. Georgian Red List Species in the Project Area

Ref.	Scientific Name	Common Name	National Status	Kind of occurrence within area
		Mammals		
1	*Myotis emarginatus*	Geoffroy's bat	VU	?
2	*Cricetulus migratorius*	Grey dwarf hamster	VU	Open landscape
3	*Ursus arctos*	Brown bear	EN	Vagrant from forest south from area
		Birds		
1	*Buteo rufinus rufinus*	Long-legged buzzard	VU	Possibly breeding
2	*Aquila heliaca*	Imperial eagle	VU	Migrant, vagrant
3	*Aquila chrysaetos*	Golden eagle	VU	Vagrant
4	*Neophron percnopterus*	Egyptian vulture	VU	Feeding area
5	*Aegypius monachus*	Eurasian black vulture	EN	Vagrant
6	*Gyps fulvus*	Eurasian griffon vulture	VU	Vagrant
7	*Falco cherrug*	Saker falcon	CR	Migrant
8	*Falco vespertinus*	Red-footed falcon	EN	Migrant
9	*Aegolius funereus*	Boreal owl	VU	Possibly breeding
		Reptiles		
1	*Testudo graeca*	Mediterranean tortoise	VU	Open areas, forest edges
		Invertebrates		
		Butterflies		
1	*Manduca atropos*	Death's head sphinx	EN	Forest edges
2	*Callimorpha dominula*	Tiger moth	VU	Forest edges
3	*Polyommatus daphnis*	Meleager's blue	VU	Open areas, forest edges
		Bumble bees		
2	*Bombus persicus*	Persian humble-bee	VU	Open areas, forest edges
3	*Xylocopa violacea*	Violet carpenter bee	VU	Open areas, forest edges

5.9 C. Endemic species of the Caucasus

Among the vertebrate species four species, which are endemic to Caucasus, can be found within the area of Project. Below, in the Table 2, one can see their names (scientific and common); our assessment of extent of possibility that these species would be impacted during construction works, or during the normal operation of the road; and preferred biotopes for these species.

Table 2. Species endemic to the Caucasus in the Project Area

	Common name	Latin name	Possibility of impact on the species	Biotopes and range of occurrence
		MAMMALS		
1	Caucasian mole	*Talpa caucasica*	Low	Forest
2	Radde's shrew	*Sorex raddei*	Low	Forest
3	Caucasian mouse	*Apodemus ponticus*	Low	Forest
		REPTILES		
1	Kura lizard	*Darevskia portschinskii*	Low	Rocks at Gorijvari monastery and along the road

D. Species protected by law

Three mammal species included in the Red Data List of Georgia occur in the project area. Construction activities may affect individual range (home range) of grey dwarf hamster (*Cricetulus migratorius*). It can't be excluded that the brown bear (*Ursus arctos*) penetrates in the Project area in Winter from neighbor forests that are to the south from the rehabilitation area. This species as well a Geoffroy's bat (*Myotis emarginatus*) will be not affected by road construction.

Available data on distribution of bats indicates that eight bat species occur in the project area. One out of these eight bat species, namely Geoffroy's bat (*Myotis emarginatus*) is included in the Red Data List of Georgia as Vulnerable. It should be emphasized that structures colonized by bats are extremely important for their survival. Table 3 below provides a list of the bat species, status and preferred shelter type for colonies (tree hollows or structures / buildings).

Table 3. Bat Species Found in the Project Area

Ref.	Scientific Name	Common Name	Status	Inhabiting	
				Tree Hollows	Buildings
1	*Rhinolophus ferrumequinum*	Greater horseshoe bat	LC	+	+
2	*Rhinolophus hipposideros*	Lesser horseshoe bat	LC	+	+
3	*Myotis mystacinus*	Whiskered bat	LC	+	+
4	*Myotis emarginatus*	Geoffroy's bat	**VU**		+
5	*Eptesicus serotinus*	Serotine bat	LC	+	+
6	*Pipistrellus pipistrellus*	Pipistrelle bat	LC	+	+
7	*Plecotus auritus*	Brown long-eared bat	LC	+	
8	*Miniopterus schreibersii*	Common Bent-wing Bat	LC		+
	Total = 8 species			6	7
	Included in the Red Data List of Georgia	1 species		1	1

Bats are strongly dependent on existing shelters and areas for propagation and wintering. Their disturbance in May-June or December-February may result in high mortality of these animals. The strong negative impact can be caused by cutting down mature trees with hollows along the existing road.

Nine bird species out of thirty-five included in the Red Data List of Georgia may occur in the project area. Two species could be nesting; others are migratory (3) or vagrant (3) visitors to area. One species (Egyptian vulture) regularly feeds on the area, but nearest known to us nest is out of the Project area on Kvernaki Ridge. For the migratory birds, the part of r. Mtkvari valley between Tbilisi and Khashuri is important as it provides route for migration, while the rivers floodplain provides shelters and feeding areas, as well as bushes and forest in the Project area provides shelters.

Bushes and deciduous forest on foothills along the road are the breeding bird habitat.

One reptile species (Mediterranean tortoise), included in the Red Data List of Georgia, may occur in the construction impact zone. Destroying of places where the tortoises lay eggs can reduce number of population in the vicinities of the construction area. Often such places are on the edges of the roads and on the slopes of gullies. Among reptiles are one regional endemic of the Caucasus – the Kura lizard (*Darevskia portschinskii)*. Generally, the rock lizards are very much depended on specific places of dwelling – rocks, rich with insects. Therefore, they meet in a plenty on a few sites removed from each other. Destruction of such sites can strongly reduce a population or even to threaten to population of the species. It can happen, during the construction, if rocks, on which they today live, will be blown up during the construction.

Sites, important for reptiles, should be defined during the pre-construction survey in the Summer. Preliminary:

- Edge of the dirt road where there is a risk of destruction of Mediterranean tortoise (*Testudo graeca*) egg-laying sites
- Rocks exposures along the upper part of existing road inhabited by rock lizards (*Darevskia* sp.). No explosive activities should be undertaken on these rocks, especially in winter.

No one amphibian species, included in the Red Data List of Georgia, are recorded within the Project area.

Available scientific data indicates that five invertebrate species protected by law may occur in the project area. These species include three butterflies, one bumblebee, and one carpenter-bee. It is unlikely that rehabilitation the road will harm these species on a population level.

In additional it should be noted that the work area lies within the ranges of distribution of some species, which are most threatened by roads. Among them are four mammals, footprints and scat of which were found within the Project area at the way-points #132 and 133. These are listed in the Table 4.

Table 4. Mammal species occurring within the work area

#	Latin name	English name
1	*Canis lupus*	Wolf
2	*Canis aureus*	Jackal
3	*Vulpes vulpes*	Fox
4	*Marten sp.* Not defined on species level	Marten

Wolf, jackal and fox are attracted to the construction area by the dump near the monastery containing bones, leather and entrails of sacrificial animals, mainly sheep. The feeding strategy of these species (picking up food from the road) leads in mortality of the carnivores on roads.

E. Ecosystems, complexes of animals and species, which may be affected

Major ecosystems found along the existing road are briefly described below:

- Agricultural landscapes. Part of the project area is represented by vicinities of village Didi Gorijvari, which include cultivated land and pastures. The existing pasture land does not support rich fauna. However, impacts of construction and operation of the road may affect the ecotone ecosystem in the gully. Species diversity is fairly high in ecotone and population density is substantial. The pasture land represents habitat for protected species (Grey dwarf hamsters and Mediterranean tortoise).

- Foothill deciduous forests and xerophytic shrubbery occupy the slopes of hills and ridge. Negative impacts on these ecosystems could occur only if large areas of shrubbery will be destroyed. The planned rehabilitation of the existing road will not substantially increase the current negative results of its presence and operation. However, it would be good to foresee a construction of some kind of "underpass" for small animals to give them possibility to cross the road safely.

1.2.3 Results of the Field Survey on 07 April 2012

During our field survey on 7 April 2012 we visited the whole construction area of the Gori-Gorijvari. Short survey on foot was executed. The zoological observations were carried out in favorable weather conditions. During the working hours weather was sunny, windless and quite optimal and favorable for direct visual observations of birds and reptiles. During the fieldwork were recorded: tracks of 4 species of mammals, 14 bird species, 2 species of reptiles (2 lizards), none amphibian species and none species of protected by law invertebrates. The results of observations (sites, data/time, GPS-data, elevation, number of animal species, with some short descriptions of visited locations, comments, etc.) are noted in the field diary. The summary of the field observation are presented in the Table 5. The terrain altitudes and coordinates of each observation point (longitude/latitude) are taken by the GPS Garmin Ventura. The coordinates are given in the projection: UTM, WGS 84 for zone 38 of Northern hemisphere in "degrees decimal" mode. Time – shows the moment of the observation start on the point.

Table 5. Observation points

#	Label	Longitude	Latitude	Elevation	Time	Comment
1	132	44.08479	41.97432	810	11:51	Upper end of the road near the Gorijvari monastery. Landslide area and dump attracting carnivores to the road. Voles colony. Habitat of Caucasian agama.
2	133	44.08292	41.97482	781	13:14	Dense bushes in dry gully on right (northern) side of the road. Scat of Marten and Hedgehog.
3	134	44.08165	41.97545	756	13:24	Covered with bushes dry channel of watercourse on the left (southern) side of the road. Border between home ranges of two foxes. The scat marks on the stone.

Map 3. Field trip route and the line of the road rehabilitation project

Field trip route – orange; Road rehabilitation line – red; Observation points - yellow

Site #132 Landslide at the upper end of road

View on the existing road

		
Site #133 Dense bushes in dry gully on right (northern) side of the road.		Site #134 Covered with bushes dry channel on the left (southern) side of the road.

1.2.4 Conclusions

This chapter provides brief list of impacts and proposed mitigation measures according to key ecological receptors (faunal component only).

Based on the review of available data, it can be stated that there are no problems related to the conservation of animal biodiversity, which cannot be resolved and / or mitigated at a reasonable cost.

List of possible impacts includes:

- Destroying of shelters and nests during the preconstruction clearings (cutting trees etc). Ecological receptors birds (mainly not protected by law passerines) and bats (one species of which is red listed).
- Animals disturbance during breeding season (some birds will abandon their nests, even with nestlings).
- An ecological barrier effect - movements of animals across the road will be hindered. That will lead to limitation of opportunities of animals to move and feed within their home ranges. Ecological receptors are middle mammalian species (e.g. fox)
- Mortality of animals on roads. Ecological receptors are middle mammalian species (e.g. jackal, fox etc), some large birds, which are using the roads as a place where they pick up food and using the lighting pylons for perching and rest.

Mitigation measures are detailed below.

General recommendations:

- To take measures to reduce amount of dust emission
- To take measures to reduce level of noise during operation
- To clean the work area and its surroundings from household solid waste and building waste: do not dispose it on the open temporal dumps and do not throw out it in the river valley or into the water
- Prevent fuel and mineral oil leakage on the soil

- Open holes, trenches and precipices should be fenced with something from falling of animals: for the large species it could be a bright tape, for the small animals it is possible to use any flat material (a tin or a polyethylene film), in trenches and holes at the night could be putted boards or large branches (with one end) to allow the fallen small animals to leave it. The holes and trenches should be checked before fulfilling.

Site specific recommendations:

- Pre-construction surveys of all mature trees planned to be removed to verify presence / absence of bat roosts. Results of field survey shows that there are no such trees.
- Usage of bat boxes to compensate the felled trees with nursing colonies and/or wintering associations of bats, if any will be found during construction.
- Verification of presence of egg laying sites of Mediterranean tortoise on the construction site.
- Habitat restoration to resolve problems of the animals seasonal movements and of animals dispersal.
- Construction culverts, modified for an animal use, and special underground passages for small mammals and reptiles to resolve problems of animals mortality on the road.

In conclusion we can say:

There are no species that should be presumed as the species impacted by the project on a population level and adversely affected by the impact factors of the construction and/or operation of the road.

There are no places which are important for the animals as a key-site (breeding or nesting place, feeding (foraging) site, stop-over site during migration, wintering or hibernation place) on which the Project activity will result in harm to fauna.

- Direct and indirect losses of habitats due to erosion increasing can be suspected, but it could be reduced by proper work organization and timely undertaken mitigation measures.
- Direct and indirect losses of habitats due to habitat fragmentation will be not large and can be neglected, because of proximity of human populated area and road Gori-Skra.
- Soil contamination by the oil or fuel (diesel) and waste products during construction and operation can be easily monitored and mitigated.
- Noise pollution – both, disturbance during construction, and residual background noise, during operation of road will be temporary.
- Animals disturbance on the key-sites will take place, but because of small area of construction site it will not have strong adverse impact on animals population.
- Mortality of mammals and reptiles on the road should be monitored in future.

The alternative road going southwards from the Gorijvari monastery is more unfavorable from the biodiversity conservation standpoint, while it is running through the forest twice more distance than the existing road.

1.2.5 References

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1.3 FLORISTIC ASSESSMENT (compiled by Mirian Gvritishvili)

Brief botanical review of the vegetation along the road-sides to & around Gorijvari church:

Botanical description of the area of interests based on one day (07.04.2012) field observation coincided with the vegetation dormant period. Consequently the present report includes mainly perennials, viz. woody plants (trees and shrubs) that nonetheless can serve as reliable indicators for environmental impact assessment.

The vegetation of the territory of interest can be botanically characterized as a derivative of more or less degraded oak-oriental hornbeam forests. None the less there is represented some noteworthy plants including Georgian Red List species, viz. elm (*Ulmus minor Mill.*) as well as a number of Economic (edible, medicinal) and amenity plants that must be used for vegetation restoration in the post road construction process.

Table 6. List of species of trees/shrubs growing along road-sides to and around Gorijvari church.

Acer campestre L.	Field maple	ჩვეულებრივი ნეკერჩხალი
Armeniaca vulgaris Lam.	Apricot	გარგარი, ჭერამი
Astragalus microcephalus Willd.	Millk vetch, Tragant	გლერძი
Atraphaxis caucasica (Hoffm.) Pavl.	Caucasian goat's wheat	ხორციფერა
AABBerberis vulgaris L .	European Barberry	კოწახური
Carpinus orientalis Mill.	Oriental hornbeam	ჯაგრცხილა
Cornus mas L.	Cornelian cherry	შინდი
Cotinus coggygria Scop.	Smoke tree	თრიმლი
Cotoneaster sp.	Cotoneaster	ჩიტაკომშა
Crataegus spp.	Hawthorn species	კუნლის სახეობები
Elaeagnus angustifolia	Oleaster	ფშატი, ჭალაფშატა
Ephedra procera Fisch. et C.A.Mey.	Ephedra	ჯორის ძუა, ცხენისმუხლა
Fraxinus excelsior L.	Common ash	იფანი
Juniperus oxycedrus L.	Juniper	ღვია
Lonicera caprifolium L.	Garden woodbine	ჯიქა
LLonicera iberica Bieb.	Georgian Honeysuckle, Woodbine	ცხრატყავა
Paliurus spina –christi Mill.	Christ's thorn	ძეძვი
Prunus divaricate Ledeb.	Bush cherry plum	ტყემალი
Pyrus caucasica Fed.	Caucasian wild pear	პანტა
Pyrus salicifolia Pall.	Willow-leaved pear	ტირიფფოთოლა ბერყენა
Rhamnus pallasii Fisch. et C.A.Mey.	Pallas's buckthorn	შავჯაგა, ჯღარდალა
Rosa canina L.	Dog-Rose	ასკილი
Spartium junceum L.	Spanish broom	ესპანური კურდღლისცოცხა
Spiraea hypericifolia L.	Spirea	გრაკლა
Tilia begoniifolia Stev.	Caucasian linden	კავკასიური ცაცხვი
Ulmus minor Mill.	Smoothleaf elm	თელა

Mitigation. In conclusion, together with anti-erosion technical measures and soil conservation practice it is recommended to develop afforestation plan for landscape improvement gardening on the terraced steep slopes in immediate proximity to church. Planting and seed material can be provided on the base of local resources viz. such local economic, medicinal and ornamental plants as Cornelian cherry, Wild plum (ტყემალი in Georgian), Dog-rose, etc.

1.4 HISTORICAL & CULTURAL HERITAGE (compiled by Gogi Mindiashvili)

This section is presented in the format of the Expert Opinion, which is reproduced below in Georgian language, duly signed by the expert archeologist Dr. Gogi Mindiashvili, who has conducted the visual inspection of the Gorijvari road rehabilitation site on 2012.04.07. The signed Expert Opinion needs to be submitted by the project proponent (MDF) to the General Director of the National Agency for Cultural Heritage of Georgia to obtain the necessary clearance, accompanied with additional recommendation issued by the Agency, if any. Once cleared with the Agency the recommendations become obligatory for implementation by the proponent and these therefore should be included in the EA and subsequently transposed into construction contract as part of the mitigation plan. English version of the Expert Opinion is provided here, with the copy of the signed Georgian original attached.

EXPERT OPINION: With regard to EA of Gorijvari Road Rehabilitation

Cultural Heritage Part

Gorijvari cultural heritage object is located in the Shida Kartli historical province of Georgia (within Shida Kartli Administrative Region), south-west of Gori, on the right bank side of River Mtkvari, at the terminal mountain spike of one of the chains in the Trialeti mountain range, on top and behind (to the south) of the village with the same name of Didi Gorijvari. Speculatively hence the name of the site: Gori-Jvari (i.e. cross erected on the mount).

Gorijvari site consists of the fortification stone fence and two story building of undefined function, which was destroyed during the 1920 earthquake. The fortification is of double wall type, with gun ports (see Annals of Historic and Cultural Heritage Monuments of Georgia, v. 5, 1990). Small size St. Giorgi Church, single hall type, with bell tower and fortification walls was built and restored in 1980-s.

Gori Municipality hosts on its territory many famous architectural and archaeological monuments: Uplistsikhe Rock Cave City (VI c. BC – VI c. AC), Gori Fortress (I-XVIII cc.), Ateni Sioni (VI-VII cc.), there are also numerous confirmed and investigated ruined settlements and graveyards, earliest of which are dated back to IV millennia. Medieval settlements of various periods are confirmed near both Didi and Patara Gorijvari settlements as well. Separate consideration should be given to ruins of St. Barbare Church, which is located behind the Gori Railway district area, along the road approaching Gorijvari from the East, across forested area.

V. Didi Gorijvari, along which passes the road selected for rehabilitation, apparently is located close to the ruined settlement. This is evident from the cliff located almost at the edge of the road, where signs of the old church can be identified, as well as the damaged graves exposed in the cliff, which were fabricated using tile shaped stones. These graves were apparently serving as multiple use family vaults, as revealed by the skeleton bones, and hypothetically could be dated as belonging to VIII-X cc. period. This site (#1) is located near the beginning of the Gorijvari road section, left side of its second turn, in some 15-20 m distance from the road (see map and photos 1-4).

Object #2 – Small fragment of the clay pipeline for water supply was identified at the end of the proposed road, near the bottom of the old graveyard. Clay pipe is considered to be not later than of XVIII century. The pipe is exposed in the left side of the road and is visible aboveground. It should not be damaged during the road construction (see map and photos 5-7).

Object #3 – The object is located between the end point of the road and the St. Giorgi Church. It represents XIX c. – beginning of XX c. cemetery, with memorial grave stones encrypted in Georgian Mkhedruli alphabet, which are in many cases shifted and relocated. The grave stones of 1830 and 1901 were documented. The grave stones were completely removed from the area which is used for foot trail towards the Church access (see map and photos 8-12); therefore, any earth works in this area will lead to excavation of graves (remnants of those buried) and damage.

Recommendations:

a). Object #2 – During road rehabilitation surviving section of the clay pipeline should be maintained intact; its upper surviving part should be researched and its entire length put on the site plan; part damaged by the existing road should be conserved;

b). Object #3 – On this section of the graveyard it is not allowed to do any grading or excavation works, unless graves and remnants of burials are excavated and relocated by archeologists. As a trade-off solution it is possible to arrange the foot trail with concrete layer or preferably tiling of local stone plates.

c). It is advisable to arrange, if technically feasible, wheelchair access for disabled from the road till the Church, provided technical solution does not lead to destruction of indicated objects.

d) Install appropriate cultural heritage road signs in the beginning of the road, at the turning point from the main road, as well as in appropriate locations along the Gorijvari road, including end point of the road. Road signs will have to be installed in accordance with international standards accepted and practiced in Georgia.

e) Near the first and last road signs erect appropriately designed durable and attractively designed interpretive boards of appropriate size, with the bilingual texts similar to attached, Interpretation Boards 1 and 2, respectively.

Signature: _____ Gogi Mindiashvili Date: _____ 2012

(Expert, Archaeologist)

DCN: 2012-GEO-063

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