



**CONSTRUCTION OF BATUMI (ANGISA) - AKHALTSIKHE NATIONAL
HIGHWAY KHULO- GODERDZI (80-110 KM) SECTION (LOT 1)**

ENVIRONMENTAL IMPACT ASSESSMENT

**Prepared by the Foundation “World
Experience for Georgia”**

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

By order of Transproject Ltd.

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Abbreviations

| | |
|---------|--|
| ADB | Asian Development Bank |
| EIA | Environmental Impact Assessment |
| EP | Environmental Permit |
| EMP | Environmental Management Plan |
| HWL | High Water Level |
| IFI | International Financial Institutions |
| JBIC | Japan Bank for International Cooperation |
| JICA | Japan International Cooperation Agency |
| CC | Credit Contract |
| TLV | Threshold Limit Value |
| MEP | Ministry of Environmental Protection and Natural Resources |
| NSFSVPP | National Service of Food Safety, Veterinary and Plant Protection |
| ODA | Official Development Aid |
| PAP | Project Affected Population |
| RAP | Resettlement Action Plan |
| RD | Roads Department |
| RDMRDI | Roads Department of Ministry of Regional Development and Infrastructure of Georgia |
| RoW | Right-of-way |
| RPF | Resettlement Policy Framework |
| TERN | Trans-European Road Network |
| TT | Tender Terms |
| USSR | Union of Soviet Socialist Republics |
| WB | The World Bank |

Units of measurement

| | |
|---------------------|------------------------|
| ha | Hectare |
| km | Kilometer |
| km ² | Square kilometer |
| l/sec | Liter per second |
| m | Meter |
| m ² | Square meter |
| m ³ /sec | Cubic meter per second |
| m ³ | Cubic meter |
| mm | Millimeter |
| sec | Second |

1. Introduction

1.1. General Information about the Project

The transport sector development is of great importance to the economic growth and poverty reduction in Georgia. Poor transport infrastructure increases the business production costs, hinders attraction of foreign investments, growth of transit volume, and economic activity of the country's population. Georgia, with its favorable geographic location is situated at the crossroads of the East-West (the Black and Caspian Seas) and the North-South (between Russia and Turkey) transit lines. The development of the country's national economy, in particular its trade with neighboring countries requires development of transport network.

The Batumi (Angisa) – Akhaltsikhe national highway (S-1), with a total length of 159 km, runs through the Autonomous Republic of Adjara and Samtskhe-Javakheti region. It connects the Senaki - Poti - Sarpi (Turkish border) (S-2), Khashuri - Akhaltsikhe - Vale (Turkish border) (S-8) and Akhaltsikhe - Ninotsminda (Armenian Border) (S-11) international highways with various regions of the country and neighboring states.

According to the Roads Department of Georgia the average daily traffic intensity of the Batumi - Akhaltsikhe road by 2008 was as follows:

Table 1.1

| Section | Year | Motorcars | Vans | Buses and trucks | Trailers | Total |
|------------------------|------|-----------|------|------------------|----------|-------|
| Shuakhevi-Khulo 55-80 | 2008 | 306 | 140 | 32 | 1 | 478 |
| Khulo-Zarzma 80-128 | 2008 | 105 | 35 | 38 | 4 | 182 |
| Zarzma-Adigeni 128-140 | 2008 | 246 | 10 | 5 | 7 | 267 |

The projected section of 80 km - 110 km of the road is in poor condition and requires rehabilitation and reconstruction of some areas. In particular, the road cover on the projected section of the road is mainly gravel, in some sections of the road the cover is asphalt-concrete, which is worn out, distressed, shoulders are damaged. Because of absence of drainage system the roadway is gullied, the transverse profile of slopes is breached. The surface cover has different types of defects and damages. Culverts require cleaning and restoration, most of them shall be replaced with new pipes. The bridges need restoration, in order to adjust curvatures it is necessary to offset locally the roadbed in some areas; 2 bridges shall be rehabilitated and in place of 2 bridges shall be built a new bridge and a specific pipe.

The completion of the works will improve the capacity of the road and better connect Batumi and Akhaltsikhe with Beshumi, which in turn will make this ski resort under construction in this village more attractive and comfortable for tourists. Meanwhile, a better road will improve promote the social and economic conditions of the Upper Adjara and Samtskhe-Javakheti population.

The traffic intensity forecast after the project implementation is given in Table 1.2. It should be noted that the traffic intensity will be switched step by step after implementation of the project; it is possible to allow the gradual switch on the project section: 60% in the first year, 40% in second year.

In accordance with the above tables, the traffic intensity forecast with a gradual switch in given in the following table:

Table 1.2. Traffic intensity after project implementation

| Year | Motorcars | Vans | Buses/trucks | Trailers | Total |
|------|-----------|-------|--------------|----------|-------|
| 2015 | 1,155 | 346 | 116 | 45 | 1,662 |
| 2016 | 1,861 | 554 | 155 | 73 | 2,643 |
| 2017 | 1,946 | 579 | 161 | 76 | 2,762 |
| 2018 | 2,035 | 605 | 167 | 79 | 2,886 |
| 2019 | 2,128 | 633 | 172 | 81 | 3,014 |
| 2020 | 2,216 | 659 | 177 | 84 | 3,136 |
| 2021 | 2,307 | 686 | 183 | 86 | 3,262 |
| 2022 | 2,402 | 714 | 188 | 89 | 3,393 |
| 2023 | 2,490 | 740 | 194 | 92 | 3,516 |
| 2024 | 2,581 | 767 | 200 | 94 | 3,642 |
| 2025 | 2,675 | 796 | 204 | 96 | 3,771 |
| 2026 | 2,773 | 825 | 208 | 98 | 3,904 |
| 2027 | 2,874 | 855 | 212 | 100 | 4,041 |
| 2028 | 2,966 | 882 | 216 | 102 | 4,166 |
| 2029 | 3,061 | 910 | 220 | 104 | 4,295 |
| 2030 | 3,158 | 939 | 225 | 106 | 4,428 |
| 2031 | 3,259 | 969 | 229 | 108 | 4,565 |
| 2032 | 3,363 | 1,000 | 234 | 110 | 4,707 |
| 2033 | 3,470 | 1,032 | 239 | 113 | 4,854 |
| 2034 | 3,580 | 1,065 | 244 | 115 | 5,004 |
| 2035 | 3,694 | 1,099 | 249 | 117 | 5,159 |

The terms of reference of the project provides for preparation of the project estimates and tender documentation for the rehabilitation-reconstruction works of Batumi (Angisa)- Akhaltsikhe highway of national significance in two lots: 1) from Khulo to Goderdzi Pass and 2) from Goderzi pass to the village Zarzma. The total length of Khulo – Zarzma rehabilitation - reconstruction section is 47.112 km.

The design and tender documentation of the rehabilitation and reconstruction jobs of the Khulo-Goderzi Pass (Lot 1) of the Batumi (Angisa) –Akhaltsikhe road presented by the project has been prepared by Kooocks Consult GmbH and design-consulting company “Bit” under the contract signed with the Roads Department.

The road project section starts on 80 km elevation at the village Khulo and after passing several small villages ends on 110 km elevation before the rise to the Goderdzi Pass. The areas located in the mountainous zone of the road are twisting and crooked and includes several rises with large inclination. The length of this road section is approximately 30 km.

1.2. General Context and Terms of Reference

According to the law of Georgia On Environmental Permit (2007), the environmental documents submitted for the environmental approval shall include together with the EIA, the description of the expected emissions volume and types (the inventory report of stationary pollution sources and their emitted/discharged hazardous substances, and the project of threshold limit value of emission/discharge of harmful substances. The emission/discharge threshold limit value should be developed for the objects subject to the environmental expertise, including auxiliary facilities for the construction of roads, such as asphalt concrete plants, concrete plants and construction camps. To draft TLV it is necessary to pinpoint the location of the object, to prepare the master plan indicating all the technological nodes and elements on the plan, the data of hazard generating (emission/discharge) sources and their localization, technological process and pollutants volumes, exact coordinates of discharge in the surface water body and the hydrological characteristics of the surface water body.

During the implementation of the linear infrastructure systems projects funded by the international donor the design, contracting, procurement, and construction are carried out in compliance with the recognized international engineering and construction rules and schemes and, in particular, FIDIC's, the so-called "Red" and "Yellow" contractual forms. This condition, in turn, is fixed in the credit contract. According to FIDIC's "Red" and "Yellow" forms of contract, the competences of the project implementing organization, design organization and construction contractor are clearly defined.

According to the FIDIC's "Red" contract form, the responsibility of the project developer and the design company hired it is to prepare the detailed design documentation of the project (in our case, the road and road infrastructure). As to the maintenance projects of auxiliary facilities to be used by construction contractor, this issue does not fall within the competence of the project implementing organization or design organization and the auxiliary facilities project is not prepared at the major construction permit stage. Preparation of project of auxiliary facilities (construction camp, construction facilities access roads, concrete or asphalt-concrete plants, etc.) and obtaining permits thereof is the construction contractor's responsibility.

According to the FIDIC's "Yellow" contract form (Design and Build contract), the project implementing organization and the design organization hired by it prepare only the basic design while the completion of the final detailed project as well as preparation of the project of auxiliary facilities and further construction, are the prerogative of the construction contractor.

Thus, in both cases, the contract with the construction contractor shall be made after the construction permit is issued, that is the construction permit, and hence, the environmental approval will be issued earlier than the construction contractor will prepare the auxiliary facilities project and related environmental documentation (the TLVs for surface water bodies, the TLVs for air, etc.). Accordingly, in the process organized under FIDIC's "red" and "yellow" contract forms, it is not possible to submit the TLV normative documents for auxiliary facilities together with the environmental impact assessment report.

Within the EIA framework it is only possible to reflect the basic principles, the qualitative and semi-quantitative assessments of expected impacts and general situation, while the necessity of accurate and detailed quantitative assessments and TLV normative documentation will be recorded in the EIA as the construction contractor's responsibility. This commitment must be clearly focused in the contract between the project implementing organization and the construction contractor, and in the construction permit it must be reflected as the condition for permit.

Given the above, the data, calculations and recommendations presented in the Annex to the EIA in connection with the facilities to be built by the construction contractor serve the reflection of the general model situation and the possible impact scenarios, but not preparation of the final, the site-specific assessment and normative documents.

In particular, the model presented in Annex 2 describes the typical water supply and sanitation aspects of the construction camp, which is designed for accommodation of up to 50 builders and construction equipment. The construction equipment site means the area designed for fueling, maintenance and washing of the equipment and machines.

It is important to note that this model is consistent with the worst case scenario, because in our particular case, with high probability we can assume that personnel will be accommodated not in the construction camp, but in the rented flats in the roadside villages and towns. The assessments and recommendations provided in the IEA, as well as the TLV documents prepared at the preconstruction stage, should be based on the applicable standards and norms.

Article 8.1.1.11. of the EIA provides the principles and guidelines of the regulatory documents, which must be mandatory for the projects of asphalt concrete plant, camp and other auxiliary facilities and their operation conditions. The quantitative assessments in connection with the camp water supply and sewerage and surface water bodies protection measures (model) are discussed in Annex 2 and the quantitative assessment of dust formation and emissions in the construction process is given in Annex 3.

The Roads Department, as the project implementation responsible party undertakes to develop all required environmental documents related to the construction and operation of auxiliary facilities after preparation by the contractor of all required design documentation in connection with the Batumi-Akhaltzikhe road reconstruction and construction and to submit them to the Ministry of Environmental Protection and Natural Resources.

2. Project Description

The Batumi-Akhaltshikhe road 80 km - 110 km (0 km - 30 km on the map) section rehabilitation/reconstruction project includes three main components:

the roadbed rehabilitation / reconstruction, that mainly implies repaving and optimization of the roadbed in some localized areas;
rehabilitation of existing engineering structures and construction of new ones;
geological hazards mitigation measures

Below, each of these components is discussed in more detail.

2.1. Road Bed Rehabilitation/ Reconstruction Project

2.1.1. Used Standards and Project Parameters

In 2009 a new standard of road geometric design was confirmed in Georgia. According to the design standards¹ 80 km -110 km of Batumi-Akhaltshikhe road section belongs to the roads of local significance. The calculating speed on project road section is 40km/h, which reflects the location in rural and mountainous lands.

After selecting the calculating speed, calculating values for geometric basics can be determined, like road cross section, desired horizontal and vertical profiles.

Project road cross section calculating elements:

Number of traffic lines: 2

Line width: 3,00 m

Carriageway width: 6,00 m

Road side width: 1,50m (including 0,5 m covered)

Total road width: 9,00 m

Preferred parameters of appropriate geometric design for the selected 40 km/h calculating speed:

Min. horizontal radius 65m

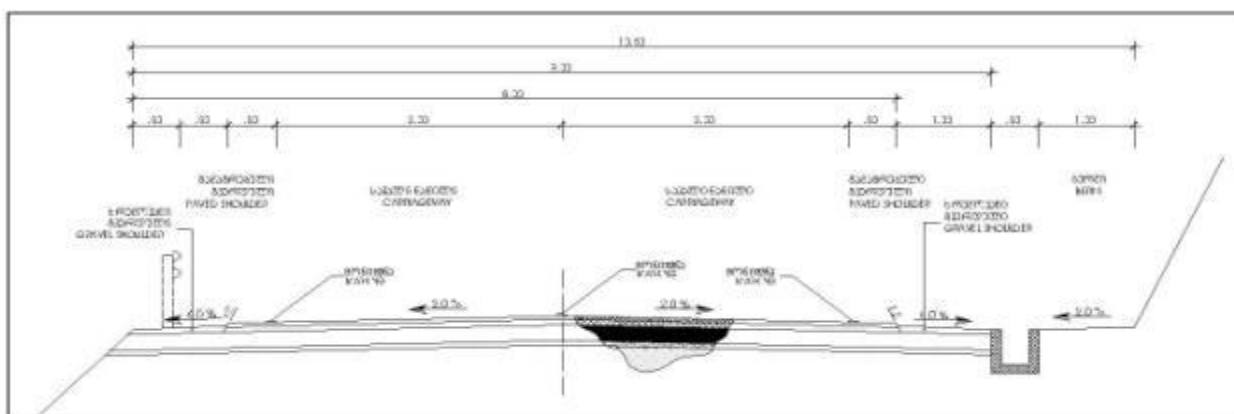
Max. Inclination 10%

Min. convex curve radius 400 m.

Min. concave curve radius 850 m.

Min. transverse slope 2,5%

Curve max. Slope 7%



PPic. 2.1: The Road Cross Section

¹ "Geometric and Construction Requirements for Georgian Motorway General Purposes", Ministry of Regional Development and Infrastructure of Georgia, Road Department, Tbilisi, 2009.

² "Geometric and Construction Requirements for Georgian Motorway General Purposes", Ministry of Regional Development and Infrastructure of Georgia, Road Department, Tbilisi, 2009.

On Batumi - Akhaltsikhe motorway mountainous sections were used the following calculating parameters of serpentine of 20 km/h project speed. The data are based on the 16th paragraph of Georgian geometric design standards:

| | |
|---------------------------------------|--------|
| Min horizontal radius | 20m |
| Curve max. Slope | 7% |
| The transition curve length | 25m |
| Carriageway expansion | 3, 0 m |
| Max. Longitudinal curve on serpentine | 3, 5% |

2.1.2. Evaluation of Road Existing Cover

In order to determine the rehabilitation and cover design procedures of the road section between Khulo and Goderdzi passes, on the first stage the condition of existing road cover was evaluated.

As of today, calculating resource of research road current asphalt cover have ended and due to the depreciation on some road sections gravel road is apparent. All kinds of cracks and various defects can be detected on asphalt surface.

Geotechnical researches revealed, that on granular cover, which is represented by variable contents of natural granular sand and clay, one layer of asphalt is set. Land bed along the road is constructed with powdery materials and with relatively bigger stones and and clay variable contents. High content of clay in some areas determine characteristics of mixed materials. Rather deeply was observed weathered tuff.

The lower layer of basis was revealed in just one location and it is obvious, that it either does not exist or is impossible to distinguish from other sections of cover.

The current condition of asphalt cover is inconsistent. Relatively small part of project section is in suitable condition for exploitation, while its big part is in critical situation, with typical cracks and almost fully dismantled asphalt cover.

2.1.3. The Solution to the Road Cover Reconstruction Project

Reconstruction is the most labor-consuming option of rehabilitation. Although it can be the most cost-effective among other options, if we take into account service period of the road. Reconstruction is the most appropriate measure in case of the resilient road pavement, which is characterized by serious fissures and crackings, for example cracks caused by fatigue, holes and material solidity problems. Traditionally, reconstruction means removal and replacement of the whole pavement or its large section that is followed by construction of pavement new layers.

Considering the suggested reconstruction project of current road pavement, the new structure road surface must be designed.

Three main given project parameters were considered in the process of selecting road cover and design:

Land bed characteristics, on which road pavement must be constructed;

Road loading and

Ecological environment.

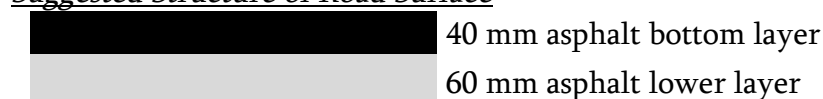
Design procedure relies on geotechnical research results analysis and also other project parameters and existing traffic data. The road pavement primary structure was designed according to geotechnical researches, examination results and analysis of existing traffic data.

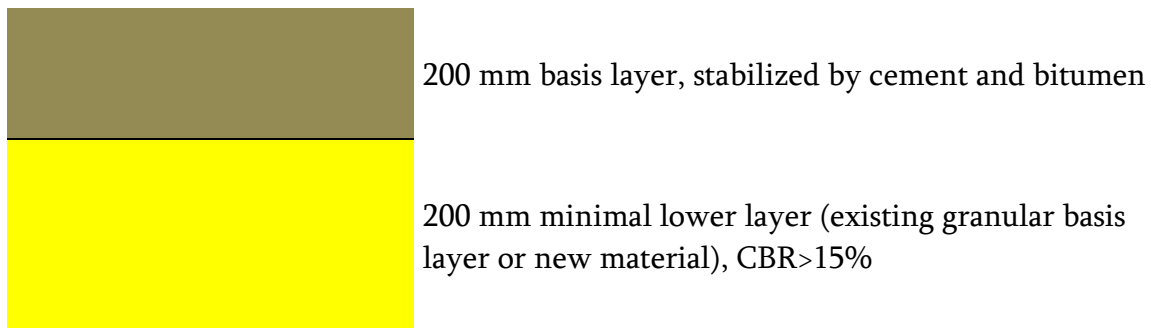
The pavement thickness was determined by AASHTO project computer program DARWin 3.1, which uses AASHTO's method and parameters according to "Road Pavement Design References" [5]. Obtained result:

Table 2.1. Road Pavement Recommended Thickness

| The Road Section | Asphalt A Cover Layer | Asphalt A bottom Layer | Basis Stabilized Layer of Cement and Bitumen | Minimal Thickness of Basis Lower Layer |
|------------------|-----------------------|------------------------|--|--|
| (km) | (mm) | (mm) | (mm) | (mm) |
| From 0.0 to 30.0 | 40 | 60 | 200 | 200 |

Suggested Structure of Road Surface





2.1.4. Road Cover Reconstruction Related Works

Road Cover Reconstruction

Existing road cover reconstruction and strengthening on research road requires fulfillment of the following basic works:

Removal of asphalt existing cover, it is desired to grind, reuse/recycle. Cold mixture recycling (CMR) is recommended for given road section;

Cold mixture recycling (CMR) foresees to reuse existing cover material without high temperature mode. Use of cold mixture recycling material should happen in new layer of the basis.

Cold recycling requires removal of damaged cover, adding of addition (additions) and paving of recycled mixture, which represents road pavement structural solid layer, on which old layer characteristic damages are not reflected. On road pavement recycled asphalt cover, typically one or two layers of asphalt are paved – according to structural requirements.

Two methods of recycling cold mixture are selected:

Cold mixture recycling on-site and

Cold mixture recycling in plant.

Recycling of cold mixture in direct or indirect ways, by using the method of “Cold Mixture on-Site Recycling” allows to use the materials of whole existing asphalt cover of the road. Cold recycling method “indirect, on-site” or “in plant”, that foresees material removal and preservation in order to reuse it in district, should be used on Batumi – Akhaltsikhe road section, because the road is characterized with big deflection, generally in vertical direction and on the districts, where ground changing or surfacing or improving basis is needed.

Before and in parallel to removing and recycling of asphalt cover, should be repaired soft points (clay) and other defective districts. For the above mentioned, it becomes necessary to excavate approximately on 0.5 m deep from road benchmark and replenish with basis layer materials. New material (thickness 200mm) should be layered and tamped (95% MDD). The exact place of ground changing, length and depth must be determined on-site.

Putting of drainage system into service as needed.

In case of using cold recycling plant method, it is necessary to profile and tamp the existing granular layer, or alternatively it is possible to shape and profile by adding additional materials, for example by adding correcting or profiling layer. This layer must be paved with sandy gravel.

Arrangement of new depleted stone and recycled asphalt new basis layer (proportion: at least 50% new materials and maximum 50% recycled asphalt).

For the purpose of increasing road pavement bearing capacity and/or in purpose of contracting the asphalt planned new layers, it is admissible to reinforce asphalt grained and mixture of gravel and sand materials by mixing them with cement and/or bitumen, as binders. In case of Batumi – Akhaltsikhe road this kind of reinforcing with cement and/or bitumen is recommended to increase construction force of the layer that gives us opportunity to decrease common thickness of layers.

The conclusive stage is for paving of new layer of asphalt and concrete.

Earthworks

Existing cover reconstruction requires the following earthworks:

Districts with inadequate basis or features, which were detected during preliminary research stages or during the construction, should be processed as follows:

Removal and recovery of road cover layers, that are repaved on shaky materials and spreading them as heaps for reusing;

Excavation of soft / worthless material on required depth and dumping;

Reverse filling of trenches with suitable materials for the layer of not more than 200mm thickness;

The existing road pavement does not have required transverse inclination. To arrange transverse inclination it is necessary to give a required form to the existing granular surface. Giving a form to the existing surface and profiling by loosening, profiling and retamping,

typically needs a certain number of additional materials. Alternatively, additional correcting or profiling layer can be arranged on-site, that will increase road surface height benchmark.

On several places, were observed road edge erosion due to surface waters. Erosion processes should be ended by putting into service drainage systems, by recoverin slope inclination and by fixing it by supporting construction. The exact location and suggested sizes are discussed in a chapter dedicated to geological disasters issues.

2.2. Artificial Buildings

2.2.1. Existing bridges and necessary measures for improvement

In the table below four existing bridges are represented.

Table 2.2 Existing bridges

Bridge name/ Location /Beggining/End/Length/Span Quantity and Length/Truncation in plan

1. Diakonidze Bridge – 2 Borjomi Bridge – 3. Adjaristskali bridge 4. Danispirauli Bridge

| № | ხიდის დასახელება | ადგილმდებარეობა(კმ+მ) | | სიგრძე, მ | მალის რაოდენობა და სიგრძე | წაკვეთი ღრობა გეგმაში ⁰ |
|------|--------------------|-----------------------|------------|-----------|---------------------------|------------------------------------|
| | | დასაწყისი | ბოლო | | | |
| ხ 01 | დიაკონიძის ხიდი | 3+180.000 | 3+189.700 | 9.700 | 1 9.70 | 90 |
| ხ 02 | გორჯომის ხიდი | 4+560.000 | 4+603.300 | 43.300 | 2 21.65 | 90 |
| ხ 03 | ხიდი აჭარისწყალზე | 7+080.000 | 7+101.650 | 21.650 | 1 21.65 | 90 |
| ხ 04 | დანისპირაულის ხიდი | 18+580.000 | 18+595.700 | 15.700 | 1 15.7 | 90 |

Diakonidze bridge span construction represents steel and reinforced details combination (composite bridge), fifty/fifty, as shown below.

Pic. 2.2 Bridge 01, Span Construction

Drainage is not set. In the river are observed rinsing traces of sub construction. Bridge accesses do not meet safety requirements. (Pic. 2.3) Inspections with Schmidt hummer revealed a big loss of concrete solidity.

Pic. 2.3 Bridge Wash and Accessing Sections

Borjomi bridge span construction is represented by freely leaned, prepared in advance, tense bobbin sections on-site. Measurements showed satisfying bearing capacity of bobbins, although bridge accessories do not meet exploitation requirements.

Pic. 2.4. Bridge 02, Accessories and Accessing Sections

Adjara water bridge span construction is represented freely leaned, prepared in advance, tense bobbin sections. Main bobbin bearing capacity is satisfying. The bridge is built next to old bridge remains, which currently exists. The inspection of the river bed detected a strong washout to the nearby retaining wall and marginal columns. Each flood negatively impacts on bridge belongings (Pic. 2.6). the mentioned is caused by inappropriate location of the bridge, that literally caused blocking of the river hydraulic section (Pic. 2.5)

Pic. 2.5. Bridge 04, Building Restricts hydraulic section of river

Pic. 2.6. Examples of Adjaristskali Affects

Danisparauli bridge was built recently. Span construction represents freely leaned frame with longitudinal and transverse bobbins. Bridge condition is satisfying, however the bridge is located near to the sharp turn.

Pic. 2.7. Danisparauli Bridge Situational Location

Based on the above described results of the existing bridges, following engineering decisions are provided:

Table 2.3.

| Bridge # | Name | Proposed Event | Reason of Proposed Event |
|-----------|-------------------|---|---|
| Bridge 01 | Diakonidze Bridge | Change of existing bridge, construction of new one on the | Improvement of existing bridge is not expedient according to expanses |

| Bridge # | Name | Proposed Event | Reason of Proposed Event |
|-----------|-----------------------------------|---|--|
| | | same place | |
| Bridge 02 | Borjomi Bridge | Rehabilitation (change of existing accessories) | Existing accessories of the bridge do not meet exploitation requirements |
| Bridge 03 | Adjaristskali Bridge ² | Rehabilitation, measures against washing | Narrowing of river bed caused by the existing bridge resulted lavage |
| Bridge 04 | Danisparauli Bridge | Change of specific span on new site | Changing of current route in order to improve road parameters |

The bridge on Adjaristskali and firsthand surrounding district of the road is removed from present project. This bridge and surrounding district of the road will be reconstructed during the project Shuakhevi Hess construction and exploitation and working project and EIA will be prepared separately.

2.2.2. Project Accesses for Bridges

New bridges are designed like “permanent” buildings, considering specific loadings, for 70 year exploitation period. The decision is made considering current standards and available resources. For further development, in distant future, in order to increase bridge features, existing bridges renovation is expected in case of necessity.

Selection of locations for project bridges and issues on span placing were developed and agreed with the customer, when planning, we were guided by suggested engineering decisions, crossing functionalities, hydrology, geotechnical researches, road safety, easy care-preservation, optimum expanses and esthetic criterion.

Below, cross section measures of bridges presented on picture 10.7 match with road section measures and meet safety requirements of national standards, for state roads, 40km/h project speed. Bridge typical width (from edge to edge) is 10 meters, including concrete jumper, sidewalk and railing.

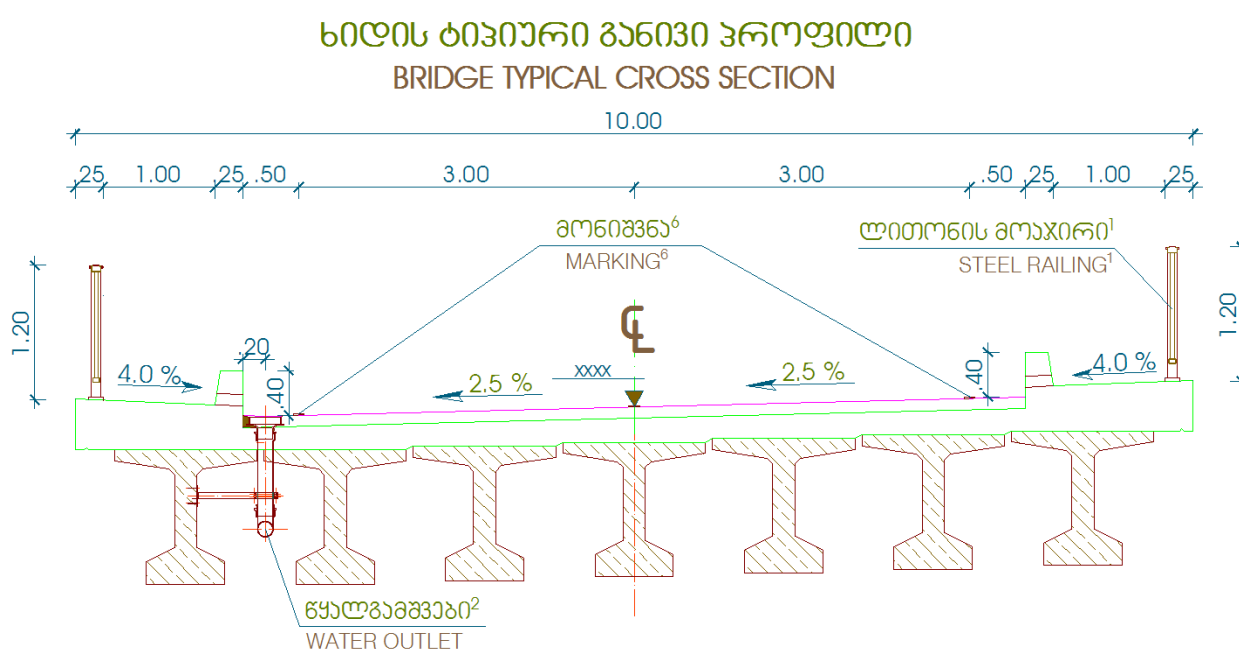
Following guide sources are foreseen in the start of project process:

Available technology;

Experience obtained during the construction of various bridges;

Available materials; and

Standard practice obtained for the region.



Pic. 2.8 Typical cross section for bridge Platform

Pic. 2.10 Diakonidze Bridge km 3 + 368; Bridge Longitudinal Section

²The bridge on Adjaristskali and firsthand surrounding district of the road is removed from present project. This bridge and surrounding district of the road will be reconstructed during the Shuakhevi Hess construction project and working project and EIA will be prepared separately.

Considering the above mentioned criteria, the consultant relies on the following recommendations:

For the spans with length of more than 15m, span construction must be built from the in advance prepared reinforced beams, which are connected to each other in transverse direction and with monolith reinforced tile

For the spans with the length less than 15m, span construction must be built with monolith reinforced tile.

Preliminarily created beams can be manufactured on contactor's field and can be fixed on piers with cranes. In advance made beams, as connecting mountings, integrated anti-shear claws ensure monolith reinforced tile participation in bearing capacity of orte shaped crossing, which consists of longitudinal claws and from the crossing of monolith tile. It is possible to setup reinforcement continuously that will minimize number of deformational stitches. Other advantages and major criteria for suggested project span is that were prepared in advance, element producers are local, Georgian ones.

The bridges will be designed according to AASHTO LRFD standards. Programmed insurance of bridge design will be used and excel calculating modules, when calculating structural analysis.

For calculating **seismic load** the design bridges are considered under "Essential Bridges" category AASHTO LRFDO 3.10.3 chapter classification. For ground type pf Design Bridge are common II type classification according to AASHTO LRFDO chapter 3.10.5. During the design, peak speeding will be derived from seismic zoning (decree #1-1/2284, October 7, 2001)

2.3. Geodangerous Areas

Areas carrying ecological hazards (landslides, rockfall, mudflow) are described in paragraph 4.2.2 and herewith is enclosed map of geologically hazardous processes.

The Collapse of Road Sides on Several Sites

In several design sections were observed serious cases of road side collapses (details in parapgraph 4.2.2). The undisputed cause of this is an inadequate drainage, because of which shallow water uncontrollably leaks on road surface and beneath, on bed slope and leads to serious soil washing.

In order to terminate the erosion, as a prior proposal, it is recommended to form adequate ditches and arrange other drainage facilities.

Already collapsed road edges and sides need rehabilitation that require implementation of proper measures on the lower slope of the road and/or constructions of buildings in order to secure adequate abutments.

Because the evaluation process is not completed and is still rolling, the aforesaid considerations carry initial character.

2.4. Construction Materials Required for Reconstructions/Rehabilitation

In order to design Batumi-Akhaltsikhe motorway section of 80km - km 110 it was required to study construction materials to provide developers with proper information.

In this part of report are described researches and reviews, that were fulfilled to identify existing and potential sources of required constructions materials for constructing road beds, base layer correction, basis, asphalt and cement-concrete pavement. The attention was focused on the favorable sources of materials located in the proximate area of construction districts and on using as efficiently as possible the materials during project implementation process.

Datas and information about construction materials obtained from the surveys of previous period were evaluated, that are suitable for the current project. In order to define a location of existing and potential groundwater reserves and quarries, were used geological maps and available reports. Preliminary examinations for favorable materials were fulfilled by consultants, with the participation of local experts.

2.4.1. Identified Sources of Beds, Road Surface Granular Layers da Intake Materials

During field research periods were outlined favorable districts for construction materials and their inspections was conducted.

On the current stage of examination are presented general observations on the sources of suitable materials on research territory. On the next stage should be accomplished more detailed research of natural contructions materials quality and availability to receive more data on supplies.

In the following table are presented locations and calculating reserves for existing and potential districts of soil and gravel extraction

Table 2.4. Existing and potential suources of materials

| Existing Soil Reserves / Quarries | Material Type | Calculating Available Reserve (m ³) |
|-----------------------------------|---------------|---|
| | | |

| | | | |
|---|------------------------|-------------------|------------------|
| 1 | Maglakoni ⁾ | Gravel | 93 500 |
| 2 | Milisi ⁾ | Gravel | 155 100 |
| 3 | Maglakoni ⁾ | Andesite-dacite | 1 330 000 |
| 4 | Kolotauri ⁾ | Gravel | 112 500 |
| 5 | Gundauri ⁾ | Diorites | 341 600 |
| 6 | Janveri | Gabbro | 1 419 400 |
| 7 | Danispireuli | Andesite-basalt | 22 892 000 |
| 8 | Danispireuli | River solid waste | Potential source |

⁾ – soil reserves with acting licenses

Apart from existing soil reserves around village Danaspireuli, all other units from borough Khulo are located in the direction of Batumi. On all sources of road surface constructive layers, were identified border coordinators and thus defined exact locations are presented in Annex 9 on the map of given soil reserves and quarries.

Pic. 2.11 Quarries location in the region

2.4.2. Cement

The cement is produced locally in the plants of JSC “Sakcementi” Rustavi (in 30Km of South-East of Tbilisi) and Kaspi (in 60 Km of North-West of Tbilisi), that produce portland cement of various mark and trade name, including sulfate resistant:

portland cement M-400 D20

portland cement M-400 S/R

portland cement M-500 DO

M-500 mark Portland cement is used in high class B20-B40 concrete manufacturing and construction of reinforced construction and buildings.

Average annual total capacity in all three plants in Kaspi and Rustavi is 2 million tones.

The major products of the company are cement and clinker.

In February 2004, LTD “Kaspicement” and LTD “Rustavcement” entered in “Heidelbergcement” group, and Kaspi and Rustavi Plants united under common corporate name LTD “Sakcementi”.

Generally, locally produced cement is usable for manufacturing of cement-concrete, which should be used for construction of buildings forecasted under the project, which mostly cover culverts and bridges. Type and quality of cement should be selected by foreseeing design requirements of relevant constructions.

2.4.3. Bitumen

Asphalt and bitumen are not produced locally. All bitumen products should be imported and should satisfy relevant European and other recognized international standards.

2.5. Topsoil Removal

Rehabilitation project of existing road does not imply removal of topsoil during road bed preparation. Road widening on local districts and occupation of new areas when settling of curves happens only when invading the rocky slopes. Removal of topsoil might occur only in construction camps and/or in the districts of asphalt-concrete plant construction, location of which, necessary area and other design details is defined by constructor contractor. Constructor contractor will prepare recultivating projects for the districts and will ensure protection of all requirements of “technical regulations on removal, storage, use and recultivation of soil fertilized layer”.

2.6. Ground Works and Waste Generation

The total volume of excavation comprises 320 318m³-s.

Excavation volume 51 513 m³-s

For the settlement of the bed, from the excavation will be transported materials of 51 513 m³ (bedwill be formed in the main cut by using received material).

Also, as a temporary reserve in the excavation will be warehoused 138 038 m³ excess soil materials, which will be used afterwards for roads reinforcement and bridge reconstruction districts for reinforcing walls and gabions.

The elaborated 320 318m³ in the excavation, from the excess soil - 130 767 m³ require placement in bulk.

Waste management issues are described in the 7th and 8th chapters, where differentiated are expected types and quantity of waste of given construction process. Here we shortly mention, that main quantity of waste is a bulk –materials received from excavating the slopes and widening of roads mixed with excess soil, which are not used for construction, is subject to disposing. Total amount of bulk is – 130 767 m³.

Earthworks bill of quantities according to kilometer points are given below:

Table 2.5.

Rehabilitation-Reconstruction Works on “Batumi (Angisa)-Akhatsikhe” Nationally Significant Motorway, Khulo-Zarzma Section

Lot1, Khulo-Goderdzi Pass. km 0+000 km 29+732

REHABILITATION-RECONSTRUCTRUTION WORKS FOR THE "BATUMI (ANGISA)- AKHALTSIKHE ROAD" KHULO-ZARZMA SECTION LOT 1 KHULO-GODERDZI PASS (KM 0+000 - KM 29+732)

Bill Of Quantities For Earthworks Merged According To Chainage

Bill Of Quantities For Earthworks Merged According To Chainage

| # | Location | (m) | (m ³) | (m ³) | (m ³) | (m ³) | , |
|---|----------|-----|-------------------|-------------------|-------------------|-------------------|---|
|---|----------|-----|-------------------|-------------------|-------------------|-------------------|---|

| | Design Chainage | Section Start | Section End | Section Length (m) | Cut total (m ³) | Fill total (m ³) | From Cut to Fill total (m ³) | From Cut to disposing (m ³) | From Cut to storage (for further use for backfilling of walls, ripraps etc.) (m ³) |
|----------|-----------------|---------------|-------------|--------------------|-----------------------------|------------------------------|--|---|--|
| <i>1</i> | <i>2</i> | <i>3</i> | <i>4</i> | <i>5</i> | <i>6</i> | <i>7</i> | <i>8</i> | <i>9</i> | <i>10</i> |
| 1 | 81-82 | 0+000 | 1+000 | 1 000 | 4 814 | 301 | 301 | 1 326 | 3 187 |
| 2 | 82-83 | 1+000 | 2+000 | 1 000 | 6 078 | 230 | 230 | 1 243 | 4 605 |
| 3 | 83-84 | 2+000 | 3+000 | 1 000 | 24 170 | 553 | 553 | 2 717 | 20 900 |
| 4 | 84-85 | 3+000 | 4+000 | 1 000 | 12 139 | 324 | 324 | 1 595 | 10 220 |
| 5 | 85-86 | 4+000 | 5+000 | 1 000 | 13 217 | 855 | 855 | 4 861 | 7 501 |
| 6 | 86-87 | 5+000 | 6+000 | 1 000 | 13 301 | 320 | 320 | 6 240 | 6 741 |
| 7 | 87-88 | 6+000 | 7+000 | 1 000 | 7 226 | 150 | 150 | 4 338 | 2 738 |
| 8 | 88-89 | 7+000 | 8+000 | 1 000 | 8 256 | 241 | 241 | 2 502 | 5 513 |
| 9 | 89-90 | 8+000 | 9+000 | 1 000 | 12 250 | 463 | 463 | 4 200 | 7 587 |
| 10 | 90-91 | 9+000 | 10+000 | 1 000 | 5 727 | 65 | 65 | 2 231 | 3 431 |
| 11 | 91-92 | 10+000 | 11+000 | 1 000 | 17 528 | 943 | 943 | 5 917 | 10 668 |
| 12 | 92-93 | 11+000 | 12+000 | 1 000 | 10 061 | 79 | 79 | 3 675 | 6 307 |
| 13 | 93-94 | 12+000 | 13+000 | 1 000 | 7 440 | 319 | 1 156 | 4 070 | 2 214 |
| 14 | 94-95 | 13+000 | 14+000 | 1 000 | 5 204 | 3 033 | 980 | 3 643 | 581 |
| 15 | 95-96 | 14+000 | 15+000 | 1 000 | 15 162 | 1 046 | 2 262 | 7 663 | 5 237 |
| 16 | 96-97 | 15+000 | 16+000 | 1 000 | 9 571 | 967 | 967 | 2 197 | 6 407 |
| 17 | 97-98 | 16+000 | 17+000 | 1 000 | 10 926 | 804 | 804 | 3 619 | 6 503 |
| 18 | 98-99 | 17+000 | 18+000 | 1 000 | 11 235 | 1 072 | 8 459 | 2 221 | 555 |
| 19 | 99-100 | 18+000 | 19+000 | 1 000 | 14 347 | 17 515 | 2 351 | 11 996 | 0 |
| 20 | 100-101 | 19+000 | 20+000 | 1 000 | 20 232 | 6 579 | 6 800 | 13 432 | 0 |
| 21 | 101-102 | 20+000 | 21+000 | 1 000 | 10 393 | 86 | 7 097 | 2 381 | 915 |
| 22 | 102-103 | 21+000 | 22+000 | 1 000 | 10 581 | 272 | 818 | 3 114 | 6 649 |
| 23 | 103-104 | 22+000 | 23+000 | 1 000 | 13 204 | 132 | 132 | 3 329 | 9 743 |
| 24 | 104-105 | 23+000 | 24+000 | 1 000 | 20 167 | 1 879 | 3 564 | 12 167 | 4 436 |
| 25 | 105-106 | 24+000 | 25+000 | 1 000 | 6 055 | 3 685 | 2 000 | 4 055 | 0 |

| | | | | | | | | | |
|------------|---------|--------|--------|---------------|--------------------|---------------|---------------|----------------|----------------|
| 26 | 106-107 | 25+000 | 26+000 | 1 000 | 7 302 | 1 414 | 1 414 | 4 502 | 1 386 |
| 27 | 107-108 | 26+000 | 27+000 | 1 000 | 8 867 | 4 072 | 2 726 | 4 083 | 2 058 |
| 28 | 108-109 | 27+000 | 28+000 | 1 000 | 4 842 | 1 074 | 2 420 | 2 042 | 380 |
| 29 | 109-110 | 28+000 | 29+000 | 1 000 | 4 520 | 1 221 | 1 225 | 1 720 | 1 575 |
| 30 | 110-111 | 29+000 | 29+732 | 732 | 5 503 | 1 818 | 1 814 | 3 689 | 0 |
| sul | | | | 29 732 | 320 318 | 51 513 | 51 513 | 130 767 | 138 038 |

2.7. *Equipment Used during Construction*

Table 2.4 for equipment used during working process and the given listing will be approved by constructor contractor. Below we give advance list, which is prepared by the designing group.

Table 2.6. Equipment and Construction Machinery Necessary for Construction

| # | Equipment Type and Minimal Characteristics | Minimal Quantity of Necessary Equipment |
|----|--|---|
| 1 | Bulldozer fertilizing | 4 |
| 2 | Front loader | 3 |
| 3 | Dump Truck | 6 |
| 4 | Power Grader | 2 |
| 5 | Truck excavator | 1 |
| 6 | Backhoe excavator | 2 |
| 7 | Vibratory road roller | 2 |
| 8 | Pneumonic tamping | 1 |
| 9 | Double rotary compactor | 3 |
| 10 | Shallow vibratory | 1 |
| 11 | Crusher | 1 |
| 12 | Fully automated Dispenser | 1 |
| 13 | Fully automated mixer | 1 |
| 14 | Power sensor for road pavement | 1 |
| 15 | Compressor | 2 |
| 16 | Concrete mixer | 3 |
| 17 | Water injector system | 2 |
| 18 | Hoist | 1 |
| 19 | Concrete resistant with electronic sensor | 1 |

2.8. **Complex of Auxiliary Facilities**

Construction contractor will make a decision that relates to the auxiliary construction units (structure, composition, location, design and etc.). Despite this, on different sections of E-60 motorway according to the experience of setting construction works, we consider that there will be built auxiliary construction facility complex, among them – building

camp for accommodation of 50 workers (app. 0.75 H area), transport and equipment yard for 25 units of transport vehicles and heavy construction equipment (app. 1 H) (bulldozers, excavators, hoists etc.) and asphalt-concrete plant (app. 1H).

In the chapter 8.1.1.11 on mitigation measures in the Environment Impact Reduction, we described procedures and conditions to be used for auxiliary construction facilities design and exploitation and also optimal location options.

3. Legal Framework

3.1. Georgian Environmental Legislation.

Georgian Environmental Law includes legal framework in the form of a law on country's constitution and environment protection, specific environmental laws, international conventions, subordinate legislation, Presidential decrees, governmental decrees, Ministers' decrees, instructions etc.

In the table 3.1. is presented list of Georgian laws and regulations, which are foreseen in the process of evaluation of impact on environment.

Table 3.1. List of Laws and Regulations Related to Project

Table 3.1. List of Laws and Regulations Related to Project

| Making year | Law Title | Registration Code |
|--|---|-----------------------------------|
| | Framework Legislation | |
| 1995 | Georgian Constitution (last correction <i>04.10.2013</i>) | <i>010.010.000.01.001.000.116</i> |
| 1996 | Environment Protection (last correction <i>11/11/2015</i>) | 360.000.000.05.001.000.184 |
| Legislation on Issuing Permission | | |
| 2005 | Licenses and Permissions (Adopted <i>24.06.2005</i> წ., (Last correction <i>11/11/2015</i>) | 300.310.000.05.001.001.914 |
| 2007 | Environmental Expertise (Adopted <i>14.12.2007</i> წ., Last correction <i>25/03/2013</i> | 360.130.000.05.001.003.079 |
| 2007 | Environmental Impact Permit (Adopted <i>14.12.2007</i> წ., As of <i>11/11/2015</i>) | 360.160.000.05.001.003.078 |
| 2013 | Regulation on Evaluation of Environmental Impact (Minister's decree <i>N31 15.05.2013</i>) | 360160000.22.023.016156 |
| 2009 | Georgian Government Regulation on „ The Procedure Of Issuing Construction Permit and | 330130000.10.003.019241 |

| Making year | Law Title | Registration Code |
|------------------------------------|--|----------------------------|
| | Conditions for Permission“ (24/03/2009 №57, Last correction - 19/04/2016); | |
| Specific Environmental Laws | | |
| 1994 | Soil Protection (Adopted 12.05.1994 №., Last Correction - 16/07/2015); | 370.010.000.05.001.000.080 |
| 2003 | Georgian Law on "Conservation of Soil and Fertility Restoration and Improvement" Adopted 08/05/2003 №2260, Last Correction - 19/04/2013); | 370.010.000.05.001.001.274 |
| 1997 | Water (Adopted 26.10.1997 , as of 26.12.2014) | 400.000.000.05.001.000.253 |
| 1999 | Ambient Air Protection (as of 22.06.1999, 5.02.2014 -) | 420.000.000.05.001.000.595 |
| 1999 | Forest Code of Georgia (as of 22.06.1999 , 6.09.2013) | 390.000.000.05.001.000.599 |
| 2003 | Georgia's Red List and Red Book (as of 6.06.2003, 6.09.2013) | 360.060.000.05.001.001.297 |
| 2006 | Georgian Sea and River Banks Regulation and Engineering Protection (as of 05/05/2011) | 330.130.000.11.116.005.130 |
| 1996 | Protected Territories System (as of 30.04.2014) | 360.050.000.05.001.000.127 |
| 2007 | Protected Territories Status (as of 30.04.2014) | 360.050.000.05.001.003.060 |
| 2007 | Public Health (as of 1/12/2015) | 470.000.000.05.001.002.920 |
| 1996 | Entrail (as of 26.12.2014) | 380.000.000.05.001.000.140 |
| 1997 | Wildlife (as of 26.12.2014) | 410.000.000.05.001.000.186 |
| 2014 | Code on Waste Management (Last Correction-19/02/2015) | 360160000.05.001.017608 |
| 1995 | Georgian Law " Transit and Import of Waste on the Territory of Republic of Georgia " (08/02/1995 №631, Last correction - 06/09/2013). | 300230000.05.001.017071 |
| 1998 | Pesticides and Agrochemicals (as of 08.05.2012) | 340120000.05.001.016723 |
| Other Relevant Laws | | |
| 2007 | Cultural Heritage (as of 8.05.2007, 26.12.2014) | 450.030.000.05.001.002.815 |

| Making year | Law Title | Registration Code |
|--------------------|--|----------------------------|
| 2005 | Fire Safety (as of 24.06.2005) | 140.060.000.05.001.000.355 |
| 1994 | Law of Georgia on Roads (as of 24/12/2013) | 310.090.000.05.001.000.089 |

Table 3.2 Environmental Regulations

| Water Protection | Regulation | Approved |
|-------------------------------------|---|--|
| | Manufacturing and non-manufacturing facilities of waste water discharge to surface water bodies in the technical regulations; | Georgian Government Resolution No. 17, January 3, 2014, "Approval of the Environmental Technical Regulations." |
| | Technical Regulations on Water Extraction from Surface Water Body | Georgian Government Resolution No. 17, January 3, 2014, "Approval of the Environmental Technical Regulations." |
| | Technical Regulations on Water Extraction from Surface Water Body | Georgian Government Resolution No. 17, January 3, 2014, "Approval of the Environmental Technical Regulations." |
| | Technical Regulations on Protecting of Waters from Pollution | Georgian Government Resolution №425, December 31, 2013 "Approval of Technical Regulation on Protection of Surface Water from Pollution" |
| | Technical Regulations on Water Protection Areas | Georgian Government Resolution №440, December 31, 2013 "Approval of Technical Regulation on Water Protection Areas" |
| | Technical Regulations on Georgian Small River Water Protection (Zone) Areas | Georgian Government Resolution №445, December 31, 2013, "Approval of Technical Regulation on Georgian Small River Water Protection (Zone) Areas." |
| Protection of Drinking Water | Technical Regulation on Drinking Water | Georgian Government Resolution #58, January 15, 2014, |
| Ambient Air Protection | For the Activities Polluting Ambient Air | Georgian Government Resolution #17, January 3, 2014, „Approval of |

| | | |
|----------------------------|---|--|
| | | Environmental Technical Regulation“ |
| | Technical regulation of Air Pollution Stationary Sources Inventory | Georgian Government Resolution #42, January 6, 2014, „Approval of Technical regulation of Air Pollution Stationary Sources Inventory |
| | Self-Monitoring and Reporting Technical Regulations of Pollution Stationary Sources Emissions | Georgian Government Resolution №413, December 31, 2013 „Approval of Self-Monitoring and Reporting Technical Regulations of Pollution Stationary Sources Emissions“ |
| Soil Protection | Technical Regulations On Topsoil Removal, Storage, Use and Cultivation | Georgian Government Resolution №424 December 31, 2013, „Approval of Technical Regulations On Topsoil Removal, Storage, Use and Cultivation As of 08/08/2014 |
| Waste Management | Technical Regulations - "Landfill Setup, Operation, Closure and Post-care" | Georgian Government Resolution №421, 11 August, 2015 |
| Occupational Safety | Technical Regulations on Construction Safety | Georgian Government Resolution №361 May 27, 2014 “Approval of technical regulations on Construction safety“ |

Some of International Agreements and Conventions Adopted in Georgia

- **Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (Aarhus Convention 1998)**, Georgia joined in 2001.

The aim of the convention is to guarantee the right of generations to live in healthy and safe environment, make available for the citizens environmental information, ensure their participation right in decision making process, also the right of the citizens to have access to the Judiciary system in case of violating their rights.

- **Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal**, Basel, 1989. Georgia joined in 1999.

- **UN Convention on Persistent Organic Polluters (POPs)**, Stockholm, 2001. Georgia joined in 2006.

- **Convention on Biological Diversity**, Rio de Janeiro, 1992. Georgia joined in 1994.
- **Cartagena Protocol**, Georgia joined in 2008.
- **Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)**, Washington, 1973. Georgia joined in 1996.
- **Vienna Convention for the Protection of the Ozone Layer, Vienna, 1985. Georgia joined in 1996w.**
- **Montreal Protocol on Substances that Deplete the Ozone Layer**, Montreal, 1987. Georgia joined in 1996-s.
- **1987 Amendment of Montreal Protocol on Substances that Deplete the Ozone Layer**, Montreal, 1997. Georgia joined in 2000.
- **1987 Amendment of Montreal Protocol on Substances that Deplete the Ozone Layer**, Copenhagen, 1992. Georgia joined in 2000.
- **United Nations Framework Convention on Climate Change, New-York, 1994.** Georgia joined in 1994.
- **Kyoto Protocol**, Kyoto, 1997, Georgia joined in 2005;
- **Convention on Long-Range Transboundary Air Pollution, Geneva, 1979.** Georgia joined in 1999.
- **United Nations Convention to Combat Desertification, Paris 1994.** Georgia joined in 1999.
- **Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (POPs)**, Rotterdam, 1998. Georgia joined in 2006.
- **Strategic Approach to International Chemicals Management (SAICM)**, 2002. Georgia joined in 2002.

4. Description of Project Natural Environment

4.1. *Climate, Air Quality, Background Noise and Radiation*

4.1.1. *Climate*

When designing a road should be considered a major climatic parameters presented in the document approved by the Ministry of Economic Development (Decree 1-1/1743) „Building Climatology“. Important meteorological characteristics to be foreseen when arranging power lines and operation: wind speed, relative humidity, daily maximum of precipitation and snow cover.

Variety of wind speeds are provided in 0. Relative humidity values of the project corridor are provided in 0. These settings are important to consider when designing ETL.

Daily maximum of precipitation along the project corridor significantly changes (see. 0). These dimensions are important in the construction and planning of mitigation measures.

According to construction-climatology territory zoning map of Georgia, research territory belongs to II climate region's II-b subregion. On Khulo territory average temperatures of January and July differ from -5 °C to -2 °C and from +21 °C to +25 °C. The average values of the temperature are presented in the following table.

Table 4.1. Air Temperatures

| Absolute Minimum | Absolute Maximum | Average Maximum of the Hottest Month | The Coldest 5 day period Average | The Coldest day Average | Average of the Coldest Period | Average Temperature at 13:00 | |
|------------------|------------------|--------------------------------------|----------------------------------|-------------------------|-------------------------------|------------------------------|-----------------------|
| | | | | | | For the Coldest Month | For the Coldest Month |
| -18 | 39 | 25 | -8 | -11 | 0,7 | 2,9 | 23,7 |

Table 4.2 Soil Freezing Depth

Normative depths of soil freezing for the research road territory:

- Loam and clay 0,0 sm
- Fine and dusty sand/sandy 0,0 sm
- Large and medium-thick gravel sand 0,0 sm
- Large pieces 0,0 sm

Based on temperature long-term datas and observations, dissipation of soil freezing does not happen. Accordingly, there is no need to take additional measures against oil freezing.

Table 4.3 Ambient air temperature, precipitation, relative humidity

| Administrative Unit | Average Annual Temperature, °C | Precipitations | | Average Annual Humidity % |
|---------------------|--------------------------------|----------------|------------------|---------------------------|
| | | Annual, mm | Daily Maximum mm | |
| Khulo | 10.4 | 1228 | 133 | Khulo |

Table 4.4 Wind characteristics

| Administrative Unit | Wind Speed, M/S | | |
|---------------------|-----------------|------|---------|
| | January | July | January |
| | | | |

| | MAX | MIN | MAX | MIN | MAX | 5 Years | MAX | 15 Years | MAX |
|-------|-----|-----|-----|-----|-----|---------|-----|----------|-----|
| Khulo | 3.8 | 2.1 | 2.6 | 1.6 | 14 | 18 | 19 | 20 | 21 |

Table 4.5 Wind Direction and Repeatability of Calmness in a Year

| Administrative Unit | Repeatability of Wind Direction and Calmness in a Year, % | | | | | | | | |
|---------------------|---|-----|---|----|----|----|---|-----|----------|
| | ch | cha | a | sa | s | sd | d | Chd | Calmness |
| Khulo | 26 | 21 | 1 | 1 | 24 | 20 | 3 | 4 | 14 |

Table 4.6 Atmospheric Relative Humidity per Months for ETL Corridor

| Administrative Unit | Atmospheric Relative Humidity, % | | | | | | | | | | | | |
|---------------------|----------------------------------|----------|-------|-------|-----|------|------|--------|-----------|---------|----------|----------|----------------|
| | January | February | March | April | May | June | July | August | September | October | November | December | Average Annual |
| Khulo | 69 | 69 | 68 | 64 | 66 | 72 | 77 | 75 | 74 | 70 | 66 | 65 | 70 |

The road corridor is significantly changing the characteristics of the snow cover. In the municipalities of Akhaltsikhe and Adigeni snow cover lasts approximately 60-70 days da the weight of snow cover is relatively light. In Khulo Municipality snow cover duration is 93 days; the water content of the snow cover and accordingly weight of snow cover in this territorial unit is relatively high. Snow cover characteristics, on other sections of the transmission line, in sea direction gradually soothes. The snow cover parameters are presented in 0 for ETL route.

Table 4.7 Snow Cover Characteristics for ETL Corridor

| Administrative Unit | Snow Cover Weight, KPA | Snow Cover Day Number | Water Content in Snow Cover, MM | Snow Cover Weight, KPA |
|---------------------|------------------------|-----------------------|---------------------------------|------------------------|
| Khulo | Khulo | 1.69 | 93 | 222 |

4.1.2. Air Quality and Noise

Air Quality

Before collapse of the Soviet Union, State hydrometeorological services were responsible for the major air polluting concentrations (3 times per day) for regular measuring: solid particles, SO₂, NO₂ and CO, also some specific pollutants from local stationary sources. Aforesaid measurements in Georgia were made before 1991 in 11 big cities and in 33 measuring locations. Though, over time their coverage area gradually decreased. Since 1994 air quality reliable assessment has not been done. In the majority of cities maximum allowable concentrations limit is overdue. In the below table is indicated measured concentration coefficient in municipal measuring stations compared to maximum allowable data in Batumi.

Table 4.8.

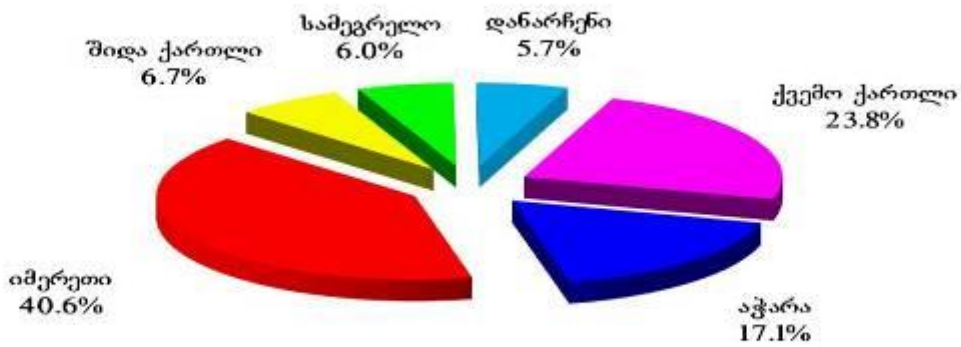
| Average Annual Quantity of Concentrations mg/m ³ | | | | | |
|---|-------|-----------------|-----------------|-----------------|------------------|
| Year | Dust | SO ₂ | SO ₄ | NO ₂ | H ₂ S |
| 2004 | 0.203 | 0.097 | 0.02 | 0.049 | – |
| 2005 | 0.17 | 0.098 | 0.023 | 0.052 | 0.0047 |
| 2006 | 0.295 | 0.1024 | 0.0209 | 0.0639 | 0.00825 |
| 2008 | 0.5 | 0.09 | 0.01 | 0.12 | = |
| 2013 | 0.4 | 0.16 | | 0,16 | |
| Maximum Concentration mg/m ³ | | | | | |
| Year | Dust | SO ₂ | SO ₄ | NO ₂ | H ₂ S |
| 2004 | 0.5 | 0.15 | 0.04 | 0.08 | – |
| 2005 | 0.5 | 0.19 | 0.04 | 0.08 | 0.008 |
| 2006 | 2.3 | 0.29 | 0.09 | 0.13 | 0.019 |
| 2008 | 1.2 | 0.21 | 0.02 | 0.25 | = |
| 2013 | 0.7 | 0.24 | | 0,25 | |

source: Ministry of Environment Protection and Natural Resources of Georgia. National Environmental Agency

Air Pollution from Emission

There are approximately 300 stationary sources of air pollution in industrial sectors of Georgia, such as energy, iron and steel, chemical and petrochemical, wood and paper, food recycling sectors. Although, currently only some of them function full-time. The whole emission from the selected air pollutants is represented in the table below. These data are obtained using CORINAIR methodology, according to emission indicators and activity indicators (mainly energy consumption or productivity form) for various sectors. They include the following stationary sources: power stations, fuel combustion in industrial and non-industrial plants, and industrial processes. Mobile sources include road transport, railway transport and other mobile sources.

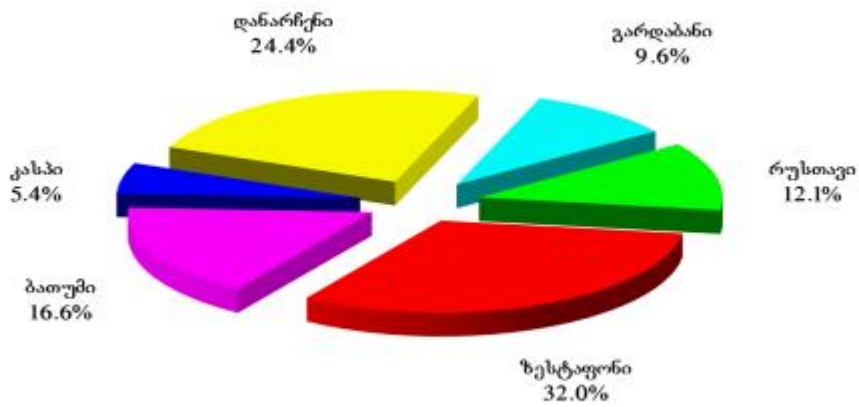
პირითადი დამაბინძურებელი რეპრონების წილი ძველის დამბინძურებაში



ნახ. 1

Pic. 4.1.

პირითადი დამაბინძურებელი ქალაქების წილი ძველის დამბინძურებაში



ნახ. 2

Table@4.9

Hazardous Substance Emission in Atmospheric Air, Cleaning, Utilisation

Ton/Year

Adjara Region 2010

Plant Quantity 136

| მაგნე ნივთიერებების დასახელება | სტაციონარული წყაროებიდან გამოყოფილი მაგნე ნივთიერებათა რაოდენობა | აქედან | | | | მაგნე ნივთიერებათა დატვირთვის % | გაფრქვევის მომატება(+) შემცირება (-) წინა წელთან შედარებით |
|--------------------------------|--|--------------------------------|------------|---------------------------|------------------------------|---------------------------------|---|
| | | გამწმენდ ნაგებობაში მოხვედრილი | მათ შორის | | ატმოსფერულ ჰაერში გაფრქვეული | | |
| | | | დატვირთილი | დატვირთილიდან უტილიზებული | | | |
| სულ | 4180,636 | 2162,933 | 2106,713 | 485,985 | 2073,923 | 50,4 | -1078,069 |
| აქედან | | | | | | | |
| მყარი | 2229,796 | 2162,933 | 2106,713 | 485,985 | 123,083 | 94,5 | -375,877 |
| აირადი და თხევადი | 1950,840 | — | — | — | 1950,840 | — | -702,192 |
| მათ შორის | | | | | | | |
| გოგირდის ორჟანგი | 64,696 | — | — | — | 64,696 | — | 40,305 |
| აზოტის ჟანგბულები | 30,983 | — | — | — | 30,983 | — | 9,123 |
| ნახშირჟანგი | 91,689 | — | — | — | 91,689 | — | 35,233 |
| ნახშირწყალბადები | 1710,444 | — | — | — | 1710,444 | — | -783,175 |
| დანარჩენი ნივთიერებები | 53,028 | — | — | — | 53,028 | — | -3,678 |
| ნახშირორჟანგი | 15330,404 | — | — | — | 15330,404 | — | 1784,647 |

Table 4.10
Hazardous Substance Emission in Atmospheric Air, Cleaning, Utilisation
Ton/Year
Samtskhe-Javakheti Region 2010
Plant Quantity 76

| მაგნე ნივთიერებების დასახელება | სტაციონარული წყაროებიდან გამოყოფილი მაგნე ნივთიერებათა რაოდენობა | აქედან | | | | მაგნე ნივთიერებათა დატვირთვის % | გაფრქვევის მომატება(+) შემცირება (-) წინა წელთან შედარებით |
|--------------------------------|--|--------------------------------|------------|---------------------------|------------------------------|---------------------------------|---|
| | | გამწმენდ ნაგებობაში მოხვედრილი | მათ შორის | | ატმოსფერულ ჰაერში გაფრქვეული | | |
| | | | დატვირთილი | დატვირთილიდან უტილიზებული | | | |
| სულ | 485,564 | 677,885 | 434,686 | 434,686 | 50,878 | 89,522 | -96,527 |
| აქედან | | | | | | | |
| მყარი | 453,921 | 677,885 | 434,686 | 434,686 | 19,235 | 95,763 | -112,708 |
| აირადი და თხევადი | 31,643 | — | — | — | 31,643 | — | 16,181 |
| მათ შორის | | | | | | | |
| გოგირდის ორჟანგი | 1,231 | — | — | — | 1,231 | — | 1,033 |
| აზოტის ჟანგბულები | 0,599 | — | — | — | 0,599 | — | -0,093 |
| ნახშირჟანგი | 7,321 | — | — | — | 7,321 | — | 6,059 |
| ნახშირწყალბადები | 21,572 | — | — | — | 21,572 | — | 8,282 |
| დანარჩენი ნივთიერებები | 0,920 | — | — | — | 0,920 | — | 0,900 |
| ნახშირორჟანგი | 124,727 | — | — | — | 124,727 | — | 123,370 |

In February ambient air pollution monitoring was conducted in Batumi on observation point located on Abuseridze Street. Following polluting substance concentrations of ambient air were determined: dust, sulfur and nitrogen dioxide, carbon dioxide and projectile.

Table 4.11 Maximum Disposable and Monthly Average Concentrations Observed in Batumi in February 2016

| დაკვირვების პუნქტი | მტვერი | | აზოტის დიოქსიდი | | გოგირდის დიოქსიდი | | ნახშირჟანგი | | ტყვია |
|-----------------------|--|------------------------------------|--|------------------------------------|--|------------------------------------|--|------------------------------------|----------|
| | მედიანური ენოვანადი კონცენტრაცია | საშუალო- თვეური კონცენტრაცია | მედიანური ენოვანადი კონცენტრაცია | საშუალო- თვეური კონცენტრაცია | მედიანური ენოვანადი კონცენტრაცია | საშუალო- თვეური კონცენტრაცია | მედიანური ენოვანადი კონცენტრაცია | საშუალო- თვეური კონცენტრაცია | |
| აბუსერიძის ქუჩა | 0,7 | 0,47 | 0,23 | 0,16 | 0,18 | 0,13 | 6,0 | 1,7 | 0.000054 |

Noise

Before it was annulled, Environment Scientific Research Institute was responsible for noise monitoring and management, but because of limited resources, systematic monitoring of noise on national scale does not happen. The noise is measured in order to react on the complaints of communities.

From 1992 to 2002 noise was measured at five places in Tbilisi. Noise level 7.5 m high from sidewalk varied from 71db to 80 db. Railway noise in 25m to from gauge was 65 db during daytime and 63 db at night. Noise was also measured in 1990-2001, in Rustavi (73-75 db), in Poti (72-74 db), Telavi (70 db) and Gori (72 db). According to European standards noise maximum is 65 db during daytime and 55 db at night in urban areas. Spontaneous measurement of noise means that the level of noise caused by public transport in the big cities achieved a disturbing level and together with the increased growth of traffic density, increase of noise is also expected.

Current standards of noise level in Georgia is based on Ex-Soviet Union sanitary norms, N 3077-84, where various norms from various zones are indicated. However, the most appropriate standards are about noise limit in and out (to the walls) of residential houses, which are:

In residential houses:

EQ (Equivalent continuous noise level) (7 am – 11 pm) indicative (relevant) noise = 40 db (A), maximum level= 55 db (A)

EQ (11 pm – 7 am) indicative (relevant) noise = 30 db (A), maximum level = 45 db (A)

Out of Residential Houses (Measures to the Wall):

EQ (7:00-11:00) indicative (relevant) noise = 55 db (A), maximum level = 70 db

EQ (7:00-11:00) indicative (relevant) noise = 45 db (A), maximum level = 60 db

Fluctuation/Primary/Background Noise Measurement Data

Noise was measured on April 17, 2014.

Existing noise background was measured by British machine “PCE-EM882”. Measurements were conducted with following methodology. In each 5 minutes during half hour data reception from device indicator is implemented (6 data in total) in each point and average for each noise point is calculated.

Control points were selected in 3 districts: district N1 starting point of the track (km 0) at borough Khulo (existing road: from track 5 and 25 m distance), district N2 to village Diakonides (km, 0) and N3 district village Beghle (km 14, 0). As shown in the data given in the table below, the noise background level existing at N2 and N3 points is low enough at the road and even lower – far from the road. And at the district N1, which is situated in Khulo, noise level is high as near the road, so far from it.



Pic.4.3 Noise Measuring Device

Table 4.12 Measured Noise Background Level

| District № | Dime | Max Db | Med Db |
|--------------------------------|-------|--------|--------|
| 1 (5m from existing road) | 12:00 | 74 | 57 |
| 1 (25 m from existing road) | 12:30 | 65 | 55 |
| 2 (5 m from existing road) | 14:30 | 65 | 45 |
| 2 (25 m from existing road) | | 48 | 40 |
| 3 (5m from existing road) | 15:45 | 60 | 45 |
| 3 (25 m from existing road) | | 45 | 40 |

4.2. Physical and Geographical Description of Environment

4.2.1. *Geomorphology and Terrain*

Geomorphological territory is included in Adjara-Trialeti folded, chalky and paleogene rocky and half-rocky volcanogenic sediments in rocky regions and partially includes paleogene neogene rocky and half-rocky sub-argillites and pyroclastic rock region – particularly Akhaltsikhe depression sub-district.

Adjara –characteristic feature of Trialeti folded system is to roll over like a fan in the Northern part of Georgia in clod direction and South part Artvini – Bolsnisi clod direction.

The research region is built with coarse-grained, andesite-basalt spreads, tuffs, tuff breccias, tuff sand-stone and tuff conglomerates of various strengthes of middle eocene age, also with andesite-dacitic spreads, tuff sand-stoneb, tuffs and tuff breccias of neogene age ($N_1^3-N_2^1$) of Goderdzi series.

In the western part of Goderdzi pass, towards village Danisparauli in the geological structure of the territory also participate glacial sediments. Modern quaternary sediments are generally represented by dealluvial (dQ_4), dealluvial colluvial (dcQ_4) and dealluvial-proalluvial (dpQ_4) formations, power of which (among them glacial sediments) varies from 2-5 m to 40-50m.

From lithological point of view, grounds are composed of clay grounds with gravel, shingle, rock supplements, shingle and silty sand.

Geomorphologically, research section passes through Adjara-Imereti anticlinal ridge and in cavernous of Adjara. The territory is characterized with middle mountainous erosional- denudational terrain, which is dismembered with simmetric and assimetric V-shaped canyon ravines too. Terrain surface is covered with forests and shruberry. Some places are settled.

In terms of tectonism, region is characterized with neotectonic movements, which is due to the steep slopes, many canyons, narrowings, numerous torrents and floods, stepped waterfalls, landslides, downpours, gravitational occasions (weathered stone/rockfall, avalanche), active erosional occasions, side and regressive erosion. All above mentioned indicates that in this region, especially at riv. Adjaristskali valley and surrounding territories around terrain rise occurs, that causes intensive deep erosion, and the latter endangers development of dangerous geodynamic processes.

“Difficult” climatic conditions that are typical for the region also trigger new dangerous geodynamic occurances and activation of existing ones. Exactly this kind of occurances represent quaternary layer creators of great powered grounds (weather crust thickness varies in 10-15 m intervals) and reason of low physical-mechanical features.

4.2.2. *Dangerous Geodynamic Processes*

Terrain-climatic features of the research territory and geological conditions lead to variety of engineer-geological features and as a result to divergent and disordered geological processes.

Aside from geological occurrences, attention must be paid to erosional and landslides happenings, which cover hundreds of districts.

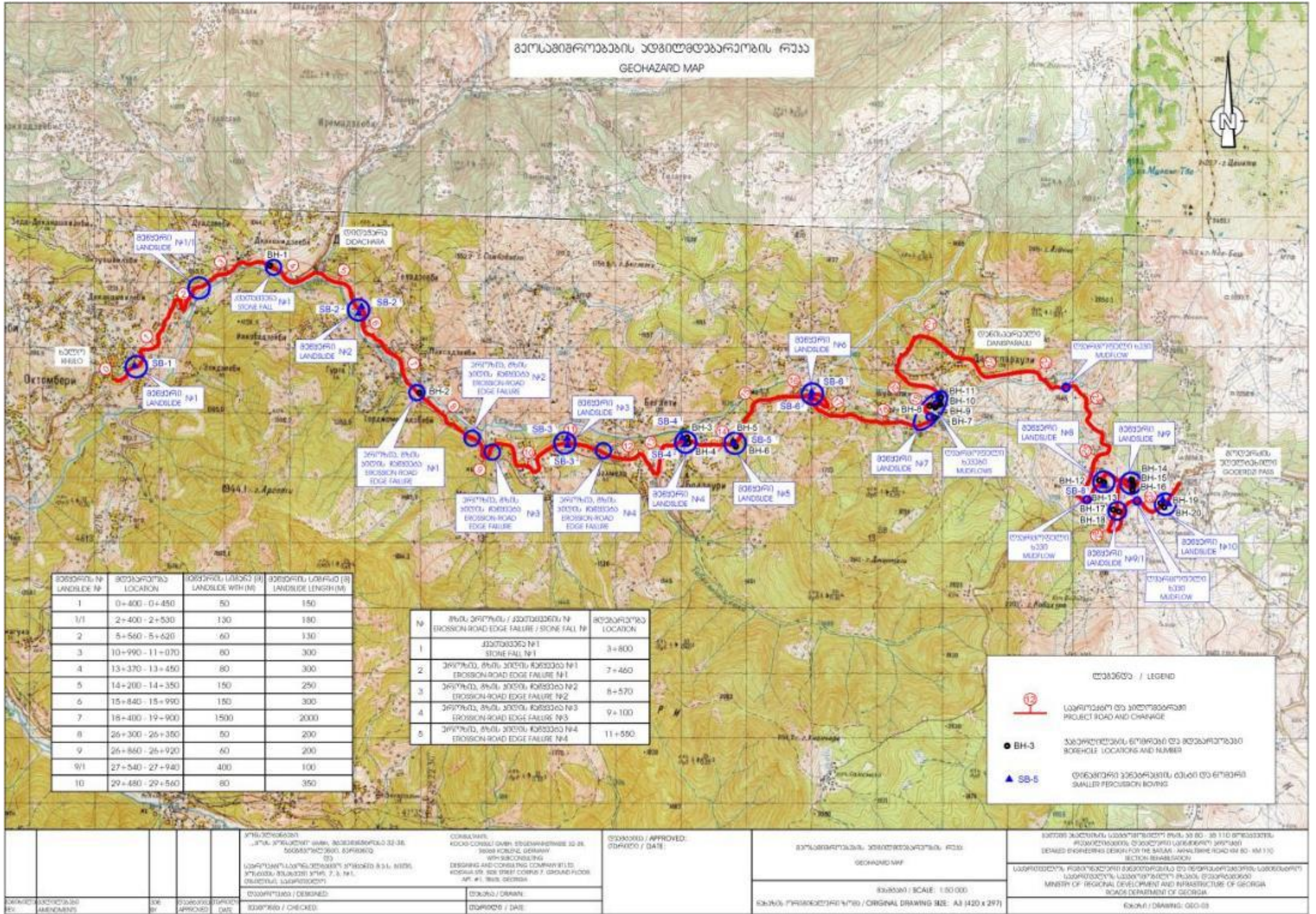
Dangerous geodynamic processes detected on the research section, such as erosions and landslides, are discussed in a separate chapter (“Dangerous Geodynamic Processes”) with related researches result evaluation.

Landslide #1 (from km 0+400 to 0+450)

General Information

Landslide is developed on right side of the road. Head of detaching stage is exactly under the concrete wall. Creeping district width along the road is approximately 50m, and the length of relocated mass is approximately 150m.

Behind the landslide district plants and trees are in vertical position and have not disclosed any signs of displacement so far. Traffic signs are not observed on the road passing through the landslide district and nor are observed damages on buildings located above the road. Apparently actual raft is localized and do not traverse right part of the road



Pic 4.4 Dangerous Geological Process Map



Pic 4.5 Current Situation on Landslide District (km 0+400)

Newly created slope under retaining wall is quite steep and in future can be at risk of slipping and root washout.

Actually, existing retaining wall does not have resistant base and its collapse during the next rainstorm is possible, when surface waters will pour from road surface and lavage bottom of wall. Water infiltration can also cause additional slide of landslide.

Landslide is developed on riv. Adjaristkali valley right slope. The slope has South-West exposition, 20°-25° inclination and wavy surface. Upper eocene (P₂³) sediments consisting of tuff breccia are involved in the geological structure of slope on which are covered delluvial surface sediments of various intensity.

Landslide is developed in so-called “Delluvial Pockets”. Landslide body length is 150 m, width in upper part 50 m, and 7-8 m in lower part. The surface is slightly stepped. Detachment point height is up to 1,5 m, and its head is located at the bottom of retaining wall. Detachment step inclination varies to 45°-50° . Landslide is developed in clay facies sediments. Clay is grey and soaked. Its consistency varies from very soft and soft to very low plastic (deeper than 4,0 m). Steep (tuff breccia) exposings are fixed in both sides edges of landslide bodies contour.

Landslide N2 (from km 2+400 to km 2+530)

The road is damaged on this location and apparently is a bit moved because of ground scrambling and erosion. New filling material is spread over district for ensuring road pass.



Pic. 4.6 Damaged and Repaired Districts of the Road

Field geotechnic works and surveys have not been conducted on this location.

Weathered Stone (km 3+800)

On the right side of the road, on that project section is located a steep slope on the surface of which are scattered stones and rather big rocks. Riped off materials are falling on the road as a result of weathering, especially during rains.

Steep slope on the lower side of the road runs till the river. Accumulated material on upper slope of the road negatively affects on traffic, because vehicles find difficult to bypass stones and rocks.

Field geotechnic works and survey have not been conducted on this location.



Pic. 4.7 Steep Slope Ripped Off Stones and Rocks

From Khulo to Goderdzi pass road, approximately at the benchmark of km 3+800, is present rather unstable sand stone built plate of 12-15 m height, which causes danger for road users, because of high risk of cobbles fall. Unbound stones and rocks fall causes partial road blocking.

Conclusions made as a result of first obtained data and initial evaluation are summarized below.

Because it is impossible to change road track by bypassing the plate, following options of combating weathered stones are left:

Moving rock aside by cutting frontal part. For this purpose steps can be arranged on the rock approximately of 4, 0-5, 0 height interval, and in order to form a berm, rock can be cut in its upper part.

Removal of ripped off stones and rocks. This option represents just temporary solution, because it cannot provide interruption of weathering process, and rock surface condition will worsen again and stone fall will start again in a short period.

Covering of rock whole frontal surface with wire. Considering slot heights, installed wire will need appropriate monitoring and care including removal of large pieces.

Because assessment process is not finished and is in process, above mentioned opinions should be considered as initial proposals.

Landslide N2(km from 5+560 to km 5+620)

General Information

On the district, on the right slope of the road was observed a landslide. Water flows on the road from several places of the slope. Currently landslide is in stable condition. Rocky plate is observed on the road's lower slope in 80-100m from the district.



Pic. 4.8 Landslide N2 (km from 5+560 to km 5+620)

The landslide is developed on the right lower side of the slope of riv. Adjaristskali valley. Slope inclination basically varies between 25° - 30° . The surface is wavy. The slope is geologically built in upper eocene (P_2^3) lava breccia, which is covered with loam and clays of delluvial origin.

Landslide body is in active phase. Its length is 130m, width 60-65m, and strength up to 5 m. The inclination of landslide body surface is 15° - 20° . The surface is tuberous and has separate holes. Acacia trees are cultivated on the other side of the road. Landslide is developed in clay facies sediments. Surface layer, thickness of which varies between 1,5-2,0 m, is represented by grey clays, in which are mixed grained weathered rocks. Below are yellowish plastic clays. Vaguely defined stepped surface is observed on landslide body. Each step width is between 4-5 m. Detachment surface is represented by closed shear gaps, which are observed above the road, in the middle of landslide body.

It should be noted, that approximately in 90 m on the back of the road begin rocky cliffs with steep surfaces. Rocky cliffs are covered with 4-4.5 m thick delluvian sediments. Landslide body floating surface must be 4-4.5 m deep. Landslide is weakly active and is in process of stabilisation, although deep excavation of the slope for road route correction, may reactivate landslide process and trigger massive collapse of ground.

Road Edge Collapse District N1 (km7-460)

General information

Left side of the road is heavily failed in two areas in this district. Obviously this is caused by improper sewerages, therefore surface water from the opposite slope passing the road to the lower edge and from there to the road lower slope flows and causes road edge collapse.

Road Edge Collapse District N1 (km 7+460)

General information

On this district, the left side of the road is immensely washed. This is obviously caused by inadequate wastewaters, because of which surface water from the slope in front, bypassing the road from lower edge, flows into bottom slope and conditions dissolution of the edge.

Road Edge Collapse District N2 (km 8-750)

General information

A side is collapsing on the left side of the road. In case the process continues, together with the side, the road will also be involved. It's clear, that water flown from the road and also from the slope is collected in a low space and flows to the left side of the slope.

At this stage special geotechnical research works have not been conducted in the district.

Road Edge Collapse District N3 (km 9+100)

The road left shore is heavily collapsed in three places. Apparently, some repair works have been conducted in order to reinforce the road edge. Early laid logs are exposed and partly washed off by surface water influence.

On that district of road are not located any cuvettes or extraction instruments.

Pic. 4.9 Road Edge Collapse (lavage)

Surface water running from the road, to the opposite slope flows into road bottom site, therefore the road edge is collapsing, and there are deep holes on lower slopes.

At this stage special geotechnical research works have not been conducted in the district.

Pic 4.10 Collapsed Edge of the Road and Exposed Logs

Pic. 4.11 Deformed and Steady District

Landslide is developed in left slope of lower part of riv. Adjaristskali valley. It is the North exposition slope. Its inclination is 30°-35°, and surface is wavy and stepped. Upper eocene

(P₂³) sediments participate in geological structure of the slope, which are represented with lava breccias. Bedrock surface is covered with delluvian loamy and various, mostly thick clays, which are mixed with solid weathered rock.

Landslide is developed in loamy sediments. Landslide body lenght from detachment surface to river grove is up to 300m, and width 80-85m. Detachment surface is exposed on 3-6 m high step.

Lanslide slope surface is wavy and segregated into small cracks and holes. Directly under loamy ground, 7,5-8m deep from surface is yellowish waterproof clay layer, on the surface of which landslide body slips. Above road carriageway, approximately 70 m far, terrain and slope sharply change and accordingly landslide body with big inclination slips in river grove direction. Steep surface is cracked, and ground water outlet is observed in its lower part.

The landslide threatens the road.

Road Edge Collapse District N4 (km 11+550)

On these districts surface water action caused not only collapse of the road edge, but also road lower slope slip and cracking.

Steel pipe put on the place, that has water redirecting function, is not equipped with outletting construction and does not have enough lenght.

Accordingly, water running from the pipe washes out not only lower part of the slope, but also the bottom of the pipe.

At this stage special geotechnical research works have not been conducted in the district.

Pic. 4.12 Collapse of Road Edge

Landslide N4 (from km 13+370 to km 13+450)

General Information

Landslide is developed on left side of the road. Upper part surface is wavy and stepped, and lower is cracked with micro steps. Landslide collapses and detachment contours are observed.

Landslide body calculated power is 9-10m. Landslide district outgoing road is indentated and deformed. Water ground several outlets are observed in landslided slope middle and lower parts.

During research process, ground water outlets were observed 6,3-7,4 m deep.

Landslide is developed on the left slope lower part of riv. Adjaristskali valley. Slope inclination is 25°-35°, and 70 m from the road increases to 50°. The surface is bumpy and avy. Eucene (P₂³) sediments, which are represented by lava breccia participate in slope geological stucture. Bedrock surface is covered by dealluvial origin loamy and clays, which are mixed with solid weathered rocks.

Pic. 4.13 Wavy Surface Landslide

Landslide body is developed in dealluvial loamy and is in active phase. Its body is up to 300m, and width – 70-80m. Landslide body surface is stepped and cracked, and its inclination is between 20°-25°. Crack length is from 5 to 15 m, width 10-20cm, and depth 1,5m. Detaching surface is expressed in 3-5 m high cliff type steps. Detaching surface inclination is 50°-55°.

Road back part of landslide body is more active and is represented by bumpy embankment. The surface is more cracked. High voltage power line old pillar is moved 7-8 m far. Landslide body lower part relief is sharply transformed, and ground water outlets are observed in its front side.

During research, ground waters were fixed in 2m of the road upper slope and in 3,5m of lower slope and ground water in drilled boreholes on the road surface level were 6,3-7,4 m deep. Considering ground humidity, terrain conditions and waterproof clay layer, located under water containing layer, can be considered, that landslide body slip surface upper part is 4 m deep, and 5m in lower part.

Landslide is in active condition and has already caused road deformation.

As a preliminary proposal, it would be appropriate to make a deep drainage as a protective measure.

Landslide N5 (from km 14+200 to km 14+350)

General Information

The road passes through landslide slope on this place and is replaced and deformed. The slope located directly on of the road is of relatively small inclination and gives impression of stabilized phase landslide. This slope is partly covered with trees. A ravine is developed on the lower slope of the road, which is full of stones and rock pieces.

Pic.4.14 Deformed Road by Landslide

The landslide is developed on the left slope lower part of riv. Adjaristskali valley. The inclination of the North-West exposition slope is 20°-30°. The surface is bumped, stepped and wavy, it is also cut up with thin cracks and holes. Above the road, on the slope trees are

growing. There are pastures and farming buildings on the slope, and lower – residential houses. Upper eocene (P_2^3) sediments lava breccias are ingredients of geological structure of the slope, which are covered with colluvial and dealluvial-colluvial sediments – with loamy filler rock parts and weathered stone in the borders of landslide district. Rocky part share is less in the lower slope of the road in loamy ground, and weathered stone share is up to 40%. The length of the landslide body is 250m, width – 150m. The surface is sharply wavy. mowvyetis zedapiri Runs along the bottom of the rocky wall and the upper side of the road is covered with colluvial rock parts. A shallow ravine comes along landslide body, which goes under the road and bed of which is full of rock parts. The ravine depth in the lower part is 3-3,5 m. South-West retaining wall built on the lower part of the road is fully reformed. Ground water outlets with 0,5 l/min are observed on the frontal surface of the lower side of landslide body. In above mentioned ravine, cement pipes are put for redirection in running water settlements. During heavy rains it is impossible to pass a big amount of water through these pipes and the swollen water is flooding lands. The landslide is in active phase and has already caused the deformation of carriageway and 1-1,5 m subsidence. According to visual observation and geomorphological conditions, landslide body height must be 5-7 m.

Landslide N6 (from km 15+840 to km 15+990)

General Information

Landslide district, which is located on left side of the road is the first one between research section existing active phase landslides. The road on this district is already deformed and indented with landslide processes from previous periods of time.

Pic. 4.15 Indented and Deformed Road

The landslide is developed on the North, left, middle part of exposition slope of riv. Adjaristskali. Its inclination on upper and middle parts is 15° - 20° , and on lower part increases till 45° . The surface is erosive-denuded, wavy and slightly concaved.

Upper eocene (P_2^3) sediments lava breccias are ingredients of geological structure of the slope, which are covered with dealluvial origin clay-loamy grounds with parts of solid weathered stones and separate rocks in the borders of slope.

The length of the landslide body is 300m, width – 150m. Detachment surface is expressed by 10-15m high (in various places) steep surface. Above the road, landslide body has slightly expressed stepped surface, and lower of the road landslide is identified with stepped-bumpy and hole cracked surface. 200 m from mowvyetis surface the slope joins the river with 45° angle.

Ground waters are 3,5m on the upper side of a slope, and 1,0m deep below the road. Considering ground humidity, we can conclude, that slip surface is more than 5,5-3,8 deep.

The landslide is in active phase and has already caused the road deformation. In case of regressive (to the west) development of the process, it threat the village population.

Landslide N7 – “Village Danisparauli” (from km 18+400 to km 19+900)

Field Study Result

Landslide processes impact big territory of the village. Therefore field geophysical/asymmetrical power survey was held on the landslided territory. Survey results are given below.

Pic. 4.16 Landslide Slopes

Pic. 4.17 Rehabilitated Landslide District

Several landslide and mudslide districts are observed around village Danisparauli, on which are conducted several geotechnical and geophysical surveys. The survey results are represented in the paragraph dedicated to geotechnical researches and in the report prepared separately for geophysical researches.

Danisparauli landslide territory spreads on a vast territory and is characterized by difficult dynamics and mechanism. Finding solution at the current stage, that would improve the territory and partly stabilize it, is a very hard task and requires further data review and consideration with multi geological researches.

Landslide N8 (from km 26+300 to km 26+350)

General Information

Landslide body is clearly observed on the right side of the road. Detachment step height varies between 6,0-8,0. Landslide slope is of rather small inclination, and the surface is wavy and wet. Landslide body surface was water pool, which is nourished by above located springs.

Ground wash out process has begun on the lower slope of the road by water running from above, that promotes masses new slip.

Pic. 4.18 Landslide Slope

The landslide is developed in West of Goderdzi pass, in the middle part of North-West exposition slope. Up the road, slope inclination is 25°-30°. Beneath the road, slope inclination at 60 meters varies between 35°-40°, after that it straightens and goes to the landslide body base. Slope surface is wavy and cut with 1-1,5 m deep holes. Slope geological structure is represented by neogenic (N₂¹) andesite basalts, which is covered with solid weathered stone containing dealluvial loamy in landslide district borders.

Landslide body length is 200 meters, width – 50 meters. Detachment step is expressed by 6-8 m high precipice surface. Step is exposed in loamy rock parts 25-30% consistency. From detachment surface to the road straight surface and 15-30 width step is formed, which is

located 3-5 m high from the road bed. Above the detachment surface, the slope is covered with softwood. Flat, stepped surface, located to the road is cut with erosive holes and washed districts. Ground consists of loam, which includes big quantity of rock parts and shingle.

Slope collapse has started below the road and new landslide has developed. Above the road, in the bottom of detachment step and below the road, 3-3,5 m from road bed, rock bedrock (basalt) and in deluvial layer contact place, ground water frontal outlets are observed. Therefore, landslide body height above the road should be up to 6 meters, and below the road – 3,5-4 m. Landslide process is in active phase and threatens traffic and road construction. According to preliminary evaluation, one of process stabilisation options is regulation of ground water by drainage channels.

Landslide N9 (from km 26+860 to km 26+920)

General Information

Landslide is developed on the right side of the road. The road is indentated and deformed and as we know is lowered 0,5-0,1 m from initial level.

The surface is wavy in the lower body of landslide body and water is damming in places. One part of the slope is partly covered with trees.

Pic. 4.19 Landslide Slope

The landslide is developed in West of Goderdzi pass, in North-West exposition, 15°-20° inclination slope. Landslide district surface is wavy and precipiced. Step is 20-25 m high from the road and is partly covered with coniferous wood. The slope is structured with neogenic (N₂¹) rocks, which consists of andesite and andesite dacite. Slope bedrock is covered with dealluvial-colluvial sediments, including loamy ground and rock 35-40 percent. Landslide is developed in delluvial layer. Landslide body length is up to 200 m, width 50-60 m. Detachment surface is expressed by 1m high surface and shear gaps. 5-10 cm transversal cracks and holes are observed on landslide surface. Above the road, in upper side of landslide body surface is more disrupted and it is clearly visible bumps and steps, and below the road slope relief is more stable.

Apart from mentioned above, excavated road in delluvial layer by landslide processes is deformed and in various places 0, 5-1,0m is lowered from initial level. Considering relief conditions and whole forms, it can be admitted that landslide body strength/height is 3-5 m.

Landslide N9/1I (from km 27+540 to km 27+940)

General Information

This landslide district is developed on the right side of the road, on slightly inclined slope. After last slip process, the road is slightly moved.

Landslide slope upper side is partly covered with coniferous wood.

Pic.4.20 Landslide District Surface with Coniferous Wood

Landslide N10 (from km 29+480 to km 29+560)

General Information

On this district, the landslide is developed right of the road, on the slightly inclined slope. Landslide surface is wavy and cut with watercovered holes, and in the lower part, surface is broken and has mixed texture.

Pic. 4.21 Lower Part of Landslide Body

The landslide is developed in West and South-West located North-West exposition Slope of Goderdzi pass, which inclination varies from 10°-15° to 25°. The surface is obviously wavy and cut with shallow and dry ravines. The slope is structured with neogenic (N₂¹) aged andesites and andesite dacite, which are covered with delluvial and delluvial-colluvial sediments (loamy) powerful layer with big quantity of weathered rock parts.

Landslide body length is up to 350m, and width 80 m. The landslide is developed in lowered part of relief. Landslide body surface is wavy and stepped. The height between each step is 2-3 m, and step width is up to 40 m. Steps have flat and drenched with water surfaces. Detachment surface is developed with shear gaps. **flateebi** Are developed on landslide body, which cut depth (in various places) are from 2-3 to 3-5 m. From detachment point to the road are ground water outlets with 0,1-0,5 l/sec debits. Water reservoir is set in the center of landslide body, from which Goderdzi pass population is supplied with water.

Along the road bumpy and stepped surface with **flateebi** is formed by landslide action, which has caused desormation of carriageway. Landslide body base is situated 150m below the road. According to relief conditions and visual rate, landslide body height/thickness is 5-7 m. In case of carriageway expansion in side of the slope, as a protective measure, setting drainage system and decrease of slope angle to the road is recommended on basis of preliminary evaluation in order to maintain partly landslide district sustainability

Collapse of Road Edge in Several Area

In several areas of project section, serious accidents of road edge collapse have been detected. The compelling reason is insufficient drainage, therefore surface water flows uncontrollably on the road surface and further below, on a bulk slope and causes ground wash out.

In order to interrupt erosion, as an initial sentence, adequate cuvettes and other drainage means must be set.

Collapsed edges and sides of the road need restoration, that requires appropriate measures on the lower slope of the road and/or construction of buildings, in order to provide adequate retainings.

As the assessment process is not finished and is in process, opinions given above are initial.

4.2.3. Tectonics and seismicity

According to tectonic zoning, the research region is included in the Southern zone of Adjara-Trialeti folded system area, namely in Akhaltsikhe subzone.

Akhalsikhe subzone is constructed with middle and upper eocene oligocene and volcanic miocene (Goderdzi pass), volcanic and sandstone formations.

Particularly this subzone in terms of tectonics represents synclinal depression which is complicated with numerous, intensively compressed folds, which spread mostly in its central part.

According to the acting normative document of Georgia PN 01.01-09 - „Postseismic Constructions”, project road Goderdzi -

Zarzma section is located on MSKK64 scale at 7 point seismic zone, where maximum horizontal acceleration value (according to seismic dimensionless coefficient - A) equals to 0.12-0.15. as per seismic coefficient significance 0.11. Georgian seismic hazardous plan is given on image 2-1.

Pic.4.22 Image 2-1 Seismic Hazardous plan, which Reflects Maximum Horizontal Acceleration and Intensity

Note : acceleration is given in “g” units

4.2.4. Hydrogeology

According to hydrogeological zoning, research region belongs to Adjara-Imereti fractured pressurized water district, located in Adjara-Trialeti folded system pressurized water zone.

From hydrogeological point of view the region is affluent and ground and underground water vents are fixed along the existing road.

Geological structure.

Research region from geological point of view is basically built with tertiary aged continental formations, which is covered with quaternary aged alluvial and proalluvial-dealluvial sediments strong complex.

Tertiary formations are represented by paleogene boulder breccia on clay cement, with clay layers and neogene breccia and conglomerated clay-carbonated cement. Also are found volcanic porphyritic tuff sandstone and tuff breccias, which are distinguished with solidity and also we meet volcanic porphyritic tuff sandstones and tuff breccias that differ with solidity and exposure of which is observed along the mentioned road, in the last section of rehabilitation part.

Hills located along the existing road are made of breccia. They belong to easily weathering group of slopes and collection of the weathered materials takes place in slope bottom.

Quaternary sediments under research region are presented with deluvial and eluvial various consistencies, carbonate partitions and clay-stones, with inclusions of shingle and rocks up to 20-35%, with shingle ground clay fillers and eluvial, characterized by deposits of gravel fillers, mostly in valleys.

4.2.5. Hydrologic Researches

4.2.5.1. Description of Design Territory

Batumi-Akhaltsikhe rehabilitation road from km 80+00 until km 110+00 is crossed with 73 water ducts, including big rivers like Adjaristskali, Satsikhuri, Diakonezi and Tabakhmelitskali. It should be noted that on separate sections, especially on Goderdzi pass, rehabilitation road is meandered, and is crossed with the same unnamed streams several times. For this reason, whole quantity of crossings are 91.

Below is given short hidrographic description of rehabilitation road main crossing rivers.

River Adjaristskali outfalls from Arsiani slope's Western ridge Norther part, in the East of mount Chanchakhi (2506,7 m) in 1 km on the height of 2450 meters and attaches to river Chorokhi from the right side of village Kveda Khertvisi in 1 km. Total length of river is 90 km, overall decline 2397 m, average inclination 26, 6 ‰, watershed area 1540 km², average height of pool is 1400 m.

Hydrographic network of the riverbed consists of 988 rivers, the total length of which is 2165 km. The main tributaries of the river are Satsikhuri (14 km length), Skhalta (29 km), Tsurukhitskali (32 km), Etsvanistskali (21 km) and Akavreta (19 km).

River watershed bed boundary passes along watersheds of Chakvi, Adjara-Imereti, Arsiani and Savseti. River bed is distinguished with mountainous, segregated terrain, watershed benchmarks, which exceed 1500-2000 m.

In the geological construction participate tuff genes, sandstones and clay-slates. There are also young andezite-basalt lavas. The basin is engaged with dense mixed forest, which are replaced on watershed ridge with alpine plants.

River stream on it whole length is of V shape. Its bottom width changes from 5-20 meters to 200-250 meters. Steep slopes valleys are tall and merge with adjacent ridges slopes. Steep slopes in different places represent river rocky shores. The confluence of the slopes are terraced. The width of the bilateral river terraces change from 20 to 30 meters, height from 3 to 10 meters. Terrace surfaces are smooth and planted. Bilateral river floodplains, 40-100 meters width can be found in the middle and lower reaches. Floodplains, height of which is 0, 5-1, 2 meters, is flooded during floods on 0, 3_1, 0 meters.

River bed on the whole length is moderately curved and branched in middle and lower reaches. Alluvial islands with the length of 10-100 meters and width of 5-30 meters and height of 0,5-1,0 meters, can be met on each 0,5-1 km. Origins of the river bed are characterized with high slopes (100-115‰) and rocky rapids. In different locations waterfalls are common, the tallest of which is of 12-13 meters. On other sections, slopes change with smooth flow sections on every 100-300 meter. The flow width changes from 1-6 meters up to 40-60 meters, depth 0,2-0,8 meters, 0,5-1,5 meters, and speed from 1,5-2,0 m/s till 0,8-1,2 m/s.

The river is fed by snowy, rainy and soil waters. In addition in river feeding high is the role of snowy water, which is increased at the beggining of the river head. River watery regime is characterized with spring floods, autumn floodings and summer and winter water shortages. In the spring, there flows 50% of annual runoff, in summer 17%, in Autumn 19% and in Winter 14%.

Batumi-Akhaltsikhe rehabilitation road is crossed by river Adjaristskali at village Paksadzeebi. Before the mentioned crossing length is 17,1 km, overall incline 1605 m, average inclination 94,0 ‰, watershed basin area 103 km².

Average multiannual outflow h/s in Khulo Kveti, where river watershed basin area is 251 km², equals to 8,73 m³/s. In the same Kveti, maximum outflow of water was observed on October 30, 1947 of 189 m³/s, and minimal outflow was observed on August 30, 1949 with

0,25 m³/s. Maximum of solid outflow was observed in April of 1968 and composed 460 kg/s, and the minimum equaled to 0,086 kg/s in July of 1979.

River water is suitable for drinking in the period of being clean, transparent and short.

The river is used for power and irrigative purposes.

River Satsikhuri starts in Meskheti slope southern branching in the Eastern part of mount Sakulaferdi (2451,8 m) in 1 km on 2028 meters high and flows into river Adajaristskali from the right side at the village Didatsara on the height of 738 meters. The whole length of the river is 14 km, overall decline 1790 m, average incline 92,9 ‰, watershed basin area 98 km². Rehabilitation road crosses the river 200 metres higher from its start, where its length is 13,8 km. The main tributaries of the river are Rorjomi (8 km length) and Naplatistskali (10 km).

River watershed basin is located on the branching of Meskheti ridge Southern slope and is highly segregated with deep streams of tributaries. It is bordered from the Northern side river Chudurauli, from Eastern Adjarsitskali and from Western river Diakonizeebi watershed, height of which alters from 1652 meters to 2451 meters.

In the geological construction of the basin participate sandstones, clay-slates, andezit-basalt lavas. The basin is engaged with dense mixed forest, which are replaced on watershed ridge with alpine meadows.

River stream on its whole length is of V shape. Its bottom width changes from 3-6 meters to 15-25 meters. Steep slopes valleys are tall and merge with adjacent ridges slopes. Steep slopes in different places represent river rocky shores. The confluence of the slopes are terraced. The width of the bilateral river terraces change from 20 to 1000 meters, height from 3 to 6 meters. Terrace surfaces are smooth and agricultured. Bilateral river floodplains can be found in the middle reaches. Floodplains, height of which is 0, 5-0, 8 meters, is flooded during floods on 0, 5-1, 0 meters.

The river is fed by snowy, rainy and soil waters. In addition in river feeding high is the role of snowy water, which is increased at the beginning of the river head. River watery regime is characterized with spring floods, autumn floodings and summer and winter water shortages. In the spring, there flows 50% of annual runoff, in summer 17%, in Autumn 19% and in Winter 14%.

Average multiannual outflow h/s in Didachara Kveti, where river watershed basin area is 98 km², equals to ,66 m³//s. In the same Kveti, maximum outflow of water was observed on May 3, 1942 of 70,0 m³/s, and minimal outflow was observed on June 22, 1954 with 0,15 m³/s. Maximum of solid outflow was observed in September of 1978 and composed 140 kg/s, and the minimum equaled to 0,007 kg/s in November of 1974.

River water is suitable for drinking in the period of being clean, transparent and short.

The river is used for power purposes.

River Diakonidze starts from Meskheti ridge Southern branch on Eastern side of mount Turgvina (2272,1 m) in 0,1 km on 2075 meters height and attaches to the river Adjaristskali from right side at village Diakonidzeebi on 722 meters height, where it crosses with Batumi-Goderdzi pass on road rehabilitation section. Before the section river length is 8,60 km, overall decline 1350 m, average incline 157 ‰, watershed basin area is 32,2 km². The river is attached by 6 main inflows with total length of 15 km.

River watershed basin is located on the branching of Meskheti ridge Southern slope and is highly segregated with deep streams of inflows. It is bordered from the North-Western side

by river Naghvarevistskali, from Eastern side by Satsikhuri and from Western by river Vanistskali watersheds, height of which changes from 1045 meters to 2272 meters.

In the geological construction of the basin participate sandstones, clay-slates, young andezit-basalt lavas. In the basin widespread are loamy soils of the mountain forest. The basin is engaged with dense mixed forest, which are replaced on watershed ridge with alpine meadows.

The river is fed by snowy, rainy and soil waters. In addition in river feeding high is the role of snowy water, which is increased at the beginning of the river head. River watery regime is characterized with spring floods, autumn floodings and summer and winter water shortages.

River water is suitable for drinking in the period of being clean, transparent and short.

The river is used for rural windmills.

River Tabakhmelistskali outflows from Northern part of mount Mukhelta of Namanseri slope (2336,0 m) in 0,5 km on 2170 meters height and attaches to river Adjaristskali from left side at village Tabakhmela. Before Batumi-Goderdzi pass rehabilitation road crossing the river length is 7,30 km, overall decline 1050 m, average incline 144 ‰, watershed basin area 18,0 km². Several unimportant inflows of the river are totally of 10 km length.

River basin, which is located on Namanseri slopes northern ridge, between Adjaristskali and Skhalta watershed basins, is highly segregated by tributaries and streams. Its watershed heights change from 1452 meters to 2403 meters.

In the geological construction of the basin participate sandstones, marls, andezits, basalts, tuffs and profiteers, which are covered by grey soils of Loamy composition. Plant cover of the basin is characterized by vertical zoning. On the height of 2000 meters widespread is alpine meadows that are replaced by dense mixed forest. Small territory of the basin at the beginning, near village Tabakhmela and Bozauri are used as arable land.

The river is fed by snowy, rainy and soil waters. In addition in river feeding high is the role of snowy water, which is increased at the beginning of the river head. River watery regime is characterized with spring floods, autumn floodings and summer and winter water shortages.

River water is suitable for drinking in the period of being clean, transparent and short.

The river is used for rural windmills.

Feeding sources for other unnamed streams on Batumi-Akhaltzikhe rehabilitation roads and watery regime is identical to abovementioned feeding sources of relatively large rivers, and for this reason their detailed characterization was not considered desirable.

Also, it should be noted that geological structure, their geomorphologic and climate conditions, also after intensive cutting of the forests in their basins and as a result exposure of steep slopes, conditions formation of mudflows.

4.2.5.2. Maximum Outflow of Water and Mudflows

From the rehabilitation section of Batumi-Akhaltzikhe road in the hidrological point of view from the crossing rivers, only river Adjaristskali and river Satsikhuri have been studied. For this reason river Adjaristskali and Satsikhuri water maximum outflow on rehabilitation road crossings is established according to analogy method.

As per request of customer, rehabilitation road crossings, as on hidrologically studied, so on to be studied and unnamed streams maximum outflow of water is settled with 100 years and 50 years repeatable properties (1% and 2% ensuring).

In the proximity of rehabilitation road crossings runoff of river Adjaristskali was studied in hydrologic checkpoint (h/s) at Khulo crossing, where observations were made on river maximum outflow from 1942 until 1991, but officially have been published only including 1986. In the mentioned period, river Adjaristskali maximum outflow values in h/s Khulo crossing ranged from 28,8 m³/s (1966 w) to 189 m³/s (1947 w).

H/s Khulo crossing outflow observation, officially published data variational series of 44 years (1942-69,1971-86) is statistically processed by the method of moments, as a result of which we have received the following parameters of curve distribution:

The maximum cost average multiannual value $Q_0 = \frac{\sum Q_i}{n} = 67,0 \text{ m}^3/\text{s}$;

The coefficient of variation $C_v = \sqrt{\frac{\sum(K-1)^2}{n-1}} = 0,43$;

The asymmetry coefficient is taken from the maximum cost for the $C_s = 4 \cdot C_v = 1,72$.

Variational parameters for evaluation established by the order of representation:

The maximum cost average multiannual value's proportionate square error which is equal to

$$\varepsilon_{Q_0} = \frac{C_v}{\sqrt{n}} \cdot 100 = 6,48 \%$$

The coefficient of variation of proportionate square error $\varepsilon_{C_v} = \sqrt{\frac{1+C_v^2}{2 \cdot n}} \cdot 100 = 11,6 \%$.

The parameters are satisfactory, because of construction norms and requirements $\varepsilon_{Q_0} \leq 10\%$ da $\varepsilon_{C_v} \leq 15\%$.

Also is established mean square deviation, which equals to $\delta = 28,8$.

Derived parameters and through three parameter gamma-distribution normalized ordinates is established maximum outflow of river Adjaristskali of 100 years and 50 years repeatability (1% and 2% guarantee) values in h/s Khulo crossing.

Switch from h/s Khulo crossing to rehabilitation road switch crossing is executed by switch coefficient, value of which is obtained as an image

$$K = \left(\frac{F_{sapr}}{F_{anal}} \right)^N$$

Where F_{sapr} – river Adjaristskali watershed basin area is in rehabilitation road switch crossing, which equals to 103 km²;

F_{anal} – River Adjaristskali watershed basin area is of analogy, or in h/s Khulo crossing, which equals to 251 km²;

N – Quality indicators of reduction which is obtained for maximum outflow of 0, 5.

By entering given numeric values in presented images is obtained from analogy design crossing of switch coefficient value of 0,640i.

By multiplying established maximum outflow in Khulo crossing hydro checkpoint on switching coefficient, Adjaristskali maximum outflow is obtained in rehabilitation road switch cross. Received results are given in №1 table.

Table 4.1.3 river Adjaristskali maximum outflow in m³/s according to established analogy method

| Crossing | FF | Q m ³ /s | Cv | Cs | K | Maximum Outflow |
|----------|----|---------------------|----|----|---|-----------------|
|----------|----|---------------------|----|----|---|-----------------|

| | km ² | ave. | | | | $\tau = 100$ Wels | $\tau = 50$ wels |
|---------|-----------------|------|------|------|-------|----------------------|---------------------|
| analogy | 251 | 67,0 | 0,43 | 1,72 | – | 165 | 150 |
| Design | 103 | 42,9 | – | – | 0,640 | 105 | 96,0 |

Runoff of river Satsikhuri has been studied in hydrological checkpoint (h/s) Didadjara crossing, where observations were made on river maximum outflows from 1942 till 1990, but officially are published only including 1986. In the mentioned period river Satsikhuri's maximum outflow values in Didadjara crossing ranged from 10,3 m³/s (1967) till 70,0 m³/s (1942).

Officially published data of observation during 42 years on h/s Didadjara crossing maximum (1942-48,1950-73,1975-86) variation series are statistically treated by moment method, as a result of which is received curve distribution following parameters:

Average multiannual value of maximum outflows

$$Q_0 = \frac{\sum Q_i}{n} = 34,0 \text{ m}^3/\text{s};$$

$$\text{The coefficient of variation } C_v = \sqrt{\frac{\sum(K-1)^2}{n-1}} = 0,47;$$

The asymmetry coefficient is taken from the maximum cost for the $C_s = 4 \cdot C_v = 1,88$.

Variational parameters for evaluation established by the order of representation:

The maximum cost average multiannual value's proportionate square error which is equal to

$$\varepsilon_{Q_0} = \frac{C_v}{\sqrt{n}} \cdot 100 = 7,20 \%;$$

$$\text{The coefficient of variation of proportionate square error } \varepsilon_{C_v} = \sqrt{\frac{1+C_v^2}{2 \cdot n}} \cdot 100 = 12,0 \%.$$

The parameters are satisfactory, because of construction norms and requirements $\varepsilon_{Q_0} \leq 10\%$ da $\varepsilon_{C_v} \leq 15\%$.

Also is established mean square deviation, which equals to $\delta = 16,0$.

Through dparameters and three parameter gamma-distribution normalized ordinates is established maximum outflow of river Satsikhuri of 100 years and 50 years repeatability (1% and 2% guarantee) values in h/s Didadjara crossing, which practically coincide with rehabilitation road switch, or design crossing.

Maximum outflows of river Satsikhuri in h/s Didadjara or rehabilitations road switch crossing, according to established observational data are given in table #2.

Table 4.14. River Satsikhuri maximum outflows in m³/s according to established observational data

| Crossing | FF km ² | Qm ³ /s ave. | Cv | Cs | Maximum Outflow | |
|----------|-----------------------|----------------------------|------|------|----------------------|---------------------|
| | | | | | $\tau = 100$ wels | $\tau = 50$ wels |
| Design | 98,0 | 34.0 | 0.47 | 1.88 | 89,5 | 80,5 |

As it is obvious from presented #1 da #2 tables, river Adjaristkali and Satsikhuri máximum outflows, based on observational data, are significantly low compared to data published in

hydrological literatura, that can be explained by wáter realistic máximum outflows between the periods of observations and accordingly with their unaccountability.

For this reason, máximum outflow of hydrologically not studied rivers of Adjaristskali and Satsikhuri and other unnamed streams, calculating values of rehabilitation road crossings are done by the method given in “Calculating of Maximum Runoff in Technical Indication among Rivers in Caucasian Conditions”.

According to the method, máximum outflow values of wáter on the rivers and streams, watershed área from which they do not exceed 400 km², is calculated with a formula, which looks like below

$$Q = R \cdot \left[\frac{F^{2/3} \cdot K^{1,35} \cdot \tau^{0,38} \cdot \bar{i}^{0,125}}{(L + 10)^{0,44}} \right] \cdot \Pi \cdot \delta \cdot \lambda \text{ m}^3/\text{s}$$

where R _ regional parameter. Its significance in Western Georgia conditions is of 1,35;

F _ watershed basin área of river or stream is in km²-Si;

K _is regions climate coefficient, significance of which is derived from specially treated map;

τ _Repeatability in years;

\bar{i} _balanced inclination of river or stream is in units from its head until design crossing;

L _length of river or stream bed from head to design crossing in km;

Π _Characteristic coefficient of soil cover existing in river or stream basin. Its significance is derived from specially treated relevant table;

δ _basin shape coefficient. Its significance is in the following image

$$\delta = 0,25 \cdot \frac{B_{\max}}{B_{sas}} + 0,75$$

where B_{\max} _asin maximum width in kms;

B_{sas} _average width of basin in km, its significance is in the image $B_{sas} = \frac{F}{L}$;

λ _is basins’s foresting coefficient, value of which is calculated with the image

$$\lambda = \frac{1}{1 + 0,2 \cdot \frac{F_t}{F}}$$

here F_t _ covered area of basin with the forest in %.

When calculating maximum outflows of the small rivers and streams, watershed basin of which are less then 5 km², in above discised formula additionally is entered into watershed basin areas with specially treated, below given coefficients

Table 4.15. Area Coefficient

| | | | | | | |
|------------------|------|------|------|------|------|------|
| $F \text{ km}^2$ | <1 | 1 | 2 | 3 | 4 | 5 |
| K^1 | 0,70 | 0,80 | 0,83 | 0,87 | 0,93 | 1,00 |

Meaning of morphometric elemets required to calculate maximum outflow of design road crossing rivers and streams, established from 1:25000 scale topograohic map, also guarantee 1% and 2% of water maximum outflow according to calculating formula given above (100 and 50 year repeatability), are given below in #3 table.

In the below #3 table streams watershed basins and relevant numbering sare marked on 1:25000 scale topograohic map.

Table 4.16. Batumi-Akhalsikhe road rehabilitation section crossing rivers and streams water maximum outflow in m³/s

| Crossing # and River Name | F km ² | L km | i kal | Π | K | δ | λ | K ¹ | Maximum outflow | |
|---------------------------------|----------------------|---------|----------|-----|-----|------|------|----------------|--------------------|----------------|
| | | | | | | | | | τ = 100 wels | τ = 50 wels |
| #1 _ gully | 0,91 | 2,07 | 0,285 | 1,0 | 5,0 | 1,18 | 0,96 | 0,70 | 14,0 | 10,2 |
| #2 _ gully | 0,11 | 0,50 | 0,260 | 1,0 | 5,0 | 1,03 | 1,00 | 0,70 | 3,40 | 2,62 |
| #2 ¹ _ gully | 0,11 | 0,50 | 0,260 | 1,0 | 5,0 | 1,03 | 1,00 | 0,70 | 3,40 | 2,62 |
| #3 _ gully | 0,15 | 0,70 | 0,371 | 1,0 | 5,0 | 1,01 | 0,99 | 0,70 | 4,02 | 3,09 |
| #4 _ gully | 0,04 | 0,20 | 0,425 | 1,0 | 5,0 | 1,00 | 1,00 | 0,70 | 1,73 | 1,33 |
| #5 _ gully | 2,34 | 3,55 | 0,239 | 1,0 | 5,0 | 1,26 | 0,95 | 0,84 | 31,1 | 23,9 |
| #5 ¹ _ gully | 0,10 | 0,62 | 0,355 | 1,0 | 5,0 | 1,00 | 0,93 | 0,70 | 2,84 | 2,18 |
| #6 _ gully | 0,05 | 0,35 | 0,600 | 1,0 | 5,0 | 1,14 | 0,85 | 0,70 | 2,01 | 1,54 |
| #7 _ gully | 0,10 | 0,62 | 0,355 | 1,0 | 5,0 | 1,00 | 0,93 | 0,70 | 2,84 | 2,18 |
| #8 _ gully | 0,06 | 0,32 | 0,406 | 1,0 | 5,0 | 1,02 | 0,98 | 0,70 | 2,23 | 1,72 |
| #9- diakoniZe | 32,2 | 8,60 | 0,157 | 1,0 | 5,0 | 1,00 | 0,84 | _ | 125 | 95,0 |
| #10 _ gully | 0,05 | 0,40 | 0,300 | 1,0 | 5,0 | 1,10 | 1,00 | 0,70 | 2,08 | 1,60 |
| #11 _ gully | 0,12 | 0,75 | 0,347 | 1,0 | 5,0 | 1,22 | 1,00 | 0,70 | 4,19 | 3,22 |
| #12 _ gully | 0,06 | 0,30 | 0,450 | 1,0 | 5,0 | 1,00 | 0,98 | 0,70 | 2,22 | 1,71 |
| #12 ¹ _ gully | 0,05 | 0,40 | 0,300 | 1,0 | 5,0 | 1,10 | 1,00 | 0,70 | 2,08 | 1,60 |
| #13 _ gully | 0,14 | 1,00 | 0,225 | 1,0 | 5,0 | 1,15 | 0,99 | 0,70 | 4,06 | 3,12 |
| #14 _ gully | 0,12 | 0,80 | 0,219 | 1,0 | 5,0 | 1,17 | 0,99 | 0,70 | 3,75 | 2,88 |
| #15- sacixuri | 98,0 | 13,8 | 0,093 | 1,0 | 5,0 | 1,00 | 0,84 | _ | 220 | 170 |
| #16 _ gully | 0,19 | 0,88 | 0,517 | 1,0 | 5,0 | 1,01 | 0,87 | 0,70 | 4,54 | 3,49 |
| #17 _ gully | 0,38 | 1,40 | 0,557 | 1,0 | 5,0 | 1,03 | 0,88 | 0,70 | 6,96 | 5,35 |
| #17 ¹ _ gully | 0,04 | 0,30 | 0,583 | 1,0 | 5,0 | 1,00 | 0,94 | 0,70 | 1,68 | 1,29 |
| #18 _ gully | 1,19 | 1,80 | 0,450 | 1,0 | 5,0 | 1,13 | 0,89 | 0,81 | 18,3 | 14,1 |
| #19 _ gully | 0,13 | 0,50 | 0,570 | 1,0 | 5,0 | 1,00 | 0,89 | 0,70 | 3,46 | 2,66 |
| #20 _ gully | 0,04 | 0,30 | 0,583 | 1,0 | 5,0 | 1,00 | 0,94 | 0,70 | 1,68 | 1,29 |
| #21 _ gully | 0,012 | 0,12 | 0,417 | 1,0 | 5,0 | 1,06 | 1,00 | 0,70 | 0,83 | 0,62 |
| #22 _ gully | 0,15 | 0,65 | 0,531 | 1,0 | 5,0 | 1,08 | 0,97 | 0,70 | 4,42 | 3,40 |
| #23 _ gully | 0,18 | 0,68 | 0,515 | 1,0 | 5,0 | 1,00 | 0,91 | 0,70 | 4,31 | 3,31 |
| #24 _ gully | 0,59 | 1,53 | 0,435 | 1,0 | 5,0 | 1,14 | 0,96 | 0,70 | 10,9 | 8,38 |
| #25- aWariswyali | 103 | 17,1 | 0,094 | 1,0 | 5,0 | 1,00 | 0,88 | _ | 225 | 175 |
| #26 _ gully | 0,05 | 0,30 | 0,500 | 1,0 | 5,0 | 1,00 | 0,96 | 0,70 | 1,95 | 1,50 |
| #27 _ gully | 0,08 | 0,45 | 0,522 | 1,0 | 5,0 | 1,00 | 0,91 | 0,70 | 2,53 | 1,95 |
| #28 _ gully | 0,17 | 0,80 | 0,556 | 1,0 | 5,0 | 1,01 | 0,86 | 0,70 | 3,97 | 3,05 |
| #29 _ gully | 1,41 | 2,55 | 0,308 | 1,0 | 5,0 | 1,11 | 0,88 | 0,81 | 18,6 | 14,3 |
| #30 _ gully | 0,09 | 0,40 | 0,688 | 1,0 | 5,0 | 1,03 | 0,83 | 0,70 | 2,67 | 2,05 |
| #31 _ gully | 0,09 | 0,63 | 0,476 | 1,0 | 5,0 | 1,10 | 0,89 | 0,70 | 2,89 | 2,22 |

| Crossing # and River Name | F km ² | L km | i kal | Π | K | δ | λ | K^1 | Maximum outflow | |
|---------------------------------|------------------------|-----------|------------|-------|-----|----------|-----------|-------|-------------------------|---------------------|
| | | | | | | | | | $\tau =$ 100 wels | $\tau = 50$ wels |
| #32 _ gully | 3,94 | 3,05 | 0,334 | 1,0 | 5,0 | 1,09 | 0,89 | 0,93 | 41,9 | 32,2 |
| #33 _ gully | 0,04 | 0,23 | 0,435 | 1,0 | 5,0 | 1,04 | 0,84 | 0,70 | 1,51 | 1,16 |
| #34 _ gully | 0,29 | 0,85 | 0,294 | 1,0 | 5,0 | 1,04 | 0,89 | 0,70 | 5,59 | 4,30 |
| #35 _ gully | 4,28 | 3,45 | 0,317 | 1,0 | 5,0 | 1,10 | 0,86 | 0,95 | 43,2 | 33,2 |
| #36 _ gully | 0,14 | 0,60 | 0,317 | 1,0 | 5,0 | 1,00 | 0,94 | 0,70 | 3,56 | 2,74 |
| #36 ¹ _ gully | 0,13 | 0,58 | 0,466 | 1,0 | 5,0 | 1,03 | 0,85 | 0,70 | 3,31 | 2,54 |
| #37 _ gully | 0,16 | 0,53 | 0,377 | 1,0 | 5,0 | 1,00 | 0,93 | 0,70 | 3,94 | 3,03 |
| #38 _ gully | 0,11 | 0,55 | 0,436 | 1,0 | 5,0 | 1,00 | 0,88 | 0,70 | 2,95 | 2,27 |
| #39 _ gully | 0,13 | 0,58 | 0,466 | 1,0 | 5,0 | 1,03 | 0,85 | 0,70 | 3,31 | 2,54 |
| #40 _ gully | 0,09 | 0,43 | 0,407 | 1,0 | 5,0 | 1,00 | 0,86 | 0,70 | 2,51 | 1,93 |
| #41 _ gully | 0,15 | 0,73 | 0,363 | 1,0 | 5,0 | 1,05 | 0,88 | 0,70 | 3,71 | 2,85 |
| #42- tabaxmela | 18,0 | 7,30 | 0,144 | 1,0 | 5,0 | 1,07 | 0,86 | _ | 95,0 | 70,0 |
| #43 _ gully | 0,25 | 1,03 | 0,325 | 1,0 | 5,0 | 1,08 | 0,97 | 0,70 | 5,75 | 4,42 |
| #44 _ gully | 0,06 | 0,35 | 0,343 | 1,0 | 5,0 | 1,04 | 1,00 | 0,70 | 2,28 | 1,75 |
| #44 ¹ _ gully | 0,06 | 0,35 | 0,343 | 1,0 | 5,0 | 1,04 | 1,00 | 0,70 | 2,28 | 1,75 |
| #45 _ gully | 0,18 | 0,75 | 0,427 | 1,0 | 5,0 | 1,09 | 0,93 | 0,70 | 4,67 | 3,59 |
| #46 _ gully | 0,12 | 0,80 | 0,419 | 1,0 | 5,0 | 1,00 | 0,92 | 0,70 | 3,23 | 2,48 |
| #47 _ gully | 0,19 | 0,96 | 0,438 | 1,0 | 5,0 | 1,09 | 0,92 | 0,70 | 4,77 | 3,67 |
| #48 _ gully | 0,18 | 0,70 | 0,464 | 1,0 | 5,0 | 1,13 | 0,94 | 0,70 | 4,96 | 3,81 |
| #49 _ gully | 0,81 | 1,88 | 0,372 | 1,0 | 5,0 | 1,21 | 0,92 | 0,70 | 13,2 | 10,2 |
| #50 _ gully | 0,46 | 1,45 | 0,386 | 1,0 | 5,0 | 1,10 | 0,95 | 0,70 | 8,70 | 6,67 |
| #51 _ gully | 0,08 | 0,50 | 0,230 | 1,0 | 5,0 | 1,00 | 0,99 | 0,70 | 2,48 | 1,90 |
| #52 _ gully | 0,12 | 0,60 | 0,317 | 1,0 | 5,0 | 1,09 | 0,95 | 0,70 | 3,54 | 2,72 |
| #53 _ gully | 0,07 | 0,30 | 0,417 | 1,0 | 5,0 | 1,00 | 0,92 | 0,70 | 2,29 | 1,76 |
| #54 _ gully | 0,08 | 0,46 | 0,391 | 1,0 | 5,0 | 1,00 | 0,98 | 0,70 | 2,63 | 2,02 |
| #54 ¹ _ gully | 0,08 | 0,46 | 0,391 | 1,0 | 5,0 | 1,00 | 0,98 | 0,70 | 2,63 | 2,02 |
| #55 _ gully | 0,28 | 1,05 | 0,405 | 1,0 | 5,0 | 1,08 | 0,89 | 0,70 | 5,85 | 4,49 |
| #56 _ gully | 0,11 | 0,63 | 0,428 | 1,0 | 5,0 | 1,07 | 0,85 | 0,70 | 3,04 | 2,33 |
| #57 _ gully | 0,10 | 0,78 | 0,474 | 1,0 | 5,0 | 1,19 | 0,85 | 0,70 | 3,19 | 2,45 |
| #58 _ gully | 0,07 | 0,40 | 0,475 | 1,0 | 5,0 | 1,00 | 0,85 | 0,70 | 2,14 | 1,64 |
| #59 _ gully | 0,15 | 0,80 | 0,444 | 1,0 | 5,0 | 1,15 | 0,93 | 0,70 | 4,39 | 3,37 |
| #60 _ gully | 0,08 | 0,55 | 0,627 | 1,0 | 5,0 | 1,02 | 0,89 | 0,70 | 2,57 | 1,97 |
| #61 _ gully | 0,13 | 0,52 | 0,308 | 1,0 | 5,0 | 1,00 | 0,86 | 0,70 | 3,09 | 2,38 |
| #62 _ gully | 1,59 | 1,98 | 0,361 | 1,0 | 5,0 | 1,15 | 0,85 | 0,82 | 21,2 | 16,3 |
| #63 _ gully | 1,00 | 2,50 | 0,274 | 1,0 | 5,0 | 1,25 | 0,85 | 0,80 | 15,7 | 12,1 |
| #63 ¹ _ gully | 0,13 | 0,52 | 0,308 | 1,0 | 5,0 | 1,00 | 0,86 | 0,70 | 3,09 | 2,38 |
| #64 _ gully | 15,9 | 6,85 | 0,144 | 1,0 | 5,0 | 1,26 | 0,91 | _ | 109 | 83,7 |
| #65 _ gully | 0,74 | 2,65 | 0,108 | 1,0 | 5,0 | 1,17 | 0,99 | 0,70 | 10,8 | 8,30 |

| Crossing # and River Name | F km ² | L km | i kal | Π | K | δ | λ | K ¹ | Maximum outflow | |
|---------------------------------|----------------------|---------|----------|-----|-----|------|------|----------------|--------------------|----------------|
| | | | | | | | | | τ = 100 wels | τ = 50 wels |
| #66 _ gully | 4,16 | 5,85 | 0,180 | 1,0 | 5,0 | 1,15 | 0,90 | 0,94 | 39,8 | 30,6 |
| #67 _ gully | 0,22 | 0,50 | 0,310 | 1,0 | 5,0 | 1,00 | 0,97 | 0,70 | 4,98 | 3,83 |
| #68 _ gully | 0,05 | 0,25 | 0,380 | 1,0 | 5,0 | 1,00 | 1,00 | 0,70 | 1,96 | 1,51 |
| #68 ¹ _ gully | 0,05 | 0,25 | 0,380 | 1,0 | 5,0 | 1,00 | 1,00 | 0,70 | 1,96 | 1,51 |
| #69 _ gully | 0,02 | 0,15 | 0,400 | 1,0 | 5,0 | 1,00 | 0,98 | 0,70 | 1,06 | 0,81 |
| #69 ¹ _ gully | 0,05 | 0,25 | 0,380 | 1,0 | 5,0 | 1,00 | 1,00 | 0,70 | 1,96 | 1,51 |
| #70 _ gully | 0,06 | 0,30 | 0,400 | 1,0 | 5,0 | 1,06 | 0,88 | 0,70 | 2,09 | 1,60 |
| #71 _ gully | 0,16 | 0,42 | 0,417 | 1,0 | 5,0 | 1,00 | 0,85 | 0,70 | 3,66 | 2,82 |
| #72 _ gully | 0,14 | 0,55 | 0,354 | 1,0 | 5,0 | 1,04 | 0,85 | 0,70 | 3,40 | 2,61 |
| #73 _ gully | 0,20 | 0,70 | 0,371 | 1,0 | 5,0 | 1,12 | 0,85 | 0,70 | 4,63 | 3,56 |
| #74 _ gully | 0,14 | 0,65 | 0,377 | 1,0 | 5,0 | 1,16 | 0,93 | 0,70 | 4,16 | 3,20 |
| #75 _ gully | 0,19 | 0,92 | 0,255 | 1,0 | 5,0 | 1,14 | 0,93 | 0,70 | 4,73 | 3,63 |
| #76 _ gully | 2,80 | 3,90 | 0,210 | 1,0 | 5,0 | 1,13 | 0,93 | 0,86 | 30,6 | 23,5 |
| #77 _ gully | 2,44 | 2,95 | 0,237 | 1,0 | 5,0 | 1,20 | 0,90 | 0,85 | 29,7 | 22,9 |
| #77 ¹ _ gully | 0,07 | 0,35 | 0,314 | 1,0 | 5,0 | 1,00 | 0,96 | 0,70 | 2,30 | 1,76 |
| #78 _ gully | 0,07 | 0,35 | 0,314 | 1,0 | 5,0 | 1,00 | 0,96 | 0,70 | 2,30 | 1,76 |
| #79 _ gully | 0,17 | 0,65 | 0,292 | 1,0 | 5,0 | 1,04 | 0,84 | 0,70 | 3,72 | 2,86 |
| #80 _ gully | 1,51 | 1,85 | 0,211 | 1,0 | 5,0 | 1,18 | 0,94 | 0,82 | 21,9 | 16,8 |
| #81 _ gully | 0,11 | 0,40 | 0,325 | 1,0 | 5,0 | 1,04 | 1,00 | 0,70 | 3,39 | 2,60 |
| #82 _ gully | 0,10 | 0,50 | 0,250 | 1,0 | 5,0 | 1,06 | 1,00 | 0,70 | 3,12 | 2,40 |
| #83 _ gully | 0,60 | 2,02 | 0,191 | 1,0 | 5,0 | 1,13 | 1,00 | 0,70 | 10,0 | 7,71 |
| #84 _ gully | 0,13 | 1,38 | 0,174 | 1,0 | 5,0 | 1,08 | 1,00 | 0,70 | 3,50 | 2,69 |
| #85 _ gully | 0,58 | 1,87 | 0,195 | 1,0 | 5,0 | 1,11 | 1,00 | 0,70 | 9,73 | 7,48 |
| #86 _ gully | 0,09 | 0,35 | 0,200 | 1,0 | 5,0 | 1,00 | 1,00 | 0,70 | 2,68 | 2,06 |
| #87 _ gully | 0,04 | 0,20 | 0,350 | 1,0 | 5,0 | 1,06 | 1,00 | 0,70 | 1,79 | 1,37 |
| #88 _ gully | 0,12 | 0,50 | 0,200 | 1,0 | 5,0 | 1,04 | 1,00 | 0,70 | 3,37 | 2,59 |
| #89 _ gully | 0,07 | 0,40 | 0,375 | 1,0 | 5,0 | 1,04 | 0,99 | 0,70 | 2,51 | 1,93 |
| #90 _ gully | 0,06 | 0,22 | 0,409 | 1,0 | 5,0 | 1,00 | 1,00 | 0,70 | 2,25 | 1,73 |
| #91 _ gully | 0,05 | 0,30 | 0,233 | 1,0 | 5,0 | 1,00 | 1,00 | 0,70 | 1,84 | 1,42 |
| #92 _ gully | 0,39 | 1,10 | 0,192 | 1,0 | 5,0 | 1,07 | 1,00 | 0,70 | 7,39 | 5,68 |
| #93 _ gully | 0,02 | 0,16 | 0,250 | 1,0 | 5,0 | 1,00 | 0,99 | 0,70 | 1,01 | 0,78 |
| #94 _ gully | 0,16 | 0,62 | 0,214 | 1,0 | 5,0 | 1,06 | 1,00 | 0,70 | 4,17 | 3,20 |
| #95 _ gully | 0,11 | 0,55 | 0,254 | 1,0 | 5,0 | 1,06 | 1,00 | 0,70 | 3,32 | 2,55 |
| #96 _ gully | 0,09 | 0,30 | 0,233 | 1,0 | 5,0 | 1,00 | 1,00 | 0,70 | 2,74 | 2,10 |

In above given #3 table rivers – Diakonidze, Satsikhuri, Adjaristskali and Tabakhmelistskali maximum outflows are received as calculating values on Batumi-Akhaltshikhe road rehabilitation section.

Significant areas of Batumi-Akhaltshikhe road rehabilitation section crossing unnamed streams basin are exposed, as a result gravitational processes (Rockfall etc.) take place

intensively and on the bottom of the basin large quantity of solid materials are being gathered. The latter in the process of floodings represent a source of intensive filling the floe with solid materials, as a result of which the given meaning of the basins longitudinal slopes, flooding flows are loaded with clastic materials and create double phase of of flow, mudflow. In similar stony and watery mudflows, volume of solid waste (Volumetric concentration) reaches $\beta_z = 0,20_0,25$. In our case, for the research gullies significance of β_z is averagely 0,22 that will equal to mudflow concentration

$$\beta_s = \frac{\beta_z}{1 + \beta_z} = \frac{0.22}{1 + 0.22} = 0.18$$

From here, doublé phase or mudflow outflow will equal to

$$Q_s = Q_w \cdot \frac{1}{1 - \beta_s} \text{ m}^3/\text{s}$$

where Q_w -water calculation guarantee máximum outflow will be m^3/s ;

Research gullies mudflows máximum outflows are given in table #4.

Table 4.17. Maximum Outflow of Crossing Rivers and Gullies Mudflows on Batumi-Akhalsikhe Road Rehabilitation in m^3/s

| Crossing # | Water Maximum Outflow | | Mudflow Maximum Outflow | |
|-------------|-----------------------|----------------------|-------------------------|-----------------------|
| | $\tau = 100$ years | $\tau = 50$ years | $\tau = 100$ wels | $\tau = 100$ years |
| #1 _ gully | 14,0 | 10,2 | 17,1 | 12,4 |
| #2 _ gully | 3,40 | 2,62 | 4,15 | 3,20 |
| #3 _ gully | 4,02 | 3,09 | 4,90 | 3,77 |
| #4 _ gully | 1,73 | 1,33 | 2,11 | 1,62 |
| #5 _ gully | 31,1 | 23,9 | 37,9 | 29,2 |
| #6 _ gully | 2,01 | 1,54 | 2,45 | 1,88 |
| #7 _ gully | 2,84 | 2,18 | 3,46 | 2,66 |
| #8 _ gully | 2,23 | 1,72 | 2,72 | 2,10 |
| #10 _ gully | 2,08 | 1,60 | 2,54 | 1,95 |
| #11 _ gully | 4,19 | 3,22 | 5,11 | 3,93 |
| #12 _ gully | 2,22 | 1,71 | 2,71 | 2,10 |
| #13 _ gully | 4,06 | 3,12 | 4,95 | 3,81 |
| #14 _ gully | 3,75 | 2,88 | 4,58 | 3,51 |
| #16 _ gully | 4,54 | 3,49 | 5,54 | 4,26 |
| #17 _ gully | 6,96 | 5,35 | 8,49 | 6,53 |
| #18 _ gully | 18,3 | 14,1 | 22,3 | 17,2 |
| #19 _ gully | 3,46 | 2,66 | 4,22 | 3,24 |
| #20 _ gully | 1,68 | 1,29 | 2,05 | 1,57 |
| #21 _ gully | 0,83 | 0,62 | 1,01 | 0,76 |
| #22 _ gully | 4,42 | 3,40 | 5,39 | 4,15 |
| #23 _ gully | 4,31 | 3,31 | 5,26 | 4,04 |
| #24 _ gully | 10,9 | 8,38 | 13,3 | 10,2 |
| #26 _ gully | 1,95 | 1,50 | 2,38 | 1,83 |
| #27 _ gully | 2,53 | 1,95 | 3,09 | 2,38 |

| Crossing # | Water Maximum Outflow | | Mudflow Maximum Outflow | |
|-------------|-----------------------|----------------------|-------------------------|-----------------------|
| | $\tau = 100$ years | $\tau = 50$ years | $\tau = 100$ wels | $\tau = 100$ years |
| #28 _ gully | 3,97 | 3,05 | 4,84 | 3,72 |
| #29 _ gully | 18,6 | 14,3 | 22,7 | 17,4 |
| #30 _ gully | 2,67 | 2,05 | 3,26 | 2,50 |
| #31 _ gully | 2,89 | 2,22 | 3,53 | 2,71 |
| #32 _ gully | 41,9 | 32,2 | 51,1 | 39,3 |
| #33 _ gully | 1,51 | 1,16 | 1,84 | 1,42 |
| #34 _ gully | 5,59 | 4,30 | 6,82 | 5,25 |
| #35 _ gully | 43,2 | 33,2 | 52,7 | 40,5 |
| #36 _ gully | 3,56 | 2,74 | 4,34 | 3,34 |
| #37 _ gully | 3,94 | 3,03 | 4,81 | 3,70 |
| #38 _ gully | 2,95 | 2,27 | 3,60 | 2,77 |
| #39 _ gully | 3,31 | 2,54 | 4,04 | 3,10 |
| #40 _ gully | 2,51 | 1,93 | 3,06 | 2,35 |
| #41 _ gully | 3,71 | 2,85 | 4,53 | 3,48 |
| #43 _ gully | 5,75 | 4,42 | 7,02 | 5,39 |
| #44 _ gully | 2,28 | 1,75 | 2,78 | 2,14 |
| #45 _ gully | 4,67 | 3,59 | 5,70 | 4,38 |
| #46 _ gully | 3,23 | 2,48 | 3,94 | 3,02 |
| #47 _ gully | 4,77 | 3,67 | 5,82 | 4,48 |
| #48 _ gully | 4,96 | 3,81 | 6,05 | 4,65 |
| #49 _ gully | 13,2 | 10,2 | 16,1 | 12,4 |
| #50 _ gully | 8,70 | 6,67 | 10,6 | 8,14 |
| #51 _ gully | 2,48 | 1,90 | 3,03 | 2,32 |
| #52 _ gully | 3,54 | 2,72 | 4,32 | 3,32 |
| #53 _ gully | 2,29 | 1,76 | 2,79 | 2,15 |
| #54 _ gully | 2,63 | 2,02 | 3,21 | 2,46 |
| #55 _ gully | 5,85 | 4,49 | 7,14 | 5,48 |
| #56 _ gully | 3,04 | 2,33 | 3,71 | 2,84 |
| #57 _ gully | 3,19 | 2,45 | 3,89 | 2,99 |
| #58 _ gully | 2,14 | 1,64 | 2,61 | 2,00 |
| #59 _ gully | 4,39 | 3,37 | 5,36 | 4,11 |
| #60 _ gully | 2,57 | 1,97 | 3,14 | 2,40 |
| #61 _ gully | 3,09 | 2,38 | 3,77 | 2,90 |
| #62 _ gully | 21,2 | 16,3 | 25,9 | 19,9 |
| #63 _ gully | 15,7 | 12,1 | 19,2 | 14,8 |
| #64 _ gully | 109 | 83,7 | 133 | 102 |
| #65 _ gully | 10,8 | 8,30 | 13,2 | 10,1 |
| #66 _ gully | 39,8 | 30,6 | 48,6 | 37,3 |
| #67 _ gully | 4,98 | 3,83 | 6,08 | 4,67 |
| #68 _ gully | 1,96 | 1,51 | 2,39 | 1,84 |
| #69 _ gully | 1,06 | 0,81 | 1,29 | 0,99 |

| Crossing # | Water Maximum Outflow | | Mudflow Maximum Outflow | |
|-------------|-----------------------|----------------------|-------------------------|-----------------------|
| | $\tau = 100$ years | $\tau = 50$ years | $\tau = 100$ wels | $\tau = 100$ years |
| #70 _ gully | 2,09 | 1,60 | 2,55 | 1,95 |
| #71 _ gully | 3,66 | 2,82 | 4,46 | 3,44 |
| #72 _ gully | 3,40 | 2,61 | 4,15 | 3,18 |
| #73 _ gully | 4,63 | 3,56 | 5,65 | 4,34 |
| #74 _ gully | 4,16 | 3,20 | 5,08 | 3,90 |
| #75 _ gully | 4,73 | 3,63 | 5,77 | 4,43 |
| #76 _ gully | 30,6 | 23,5 | 37,3 | 28,7 |
| #77 _ gully | 29,7 | 22,9 | 36,2 | 27,9 |
| #78 _ gully | 2,30 | 1,76 | 2,81 | 2,15 |
| #79 _ gully | 3,72 | 2,86 | 4,54 | 3,49 |
| #80 _ gully | 21,9 | 16,8 | 26,7 | 20,5 |
| #81 _ gully | 3,39 | 2,60 | 4,14 | 3,17 |
| #82 _ gully | 3,12 | 2,40 | 3,81 | 2,93 |
| #83 _ gully | 10,0 | 7,71 | 12,2 | 9,41 |
| #84 _ gully | 3,50 | 2,69 | 4,27 | 3,28 |
| #85 _ gully | 9,73 | 7,48 | 11,9 | 9,13 |
| #86 _ gully | 2,68 | 2,06 | 3,27 | 2,51 |
| #87 _ gully | 1,79 | 1,37 | 2,18 | 1,67 |
| #88 _ gully | 3,37 | 2,59 | 4,11 | 3,16 |
| #89 _ gully | 2,51 | 1,93 | 3,06 | 2,35 |
| #90 _ gully | 2,25 | 1,73 | 2,74 | 2,11 |
| #91 _ gully | 1,84 | 1,42 | 2,24 | 1,73 |
| #92 _ gully | 7,39 | 5,68 | 9,02 | 6,93 |
| #93 _ gully | 1,01 | 0,78 | 1,23 | 0,95 |
| #94 _ gully | 4,17 | 3,20 | 5,09 | 3,90 |
| #95 _ gully | 3,32 | 2,55 | 4,05 | 3,11 |
| #96 _ gully | 2,74 | 2,10 | 3,34 | 2,56 |

Maximum outflow of mudflow unnamed rivers and gullies crossing Batumi-Akhaltzikhe road rehabilitation sections, given in table #4, are received according to calculating values of design crossings.

4.3. Soil, Landscape and Vegetative Cover

4.3.1. Soil Cover

Introduction

During construction of Batumi (Angisa) – Akhaltzikhe motorway’s Khulo-Goderdzi (km 80- km 110) section, which carries high significance for the state, it is very important to protect environment and especially one of its components – soil. Land excavation works need to

be carried out in Georgia under the existing environmental, soil protection legislation and the internationally accepted standards.

On the initial phase of construction it is very important to research the soil cover, type and main characteristics (soil, soil thickness, mechanical composition, structure) that run along the road.

Laws and Regulations on the Protection of Soil

During construction of Batumi (Angisa) – Akhaltsikhe motorway's Khulo-Goderdzi (km 80- km 110) section, which carries high significance for the state, protection and conservation of removed soil cover should happen according to the acting legislation and regulation of Georgia on environment protection, namely:

Georgian law on „Protection of the Soil" (12.05.1996)

„Topsoil Removal, Storage, Use and Cultivation“ Technical Regulation, Georgian Government Decree N 424, 31.12.2013)

„Environmental Damage Determination (Calculation) Methods (Technical Regulation, Georgian Government Decree N 54; 14.01.2014)

Natural Conditions, Land and Soil-Forming Bedrock (short review)

During construction of Batumi (Angisa) – Akhaltsikhe motorway's Khulo-Goderdzi (km 80- km 110) section, which carries high significance for the state is located on the territory of Khulo Municipality. The section will cross the villages of Khulo Municipality. The length of road project section is 30 km.

Part of design road surrounding territories are presented in agricultural lands (Meadows, pastures, arable land), majority of which are slightly and averagely eroded. The rest of the part is presented by natural forest landscapes.

Soil-forming rocks are mainly represented by volcanic and sedimentary rocks and their weathering products.

Soil Classification and Zoning

Soil and zoning classification is based on the geological structure of the territory, terrain, climate, hydrological regime, vegetation and anthropogenic factors.

According to the soil-geographical zoning scheme (m.sabashvili), soils along the project road are situated between the Southern soil district and Akhaltsikhe-Khulo sub-region zone.

FAO - classification is used as soil taxonomic unit.

Along the project road and in the vicinity the following types of soil are common:

PRIMITIVE MOUNTAIN MEADOW (LEPTOSOL*)
MOUNTAIN MEADOW

MOUNTAIN FOREST MEADOW (HOMIC CAMBISOLS *)
BROWN FOREST ASID (DYSTRIC CAMBISOLS*)

(* - Combined with world database).

Description of Soil According to Sections along Khulo-Zarzma (km 80 – km 110) project road
(see soil map)

Section 1. (km 0+00 – 4+500).

Terrain of mentioned section is slightly inclined. Agricultural land adjacent to the road is of weathering products. In the mentioned section agricultural land is presented in private ownership.

Soil type is Brown Forest Acid, soil is slightly soddy, is of small thickness and has little content of humus, averagely skeletal, and of loamy texture. Upper humus horizon of the soil does not exceed 5-7 cm.

Section 2. (km 4+500 – 7+00)

The terrain is slightly and averagely inclined. Existing territory is covered with forests and meadows. Soil-forming bedrock is presented with igneous and sedimentary rock weathering products.

Soil cover is slightly and averagely eroded. Soil type is mountain forest meadow. Soil is slightly soddy, is of small thickness and has little content of humus, averagely skeletal, and of loamy texture. Upper soddy (A_d) and humus (A₀) horizon of the soil does not exceed 7cms.

Section 3. (km 7+00 – 10+00)

The terrain is averagely inclined. Territory adjacent to the road is covered by forest and meadow grass. Soil-forming bedrock is presented with igneous and sedimentary rock weathering products.

Soil cover is slightly and averagely eroded. Soil type is brown forest acid. The soil is of of small thickness and has little and average content of humus, is averagely skeletal, and of loamy texture. Upper humus (A₀) and (A) horizon of the soil does not exceed 10 cms.

Section 4. (km10+00 – 11+00)

The terrain is slightly and averagely inclined, slightly and averagely eroded. Agricultural land of the existing territory is presented by pasture, mowing fields and arable land, being in private ownership. Soil-forming bedrock is presented with igneous and sedimentary rock weathering products.

Soil cover is slightly and averagely eroded. Soil type is brown forest podzolised. The soil is of small thickness and has little and average content of humus, is averagely skeletal, and of loamy texture. Upper soddy horizon of the soil does not exceed 5-10 cms.

Section 5. (Km 11+00 – 16+500)

The terrain is averagely inclined. The territory is covered with forest and meadow degraded plants. Soil-forming bedrock is presented with igneous and sedimentary rock weathering products.

Soil cover is slightly and averagely eroded. Soil type is brown forest acid. The soil is of small thickness and has little and average content of humus, is averagely skeletal, and of loamy texture. Upper humus (A₀) and (A) horizon does not exceed 10 cms.

Section 6. (km 16+500 – 21+500)

The terrain is slightly and averagely inclined. The territory is covered with forest and degraded meadows. Soil-forming bedrock is presented with igneous and sedimentary rock weathering products.

Soil cover is slightly, averagely and on separate places eroded. Soil type is brown forest acid. The soil is of small thickness and has little and average content of humus, is averagely skeletal, and of loamy texture. Soil upper soddy (A_d) and (A₀) horizon does not exceed 5-7 cms.

Section 7. (km 21+500 – 24+800)

The terrain is averagely and on separate places is highly inclined, averagely eroded. The territory is covered with forest and degraded pasture. Along the road can be met arable lands of private ownership. Soil-forming bedrock is presented with igneous and sedimentary rock weathering products.

Soil cover is slightly and averagely eroded. Soil type is brown forest acid. The soil is of small thickness and has little and average content of humus, is averagely skeletal, and of loamy texture. Upper humus, (A_d) and (A₀) and arable (A_p) horizon does not exceed 10 cms.

Section 8. (km 24+800 – 28+700)

The terrain is averagely and on separate places is highly inclined, averagely and highly eroded. The territory is covered with forest and degraded pasture. Soil-forming bedrock is present with igneous and sedimentary rock weathering products.

Soil cover is averagely eroded. Soil type is mountain forest meadow. The soil is of small thickness and has little and average content of humus, is averagely skeletal and of loamy texture. Upper humus, (A_d) and (A₀) and arable (A_p) horizon does not exceed 8 cms.

Section 9. (KM 28+700 – 30+00)

The terrain is averagely inclined and averagely eroded. The territory is covered with bushes and degraded pastures. Soil-forming bedrock is presented with igneous and sedimentary rock weathering products.

Soil cover is slightly and averagely eroded. Soil type is mountain meadow soddy. The soil is of small thickness and has little and average content of humus, is averagely skeletal and of loamy texture. Soil humus upper soddy (A_d) does not exceed 5-7 cms.

4.3.2. Landscape

Motorway corridor runs from alpine zone to Skhalta valley, where its mixed forests cross steep slopes and deep valleys. Along with decrease of heights landscapes also change. In the valley subtropic climate is dominant as it is typical for mountainous Adjara. River valleys here are deep and covered with dense vegetation and are bordered with steep slopes. Slopes are covered with forests that are typical for Southern-Western Georgia, where dominant types are hornbeam, oak and beech. Vegetation of mountainous Adjara, if we compare it to Adjara Foothills and Adjara –Imereti ridge Northern slope vegetation, is relatively poor with Kolkheti flora relic elements and Western and array typical character of Southern Caucasus mountains. Vegetative forested belt on absolute height of 1200-1300 metres is divided into two sub-belts. In the below belt is dominating are deciduous species (Beech, Oak, Maple, Chestnut) and Pine. In the upper belt dark coniferous species (Spruce, Fir) and Birch.

On this section of the road we can outline the following landscapes:

Foothills covered with Colchis vegetation;

Average mountain zone covered with Colchis vegetation, which is presented by Beech and dark beech coniferous forests, where are common evergreen underbrushes;

In the landscapes of Caucasians tall mountain zones, which are presented by beech and pine forests;

In terms of land use, only small portion of this territory is populated or is arable. As it was mentioned, the major part of the territory is covered with forests. Villages are located near rivers, along main roads that pass through Deep valleys. Agricultural lands are used for beans and vegetable cultivation.

In the downstream of river Skhalta and river Adjaristskali the valley is widening and the slopes covered with forest are less steep. On the bottom of river Adjaristskali and in the bottom parts of valley slopes, vegetation is quite xerophyllous – alpine meadows are striped along the Mountain ridges of Adjara-Imereti and Savsheti and are more widespread on Arsiani ridge in the south of Goderdzi pass. On the highest level of the latter are swampy areas to which are connected small islands of watery and swampy vegetations, where are lots of boreal elements and mosses, sundew etc. Although, with main characteristics landscapes resemble Skhalta and Adjaristskali valley landscapes. ETL on this section follows existing infrastructure, because the road, villages, agricultural lands are located narrow areas of Adjaristskali valley.

Landscapes on this section are relatively modified because of antropogenic factors, cultivated lands are more frequently met and forests are more fragmented, villages are larger and

generally, more territory is used for agricultural purposes. Though, steep slopes of mountain are still covered with forests. Landscapes between River Adjaristskali and river Skhalta and village Khelvachauri are almost identical to the described.

4.3.3. Flora

Design territory includes Akhaltsikhe cave geobotanic district, Meskheta and Arsiani mountains geobotanic region (design territory is located in Adigeni region) and small Caucasian geobotanic district, Adjara-Guria region (design territory includes Adjara autonomous republic territory (later Adjara) Khulo region).

Meskheta and Arsiani ridge's geobotanic region includes Meskheta ridge Southern slope (under Meskheta; Eastern border crosses village Atskuri meridian) and Arsiani ridge Eastern slope (in Georgia), including Akhaltsikhe cave bottom adjacent territory (northern part of cave).

In the geological construction of territory are dominating tertiary bedrocks (shales, stony sands) and volcanic formations (tuffs, tuff-breccia) with Goderdzi formation material and lavas, tuffs and tuff-breccia compose river Dzindze valley (Arsiani ridge).

Region terrain is dominating type – erosive terrain. There are also volcanic formations, landslide formations, accumulation forms (river flat bottom hollows). Hypsometric extension of the territory is quite wide, from 1000 – 1300 metres (cave bottom) till 2850 metres (r. Mefistskaro).

Hydrographic network of the region is presented in riv. Mtkvari and its left inflows – riv. Kvabliani, Fotskhovi etc.

Regions' vegetative cover is various. Impact of human agricultural activities and overall antropogenic impact on riv. Mtkvari and the old terraces of its inflows was very high even from old times on lower parts of slopes and vegetation there (deforestation and forest burning to expand agricultural lands; cattle grazing disorderly in forests and in their adjacent areas; loading of pastures with cattle; invasion of enemies etc.). All these result that natural vegetation there (mostly oak trees and mixed deciduous forests) are mostly destructed, and soil covers have been washed from the slopes. In dry and rocky locations without forest hemixerophilic and xerophilic plants (that migrated from local and neighboring Minor Asian xerophilic centers) founded the vxerophilic complex vegetation spread in the area.

Specific character of natural conditions and high pressure of antropogenic press on natural plants have conditioned formation of vegetation with its own type of belts, that stand close to the type that transfers from Colchis to Caucasus (one of the types of latter). The mentioned type of belt is presented by forest and sub-alpine belts, also on riv. Mefistskaro is developed alpine belt.

Forest belt includes the territory starting from cave bottom up to 1800-1850 meters. In the bottom part of the forest belt (up to 1200-1300 meters), that should count as (still) in oak trees (*Quercus iberica*) sub-belt, are widespread oak trees and mixed Deciduous forests vegetations of the last stage of antropogenic digress – hemixerophilic and xerophilic complexes, namely Tragacanthic glerdziani (*Astragalus microcephalus*) and Zgharbiani (*Acantholimon armenum*), Joris Zuiani (*Ephedra procera*), semi-desert type of plant groups (dominants - *Nitraria schoberi*, *Reaumuria kusnetzovii*), Trimlians (*Cotinus coggygria*), Savjagians (*Rhamnus pallasii*), uroians (*Botriochloa ischaemum*) and Avshnian-Uronians (*Artemisia fragrans*, *Botriochloa ischaemum*) and Avshnian-Uronians (*Artemisia fragrans*,

Botriochloa ischaemum) teppe and etc. Core forests – oak trees (*Quercus iberica*), Hornbeam-Oak trees (*Carpinus caucasica*, *Quercus iberica*) and mixed Deciduous trees (Georgian Oak, Hornbeam, Field maple - *Acer campestre*, Ash - *Fraxinus excelsior*, Ukhravi - *Ostrya carpinifolia* and etc.) do still exist mostly in small sections and fragments.

From 1200-1300 meters to 1800-1850 meters in phytolandscape dominate coniferous forests (Coniferous forest sub-belt). Widespread are spruces forests (*Picea orientalis*). Fir-Spruces (*Abies nordmanniana*, *Picea orientalis*), Beech-Spruces (*Fagus orientalis*, *Picea orientalis*) and Pine-Spruces (*Pinus kochiana*, *Picea orientalis*). Relatively limited are pure Silver firs (*Abies nordmanniana*), and more limited is spread of Beech (*Fagus orientalis*) (both are mostly common in Western part). Pines forests (*Pinus kochiana*) are also quite common. Southern, Southern-Eastern and Southern-Western exposition on dry slopes is mostly common with Pine and Oak trees (in bottom part Georgian Oak - *Quercus iberica*, upper part Mountain Oak - *Quercus macranthera*). On the slopes of North, West, North-East exposition are dominating Dark coniferous forests (Spruces, Spruce Fir, Beech- Spruce, Fir). In other formations are not observed temporary Pines (*Pinus kochiana*), Hornbeams (*Carpinus caucasica*), rarely- Beech-Spruces (*Fagus orientalis*).

Region's dark coniferous and Pine forests are quite various from typological point of view. Dry and semi-dry type of forests are dominating (Associations), which is mostly conditioned with climate features (dryness). In the most common associations of the forests we meet: from Spruces – Spruce Mountain Fescue covers (*Festuca montana*), Spruce mosses cover (*Hylocomium splendens*), Spruce Mzhavela cover (*Oxalis acetosella*), Spruce dry (*Piceetum siccum*) and etc; From Pinewood - Pine forest broom cover (*Cytisus caucasicus*), Pine Arjakeli cover (*Lathyrus roseus*), Pinewood bersela cover (*Brachypodium silvaticum*), Pinewood Ieli underbrushes (*Rhododendron luteum*), Pinewood Forb cover, Pinewood dry (*Pinetum siccum*) and etc.

Coniferous forests sub-belt up to 1600-1700 metres high, on Southern and Southern-Eastern exposition dry slopes is spread steppe and xerophilic complex vegetation (mostly same as oak forest sub-belt), but their representatives in phytolandscape cannot take wider participation.

Sub-alpine belt spreads from 1800-1850 meters till 2500 meters. In the bottom part of the belt (up to 2000-2100 meters is spread sub-alpine (Mountainous) forests, in the composition of which participate – Mountainous Spruce (*Picea orientalis*), Mountainous Pinewood (*Pinus kochiana*), mountainous Oak (*Quercus macranthera*) and Birch (*Betula litwinowii*). In the Western part of the region can be met Mountainous Beechwood (*Fagus orientalis*). Sub-alpine forests area under antropogenic factors is highly decreased, and forest structure is more or less violated.

Sub-alpine meadows hold wide territory, in the compositions of which dominate polydominant forb meadow with its various varieties. In the northern slope are fragmentally met tall herbaceous vegetation.

From sub-alpine bushes there is Rhododendron scrubs term (*Rhododendron caucasicum*), cenoses of which is developed in Northern exposition slope. In Southern exposition slope are observed Rviani (*Juniperus depressa*) minor sections and fragments. Alpine belt is developed only in riv. Mefistskaro (3850m) ridges. Vegetative cover is presented mostly in alpine polydominant forbs meadow.

In the region you can find rare event – so-called “Goderdzi Flora”. After the volcanic eruption under the ashes was buried subtropic forest of those times (Neogene Sarmatian-

Pontic Ages), in the composition of which were: from evergreen plants - palms, laurel species, Magnolia, Myrtle, etc. approximately 90 species. Petrified and semi-petrified trunks of trees and leaf prints are still stored, but are under volcanic tuffs.

Adjarian vegetative cover is quite various, which is conditioned by the variety of natural conditions, also with very difficult history of development of flora and vegetation. As many researchers have observed, Adjara is the richest corner of relict flora. In this area are met the majority of characteristic elements of Colchic flora. Also, exist such relict species, which are widespread on Adjara territory, for example – Medvedev Birch, epigea - *Epigaea gaulterioides* and etc. in Colchic vegetation there are lots of elements of European forest flora. Adjarian, as well as vegetative covers of many mountainous countries, is characterized by different vertical belts. According to Ketskhoveli (1959) in this area several belts are reflected: 1) Hydrophytic forbs and humid forests 0-250 meters from sea level, 2) Colchic evergreen underbrushy forests from 150-250 meters up to 450-500 meters; 3) middle belt of mountains with several sub-belts from 500 meters to 2000 meters and 4) Mountainous, sub-alpine and alpine belts. For the mentioned belts is typical different vegetative complex, which are discussed shortly below.

On design territory are presented mountainous midbelt, according to Ketskhoveli (1959), it includes territory from 500 meters up to 2150 meters from sea level. In this belt are variety of phytocenoses. This is caused by the variety of trees and plants and bushes that are common there and under the impact of human agricultural activities.

In this landscape most significance is on beches, but as Dolukhavon (1957) indicates, beches are common in middle belt but they are not present there where precipitation is less than 500mm. The most important type is met from sea level till sub-alpine belt, but according to Gulisashvili (1955) beech belt, where beech creates grooves of high performance, is located (900) from 1000 meters up to 1500 (1600) meters, but in Dokukhanovi's opinion (1957) optimal area of beech growth from sea level is limited with 800-1300 meters. For this type of forest it is common to fully make major cenotype dominant, though not so rarely together with it in phytocenoses is mixed Hornbeam, Elm, Chestnut, especially in bottom belt of the mountain, Lime and etc. Beech often makes co-dominant phytocenoses with Spruce and Fir. In Adjarian mountains widespread is evergreen understory beches. This kind of beches are typical for Colchis and mostly are connected to humid regions. Understory is created by Shkeri (*Rhododendron ponticum*), Bazgi (*Ilex colchica*), Tskavi (*Laurocerasus officinalis*), somewhere *Rhododendron ungerii* and etc. At the humid locations are also linked Beech ferns. This kind of beches create live covers - *Matteuchia struchiopteris*, *Athyrium filix-femina*, *Driopteris filix-mas*, *Phyllitis scolopendrium* and etc. The latter species are common in different kind of beches, but their share on phytocenosis is not significant.

The mentioned type of beech complex, on relatively less humid slope are presented bushy beches. In this kind of forest underbrushes are created with Deciduous bushes, as are: Yale (*Rhododendron luteum*), Cranberries (*Vaccinium arctostaphylos*), Nut (*Corylus avellana*), several types of Blackberries and etc. In this beches are also well developed Synusiae of forbs. This synusiae and overall deciduous bushy beeches are rich with species compositions compared to other types of beeches. Floristically, quite rich are also tall herbaceous and fescue beeches. These two types of forest are developed in different ecological environment, but they have in common one thing that their role is insignificant in the landscape of Adjara beeches.

In Adjara and commonly in Western Georgia quite spread is dead covered beech. According to Kkolakovski (1961), insignificant is participation of other plants in such beech, and bushes and forbs are mostly never present. In this kind of beech, as Dolukhavini indicates (1938), most suitable ecological conditions are being developed for growth of beech and is characterized with high productivity. In mentioned forests less common are lianas, though some of them, for example Colchis ivy represent constant component of beech.

In complex with beeches, especially in the bottom part of its distribution, on relatively less humid slopes are common Hornbeams, approximately on 1100 meters high from sea level. Hornbeam mixed with beech is common even higher. It grows in various soil conditions, for example in lowlands it grows on podzol soils, but in other cases on humus-carbonate and forest brown soils. Structurally and floristically similar to beech, creating analogy to forest types, but distributed on much less area are: in Adjara and commonly in Western Georgia hornbeam is frequently changed with Alder. This change is mostly conditioned with human agricultural activities. When washing hornbeam intensively takes place Alder resettlement and frequently alder-hornbeam is formed.

According to existing data (Ketskhoveli, 1935, 1959; Dolukhanovi, 1953; Kolakovski, 1961; Gulisashvili, 1964; Jorbenadze, 1969), in Adjara, especially in beech and hornbeam complexes, on relatively small area are presented Chestnuts. Also it should be noted, that chestnut is in smaller quantities in all types of forests, that are developed on front ridges of the mountain and in Shuamta belt. For the belts of the latter is typical Utkhovari - *Taxus baccata*, which is located in subdued tier.

In Adjara mountains very common are coniferous forests on 900-1000 meters up to 2000 meters from sea level, though pinewood are common in relatively lower Adjara Southern slopes. In Adjara, pinewood are distributed fragmentary and are created with domination of *Pinus kochiana*. Pinewood slope is not binded, therefore well developed are bushes and forbs synusiae. Spruce-*Picea orientalis* and Fir *Abies nordmanniana* create closed forest. For this reason not common are bushy and forby tiers. This kind of forests are typologically connected to beech. Together with beech, Fir often creates coniferous forest types. This kind of phytocenoses are widely spread in Adjara mountains. Coniferous forest types are largely dense with pure Spruce, Spruce-Firs and pure Firwood. In Adjara mostly this kind of forest types are common in forest upper border.

In some valleys of Adjara, on 1000 metres from sea level are distributed specific type of bushes, which local residents call "Shkeriani". It was first described in details by Golitsin (1939, 1948) and from then the above mentioned name has been established in botanical literature. In creation of such phytocenoses participates Colchic flora tertiary relics, like: laurel, Rhododendron, Medvedev Birch - *Betula medwedewi*, Rhododendron ungerii - *Rhododendron ungerii*, Poturi oak - *Quercus pontica*, *Epigaea gaulterioides*, Cranberries, Yala, Bazghi, Zakhveli, Zmerkhlis and etc. Because of bushes cohesion forby cover is weakly developed, though ferns are widely common.

Golitsin considers the mentioned type of bushes as a core and at the same time relict phytocenose. At the same time he denies opinion of Sinskai (1933), who believed that this kind of bushes are antropogenic and are developed on burned forests location. Ketskhoveli (1959) considers the opinion of Sinskai more valid and says that the majority of bushes of it are elements of underbrush as well as epigea, which according to Sishkin data (1930) are participants of Lazistani beeches. Together with this Ketskhoveli (1959) indicates that in Western Georgia Rhododendrons are distributed on Adjara-Imereti slopes, Lomis mountain

ridges, in Upper Svaneti in the valleys of Nenskri, Nakras and other. In these places, after destruction of forests underbrush bushes remain, which are so strong that it became impossible to renew the major types of forests.

Above the aforementioned forests is located sub-alpine belt; its upper border from sea level is averagely on 2200-2300 meters. In this belt are presented complex of meadows, bushes and sub-alpine forests. In Adjara, as well as in mountainous Georgia are common two types of forests- crooked and sparse. This latter type of forest in Adjara mountains is created by mountain maple -*Acer trattvetteri* and birch *Betula litwinowii* and etc. In such forests trees grow apart from each other, distance between them is covered by vegetations and soil surface is mostly tussock. Sub-alpine sparse forests in Adjara are rarely common and mostly are of secondary origin.

In Adjara sub-alpine more common are crooked forests. They are mostly developed on Northern and Western slopes, mostly in the places where snowy cover is deep and stays for long. This kind of forest is mainly created by the above mentioned type of birch, Berries, some type of Willows and etc. also well developed are forbs and bushes synusiae. The major component of the latter is Deka-*Rhododendron caucasicum*, and forbs synusiae are mostly created for tall herbaceous representatives.

Crooked forest in Adjara and generally in Western Georgia is often created by beech. Mostly are common crooked birch analogy types, but mostly are common forby beeches where live cover is created by fern synusiae. Such beechwood differ so much from beechwoods of mountain's middle belts that some researchers, for example Dolukhavin (1957), consider it as separate formation.

In western Georgia, especially in Adjara and Guria, crooked forests are created by Medvedev birches and Pontic oaks, though this kind of forests are mostly spread in mountain middle belt. For this type of forest evergreen bushes sinusiae and sub-alpines are typical with dominance of ordinary Deka, and on bottom level - Rhododendron, Laurel, Bazghi.

Biggest part of Adjara mountain subalpine forests are cut down and on their place are developed secondary meadows. For this reason in this part of Georgia upper border of the forest ends with usual Spruces and Firs. It is necessary to recover supalpine forests. Their agricultural value is huge, because this side of forest protects the bottom forests from avalanches and has soil protective and water regime regulatory significance.

In complex with subalpine forests, also in alpine belts, mostly in north and west slopes Dekians are widespread, which are created by *Rhododendron caucasicum*. They are connected to mountain peat soils. Dekians are typologically identical, but in variety composition they are poor. This is caused by cenotic structure. Components of this floristic complex: Selshavi-*Vaccinium myrtillus*, Redberry-*V. vitis-idaea*, *Oxalis acetosella* and etc. Among them mosses and irregular rock surfaces. Dekanies are mostly common in very inclined slopes, but rarely, for example on Arsiani slope sections are common on flat terrains. On such terrains are developed special type of Rhododendron scrubs term, which in literature (K. Kimaridze, 1969) are known with the name of Rhododendron scrubs term. It is connected to such places, where snowy cover is Deep and stays for long. In subalpines fragmentary are rvinabie, which under existing data (Ketskhoveli, 1935; Nijaradze, 1948; and etc.) represents beech derivatives.

For Adjara mountains it is common to have subalpine tall herbaceous vegetation. It is connected to maximum suitable environment for plants growth and development in quite humid, rich with humus Deep soils; in vegetative period soil thermal regime is also optimal.

This type of vegetation usually develops in sub-alpine forest and Rhododendron scrubs term complex; also in mountain's top belt as an independent sinusiae. Tall herbaceous vegetation is often polydominant and includes: *Heracleum sosnowskyi*, *Campanula lactiflora*, *Delphinium flexuosum*, *Inula grandiflora*, *Doronicm macrophyllum*, *Senecio platyphyloides*, *Pyretrum macrophyllum*, *Aconitum nasutum* and etc. It is typical that this kind of vegetation is mostly created from two soiled plants, one soil, especially cereal and sedgy representatives are rarely common. For this reason, soil Surface as a rule is not tussock.

Despite the abundance of the phytomasis, tall herbaceous vegetation is not suitable for pastures and arable, but may be used as silage. In this point of view agricultural value is very important. This type of tall herbaceous vegetation is rich with curing, technical and decorative vegetations.

In the mentioned belt from herbaceous vegetation more widespread are subalpine meadows. This type of plants, and generally maountainous meadows are various typologically and are rich with compositions. But because of pasturings for long time and high load of cattles in summer natural plants are changed and presented with types of postoral degress. On Aarsiani slope mostly are common Zigvians and bent meadows, also polydominant meadows with the participation of marmus and others. Described forms are developed on mountain meadow tussock soils. On Shavshvebi slope and Adjara and Guria humid slopes are also common broad leaf grassy meadows. This kind of meadows are also present on less are on Arsiani slope, mostly in forest complexes, at the upper border of the forest. For this meadows it is typical to have weak tussock mountain meadow secondary soils.

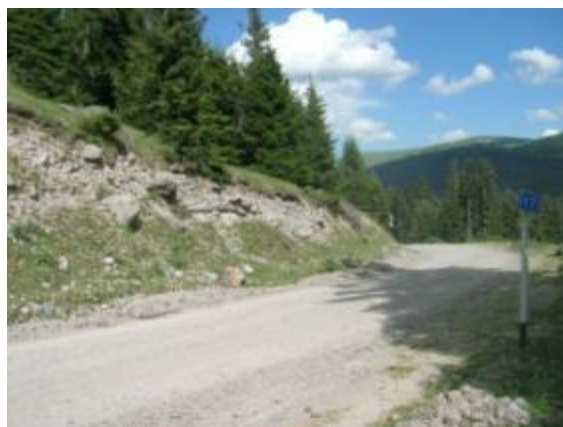
Alpine vegetation is typically reflecte don big Caucasian, in Adjarian mountains it does not create whole continuous line and is mostly developed on mountain tops on 2300 metres from sea level. In this belt vetegation period continues for 2-3 months and suitable termal regime for plants development is only on Surface. Because of this, alpine plants are usually low, and in some types meadows are stretched on ground. In vegetative landscape alpine moles are very important, which are created by various herbs. Major components of this kind of vegetations are: *Sibbaldia parviflora*, *S. semiglabra*, *Campanula tridentata*, *Taraxacum stevenii*, several types of marmus and etc. With less majority are participating grains and sedges, also fescue and dzigvi. Most cenotypes of these formations are *Festuca sulcata* da *Nardus glabriculumis*. With less quantity are mixed *Zerna adjarica*, *Poa alpina*, *Phlem alpinum* and etc. In this vegetative complex are presented other types of plants, like sedges, grainy, various herbs and etc. But they are widespread on reatively small área. In the mentioned complex of alpine meadows formations in some áreas are developed Rhododendron scrubs terms, but here this evergreen bushes are relatively low compared to subalpine Rhododendron scrubs terms.

Vegetative Cover on Design Road in the Area of Utilization (impact zone)

Section 13. GPS coordinates are 0297497/4611635, height 1748m from sea level. On this territory ends forest fragment presented on road adjacent territory (Fir-Spurce-Beech mix), which represents habitat of high conservation value. Above the road, where expansion is likely planned, will be damaged young Spruces (*Picea orientalis*). In herbaceous cover is present grainy and various grassy meadow (*Festuca varia*, *Trifolium ambiguum*, *Coronilla varia*, *Plantago lanceolata* and etc.). inclination above the road is 15°, exposition on Southern and Western part, road decline-35°, exposition the same.



Section13. Spruce-Fir with the mix of Beech



Section13. Spruce-Fir with the mix of Beech

Plot 14. Granular and Grassy Meadow

| | |
|---|---|
| Plant Community Type | Granular and Grassy Meadow Degraded from Grazing |
| Conservation Value | Low |
| Location | Beshumi area |
| Sample plot № | 14 |
| Sample plot area (m ²) | 10 |
| GPS coordinates | 0296053/4611377 |
| Height from sea level z.d. (m) | 1825 |
| Aspect | Eastern |
| Inclination | 10-15° |
| Community Structural Characteristics | |
| Grass height (cm) | 10 |
| Grass coverage (%) | 70-80 |
| Moss coverage (%) | – |
| Quantity of highest plant types | 10 |
| Quantity of moss types | – |
| Species | Multitude-Cover according to Drude Scale |
| Grass Cover | |
| Festuca varia | Soc |
| Trifolium ambiguum | Cop ³ |
| Coronilla varia | Sp ² |
| Agrostis capillaris | Sp ¹ |
| Plantago lanceolate | Sp ³ |
| Scleranthus uncinatus | Sp ¹ |
| Myosotis alpestris | Sol |
| Sedum acre | Sp ¹ |
| Ajuga orientalis | Sol |
| Rumex acetosella | Sol |
| Moss Cover | |

| | |
|------------------------|---|
| No moss types observed | — |
|------------------------|---|

On this section, cereal and grassy meadow degraded from grazing is being weeded *Cirsium caucasicum*, *Cynoglossum officinale*. Yale is grown on road sides (*Rhododendron luteum*).



Section 14. *Cirsium caucasicum* road sides



Section 14. Pasture

Section 15. GPS coordinates 0292105/4611661, height 1990m from sea level. Beshumi, Goderdzi Gorge (2025 m from sea level) following section, riv. Adjarawater valley, inclination 10-15°, North-Western exposition. On the side of the road are growing Fir (*Abies nordmanniana*) separate trees, although road expansion does not relate to them. The rest of vegetative cover is represented by degraded meadows of the following types: *Phleum alpinum*, *Trifolium ambiguum*, *Lotus corniculatus* and etc. Low conservation value habitat.



Section 15. Fir trees at the road

Section 16. GPS coordinates 0291684/4611827, height 1904m from sea level inclination 10-15°, Souther-Eastern exposition. Beshumi. On the road side on upper part young Spruce are presented by *Daphne pontica*, *Gentiana schistocalyx*, *Fragaria vesca*. Grows as a unit *Dactylorhiza urvilleana* (CITES). Starting from this section, on road sides grows this type of Chadvari. Habitat of average conservation value.



Section 16. *Gentiana schistocalyx*



Section 16. *Fragaria vesca*



Section 16. Majagveri (*Daphne pontica*)

Section 17. Cereal and Grassy Meadow Developed in Spruce Window

| | |
|---|--|
| Plant Community Type | Cereal and Grassy Meadow Developed in Spruce Window |
| Conservation Value | Tall |
| Location | Beshumi area |
| Sample plot N° | 17 |
| Sample plot area (m ²) | 10 |
| GPS coordinates | 0291718/4612051 |
| Height from sea level z.d. (m) | 1862 |
| Aspect | North Western |
| Inclination | 5-10° |
| Community Structural Characteristics | |
| Max dms (cm) | 10 |
| Average dms (sm) | 7 |
| Max. height of tree (m) | 6 |
| Average Height (m) | 4 |
| Quantity of trees on sample plot | 5 |
| Coverage of trees tier (%) | 20 |
| Bushes coverage (%) | – |
| Bushes height (cm) | – |

| Plant Community Type | Cereal and Grassy Meadow Developed in Spruce Window |
|---|---|
| Grassy coverage (%) | 70-80 |
| Grassy cover height (sm) | 30 |
| Moss cover (%) | 20 |
| Quantity of highest plant types | 17 |
| Species | Multitude-Cover according to Drude Scale |
| Trees Tier | |
| <i>Picea orientalis</i> | Cop ¹ |
| Bushes | |
| <i>buCqis saxebobi ar dafiqsirebula</i> | _ |
| Grassy Cover | |
| <i>Agrostis capillaris</i> | Cop ³ |
| <i>Phleum alpinum</i> | Cop ² |
| <i>Carex sp.</i> | Cop ² |
| <i>Trifolium ambiguum</i> | Cop ² |
| <i>Trifolium canescens</i> | Cop ¹ |
| <i>Rumex acetosella</i> | Sp ¹ |
| <i>Hieracium pilosella</i> | Sp ¹ |
| <i>Lotus corniculatus</i> | Sp ² |
| <i>Ranunculus sp.</i> | Sp ² |
| <i>Fragaria vesca</i> | Sp ³ |
| <i>Polygala alpicola</i> | Sp ¹ |
| <i>Gnaphalium silvaticum</i> | Sol |
| <i>Tripleurospermum caucasicum</i> | Sol |
| <i>Dactylorhiza urvilleana</i> (CITES) | Sol |
| <i>Listera ovata</i> (CITES) | Unic |
| Moss Cover | |
| Moss type | Sp ¹ |

Should be noted that in 1m² grows 10 copies of *Dactylorhiza urvilleana*, and several *Listera ovata*. Road sides, (namely on upper side of road) with more or less density are following *Dactylorhiza urvilleana*.



Section 17. *Dactylorhiza urvilleana* da *Listera ovata*



Section 17. *Tripleurospermum caucasicum*



Section 17. *jadvariani*

Section 18. Cereal and Grassy Meadow

| | |
|---|--|
| Plant Community Type | Cereal and Grassy Meadow Degraded from Grazing |
| Conservation Value | Tall |
| Location | Beshumi Area |
| Sample plot № | 18 |
| Sample plot area (m ²) | 10 |
| GPS coordinates | 0291263/4611765 |
| Height from sea level z.d. (m) | 1817 |
| Aspect | North-Western |
| Inclination | 5-10° |
| Community Structural Characteristics | |
| Grass height (cm) | 30 |
| Grass coverage (%) | 80 |
| Moss coverage (%) | 20 |
| Quantity of highest plant types | 23 |
| Quantity of moss types | 1 |
| Species | Multitude-Cover according to Drude Scale |
| Grass Cover | |

| Plant Community Type | Cereal and Grassy Meadow Degraded from Grazing |
|--|--|
| <i>Agrostis capillaris</i> | Cop ³ |
| <i>Phleum alpinum</i> | Cop ² |
| <i>Carex</i> sp. | Cop ² |
| <i>Trifolium ambiguum</i> | Cop ² |
| <i>Trifolium canescens</i> | Cop ¹ |
| <i>Rumex acetosella</i> | Sp ¹ |
| <i>Hieracium pilosella</i> | Sp ¹ |
| <i>Lotus corniculatus</i> | Sp ² |
| <i>Ranunculus</i> sp. | Sp ² |
| <i>Fragaria vesca</i> | Sp ³ |
| <i>Polygala alpicola</i> | Sp ¹ |
| <i>Gnaphalium silvaticum</i> | Sol |
| <i>Tripleurospermum caucasicum</i> | Sol |
| <i>Dactylorhiza urvilleana</i> (CITES) | Sol |
| <i>Valeriana alpestris</i> | Sol |
| <i>Gentiana schystocalyx</i> | Sol |
| <i>Pedicularis acmodonta</i> | Sol |
| <i>Athyrium filix-femina</i> | Sp ² |
| <i>Tussilago farfara</i> | Sp ¹ |
| <i>Carum caucasicum</i> | Sp ² |
| <i>Taraxacum officinale</i> | Sp ¹ |
| <i>Campanula collina</i> | Sol |
| Moss Cover | |
| Moss type | Sp ¹ |



Section 18. Jadvariani



Section18. jadvariani



Section 18. *Jadvariani*



Section 18. *jadvariani*

Section 19. GPS coordinates 0291289/4612180, height 1757m from sea level. Inclination 10°, North-Western Exposition. Beshumi. In cut down Spruce above the road grow units of Chkori *Ilex colchica*. Also are common *Campanula collina*. Under the road grow as a unit *Lilium szovitsianum*. Habitat of average conservation value.



Section 19. *Campanula collina*



Section 19. Cut down Spruce



Section 19. Chkori-*Ilex colchica*

Section 20. GPS coordinates 0290351/4613725, height 1610m sea level. inclination 5-10°, Western Exposition. Beshumi. Below this do not grow *Dactylorhiza urvilleana* (CITES). On this territory is presented young Spruce, which is mixed with *Populus tremula*, Trees (*Pyrus caucasica*), Nuts (*Corylus avellana*), Briar (*Rosa canina*), Plums (*Prunus divaricata*). On road

sides are common Elderflower (*Sambucus ebulus*), *Echium vulgare*, *Silene compacta*, *Verbena officinalis*, *Heracleum sosnowskyi* (Caucasian Endem), *Pteridium tauricum*, *Cuscuta europaea*. Habitat with average Conservation Value.



Section 20. riv. Adjaristskali valley, Slope erosion

Section 21. GPS coordinates 0289582/4613654, height 1565m from sea level inclination 15-20°, Southern exposition. Beshumi. On the section are developed Spruce-Firwood (*Abies nordmanniana*, *Picea orientalis*) with Etseri Fern (*Pteridium tauricum*). In forest window is developed Etseri Fern (Height-80-100cm, C-30-40%). Habitat of high conservation value.



Section 21. Spruce-Fir with Etseri Fern



Section 21. Spruce-Fir with Etseri Fern

Section 22. GPS coordinates 0289349/4613923, height 1562m from sea level, inclination 5-10°, southern-western exposition. V. Danispiruli. On this territory Alder (*Alnus barbata*) goes along the bottom side of the road, on the top side (as well as on the bottom) grows Etsera Fern (*Pteridium tauricum*), Yale (*Rhododendron luteum*), Friale (*Populus tremula*), Alder (*Sambucus ebulus*). Habitat of low conservation value.



Section 22. Murknari



Section 22. Murknari

Section 23. GPS coordinates 0288629/4613520, height 1450m from sea level inclination 5°, Southern exposition. On this territory on side road are presented Walnut (*Juglans regia*) and Plum trees (*Prunus divaricata*), White Willow (*Salix alba*) Artificial rows. Habitat of low conservation value.



Section 23. Walnut - *Juglans regia* on road side



Section 23. Walnut - *Juglans regia* on road side

Section 24. GPS coordinates 0287341/4613036, height 1326m from sea level, inclination 5-10°, Southern exposition. On this section of V. Riketi in front and after of this section the road goes through bounded villages, where major cultural landscape is presented. On the territory is developed natural Hornbeam Groves-Hornbeam (*Carpinus caucasica*) forest fragment (Kaltashekruli, Herbaceous cover is underdeveloped), which represents habitat of high conservation value.



Section 24. Slope Bound Hornbeam



Section 24. Slope Bound Hornbeam



Section 24. Slope Bound Hornbeam



Section 24. Slope Bound Hornbeam

Section 25. GPS coordinates 0287009/4613399, height 1264m from sea level, North-Western exposition. On the below section of V. Riketi, on top of the road are trees, and below on 30-35° inclined slope Spruce is maintained (*Picea orientalis*), which is mixed with chestnut (*Castanea sativa*), Hornbeam (*Carpinus caucasica*)-is dead covered forest. Habitat of high conservation value.



Section 25. Walnut trees on road side



Section 25. Walnut trees on road side



Section 25. Spruce with mixed in Walnut



Section 25. Chestnut-*Castanea sativa*

Section 26. GPS coordinates 0283024/4612603, height 1085m from sea level. Inclination 0-5°, Southern-Western exposition. After V. Doknisi on road sides are common *Robinia pseudoacacia*, *Alnus barbata*. Habitat of low conservation value. On top rocks grow Spruce (*Picea orientalis*), Chestnut(*Castanea sativa*), Mdghnali (*Salix caprea*).



Section 26. Road Side Rocks



Section 26. Black locust -*Robinia pseudoacacia*

Section 27. GPS coordinates 0279700/4615073, height 788m from sea level. Inclination 0-5°, Southern-Eastern exposition. Khulo area. On road sides are common *Robinia pseudoacacia*, Walnut trees (*Juglans regia*). On road top grow spruce of big size, which does not fall into design corridor. Habitat of low conservation value.



Section 27. Unit spruce on top of the rock



Section 27. Walnut-*Juglans regia*



Section 27. Black locust and walnut trees on road sides

After detailed botanical research of design corridor it is possible to verify sensitive places and make their detailed description. Thus, based on literature discussion and field researches in project corridor are revealed the following average and high sensitive places.

High sensitive places:

Section 13. GPS coordinates 0297497/4611635, height 1748m from sea level, on the territory end forest fragments represented on road sides (mix of Fir-Spruce-Beech).

Section 17. Cereal-herbaceous meadow in spruce Windows. Beshumi area. GPS coordinates: 0291718/4612051, height from sea level (m) 1862, aspect north-Western, inclination 5-10°. From trees and plants are present: *Picea orientalis*, from herbaceous plants: mcnareebidan: *Agrostis capillaries*, *Phleum alpinum*, *Carex sp.*, *Trifolium ambiguum*, *Trifolium canescens*, *Rumex acetosella*, *Hieracium pilosella*, *Lotus corniculatus*, *Ranunculus sp.*, *Fragaria vesca*, *Polygala alpicola*, *Gnaphalium silvaticum*, *Tripleurospermum caucasicum*, *Dactylorhiza urvilleana* (CITES), *Listera ovata* (CITES).

Section 18. Granular-Grassy Meadow. Beshumi area. GPS coordinates: 0291263/4611765, height from sea level (m) 1817, aspect North-Western, inclination 5-10°. From herbaceous

plants grow: *Agrostis capillaries*, *Phleum alpinum*, *Carex sp.*, *Trifolium ambiguum*, *Trifolium canescens*, *Rumex acetosella*, *Hieracium pilosella*, *Lotus corniculatus*, *Ranunculus sp.*, *Fragaria vesca*, *Polygala alpicola*, *Gnaphalium silvaticum*, *Tripleurospermum caucasicum*, *Dactylorhiza urvilleana* (CITES), *Valeriana alpestris*, *Gentiana schystocalyx*, *Pedicularis acmodonta*, *Athyrium filix-femina*, *Tussilago farfara*, *Carum caucasicum*, *Taraxacum officinale*, *Campanula collina*.

Section 21. GPS coordinates 0289582/4613654, height from sea level 1565m inclination 15-20°, Southern exposition. Beshumi. On the mentioned section are developed Spruce-Firwood with (*Abies nordmanniana*, *Picea orientalis*) Etsera Fern (*Pteridium tauricum*). In forest window is developed Etsera Fern (height -80-100cm, coverage-30-40%).

Section 24. GPS coordinates 0287341/4613036, height from sea level 1326m inclination 5-10°, Western exposition. V. Riketi. In front and after of this section road goes through bounded villages, where major cultural landscape is present. On this territory is developed natural hornbeam (*Carpinus caucasica*) forest fragment (herbaceous cover is underdeveloped).

Section 25. GPS coordinates 0287009/4613399, height from sea level 1264m. North-Western exposition. On V. Riketi bottom section, on the top of the road are presented walnut trees, and beneath on slope of 30-35° inclination spruce is being maintained (*Picea orientalis*), which is mixed with Chestnut (*Castanea sativa*), Hornbeam (*Carpinus caucasica*)-dead cover forest, mkvdarsafriani tyea, slope bounded.

Averagely sensitive places:

Section 16. GPS coordinates 0291684/4611827, height from sea level 1904m inclination 10-15°, South-Eastern exposition. Beshumi. On the top side of the road in Spruce Windows are present: *Daphne pontica*, *Gentiana schistocalyx*, *Fragaria vesca*. As units grow: *Dactylorhiza urvilleana* (CITES). Starting from this section downward grow this type of Chavdari.

Section 19. GPS coordinates 0291289/4612180, height from sea level 1757m. Inclination 10°, North-West exposition. Beshumi. In cut down Spruces grows Chkori *Ilex colchica*. Also are common *Campanula collina*. In the bottom of the road grow *Lilium szovitsianum*.

Section 20. GPS coordinates 0290351/4613725, height from sea level 1610m. Inclination 5-10°, Western exposition. Beshumi. Below do not grow *Dactylorhiza urvilleana*. On the territory are present Spruces, which are mixed with *Populus tremula*, (*Pyrus caucasica*), Txili (*Corylus avellana*), askili (*Rosa canina*), tyemali (*Prunus divaricata*). On road sides are common Elderflowers (*Sambucus ebulus*), *Echium vulgare*, *Silene compacta*, *Verbena officinalis*, *Heracleum sosnowskyi* (Caucasian endemic), *Pteridium tauricum*, *Cuscuta europaea*.

4.4. Fauna

4.4.1. *In the Ecosystem Project area*

Short zoological description of work area– *habitats and common species*

In terms of protecting animal biodiversity important ecosystems (habitats), which are crossed by the design road.

Georgian territory includes almost all regions of common fauna of Caucasus. It is difficult to distinguish between the different faunistic regions because of mutual penetration of species. Caucasus is characterized by difficult composition and creates kind of a mosaic of biological community., which represent various bio-geographic regions. Here are merged local, Western Asian communities, that highly affect the genetic structure of fauna. According to the most widespread zoogeographic regionalization systems, the whole territory of Transcaucasia belongs to Eastern- Mediterranean Palearctic subrealm. On the whole territory may be allocated two regions of significant landscape differences. The first – Caucasian region, which includes Colchic and Caucasian zones, which are presented with forest landscapes with number of autochthonous animals and European fauna, and the second - Middle East region, which consists of two different communities, from Lesser Caucasus mountain regions (landscapes of which very much resemble the landscapes of Turkey and Middle East) and from arid and semi-desert landscapes of Mtkvari region with the elements of Turania. In addition, the given region is also genetically linked to biological community of Central Asia. In the significant part of Georgian territories (Borjomi valley, Trialeti ridge Northern slopes and Southern Caucasian slopes of Eastern Georgia) are common Colchic, Eastern European, Middle East and Turanian fauna elements.

On the largest section of motorway, because of three biogeographic zone elements and mixed communities of animals, large quantities of protected and endemic species are observed.

Number of scientific and zoological researches of discussed district is not much. Human long-term activities and dense population along Batumi-Akhalsikhe motorway influenced the composition of nearby fauna. In the offered 4 options of new motorway (options 1, 2, 4 and 4a) for the gathering of exact data on animal communities it is necessary to conduct bypass observation on the given district.

Large part of design district until Goderdzi gorge includes the following landscapes:

Colchic low-mountainous landscapes with oak trees, mostly with evergreen underbrushes, which partially interchanges with oak-pines.

Colchic mid-mountainous landscapes with beeches, Beech-Chestnuts, mostly with well developed evergreen underbrushes (well known under “Pontic rhododendron scrub” name);

Caucasian mid-mountainous landscapes with Beech-dark coniferous and dark coniferous (spruce and fir) forests, partially with evergreen underbrushes;

Caucasian high-mountainous landscapes with birches, partially with pinewood (Caucasian pine and Colchic pine), partially with low pontic oaks.

Small portion of the motorway cross some other landscapes as well.

Mountainous forest of Adjara represents rich ecosystem, to which is typical biological diversity of endemic species, wild animals and disappearing species. At the same time, animal communities of the given ecosystems are very sensitive towards human intervention.

Field works were conducted on June 12-15 of 2013. 76 potentially interesting districts were studied under lot 1 and lot 2 design road Zarzma-Khulo sections. Detailed description is given in Annex 5. Below are given short description of research results.

Pic. 4.23 Research points at Khulo-Goderdzi section

Sensitive Habitats and EcoSystems along the Alternative Routes

Taking into account the impact on animal biodiversity conservation, it is obvious that suggested routes have sharp and large scale impacts in terms of temporary effect (during construction process) and residual effect (when exploiting the road). Noteworthy districts for protecting biodiversity, namely, animals that are on the edge of extinction, also areas of endemic and rare species habitation, which may also be affected by constructions and exploitation of motorway, are given on printed map.

Existing motorway crosses several sensitive districts. The first such sensitive district is located on map #105 and #110 (approximately) between bookmarks (kilometer-bookmarks). Sub-alpine meadows and mountain steppe represent are of vital spreading for the following species: *Prometheomys schaposchnikovi*, *Cricetulus migratorius*, *Tetraogallus caspius*, and the upper belt of the forest and shrubbery represent a residing place for *Tetrao mlokosiewiczzi*. Migration routes for the mammals of big size are listed above in #1 and #3 tables, precisely on given district. The territory represents feeding area for large number wild birds and many other not protected species. Existing motorway passes in approximately 6.5 kms from the district and on the printed map is indicated as “**Sensitive District #1**”.

The following sensitive district on the given road is located on the West side from the first ditrict between #100 and #105 bookmarks of the map. The road passes from the given district approximately on 4,5 km-s (102-106 km). Upper belt of Caucasian birch and pinewood are vulnerable ecosystems and habitation area of many species that are on the verge of extinction. Among these species should be noted *Tetrao mlokosiewiczzi* and also in #3 table are indicated all species. Given district is indicated on the printed map as “**sensitive district #3**”.

In the working area are widespread 44 species (see table 4.6) that are in the red list of Georgia (2006).

Table 4.18. Species in the Red List of Georgia (2006) that are Widespread on Working District

| # | Latin name | English name | Georgian name | National status | Khulo – Goderdzi | Goderdzi - Zarzma |
|---|---------------------------------|---------------------|--------------------|-----------------|------------------|-------------------|
| | | Mammals | ძუძუმწოვრები | | | |
| 1 | <i>Barbastella barbastellus</i> | Western Barbastelle | ევროპულიმაჩქათელა | VU | Y | |
| 2 | <i>Sciurus anomalus</i> | Persian Squirrel | კავკასიურიცივი | VU | Y | |
| 3 | <i>Cricetulus migratorius</i> | Grey Hamster | ნაცრისფერიზაზუნელა | VU | Y | Y |
| 4 | <i>Prometheomys</i> | Long-Clawed | პრომეთესმემინ | VU | Y | |

| # | Latin name | English name | Georgian name | National status | Khulo – Goderdzi | Goderdzi - Zarzma |
|----|---|-------------------------|----------------------|-----------------|------------------|-------------------|
| | <i>schaposchnikovi</i> | Mole-Vole | დვრია | | | |
| 5 | <i>Clethrionomys glareolus ponticus</i> | Pontian Bank Vole | წითურიმემინდვრია | EN | ? | |
| 6 | <i>Lynx lynx</i> | Lynx | ფოცხვერი | CR | Y | |
| 7 | <i>Lutra lutra</i> | Otter | წავი | VU | Y | |
| 8 | <i>Ursus arctos</i> | Brown Bear | მურიდათთვი | EN | Y | |
| | | Birds | ფრინველები | | | |
| 9 | <i>Accipiter brevipes</i> | Levant Sparrowhawk | ქორცქვითა | VU | | Y |
| 10 | <i>Buteo rufinus</i> | Long-legged Buzzard | ველისკაკაჩა | VU | | Y |
| 11 | <i>Aquila heliaca</i> | Imperial Eagle | ბეგობისარწივი | VU | | Y |
| 12 | <i>Aquila chrysaetos</i> | Golden Eagle | მთისარწივი | VU | Y | Y |
| 13 | <i>Neophron percnopterus</i> | Egyptian Vulture | ფასკუნჯი | VU | | Y |
| 14 | <i>Gypaetus barbatus</i> | Lammergeyer | ბატკანმერი | VU | ? | ? |
| 15 | <i>Gyps fulvus</i> | Griffon Vulture | ორბი | VU | ? | ? |
| 16 | <i>Aegolius funereus</i> | Boreal Owl | ჭოტი | VU | Y | |
| 17 | <i>Tetraogallus caspius</i> | Caspian Snowcock | კასპიურიშურთხი | VU | Y | |
| 18 | <i>Tetrao mlokosiewiczi</i> | Caucasian Black Grouse | კავკასიურიროჭო | VU | Y | Y |
| | | Reptiles | ქვეწარმავლები | | | |
| 19 | <i>Testudo graeca</i> | Mediterranean tortoise. | ხმელთაშუაზღვეთისკუ | VU | | Y |
| 20 | <i>Darevskia clarkorum</i> | Clark's lizard | თურქულიხვლკი | EN | Y | |
| 21 | <i>Darevskia mixta</i> | Adzharian Rock Lizard | აჭარულიხვლიკი | VU | | Y |
| | | Amfibians | ამფიბიები | | | |
| 22 | <i>Mertensiella caucasica</i> | Caucasian Salamander | კავკასიურისალამანდრა | VU | Y | Y |
| | | | ძვლიანითევზები | | | |
| 2 | <i>Salmo fario</i> | Brook Trout | მდინარისკალმ | VU | Y | Y |

| # | Latin name | English name | Georgian name | National status | Khulo – Goderdzi | Goderdzi - Zarzma |
|--------|--|-------------------------------|-------------------------------|-----------------|------------------|-------------------|
| 3 | | | ის | | | |
| 2 4 | <i>Capoeta (Varicorhinus) sieboldi</i> | Colchician Khramulya | კოლხურიხრამული | VU | Y | |
| | | Invertebrates | უხერხემლოები | | | |
| 2 5 | <i>Perisomena coecigena</i> | Autumn Emperor Moth | მკრათვალეზიანი ფარშევანგთვალა | VU | | Y |
| 2 6 | <i>Eudia pavonia</i> | Small Night Peacock Butterfly | ლამისმცირეფარშევანგთვალა | VU | Y | |
| 2 7 | <i>Manduca atropos</i> | Death's Head Sphinx | სფინქსიმკვდართავა | EN | Y | |
| 2 8 | <i>Rethera komarovi</i> | Komarov's Sphinx | კომაროვისსფინქსი | VU | | Y |
| 2 9 | <i>Pterogon gorgoniades</i> | Dwarfish Sphinx | ჯუჯასფინქსი | VU | | Y |
| 3 0 | <i>Callimorpha dominula</i> | Tiger Moth | დათუნელაპერა | VU | Y | Y |
| 3 1 | <i>Axiopoena maura</i> | Cave Transcaspien Tiger moth | მღვისამიერკავკასიურიდათუნელა | EN | Y | |
| 3 2 | <i>Parnassius apollo</i> | Appolo | აპოლონი | VU | Y | |
| 3 3 | <i>Parnassius nordmanni</i> | Nordmann's Appolo | კავკასიური აპოლონი | EN | Y | |
| 3 4 | <i>Anthocharis damone</i> | Eastern Orange Tip | ამიერკავკასიური აისი | VU | | Y |
| 3 5 | <i>Erebia hewistonii</i> | Hewistoni's Mountain | ჰევისტონისხავერდულა | VU | ? | Y |
| 3 6 | <i>Erebia iranica</i> | Iranian Brassy Ringlet | ირანულიხავერდულა | VU | | Y |
| 3 7 | <i>Bombus eriophorus</i> | Stone Humble-bee | ბაზიერიოფორუსი | VU | Y | Y |
| 3 8 | <i>Bombus alpigenus - (B. wurflenii)</i> | Wurflenii Humble-bee | ალპურიბაზი | VU | Y | Y |
| 3 9 | <i>Bombus persicus</i> | Persian Humble-bee | ირანულიბაზი | VU | | Y |
| 4 0 | <i>Xylocopa violacea</i> | Violet Carpenter bee | იისფერიქსილოკოპა | VU | Y | Y |
| 4 | <i>Rosalia alpina</i> | <i>Rosalia</i> | ალპურიხარაბუ | EN | Y | |

| # | Latin name | English name | Georgian name | National status | Khulo – Goderdzi | Goderdzi - Zarzma |
|--------|--------------------------------|------------------|---------------------|-----------------|------------------|-------------------|
| 1 | | <i>Longicorn</i> | ზა | | | |
| 4 2 | <i>Onychogomphus assimilis</i> | Dark pincertail | მსგავსინემსიე ლაპია | VU | Y | Y |
| 4 3 | <i>Calopteryx mingrelica</i> | Banded Agrion | სამეგრელოსტურვა | VU | Y | |
| 4 4 | <i>Helix buchi</i> | Beech Snail | ბუხისლოკოკინა | VU | Y | |

Table 4.19 Ramuri Species in Design Corridor

| Nº | Species - Latin name | Common English name | Georgian name |
|----|----------------------------------|-------------------------|---------------------|
| | <i>Rhinolophus hipposideros</i> | Lesser Horseshoe Bat | მცირეცხვირნალა |
| | <i>Barbastella barbastellus</i> | Western Barbastelle | ევროპულიმაჩქათელა |
| | <i>Pipistrellus pipistrellus</i> | Common Pipistrelle | ჯუჯადამორი |
| | <i>Plecotus auritus</i> | Brown Big-eared Bat | რუხიყურა |
| | | Supposed | |
| | <i>Rhinolophus ferrumequinum</i> | Greater Horseshoe Bat | დიდიცხვირნალა |
| | <i>Myotis blythii</i> | Lesser Mouse-eared Bat | ყურწვეტამლამიობი |
| | <i>Myotis mystacinus/brandti</i> | Whiskered Bat | ულვამამლამიობი |
| | <i>Myotis emarginatus</i> | Geoffrey's Bat | სამფეროვანიმლამიობი |
| | <i>Myotis nattereri</i> | Natterer's Bat | ნატერერისმლამიობი |
| | <i>Eptesicus serotinus</i> | Serotine Bat | მეგვიანელამურა |
| | <i>Nyctalus noctula</i> | Common Noctule Bat | მელამურა |
| | <i>Nyctalus lasiopterus</i> | Greater Noctule Bat | გიგანტურიმელამურა |
| | <i>Pipistrellus nathusii</i> | Nathusius's Pipistrelle | ტყისლამორი |
| | <i>Vespertilio murinus</i> | Parti-coloured Bat. | ჩვეულიბრივილამურა |

Table 4.20. Wild species, that are common on working districts

| | laTinuri dasaxeleba/ Latin name | inglisuri dasaxeleba/ English name | qarTuli dasaxeleba/ Georgian name |
|---|------------------------------------|---------------------------------------|--------------------------------------|
| 1 | <i>Canis lupus</i> | Wolf | მგელი |
| 2 | <i>Vulpes vulpes</i> | Fox | მელა |
| 3 | <i>Meles meles</i> | Badger | მაჩვი |
| 4 | <i>Martes martes</i> | Pine Martin | კვერნა |
| 5 | <i>Felis silvestris</i> | Wild Cat | ტყისკატა |

| | | | |
|---|----------------------------|----------|---------------|
| 6 | <i>Capreolus capreolus</i> | Roe-deer | ევროპულიშველი |
|---|----------------------------|----------|---------------|

4.5. Protected Areas

Instituting of protected areas in Georgia has a long history. The first protected area – Lagodekhi State Preserve was created in 1912. For now, the total area of protected territories is 495 892 h, which is approximately 7 % of the whole territory. In Georgia there are 14 State Preserves, 8 National Parks, 12 Reserves, 14 Natural Monuments and 2 Protected landscapes. It is noteworthy, that neither existing road, nor suggested alternative routes do not cross the protected territories. The closest territories to the road are Mtirala and Machakhela National Parks and Kintrisi protected territory, which are located in the Southern-Eastern part. The closest distance away is 5 – 5,5 km.

sur. 4.24

5. Social Impact Analysis

5.1. Socio-Economic Environment

Description of socio-economic environment in villages located along Khulo region and motorway alternative routes.

Khulo region

Demographic Data

Khulo region population - 33430;

Total area of the territory 710,0 sq.km;

Population density on 1 sq. km – 47,1

Children –30,4%

Adults - 57,7%

Elderly –11,9%

In the region are present ethnic minorities;

In the region do not live densely populated refugees;

During the recent years is tendency of population raising;

Economic structures and tendencies, development of different sectors

Agriculture

Total area composes 71000 ha-s.

Private land area – 6029 ha

State– 15866 ha

Vinayars are app. on 4 ha.

39 ha Fruit trees

The rest of the agricultural areas are used Grow the maize and potato

Agriculture is a main source of income for the locals. Mostly the agricultural products are produced by private farmer. Large agricultural companies are not present in the region. Farmers grow corn, vegetables, potatoes, fruit, and rearing animals.

Cattle livestock composes: 42000 large cattle, 2000 sheep, 3000 birds.

30% of produced potatoes and meat are being sold.

Realization of agricultural products is mostly done in Batumi. The most part of the products are purchased by retailers from Batumi. There are no processing factories in the village.

Improving of motorway will positively influence on agricultural products realization. The population will easily sell the products on the market.

Tourism

So far, tourism in the region is underdeveloped, though there exist some perspectives. In Zomleti functions – Ropeway. Mountainous Adjara forests and protected areas create eco-tourism development perspective.

Motorway improvement is a prerequisite for developing regional tourism.

Macro and Micro Business

Relatively large processing unit, which operated in region is - Textile Factory.

In Danispiruli are processed quarries.

Ongoing construction mostly relates to study and medical institutions: schools are being built, dispensaries.

Average business is represented by trade centre.

Micro business is more developed, mostly commercial activities. There private newsstands, and also retailing units. Road side trade is also developed (private newsstands, cafeterias).

Employment

In the region - 2874 people are employed.

219 from which are working in public sector, and 1941 people work for state sector.

Private employment- 714 people.

Unemployment rate is high- 17181. Most of unemployed people work on their own lands to feed their families and not to sell the products.

Poverty level is high, though much less than in Shuaguli region. Number of poor people is - 3500 (10.4%).

Medical Service

Medical service in villages is present by primary institutions: medical dispensary, available emergency;

In regional centre it is possible to receive more complex stationary aid. In Khulo there is regional hospital, polyclinic, maternity hospital, emergency.

Improvement of motorway will support improvement of emergency service and for the patients more available will be medical institutions located in big cities.

Education

In all big villages operate public schools. In small villages are beginner schools. Total number of students in 51 schools is 5300.

Opening of University is planned in regional centre.

Infrastructure and Utility Services

Regional villages are significantly distanced from railway roads. Most common transportation means are minibuses.

Water supply and sewage System needs rehabilitation in the regional centre.

Supply with electricity is mostly continuous.

In the region there is no natural gas infrastructure.

Apart from electricity, population is using woods.

Various communications are ensured in the regional centre (phone, telegraph, internet, post, etc.)

Large Infrastructural Elements in the Zone of Motorway Alternative Construction Options.

In the area of rehabilitation/reconstruction motorway are common power lines. From other types of infrastructural elements are noteworthy communication systems, namely – planned construction of fiber optic cable system.

5.2. Socio-Cultural Environment

One of the oldest part of Georgia, Southern-Western Georgia – Adjara consist of two large historic « countries » :

1. inside Mountainous region, which is called upper Adjaramis Adjaristskali valley, with its multi tributaries, Chorokh-Adjaristskali and including Goderdzi gorge.
2. Kvemo Adjara, includes coastal plains and foothills.

The latter is often called « Kobuleti Country ».

Central part of Adjara was called Shuaguli.

The oldest trace of population in Adjara has been observed since stone age and has been continuously present in the eras of following populations, including middle ages. They are also presene in magalith culture monuments.

For today, after merging of existing archeologic findings and sources of georgian and foreign origin, in science is established an opinion that in XVI_VII centuries B.C in Southern-Western Georgia represented a brilliant Colchic hearth and that this culture was developed on the basis of local metal ores.

On Adjara territory settlements of Bronze Early Iron Age are excavated (Makhnjauri, Namcheduri, Ispani settlement etc.), in solid cultural layers of which are well reflected stages of conceiving and development of leading elemets. Along with this, in some settlments and separately as well, are revealed and excavated dozens of metal foundries and metal paste forms remains. On these monuments have been discovered metal foundry remains, nozzle-bellow clay pipes, metal slags, crucibles, and the most important - Colchic weapons and agricultural tools (sieves, hoes, billhooks, segments etc.), pouring molds of prototypes transitional forms and species. Also, from the whole territory of Adjara are wellknown so-called “Metalworker Treasures” (Ureki, Meliqeduri, Qobuleti, Chaqvi, Sakhalvaso, Makhunceti, Choroki Gandzi, Didadjara, Saroreti, Sikhalizeebi and etc...). in these treasures, apart from bronze bars are variety of engraved Colchian axes, hoes, billhooks, belts, wormwoods, buckles etc.

In scientific literature opinion is instituted that in Cholok-Ochkhamuri valleys are found hundreds of iron metallurgy workshops, one of them is the oldest among the early metallurgy centres.

By merging the oldest Middle Eastern written sources and archeological data there is no doubt that in Western-Georgian (Colchic) culture was founded the first Georgian state formations - XI_VIII centuries B.C. – Diaokhi and Kolkha

In the second half of VIIIth century of B.C. Adjara is inseparable part of Colchis Kingdom. On this territory from the early stages are notable dense contact with pre-Asian, Middle Eastern and Aegean civilizations. From the middle ages of the first millennium of B.C – Antiqua World. Hellenic, Roman and Byzantine era in Georgia is considered as the era of forming state urbanized civilization and prosperity.

From the VII_VI centuries B.C. in Southern-Western Georgia and generally in coastline of Colchis Kingdom, arrived new residents from Greece. New cultural wave supported formation of new urban centres (Fasisi, Dioskuria, Gienos etc.), among them in Adjara

coastline. In the same period strong cultural layers have been observed in Petra-Tsikhidziri, Batumi Castle and Qobuleti pinewood territory. Stationary archeological excavations are being held on the territory of pinewood settlements. On the cemeteries of Greek and Colchis communities are found various and diverse items – Bronze, Golden, Silver jewelry, coins, greek ceramics, Egyptian and Syrian glass works, bead-jewelry and etc. all these well describe the trade relations between Colchis urban centres with Minor Asia and Eastern world. Also it gives us idea about social, material and spiritual culture of the population of those times.

ax.w. II-V saukuneebSi, romauli eqspansiis periodSi, aWaris teritoriaze ori msxvili saqalaqo centris arseboba igulisxmeba _ gonio-afsarosi da petra-cixisZiri. isini safortifikacio sistemebiT gamagrebul garkveuli regionebis samxedro-administraciul, savaWro-sameurneo da sulier centrebs warmoadgendnen.

As a result of archeologic excavations, are also found imported transit Tara-amphorae, glass products and jewelry, excellent samples of goldsmith – jewelry, monuments, coins and etc. all these are an excellent example of trade, economic and cultural relations with Roman world...

In Adjara, Christianity was spread in early times, in the first century of A.D. this fact is related to the missionary activities of Christ apostles, Saint Andris the First, Svimon Kananineli and Mattattah. In the life of Kartli, in Gonio-Afsaroshi, under the leadership of Saint Andris the First was built the church of Holy Virgin.

In developed feudal era Adjara was the leading part of Georgian Feodal State. In XI-XIII centuries, together with Klarjeti, Shavshveti and Samtskhe, Adjara was ruled by dukes of Kingdom Abuseridze, who have contributed a lot in formation and maintenance of Georgian Feodal State. Under their governance, Adjara sharply advanced in terms of economic, political and cultural life. Many castles, churches, monasteries, stone arch bridges were built and improved caravan and carriage roads.

In XIIIth century, here, in Skhalta valley acted wellknown scribe, scientist, astrologer Tbeli Abuseridze. To his name is related construction of Skhalta monastery.

Because of historical hardships in the forties of XVI century, together with Samtskhe-Satabago, the Ottoman Empire conquers Adjara. Until 1878, today's upper Adjara was separated from united Georgia.

During the reign of Ottoman Empire, completely were devastated Georgian Christian monasteries. The only Architectural monument that has reached with relatively complete form is Skhalta monastery.

Archeological Potential of Adjaristskali Valley

For now, subject of our discussion is valley of Adjaristskali, where passes motorway Batumi-Akhalsikhe. Apart from the acting road (option 1) additional four suggestions are made. 2nd, 3, 4 options territorially bond with the 1st option. The 5th option follows from Zomleti to South-East the right inflow of Adjaristskali valley, Skhaltistskali valley and Goderdzi gorge, and at the summer pastures joins the 1st option.

Archeologic and architectural scientific studies of Adjaristskali started in the 70s of the last century by the Scientific Research Institute of Batumi. Occasional discoveries of early and various periods of archeologic items were enriched by the findings of scientific research-studies of stones, bronze, antique and feudal era of archeologic monuments. On alpine pastures were revealed megalith cultural monuments. In Adjaristskali valley were

implemented large scale field works for studying the architect monuments of Middle Ages (X-XIII) (castels, churches, monasteries, stone arched bridges, cemeteries).

After merging the written sources and the archeologic and architectural monuments of Adjaristskali basin the scientists conclude that along Adjaristskali valley and its inflowing ravines from the earliest era were passing connecting roads of local and various regions. A clear example of this is the geography of discovering archeologic-architectural monuments. Almost in all valleys are observed castles of Middle Ages and dozens of stone arched bridges. In the road systems of upper Adjara one of the most important was the road crossing Adjaristskali, which crosses whole Adjara and connects Goderdzi gorge with Samtskhe.

Below please find the list of upper Adjara cultural heritage and their locations along the design road (Khulo-Goderdze section).

Khulo region

Satsikhuri church the same as Jvartni church – IX-X centuries, located in the valley of Adjaristskali right inflow – Rorjomistskali. Is erected on the highest peak of Jvarikedi. During archeological excavations were found bricks decorated with ornaments, doors and windows, stone tiles. Around the church are cemeteries. 36 tombs were excavated.

Vanadzeebi (Agara) church – XII-XIII centuries. Is located in the valley of river Rorjomistskali.

Village Didadjara - bronze points treasures, XIV-XII centuries of B.C., was found in sa 1964 in the household plot of a resident. In large clay vessels were placed 20 Colchis axes. Most of the axes were well protected and engraved. Researchers emphasize the high quality of Didadjara treasure. In this and other points of Adjara, foreseeing the large amount of bronze items it is believed that in Dadadjara and its area was located metallurgy hub. In Aquaretha valley, near Borough Keda, is as well-known copper ore, which in the opinion of specialists composes 90% of Adjara copper supply. Based on Didadjara treasures, the scientists consider that in Southern regions of Eastern Georgia Colchic culture reached in Adjaristskali exactly from its valley heads and via crossing roads of Goderdzi gorge.

Village Tago – bronze treasure, consistinf of bronze bars packed in clay pitchers. Was found when expanding motorway.

Village Paksadzeebi – settlements of V-IV centuries B.C., were damaged in 1959 when motorway was expanding.

In roadside plate are found clay dishes and metal spears. In the opinion of specialists the monument territory extends on one ha. No excavations were made.

Village Rorjomi - the place was faught in the past, in III millennium B.C., the fact of discovering bronze, ax found there is one of the oldest wares from Southern-Western Georgia.

Village Danisparauli – fact of discovering Stone Age weapons, stone axes are also found.

“Beshumi Settlement” – early middle ages, is located in the coniferous, Northern-Eastern forest area of Beshumi resort, on the beach of river Beshumi inflow. As a result of minor archeologic works it was found that each settlement consists of several residencies of stone monolith. So-called Settlement represents elevated four hills. They are distanced from each other with 100-150 meters. This hills are connected to each other with roadways.

In the area of Goderdzi gorge are observed different kinds of settlements of this type. They are distanced from the settlement with 3-5 km. these monuments are located on the right

side of Beshumi beach, in forest, on a place called “Vashlobi”, on 2.5 km distance, along the river in Kveruli, and below is a place **pantnari** and etc.

Close to this settlements is observed paved old caravane road section.

On Beshumi territory were found ston age places – is located at the Goderdzi pass, in 8kms, there where Beshumi river starts. In Beshumi stone age places are found several districts: Shkerneli, Big Iails, Shuaubani, Beshumi Iail, Verkhvnari, Nachadrili and etc. also are found Kaji and Obsidiani weapons. Our “Kaji” represents a petrified type of Spruce, Pine and Fir, which are frequent in Beshumi and its areas.

On Goderdzi gorge, when the motorway was being cut, were damaged natural monument, petrified forest.

5.3. Land purchase and resettlement

Below is given preliminary version data of 2013 action plan on resettlement. Final version of resettlement ction plan is under preparation.

The project following optimization has given an opportunity to the projectors to significantly reduce sellin line width and the scales of impact for private owners on lands and property. The road design width composes max 9.0m, and under Khulo village it reduces with 6 meters.

234 787 sq. m. Land, total 567 plos, from where 461 plots (188 836 sq.m) _ private, 79 (28183 sq.m) state land in private ownership, and 27 are state plots unused by private entities (total area 17 768 sq.m).

In private plot total area is 188836 sq. m. 211 from them (92 858 sq.m) registered and 250 (95 978sq.m) need to be registered. Private plots (as registered, so those that need to be registered) are subject to reimbursement. Total area of the land under state ownership is 106 (45951 sq.m). For agricultural purposes total area of 79 state plots used by private users is 28183 sq.m. The land is not subject to reimbursement. Although, reimbursement will be issued for constructions, crops and fruit trees of such plots.

On 33 impacted plots (20342 sq.m) users and owners are growing potatoes. 81 (21410 sq.m) are used for mowing. Only 4-4 land plot ise used for crop and vegetables. Land used for annual crops is 44 462 sq.m (total 122 land plot)

Table 5.1. Impact on Annual Crops

| Crop | Number of Plots | Area in sq.m. | Number of households |
|--------------|-----------------|---------------|----------------------|
| Corn | 4 | 1800 | 4 |
| Vegetables | 4 | 910 | 4 |
| Hay/Grass | 81 | 21410 | 81 |
| Potato | 33 | 20342 | 33 |
| Total | 122 | 44 462 | 122 |

Fruit trees are affected on 283 land plots that are owned by 244 households. 33 households lose 2 fruit trees on 2 plots simultaneously, and 3 households – on 3 plots. Total affected number of trees is 2947.

The project affects several major capital buildings and several auxiliary buildings (warehouses, shade, etc.) and large number fences and partitions. From capital buildings 5 living houses are subject to demolition (built with stone and wood), 4 shop buildings (2 of them inactive and 2 acting) and 2 petrol stations (1 inactive and 2 acting). Also need to be demolished non-capital buildings: 1 small windmill (wooden, 4sq.m.), 1 small petrol station (wooden, 4 sq.m.), 17 auxiliary buildings (warehouses, shades, stables, etc.), 26 stone (concrete) walls (total area 1240.5 m²), 141 metal fences on wooden pillars (total length 44 857m) and 128 wooden fence (total area 70.2 cub.m) and one digged fundament for the building.

Apart from those buildings that are subject to demolition there are several facilities that will be relocated to new location: 1 minor family belonging grave (set in internal yard) and agricultural facility – 1 container and 5 cisterns.

The project affects 4 minor family run businesses: 2 small shops and 2 small petrol station, where family members are employed. The damage caused by loss of business will be compensated with annual net profit. In addition, affected families will receive allowances against sharp impacts in the amount of 3 months minimum wage for family with 5 members.

Adopted Principles for Project Implementation

Action plan for advance resettlement was prepared according to World Bank resettlement policy (OP 4.12). The final resettlement action plan will be prepared either according to Georgian legislation, or according to the procedures of the donor who will finance project implementation. Below are listed suggested principles for resettlement.

In order to overcome discrepancies between Georgian legislation/regulations and World Bank policy, the Roads Department elaborated number of principles and policy for the project, which was approved under the name of Resettlement Policy Framework (RPF) name. These principles ensure full compensation, rehabilitation/recovery of revenue means, help for land arbitrarily owners and subsidies for such affected people, who have to resettle, lose business, and those who will be affected the most.

Foreseeing above mentioned discrepancies any kind of intervention financed by World Bank should be ongoing together with additional regulations of Georgian legislation, in order to meet the following requirements of World Bank related to the following issues: (i) rehabilitation of all affected individuals (among them of such individuals, who do not have status of legal owner on the assets falling under the project impact); (ii) ensuring compensation in case of losing business and revenue; (iii) providing of special help that will cover necessary expenses required for resettlement process, as well as special needs of socially vulnerable families. The primary goal of resettlement policy is to minimize impact/loss and support the affected individuals, for them rehabilitate revenue means at least to preproject level.

For this reason was adopted RPF (Resettlement Policy Framework Document), to foresee (a) property rights for all affected individuals indiscriminately; (b) compensation on property and/or revenue loss; (g) recovery of revenue sources and further development. Families/individuals, who are subject to resettlement in terms of project will receive

monetary compensations for land and other properties according to existing market value of the given time. Additional measures will be adopted to ensure minimum disturbance during project implementation. Thus, families subjected to physical resettlement and/or who will be economically affected, will receive compensation according to the following norms, which also represent project RPF part.

Accordingly, during implementation the Roads Department will ensure:

Where possible, will be selected road renewal and constructions alternatives, which will avoid populated areas, to minimize physical resettlement or purchase of private or public property.

Damage of assets also will be minimized, such as crops, trees, fences and newsstands and also loss of revenue, among them destruction of harvest. Any kind of negative impact will be compensated according to RPF provisions;

For the recovery of each section of the highway, which requires purchase of private lands, physical resettlement of families or commercial facilities, loss of revenue or other negative impacts, will be elaborated RAP according to procedures and provisions enacted in RPF (the latter is mostly based on World Bank OP4.12, World Bank guidelines and Georgian legislation).

Construction works that cause resettlement will not commence on none of the highway sections, while the RAP will not be finalized and will not be approved by the World Bank, according to relevant Georgian protocols;

Fair and transparent procedures will be elaborated, to define compensation (i) for the loss of land/assets during construction process; (ii) for perpetual purchase of land and assets and (iii) for limits set on land usage, that might refer to the adjacent territories of the corridor;

All affected individual, despite legal property rights, will receive various types of support, to maintain preproject level of revenues and living standards;

Those who use the land illegally, will not receive compensation for land loss, but will receive compensation for the loss of any other type of property that belongs to them on the same land. Also, they will be reimbursed for the loss of revenue and will be supported to maintain or improve living standards;

Market research will be conducted to evaluate market prices for land, construction materials, harvest and other relevant facilities that are used as indicators of facility value for defining compensation price. This will ensure that affected individuals will be able to purchase substitute lands with the compensations they receive.

Affected individuals will be compensated according to full replacement of lost property. Loss of revenues and assets will be reimbursed without any additional payments, depreciation and any other deductions.

Affected individuals will be informed about their rights. Also will be held consultations, agreement on technically and economically suitable alternatives to resettlement.

When possible, Road Department will control that local bodies ensure the affected individuals with resident houses or places or in case of necessity with agricultural territories for monetary compensation. In such situation, combination of land fertility, suitable location and other factors at least should equal to the characteristics of old territories;

During the resettlement the affected individuals will be supported in case the resettlement is imminent;

Land (or right to use land) will be obtained through negotiations and expropriation right of private property will be used only in extreme cases;

Special attention will be paid to the needs of socially vulnerable groups – children, women, cultural and ethnic minorities, elderly, those below the poverty line, disabled and refugees. Fair and available mechanism will be elaborated for dispute settlement; Compensative measures and adoption of RAP will be finished prior to beginning of construction works.

Rights on Compensation

General rights include:

The legitimate owners shall receive the compensation for the agricultural land area in the gross value of the replacement price. When more than 20% of total area of the agricultural land used by the affected households is purchased, the affected persons (owners, lessees and tenants) will receive additional compensation for severe impact, which would amount to the market price of the annual crop harvest on the land plot lost as a result of the project. In case the severe impact (more than 20% of the income loss) is spread to other types of income sources, the affected person receives additional compensation in the amount of three months income. Affected individuals who have the legal basis for the legalization of the land (legalizable owners), shall have the land legalized and receive the compensation as legal owners.

Affected persons, who do not have legal grounds for legalization of the land, shall not receive compensation for agricultural land. If possible, they will be given the opportunity to lease the land.

Non-Agricultural Land (residential / commercial land). Legal and legalizable residents will receive full compensation in the amount of land replacement cost without any discount and depreciation. Affected persons, who do not have legal grounds for legalization of the land, shall not receive compensation for agricultural land. If possible, they will be given the opportunity to lease the land.

Any affected houses, buildings and structures on the affected person's land regardless his/her legal right to the land will be compensated in cash for the replacement cost of the land without depreciation and amortization. In case of a partial impact, if the owner does not wish to move, compensation will cover only the costs of the rehabilitation of the affected part of the building to the initial conditions. The total compensation is paid if the impact makes the building unusable.

Any waste material left after the collapse of the buildings shall be considered as the property of the affected families. The affected families are responsible for the removal of the waste material prior to beginning of the construction.

Harvest: during the recent years, after the occupation of the agricultural land to be used on a regular basis for the purpose of the project, the monetary compensation will be paid without any preconditions in the amount of annual value of the current gross value. In case of lease the distribution of crop compensation will be based on the specific contract between the land owner and the lessee.

Trees: monetary compensation according to the market value of the trees per the species, age and productivity.

Businesses: If business is permanently lost, cash compensation is paid according to the annual income determined according to the tax declaration, or in the absence thereof, on the basis of a minimum annual salary. Temporary business losses will be compensated in cash on the

basis of the tax declaration data during the period of suspension of the business, or in the absence thereof, based on the minimum salary per the term suspension of the business.

Agricultural land for tenants: If tenants are treated under the influence of agricultural land, their compensation shall equal to the annual monetary rental income from the land according to the relevant supporting documents (tax declaration), or, in the absence thereof, to the annual minimum salary.

Wages / employment loss: If employed workers lose wages because of the project, they will receive the compensation equal to three month's salary.

Relocation: the affected persons who are subjected to forced resettlement, will receive housing subsidies to cover transportation costs and living expenses for three months.

Any property and utilities in joint (community) ownership: within the frameworks of the project they will be completely rebuilt or repaired so that they conform to the pre-project functions.

Socially vulnerable population: socially vulnerable affected individuals (as already explained above) will be given an allowance, which amounts to three minimum wages.

Support, assistance and cash allowance

The following types of assistance, rehabilitation measures and cash benefits are considered:

Families in need of resettlement will be given an allowance for transportation in the amount of 200 GEL per family (for vehicle renting for shipment of household items) and monetary allowance for the recovery of income resources for three months to assist in settlement on a new location. This amount is 3 minimum wages, making a total of 1,112 GEL per household. Severely affected families, or families who will lose more than 20% of income-generating assets, will receive (i) an additional compensation for the crops on the affected land; Or (ii) for the cases when the harvest rate is irrelevant, three minimum wages equivalent amount in the form of allowances³;

Affected socially vulnerable families, the families below the poverty line, families without a materially supporting member managed by the disabled or old (retired) persons, families managed by women, displaced persons or refugees will be given an allowance of three months minimum salary (as mentioned above).

6. Analysing Alternatives

6.1. Introduction

As we have mentioned several times, Batumi-Akhaltikhe road mainly passes through difficult engineering-geological and topographic conditions, - mountainous and high mountainous terrains. Specially severe situation is on the km81-km102 section of Khulo-Danisparauli, where the existing road goes through landslide districts that are more than 20. These landslides are mostly active. There are common also stabilized landslide districts, which might get active due to provocation (construction process). The most noteworthy are

³ As we explained in 3rd chapter, due to absence of minimal wage standard in Georgia, the allowance is based on the procedures of rehabilitation allowances enacted in recently approved and is based on minimum subsistence income. Based on last information of Georgian Statistics Department of January 2011 the amount equals to 304 GEL in a family (five members), that equals to 912 GEL for 3 months.

villages: Riketi, Shuasofeli, and Danisparauli landsliding bodies and mudflow outputs. Among them the most active is landslide in village Danisparauli because of existing transitive earthquakes da riv. Safristskali mudflow. All these landslides and mudflow outputs represent a real danger for normal functioning of the motorway.

Hence from above by the transproject engineering group was processed 4 major possible detour options (see below the option table). On the first stage of route selection were discussed the following alternative options:

Table 6.1.

| N | Name | Dim. | Route options | | | | | |
|---|---|------|---------------|------|------|------|-------|------|
| | | | Existing road | N1 | N2 | N3 | N4 | N4a |
| 1 | Length of the existing road | km | 86.0 | 76.2 | 66.7 | 82.0 | 51.5 | 43.2 |
| 2 | Length of the option routes (new route) | km | - | 7.8 | 16.0 | 3.9 | 49.2 | 43.4 |
| 3 | Tunnel | km | - | - | - | - | - | 5.89 |
| 4 | Total length of the route | km | 84.05 | 84.0 | 82.7 | 85.9 | 100.7 | 86.6 |
| 5 | Shortening of the route | km | 1.95 | 2.0 | 3.3 | 0.1 | - | - |
| 6 | Lengthening of the route | km | - | - | - | - | 14.7 | 0.6 |

Option 1. Starts at 95 + 150 km of the Batumi-Akhalsikhe road to the south of the existing road and is located on the left slope of the river Acharistskali, 1-1.2 km away from the river. The section length is 7.8 km and joins the existing road at the 194+859 km, at the altitude of 1810 m. According to this option the shortening of the route is 2.0 km .

Option 2. Starts at 90 + 300 km of the Batumi-Akhalsikhe road, in the north of the existing road, in one kilometer it turns left, crosses the river Adjaristskali and bypassing the populated areas Beghleti and partially Riketi it goes along the right slope of the river Adjaristskali, in 1-1.2 km away from the river. At 9+500 km it crosses the river Adjaristskali in the vicinity of the watershed, goes at a distance of 1.0-1.5 km from the existing road on the left slope and joins the existing road at the 109 + 100 km Goderdzi pass at the altitude of 2025 m. The length of the option is 16.0 km which provides the possibility of shortening the route by 3.3. km considering this route.

Option 3. A northern short option. It starts at the 95+100 km of the Batumi-Akhalsikhe road; at the first km the option crosses two tributaries of the river Adjaristskali and by a partial bypassing the settlements (Shuasopeli and Danisparauli) goes along the left side of the Adjaristskali, 100-200 meters away from the river. At 3 km, compared to the open terrain, the road turns sharply to the right and joins the existing road at 98 + 800 km, at 1440 m elevation. Option length is 3.9 km. Considering this option the route is shortened by 0.1 km.

Option 4. South (Khikhadziri) option. It starts at 71+600 km of Batumi-Akhalsikhe road; At the first kilometer the route crosses the river Adjaristskali and goes 30 km along the slope of the river Skhalta gorge (village Tkhilvana). A local rural road with the width of 5-6 meters can be used in this section with small turnings. Then the route turns sharply to the left and going to the new direction at 2100 m altitude it joins the existing road at 104+850 km, with the elevation of 1830 m. The length of the version is 49.2 kilometers. Considering this option the route lengthens by 14.7 km.

Option 4a. This is the sub-option of the fourth option and matches it up to 36 km, and then the route turns to the right and goes through the tunnel, with a length of 5.89 km, then at 112+900 km at 1813 m elevation it joins the existing road. The length of the option route is 43.4 kilometers. Considering this option the route lengthens by 0.6 km.

Below there are the analysis of each alternative reviewed at the first stage of the selection, including the survey of engineering-geological conditions and sensitive elements of natural and social environmental.

Fig. 6.1. Alternative routes

Pic. 6.2. Alternative Routes

Protected areas

Landscape (Ecosystems; Habitats), Flora

The ecologically sensitive site is located between 105 and 112 km marks (approximate boundaries) of the existing road. The motorway runs about 6, 5 km along this section. In this area there are sub-alpine meadows and mountain steppes. Subalpine zone includes the line 1800-1850 m a.s.l. to 2500 m a.s.l. The vegetation of the sub-alpine area is greatly distinguished with its structural composition and origin.

High mountain forest options play a great role in formation of subalpine forests - subalpine crooked beech forest (*Fagus orientalis*), Subalpine fir (*Abies nordmanniana*), Subalpine spruce-grove (*Picea orientalis*), Subalpine pinewood (*Pinus sosnowskyi*). Birch wood (*Betula litwinowii*) and maple wood (*Acer trautvetteri*) is a bit limited. In subalpes Ponto Oak (*Quercus pontica*) and Medvedev birch (*Betula medwedewi*) is quite wide-spread. Crooked forests are rather common, the upper limit of spreading of which reaches 2300-2400 m. The relict quality of subalpine forests of the area is quite high (the abundance of relict formations and associations).

Subalpine high grass is distinct for Colchis species abundance (*Inula magnifica*, *Pyrethrum macrophyllum*, *Telekia speciosa* etc.). Polydominant composition of high grass is dominated. Subalpine meadows cover the vast territory in the area. There is predominance of secondary bent (*Agrostis capillaries*) and forb-bent meadows. Polydominant grass meadows cover wide areas, which are presented in great variety. From the monodominant meadows, in addition to above mentioned species there are (*Geranium gymnocaulon*), (*Anemone fasciculata*), (*Nardus glabriculumis*) and other species.

Alpine zone district is featured in some of the mountain summits, with a height over 2500 meters (Sakornia, Khino, Sanislo, etc.). Between alpine meadows polydominant forb meadow is dominant. Important area is covered by holds geranium (*Geranium gymnocaulon*) meadows. North slopes are covered with (*Rhododendron caucasicum*).

In the eastern border of the region, in particular on the Arsiani Range (Goderdzi pass areas) fossilized remains of plants and prints that used to exist there prior ice age can be found between the volcanic tuffs.

Next impacted area (the existing motorway runs along the north border of this sensitive zone and is crossed at the 102-104 km section) –II sensitive site – is the area, which is situated between the valleys of the rivers Adjaristskali and Skhalta. The area is the upper border of Subalpine forests, in formation of which high mountainous variety of forest formations play a significant part - Subalpine crooked beech forest, Subalpine fir), Subalpine spruce-grove, Subalpine pinewood. In subalpes Ponto Oak (*Quercus pontica*) and Medvedev birch (*Betula medwedewi*) is quite wide-spread. Crooked forests are rather common, the upper limit of spreading of which reaches 2300-2400 m. The relict quality of subalpine forests of the area is quite high (the abundance of relict formations and associations).

Beech forest subbelts are spread from 1000-1100 m to 1500-1550 sea level. In the subbelt are dominating pure Beech (*Fagus orientalis*) and mixed forests with the dominance of Beech

(Hornbeam-Beech, Chestnut-Beech etc.). most of Beeches are of relict Colchic underbrush (*Rhododendron-Rhododendron ponticum*, *Rh. ungeronii*, *Laurocerasus officinalis*, *Ilex colchica*, Caucasian Ivy - *Hedera colchica*, Caucasian Berries - *Vaccinium arctostaphylos*, Yale - *Rhododendron luteum* and etc.). Apart from Beech, in the mentioned subbelt are spread mixed broadleaved and coniferous forests - Firwood (*Abies nordmanniana*), Spruce (*Picea orientalis*), Pinewood (*Pinus sosnowskyi*). In Adjara in Beech subbelt southern exposition on relatively dry slopes are widespread endemic River Oaks (*Quercus dschorochensis*) and oak trees. In woodless areas, mostly in inverse raftars are developed Rhododendrons (*Rhododendron ponticum*, *Rh. Ungernii*). Dark coniferous forests subbelt is spread from 1500-1550 to 1800-1850 meters above sea level. It is well reflected on the most of region territory (riv. Adkaristskali valley, Meskheta slope Northern side). In forest composition Spruce (*Picea orientalis*), Fir (*Abies nordmanniana*), Spruce-Fir, Beech-Fir, Pinewood-Spruce-Fir are dominant. Also are common pure beech and beech excessive dark coniferous groupings. Most part of the trees are of relict Colchic (evergreen) underbrush. Especially widespread is dark coniferous forests (Spruce, Beech) Rhododendron (*Rhododendron ponticum*), Cherry laurel (*Laurocerasus officinalis*) and Caucasian Berry (*Vaccinium arctostaphylos*) underbrush. In subbelts are widespread Colchic and Colchic-Lazistan endemic relicts – Medvedev Birch (*Betula medwedewi*) and Pontic Oak (*Quercus pontica*) curved forests (this forests in relevant terrains deeply intervene from subalpine belt into forest belt).

This Sensitive Site is located between benchmarks of km 102 and km 106,5, on the first sensitive section of the west. The road crosses approximately 4.5 km of this site. The territory represents subalpine upper border, in creation of which formation of mountain and forests participate and high mountains areal, the upper part of which sometimes reach 2300-2400 meters. Region subalpine forests relict quality is quite high (relict formations and association abundance).

This sensitive section is the **third sensitive section**. The territory represents subalpine upper border, in creation of which formation of mountain and forests participate - subalpine curved Beech (*Fagus orientalis*), subalpine Fir (*Abies nordmanniana*), subalpine Spruce (*Picea orientalis*), subalpine Pine (*Pinus sosnowskyi*). Relatively limited is Birchwood (*Betula litwinowii*) and Maple (*Acer trautvetteri*) distribution. In subalpine Ponto Oak is very common (*Quercus pontica*) and Medvedev Birch (*Betula medwedewi*) curved forests, upper border of their distribution sometimes reach 2300-2400 m. Subalpine forests' relict quality is quite high.

Fauna

The existing motorway crosses several sensitive districts. The first district is located between 105 km and 112 km map benchmarks. The border of these sensitive district should be specified on the field, according to open landscapes borders. Subalpine meadows and mountain steppe represents vital area for the following types of animals: *Prometheomys schaposchnikovi*, *Cricetulus migratorius*, *Tetraogallus caspius*, and the upper belt of the forest and shrubbery represent residence area of *Tetrao mlokosiewicz*. Migration seasonal route for large mammals are given on the district. The territory is the feeding area of numerous wild birds and other unprotected species. The motorway crosses the district approximately at 6,5 km and on printed map is indicated as “**sensitive district #1**”.

The following affected district (existing motorway crosses this sensitive zone on Northern border) and is crossed on sections of km 102 – 104) - II sensitive site is the territory, which is located between river Adjaristskali and Skhalta.

The district is covered with relatively untouched Caucasian Shuamta Beech and dark coniferous forests. Partially with evergreen underbrushes. The given territory, which is spread between two populated valleys (riv. Adjaristskali and riv. Skhalta), which represent Arsiani slope both sides for gene exchange of large mammals and also, Trialeti-Meskheta mountain system and Shavshveti large size mammal population. Habitat fragmentation is quite disputable. Such movement of mammals does not imply massive migration, but is typically annual and seasonal. Ungulate move according to grass abundance and wild animals follow them. This kind of movement of this types supports gene exchange among large mammals and their subpopulations, which are isolated from each other in concrete period of year. This last district discussed by us is the most sensitive and constructions works will completely lose the given area the natural importance that it carries in terms of animal biodiversity.

On the district are common the following vertebrates: *Barbastella barbastellus*, *Sciurus anomalus*, *Lynx lynx*, *Ursus arctos*, *Aegolius funereus*, *Darevskia clarkorum* and *Mertensiella caucasica*; also 13 species of invertebrates. In table 2 (6 species) and in table 3 (14 species) are listed all species that are common on the district. Apart from the danger that the construction works might destroy distribution of these animal species, waste impact of the road in exploitation can result separation and disturbance of feeding areas of the species and habitats. axali saavtomobilo gzis eqspluataciis narCeni zemoqmedeba gamoixateba habitats. Also transport movement might interrupt their seasonal migration.

The next Sensitive district is located in the West of the first district, on #100 and #105 benchmarks of the map. The road passes approximately on 4.5 km of the district (102-106 km). Caucasian mountain birch and Pine upper belt represents vulnerable ecosystem and is the subject of interest for many species and communities that are on the verge of extinction. Among these species should be noted *Tetrao mlokosiewiczii*. The given district is indicated on the printed map as “**sensitive district #3**”.

Surface waters

The existing road runs along the river Adjaristskali and crosses it at the villages Didadjara and Shuasopeli. The river is characterized by a deep bed and is fed by atmosphere precipitation, spring melting snow and partially ground water. Therefore the mode is changeable. The maximum water level rise is observed in the spring snow melt and heavy rain periods, accompanied by intense washing of the banks. From the right the river is joined by many gorges crossing the road most of which are torrent forming. Above the road the river Sapristskali is divided into two branches and both are characterized by the high debris flow features. From the rocky slopes of the gorges the torrent feeding material is continuously flowing to the river bed. The beds of the rivers are full of boulder-muddy material where the Where some boulders size reach 1-1.5 meters and the content of loam fraction reaches 40-50%.

Properly undertaken rehabilitation of the road will not cause significant environmental problems, pollution of surface waters and worsening of the ichthyofauna.

Ground waters

Ground waters are formed in the bedrock weathering crust and slope sediments. Ground waters are fed by atmosphere precipitation and underground cleft waters. They are discharged on the Adjaristskali valley slopes and the banks of the gorges.

Geodangerous areas

At the section of Shuakhevi regional center -Goderdzi pass (82-118 km) the existing motorway goes along the river Acharistskali right slope. This stretch of road in the entire complexity of the geological environment (high energy potential of the terrain, formation rocks sensitivity, frequent repeatability of abnormal adverse meteorological elements and high human pressing) is located in a high risk geological dangerous zone. Continuously updated gravitational rocky debris 15 areas, 40 torrent- transforming erosion gullies and the tributaries to the river Acharistskali, 30 different landslides with different generation, volume and dynamics, including Danisparauli landslides with the volume of 100 million cubic meters. All the above mentioned geological processes potentially represent the real threat against to the normal functioning of the road and requires constant monitoring. Above the road the river Sapristskali is divided into two branches and both are characterized by the high debris flow features. From the rocky slopes of the gorges the torrent feeding material is continuously flowing to the river bed. The beds of the rivers are full of boulder-muddy material where the Where some boulders size reach 1-1.5 meters and the content of loam fraction reaches 40-50%.

During the rehabilitation of the existing road the following conditions should be considered with respect of geo-ecological risks to the environment: during the processing of the slope above the road it should be cut as small as possible to avoid even more active landslide-gravitational effects. Moreover, there are numerous villages on the steep slopes along the road and they might be found in the direct areal of already risky area of geological danger.

Properly undertaken rehabilitation of the road will not cause significant environmental problems - Properly undertaken rehabilitation of the road will not cause significant environmental problems, pollution of surface waters and worsening of the ichthyofauna.

Archaeological sites of interest

The gorge of the river Adjaristskali, where the highway Batumi-Akhhaltsikhe runs. In addition to the existing road (the zero option) four more options are proposed. Out of which 1, 2, 3 options territorially are linked to option 1.

Khelvachauri district

Along the motorway one of the most famous monuments is the Batumi Castle, also called as Tamari Castle. Colchis settlement cultural layers of VIII-VII centuries BC have been observed in these areas as well as the cultural layers dated V-III centuries BC and IV century AD. Ruins of early medieval-era castle can be observed there.

Gvara Castle. Early medieval-era.

Makho's arched bridge. medieval-era.

Mirveti arched bridge. medieval-era.

In the vicinity of the villages Kapnistavi and Beridzeebi remains of the antique era settlement have been observed.

Near the confluence of the river Chotokhi and Adjaristskali, at the "Makhvilauri hill" remains of the antique era settlement have been found.

Keda district

Ancestral castle of Zendidi-Bezhanidzes - XVI century, archaeological excavations have revealed towers, gates, residential buildings, medieval church ruins dated IX-X centuries and tombs dated XII-XIII centuries.

Zvare tower _ medieval-era, now there is a church on the ruins of the tower.

Saghoreti (Pirveli Maisi) Castle _ XII-XIII century castle, located on the right bank of the river Adjaristskali, 2.5 km away from the Central Highway.

Saghoreti village (Pirveli Maisi) 'bronze axes treasure dated XIII-XII centuries BC.

Tsivasula Castle – XI-XIII centuries, located on the right bank of the river Adjaristskali, where Agaristskali joins the river Adjaristskali, 2.5 km away from the Central Highway.

Agara stone bridge – XI-XIII centuries.

Makhuntseti stone arched bridge –developed medieval-era.

Makhuntseti, treasure of bronze items (axes, elongated axes), XV-XII centuries BC.

Tsoniarisi arched bridge _ developed medieval-era.

Dandalo castle of developed medieval-era.

Dandalo arch bridge - developed medieval-era.

Village Kolotauri -in 1970, during the road expansion works clay vessels dated the III millennium BC were discovered.

Village Kolotauri - tower of developed feudal era.

Village Kvashti - in 1983-84 a terraced fortified settlement dated V century BC was excavated. It is located on the left bank of the river Adjaristskali, on the tenth kilometer from the regional center of Keda.

Village Sikhaldzeebi - treasure of bronze items, XII-XI centuries BC.

Village Zundagi - treasure of bronze items, XII-XI centuries BC.

Shuakhevi district

Village Khichauri, Kaviani Castle – XI-XIII centuries, located at the confluence of Chvanistskali and Adjaristskali

Chvani Castle, the same Takidzeebi Castle –X-XIII centuries.

Chvani arched bridge - developed medieval-era.

Okropilauri (Kalaboini) Castle – XI-XIII centuries, castle, located on the left bank of the river Adjaristskali

Darchidzeebi (Gogolauri) Castle – XII-XIII centuries, located on the right bank of the river Adjaristskali's left tributary, Charukhistskali.

Village Takidzeebi - in 1984 in the yard of a local resident bronze axes were discovered.

Furtio arched bridge - medieval-era, located at the confluence of Skhaltistskali and Adjaristskali.

Before the start of any earthworks on any proposed route, the areas should be studied in advance by the specialists of the field. This preventive measure will avoid the damage and destruction (in the worst case) threat against the monuments.

6.2. Alternative to motorway #1

Protected areas;

Landscape (Ecosystems; Habitats), Flora

The first alternative route crosses the ecologically sensitive sites N 2 and N 3 of the existing road.

N2 sensitive site is located between the valleys of the river Adjaristskali and Skhalta. High mountain forest options play a great role in formation of subalpine forests - subalpine crooked beech forest (*Fagus orientalis*), Subalpine fir (*Abies nordmanniana*), Subalpine spruce-grove (*Picea orientalis*), Subalpine pinewood (*Pinus sosnowskyi*). Birch wood (*Betula litwinowii*) and maple wood (*Acer trautvetteri*) is a bit limited. In subalpes Ponto Oak (*Quercus pontica*) and Medvedev birch (*Betula medwedewi*) is quite wide-spread. Crooked forests are rather common, the upper limit of spreading of which reaches 2300-2400 m. The relict quality of subalpine forests of the area is quite high (the abundance of relict formations and associations).

Subalpine high grass is distinct for Colchis species abundance (*Inula magnifica*, *Pyrethrum macrophyllum*, *Telekia speciosa* etc.). Polydominant composition of high grass is dominated.

Sensitive site #3 - This site is the upper boundary of the subalpine forests, where the high mountain forest options play a great role in formation of subalpine forests - subalpine crooked beech forest (*Fagus orientalis*), Subalpine fir (*Abies nordmanniana*), Subalpine spruce-grove (*Picea orientalis*), Subalpine pinewood (*Pinus sosnowskyi*). Birch wood (*Betula litwinowii*) and maple wood (*Acer trautvetteri*) is a bit limited. In subalpes Ponto Oak (*Quercus pontica*) and Medvedev birch (*Betula medwedewi*) is quite wide-spread. Crooked forests are rather common, the upper limit of spreading of which reaches 2300-2400 m. The relict quality of subalpine forests of the area is quite high (the abundance of relict formations and associations).

Fauna

The first sensitive route crosses ecologically sensitive #2 and #3 sensitive sites. Sensitive district #2 is covered with relatively untouched Caucasian Shuamta Beech and dark coniferous forests. Partially with evergreen underbrushes. The given territory, which is spread between two populated valleys (riv. Adjaristskali and riv. Skhalta), which represent Arsiani slope both sides for gene exchange of large mammals and also, Trialeti-Meskheta mountain system and Shavshveti large size mammal population. Habitat fragmentation is quite disputable. Such movement of mammals does not imply massive migration, but is typically annual and seasonal. Ungulate move according to grass abundance and wild animals follow them. This kind of movement of this types supports gene exchange among large mammals and their subpopulations, which are isolated from each other in concrete period of year. This last district discussed by us is the most sensitive and constructions works will completely lose the given area the natural importance that it carries in terms of animal biodiversity.

Sensitive district #3 – Caucasian mountain birch and Pine upper belt represents vulnerable ecosystem and is the subject of interest for many species and communities that are on the verge of extinction. Among these species should be noted *Tetrao mlokosiewiczii*

Surface waters

The I alternative option of the road crosses the river Adjaristskali left tributaries at several sites which are characterized by intensive development of mudflow processes. The man-made ground developed during the road construction process will significantly increase the threat of the “accelerated anthropogenic torrents” and also complicate the ecological condition of surface waters and their ichthyofauna.

The river Sapristskali and all of its tributaries are torrent- transforming, where large energy mudflows are formed and landslide-gravitational processes having the regressive nature are observed in the canyons.

Ground waters

Ground waters are formed in the high clefts of the igneous rocks and weathering crust. They are fed by precipitation and deep circulation waters flowing through the tectonic disturbance zones. Ground waters are also formed in slope sediments, the depths of which range between 2-50 m.

Geologically dangerous areas

The designed motorway joins the road leading to the Goderdzi pass at the place called Zanga, within the borders of a big serpentine - this place is morphologically the western steep surface of the Arsiani mountain range, in the south-west of which the river Sapristskali flows.

The wavy surface is indiscrete and is characterized by an inverted topography of the North-East, which is an indication that we are dealing here with an old landslide block, however, it is now in stable condition. In the north-east from this surface in the about 150 sloping terrains there can be observed some locally developed shallow landslides in the slope sediments. Overall, this area can be considered as an acceptable section of the road design.

From the site Zanga the highway must cross the river Sapristskali valley. In this section an active gravitational landslide with an active dynamic nature has been developed. It is characterized with a circus shape having 50 m circumference (see. Image 17).

The width of the River Sapristskali ravine ranges between 10-25 m and is characterized by high activity mudflow processes. The entire bed is full of the rocky and muddy material of medium density, where the composition of the clay fraction and large-grained mass is represented in almost equal proportion. Individual boulders' values range between 1-3 meters (see. Fig. 18). The ravines of the river Sapristskali is entirely built with the rocky-muddy coating material of the riverbed. Most of the slopes of the ravine (especially in its right side) suffer from landslide-gravitational collapse. Most of them are active in the dynamics experiencing regressive development.

River Sapristskali and all its tributaries are torrent- transforming, where big energy mudflows are formed. On the canyons some landslide-gravitational processes having regressive nature can be observed. Therefore bridge piers should be installed in a significant distance from the banks and at the same time, prior the engineer activities some measure should be taken to protect the banks.

The supporting piers of the bridge must be positioned in no less than 10-15 m distance from the edge of the valley slope as landslide-gravitational activities of regressive nature are almost continuously observed there.

In the frameworks of the second section of the route some landslide events with various dynamics and mechanism are widespread, a special attention is drawn to a large and deep extent tectonic landslides which will be by all means reactivated during the road construction process. Thus, the road construction process will inevitably result in the activation of intensive geological processes and lead to extreme complication of geo-ecological situation. In addition it will be required to cut down a large number of forest areas.

Archaeological sites of interest

Before the start of any earthworks on the proposed route, the areas should be studied in advance by the specialists of the field. This preventive measure will avoid the damage and destruction (in the worst case) threat against the monuments.

6.3. Alternative to motorway #2

Protected areas;

Landscape (Ecosystems; Habitats), Flora

The first 10 km of the second alternative route runs through the less sensitive landscape along the river Adjaristskali and the last 10 km crosses the III sensitive site of the first alternative.

Fauna

2nd option of alternative route from the starting point 10 km section is passing on the other side of Adjaristskali on the same landscape – on Shuamta Beech and dark coniferous forest. This section of route runs along the existing road and along the river, in the vicinity of villages and thus, separation of habitats and disturbance of live nature should be non-significant. The last 10 kilometres cross **sensitive district #3** and will negatively affect on all above listed impacts.

Surface waters

The second alternative option is crossed at several areas by the right tributaries of the river Afjaristkali characterized by the intensive development of torrent processes.

Ground waters

Ground waters are formed in the bedrock weathering crust and slope sediments. Ground waters are fed by atmosphere precipitation and underground cleft waters. They are discharged on the slopes of erosive ravines.

Geologically dangerous areas

Option N 2 which begins on the territory of the village Tabakhmela, crosses the river Adjaristskali valley and through the southern slopes of the Meskheta mountain range joins

the existing road within the area of Goderdzi pass. In this section of the alternative road, above the villages Begeti and Riketi, in the lower part of the Meskheta mountain range some powerful landslide processes having various genetics have been developed. The existing ravines are characterized by mudflows.

After the territory of the village Riketi the road option passes through the high mountainous zone of the Meskheta mountain range within the absolute altitudes 1830-1860 m. Some large scale landslide-torrent processes on the south-west slopes of the Meskheta mountain range till the Goderdzi pass should be noted.

Archaeological sites of interest

Before the start of any earthworks on the proposed route, the areas should be studied in advance by the specialists of the field. This preventive measure will avoid the damage and destruction (in the worst case) threat against the monuments

6.4. Alternative to motorway #3

Protected areas;

Landscape (Ecosystems; Habitats), Flora

The third alternative to the motorway, to be correct, its section from the 95th km to the 100th km, which is the alternative to the existing road shall pass through the settled area and consequently, the impact on the environment will be minimal.

Fauna

The 3rd option of the alternative route, which is the shortest compared to all other options, runs within the boundaries of almost entirely populated area and therefore it will have a minimal impact on the living nature.

surface waters

The third alternative crosses the upper tributaries of the river Adjarsitskali which are characterized by the formation of debris flow processes.

Ground waters

Ground waters are formed in the weathering crust of the middle Eocene rocks, which are discharged on the erosion gullies.

Geologically dangerous areas

The first alternative option (option 3) begins on the territory of the village Riketi in the north of the existing motorway and it joins the zero option of the road through the southern slope of the Meskheta ridge at the sulfur springs emergence area.

The options in terms of geological danger is characterized a much more complex geological environment environment than the current track, the more so that through this track the most difficult landslide area in Danisparaili will still be unavoidable. There are a lot of

potentially dangerous landslide areas in dynamics observed morphologically that in the conditions of cutting the slope will inevitably result in the activation of a large-scale landslide which will include parts of the settled areas. All the canyons and the crossing of the right tributary of the river Adjaristskali is characterized by the development of active torrents. Especially that the man-made ground generated in the construction process will significantly increase the danger of "the accelerated anthropogenic torrents" and also complicate the conditions of surface waters and their ichthyofauna. So the possibility to design the mentioend route has been rejected from the very beginning.

Archaeological sites of interest

Before the start of any earthworks on the proposed route, the areas should be studied in advance by the specialists of the field. This preventive measure will avoid the damage and destruction (in the worst case) threat against the monuments.

6.5. Alternative to motorway #4

Protected areas;

Landscape (Ecosystems; Habitats), Flora

The longest alternative is Option 4, which runs along the old path of the village in the river Skhalta basin. At about 20 km it will cross a sensitive section, where the mixed deciduous forests can be observed. The lower zone of the forest includes the foothill and the lower areas of the mountains up to 1000-1100 m a.s.l. There are polydominant mixed deciduous forests represented in numerous variations. The leading forest forming species include chestnutree beech, hornbeam, Colchis oak, Chorokhi oak, black alder. In some places the forests involve coniferous species - pine and spruce. In addition to broadleaf forests there are also the monodominant and bidominant forests as well, in particular, beech-hornbeam, beech and chestnut, oak and other. Most of the forests are relic, which is mainly defined by strongly developed evergreen subpforest. Between the benchmarks of 20-30 km the route will go through populated areas and at the 30-45 km points it will cross the edges of the II and I sensitive sites and at the last 3rd km – the III sensitive site.

Thus, we believe the option 4 of the road construction to be the most unacceptable.

Fauna

The longest alternative route - Option 4 runs along the old path of the village in the river Skhalta basin. For approximately 20 kilometers it crosses Colchis low-mountain oak forest, mainly covered with evergreen sub-forest, which is significantly damaged as a result of strong anthropogenic impact between the benchmark 20 and 30 the road runs through populated areas (villages Varnebi, Khikhadziri and Tkhonvala). Then about 15 km, between the benchmarks 30 and 45 it passes through both sensitive areas at the border of N2

(Relatively intact Caucasian mid-mountain beech-dark coniferous forests) and N1 (subalpine meadow).

The last 3 km of the road is located within the boundaries of sensitive area N 3. Obviously, all those negative impacts, that according to our estimations may occur in each of the sensitive areas, shall remain in force in case of the 4th alternative route as well.

- Habitat fragmentation and disturbance of nesting places for many of the individual protected species;
- Seasonal movement of large mammals and a delay in the exchange of genes on the construction sites;
- dissolution of some nests of bats in trees as a result of the cleansing activities (cut down of trees prior the initiation of the construction works) and the dissolution of the nests of bats during the reconstruction process of the bridges and likely at the buildings along the road – during the expansion of the road.
- Poachers will be able to easily access to relatively reserved forest.

Surface waters

The fourth alternative option goes along the entire length of the river Skhalta and is crossed in multiple areas by up to 150 of its tributaries many of which are characterized by active mudflow processes.

Ground waters

In terms of hydrological point of view the route passes through the middle Eocene igneous rocks and igneous complex continental deep water circulation area, as well as the alluvial-proalluvial slope sediments of ground waters area. The depth of the latter is 1-5m.

The construction of the route will result in the pollution of surface and ground waters by the.

Geologically dangerous areas

The fourth alternative option begins at the village Zomleti, follows the river Skhalta right bank till the village Khikhadziri, where it moves to the left bank of the river, near the village Baka, then it crosses the river Skhalta outlets, goes in north-west direction and at the Goderdzi pass joins the existing motorway. We believe that this alternative route passing through the medium and high mountainous area with respect of geological hazards due to road construction and impact on the environment is the most difficult. The river Skhalta valley relief is characterized by a large inclination and intense erosion and fragmentation. Out of 142 tributaries of the river all tend to produce mudflow processes, where torrents are observed almost every year. The observed single maximum output of mudflow processes reaches 240-250 thousand cubic meters. Landsliding-gravitation processes are even more widespread and frequent that are conditioned by strongly disturbed tectonic layers and high energy potential of the relief.

Landsliding-gravitation and mudflow processes often cause human casualties. The example of such disasters is the rock-slip developed on the slope of the mountain Solgogani at the left bank of the River Skhalta, at the territory of the village Tsubliani in Spring, 1981, when 200 million m³ debris blocked the river bed forming 50-60 m height dam, a significant part of the village was buried and about 50 people died.

In April 1998, as a result of landslide-torrents developed at the territory of the village Vashlovani 6 individuals were killed, also, as a result of landslides developed in 2000-2005 at the territory of the village Khikhari, 40 residential houses were destroyed. In addition to the fact that the geological processes in the river Skhalta valley are characterized by widespread development, construction of the road according to the mentioned alternative option will inevitably lead to geo-ecological complications and a large scale activation of geological processes, especially in the Skhalta -Adjaristskali mountainous watershed ridge crossing zone, where carrying out the protective engineering measures will be almost impossible.

Archaeological sites of interest

This section of the route entirely goes through Khulo district.

Village Purtio, stone arched bridge - developed medieval-era

Village Kinchauri, stone arched bridge's ruins -developed medieval-era

Village Tsaqlana, a place named Kishla - a place of discovery of stone tools, a variety of weapons made of obsidian has been found.

Village Skhalta, Skhalta architectural complex - the complex consists of the ruins visible in the form of a small church built in X-XI centuries,

Village Vernebi - XI century church,

Village Pushrukauli, place named as "Khizanaat Stream" - Late-Early Iron Age (BC XII-VII cc.) items were found during the earthworks

Village Kalota, Kaloya Church – XI-XIII cc. located on the left side of the river Skhaltistskali, on the high terrace of the village, the locals call this place "Threshing floor" .

Village Kalota – a pagan monument dated I millennium BC

Tikanauri Church – X-XI cc.

In Tikanauri area microlithic tools made of flint and obsidian flakes of Stone Age have been accidentally discovered.

Khikhadziri Village, by a bronze treasures, BC. Sec. VIII_VII cc.

Village Khikhadziri, tsikhisqelis castle, XI_XIII cc.

Village Khikhadziri, Vardtsikhe, XI_XIII cc.

Tkhilvani John evangelizing church, XIII century.

Village Khikhadziri, treasure of bronze items, VIII-VII cc. BC

Village Khikhadziri, Tsikhiskeli Castle, XI-XIII cc.

Village Khikhadziri, Vardtsikhe, XI-XIII cc.

Tkhilvani church named after John Evangelizing, XIII century.

6.6. Alternative to motorway #4a

Protected areas;

Landscape (Ecosystems; Habitats), Flora

Option 4a (a short tunnel) is less harmful, because it would bypass the III sensitive site and shorten the route on the I and II sensitive sites. However, negative impacts on sensitive sites I and II still remains.

Fauna

Option 4a (a short tunnel) is less damaging, as it avoids the sensitive site N 3 and shortens the route cutting the sensitive sites N1 and N 2, but road construction and all the negative impacts caused by the road operation will by all means apply the mentioned two sensitive areas as well. If the new road is built west of the tunnel portal directly to the direction of the village Rakvta and the village Varna, we shall avoid crossing the sensitive sites N 1 and the length of the line crossing the site N 2 will be shortened. The main part of the road will cross the degraded low-mountain oak forests of minor significance.

Ground waters

The tunnels will cross the middle Eocene volcanic rocks developed in underground waters, which are discharged in the zone of tectonic fractures.

Geologically dangerous areas

As the road construction in the watershed Tsedi zone will be extremely difficult due difficult morphological conditions of the terrain, the design data offers 5.9 km length of the tunnel. The 11.73 km long second tunnel is offered in the north of the existing road to the direction of– Shuasopeli –Danisparauli–Goderdzi Pass.

No doubt, many of the negative factors impeding the reliable operation of road tunnels shall be removed (difficult winter weather conditions, the danger of geological processes, etc.), but high ecological complications in terms of the environment as a result of the construction of the tunnels will be taken into account by all means. In particular, sites for the placement of the large amounts of soil from the tunnel; the emergence of a large scale "man-caused landslides" in the river Adjaratskali basin, pollution of surface waters and destruction of Ichthyofauna; pollution of the part of the Black Sea shelf etc.

6.7. Conclusion

We studied the advantages and disadvantages of the alignment of all of the above options and established the following:

Engineering-geological point of view

All of the above options of the new route run through the hilly and mountainous areas of Adjara, which region belong to the most difficult regions of Georgia in terms of the landslide and debris flow and other dangerous geological processes, scale of damages, and the risk of intensifying pace of the processes. The extremely difficult terrain, the high-energy potential, geologically sensitive distribution of rocks, harsh climate and geological environment, as well as high of human activities contribute to large-scale development of the processes and their activation in the short time interval.

All options of the route run mainly along the tectonically disturbed line, which resulted in the development of various slopes with different genesis and dynamics. They have large capacities and are currently active. The slopes of the gorges are characterized by frequent erosion fragmentation.

We should also note currently stabilized landslide areas, in which the excavation activities during the construction process will inevitably trigger landslides on the slopes and the activation of new ones.

Numerous debris flow ravines should be noted as well as, the activities of which have catastrophic consequences.

Ecological point of view

All the reviewed routes cross at least two of the three of the region's sensitive ecological sites. Sensitive areas are characterized by high conservation value forests. The impacts on sensitive receptors are minimal in case of the existing road rehabilitation / reconstruction project limited to only extension of the road shape in the landscape. The implementation of all other alternatives is related to new, significant damage to the previously untouched forest, (cutting down of the trees in the construction area; degradation at the borderlines). This impact would be particularly severe impact in case of the 4th alternative option.

During the forest impact assessment it should be noted that along the new routes there are mostly untouched forests distinct for their species diversity, including red-listed species as well (see. Appendix 3) and are of high-sensitivity and value.

The forest density is 3-4 times higher than the density of the sparse forest at the existing road section. Minimal damage calculation is based on methods specified in paragraph 1.4.1. The table is given below. At the same time we emphasize that damage to forests is not limited to the area of the cut down trees. Accompanying processes, which are characteristic for cutting down forest (change of surface waters drainage, erosion increase, landslides formation stimulation, the deterioration of the sanitary conditions of the surrounding area and increase of forest pests spread risk), will contribute to forest degradation and a larger area of damage than the cut area.

All of these environmental impacts, as a rule, is important in the area of new massive cutting of forests. Important side-effects of new road construction in the forested areas include illegal and uncontrolled logging increase in the availability of access roads. According to the calculations a real chance of injury increases 2-3 times compared to what is given below:

Settlement issues and other social factors

During the road rehabilitation / reconstruction its expansion is related to acquisition of approximately 129120 square meters of private land in Khulo alone. Implementation of alternatives N 1 and N 3 slightly reduces this figure and the implementation of alternative N2 considerably increases it. Implementation of N4 and N4a alternatives are related to the necessity of purchase of a larger area of private land.

Final conclusion

Engineering geological difficulties turned out to be the decisive factor in making the decision. Based on the engineering-geological conditions the following conclusions were made:

Construction of the motorway in the direction of the alternative options was virtually impossible. Finally the existing road rehabilitation and reconstruction options can be viewed which in addition can be considered in two versions:

- Open-load option.
 - The tunnel option on the existing road. way to the.
- Essentially the same conclusion follows from the analysis on the ecological basis.

Analysis of the reasonable alternatives identified at the first stage of Shuakhevi-Adigeni road route selection

6.8. Feasible options for technical-economic assessment

Table 6.2

| N | Name | meas. | Route options | | |
|---|--|-------|-------------------------------|----------------------------|-----------------------|
| | | | Existing road length 9.5-12.0 | arsebuli gza sig.10.5-12.0 | arsebuli gza gvirabiT |
| 1 | Length of the existing | km | 86.0 | 86.0 | 60.0 |
| 2 | Length of the options (new directions) | km | - | - | 1.5 |
| 3 | tunnel | km | - | - | 12.7 |
| 4 | Total length of the route | km | 84.05 | 84.05 | 74.2 |
| 5 | Shortening of the route | km | 1.95 | 1.95 | 11.8 |
| 6 | Lengthening of the route | km | - | - | - |

In case of the open-load option the road in Danisparauli-Zarzma 102-km 127 section goes through the Goderdzi pass at the altitude of 2025 m, in the harsh weather conditions zone, where the movement is seasonal and closed for 5-6 months due to heavy snow (snow cover height of 4-5 meters). The route's total length in this direction is 86 km.

The advantage of the road with a tunnel on the existing road compared with the open-load road lies in the fact that it provides unimpeded traffic flow throughout the year at the same time it is possible to avoid Danisparaili landslide section.

The tunnel length is 12.7 km, and the entrance and exit portal benchmarks 1208.8 and 1470.4, respectively. In this case, the total length of the route is 74.2 km, and the route shortening -11.8 km.

In case of choosing the route according to this option the main problem is the possibility of construction of the tunnel, with a length of 12.7 km.

The design tunnel roadway width is accepted as 8.0 m, service exit 0.5 m and 0.25 m protective barrier, gabarit height 5.0 m.

For the construction of the design tunnel first of all it is necessary to make a small cut (d-4.5 m) tunnel for geological exploration of its entire length, which in the future will be used for (the removal of water from the tunnel) as drainage adit.

Installation of the tunnel ventilation system (supply of fresh air both during the construction and its operation through the entire length of the tunnel) considering the location relief, is possible only through the vertical shafts. After the construction of surface relief profile on the tunnel longitudinal axis (which is taken from the photos of aerial maps) arrangement of the vertical shafts up to 1 km will be required.

It is noteworthy that the above mentioned tunnel ventilation became possible through a set of horizontal tunnels. So, we can say that the design of the tunnel ventilation as well as the arrangement is relatively difficult and requires a specific approach.

Consequently, due to the design tunnel's significant length and deep location, it will be necessary to make individual decisions regarding installation of ventilation, lighting and extinguishing systems, the tunnel construction technology and design to ensure safe movement of the transport.

Based on the above, the tunnel should be considered as an engineering construction of unique class, the design of which shall be handled by a special technical conditions, which will be available as a result of the scientific environmental research, this means that during the development of the design of the project it will require involvement of world-famous scientists and research institutions.

Economic calculations show that the economic return of the ratio I (discount rate) of the existing road (the roadbed width of 9.5-12.0 m) amounted to 6.9%. The old way (the roadbed width of 10.5-12.0 m) amounted to 6.9%, while in case of the existing road (with tunnel) - 7.9%. The discount rate 12% is accepted.

Discounted Net Income (NPV) for the existing road (roadbed width of 9.5-12.0 m) amounted to 12 333 111 GEL, while for the old road (the roadbed width of 10.5-12.0 m) and the road (with tunnel) there is a negative effect, and is therefore - 62 000 000 and -897 000 000 (see. Table of technical-economic indicators). Economic analysis of the discount rate of 12% is accepted.

Given all of the above, the existing road option can be considered as the most optimal variant of the road (open-load through the Goderdzi pass), based on topographic, geological, environmental, social and economic performance indicators.

At the meeting of the Technical Council of the Department of Roads of Georgia feasibility study and design solutions for the discussed Batumi-Akhaltzikhe road Shuakhvei-Adigeni 55 km - 140 km section and the option of the existing road (open load) reconstruction and rehabilitation was recommended for final development (protocol N 3 28.01.09).

Table 6.3. Table of Technical-Economical Indicators of the Options

| N | Name | Meas. | Existing road with the width, m | | Existing road with tunnel |
|---|--------------------------------------|-------|---------------------------------|-----------|---------------------------|
| | | | 9.5-12.0 | 10.5-12.0 | |
| 1 | 2 | 3 | 4 | 5 | 2 |
| 1 | Length of the route | Km | 84.05 | 84.05 | 74.2 |
| 2 | Estimated movement speed | km/sT | 50-80 | 50-80 | 50-80 |
| 3 | roadbed width | M | 9.5-12.0 | 10.5-12.0 | 10.5-12.0 |
| 4 | roadbed width with a supporting line | M | 7.5 | 7.5 | 7.5 |
| 5 | Sideway width | M | 1.25-2.5 | 1.25-2.5 | 1.25-2.5 |
| 6 | Maximum long inclination | % | 9 | 9 | 8 |
| 7 | minimum radius of curves in the | M | 50-80 | 50-80 | 50-80 |

| N | Name | Meas. | Existing road with the width, m | | Existing road with tunnel |
|--|---|---------------------|---------------------------------|-----------|---------------------------|
| | | | 9.5-12.0 | 10.5-12.0 | |
| 1 | 2 | 3 | 4 | 5 | 6 |
| | plan | | | | |
| 8 | minimaluri radiusi serpantinebze | M | 30 | 30 | 30 |
| 9 | Earthworks profile volume | 1000 m ³ | 2 900 | 3 800 | 2 700 |
| 10 | Road cover area including the supporing lines | 1000 m ² | 653.9 | 694.8 | 573.1 |
| 11 | Reinforced concrete pipes | c/grZ.m | 306/4883 | 306/4883 | 205/3204 |
| 12 | Bridges | c/grZ.m | 41/2289 | 41/2289 | 33/1826 |
| 13 | Tunnel | Km | - | - | 12.7 |
| Estimated cost for the construction-rehabilitation works | | Million GEL | | 306.7 | 1 600 |
| 1 km road cost | | Million GEL | | 3.65 | 21.56 |
| Discounted net income | | Million GEL | | -62.0 | -897.0 |
| Economic return ratio | | % | | 6.9 | -7.9 |

6.9. Environmental Assessment for feasible options

The "environmental price" of the discussed alternatives, on the basis of which it is possible to compare the alternatives, is practically limited to the cost of compensation for the damage caused to the high conservation value forest ecosystems and the expenses related to the placement of excavated ground. Below is an analysis of all relevant alternatives.

Problem related to the placement of excavated ground

Placement of excavated ground is an important environmental problem, it is necessary to be considered during the implementation of the options 1 and 2, but it becomes especially required for the 3rd option – due to a huge amount of excavated ground produced as a result of the tunnel excavation works.

As a result of tunnel construction are generated large quantity of excavated ground (635000m³). At the same time, on both sides of tunnel is present unique forest landscape. Disposing of excavated grounds into landscape is unauthorised, because this will cause degradation of forest, like ecosystem and depreciation of landscape high value. Relatively, necessity of transporting minimum on 20 km of the excavated grounds is generated, which will be related to high expenses

Below are given reports on damages caused for each alternative.

Table 6.4 Option 1. Existing Route without Tunnel

Road Embankment Width 10,5 -12m; To Settlements Narrows to Existing Width (6-8m)

Location Line width – on ave. 20 m.

| Km Benchmarks (km) | Crossed Wood Section Length (m) | Road Embankment Total Width | Cut width During Road Extension (m) | Cut Wood Area (sq.m) |
|-------------------------|---------------------------------|-----------------------------|-------------------------------------|----------------------|
| Kedi Region | | | | |
| 54.100 – 54.900 | 800 m 800 m | 20m | 12m – 14m | 9600 |
| Shuakhevi Region | | | | |
| 58.250 – 59.800 | 1500m | 20m | | |
| 60.100 – 60.200 | 100m | 20m | | |
| 61.00 – 61..250 | 250m | 20m | | |
| 62.100 – 62.300 | 200m | 20m | | |
| 63.00 – 63.900 | 900m | 20m | | |
| 64.600 – 65.800 | 1200m | 20m | | |
| 66.100 – 66.900 | 800m | 20m | | |
| 68.100 – 68.300 | 200m | 20m | | |
| 70.700 – 71.100 | 400m | 20m | | |
| 73.00 – 74.00 | 1000m | 20m | | |
| 74.500 – 75.00 | 500m | 20m | | |
| Total | 7050m | 20m | 12m | 84600 |
| Khulo reion | | | | |
| 75.00 – 76.700 | 1700m | 20m | 12m | |
| 80.00 – 80.200 | 200m | 20m | 12m | |
| 85.800 – 87.00 | 1200m | 20m | 12m | |
| 89.00 – 89.500 | 500m | 20m | 12m | |
| 90.00 – 90.200 | 200m | 20m | 12m | |

| Km Benchmarks (km) | Crossed Wood Section Length (m) | Road Embankment Total Width | Cut width During Road Extension (m) | Cut Wood Area (sq.m) |
|--------------------------|---------------------------------------|-----------------------------|-------------------------------------|----------------------|
| 88.100 – 88.300 | 200m | 20m | 12m | |
| 101.900 – 102.200 | 300m | | | |
| Total | 4300m | 20m | 12m | 51600 |
| Adigeni region | | | | |
| 115.100 – 126.100 | 11000m | 20m | 12m | |
| 126.500 – 127.500 | 1000m | 20m | 12m | |
| 131.500 – 132. | 500m | 20m | 12m | |
| Total | 12500 | 20m | 12m | 150000 |
| <hr/> | | | | |
| Total | 24650 | 20m | 12m | 295800 |
| | | | | |
| Total Area (sq.m) | | | | |
| 295800 | | | | |
| Total Area Ha | 1 ha Restoration Average Price | | Restoration Total Price | |
| 29,6 Ha | 17000 gel | | 503 200 gel | |

Table 6.5 Option 2. Existing Route without Tunnel

Road Embankment Width 9,5 – 12m ; *To Settlements Narrows to Existing Width (6-8m)*

Location Line width – on ave. 19-20m

| Km benchmarks (km) | Crossed Wood Section Length (m) | Road Embankment Total Width | Cut Width of Road Extension (m) | Cut Wood Area (sq.m) |
|-------------------------|---------------------------------|-----------------------------|---------------------------------|----------------------|
| Kedi Region | | | | |
| 54.100 – 54.900 | 800 m | 20 m | 12m – 14 m | 9600 |
| | 800 m | | | |
| Shuakhevi Region | | | | |
| 58.250 – 59.800 | 1500 m | 20 m | | |
| 60.100 – 60.200 | 100 m | 20 m | | |
| 61.00 – 61..250 | 250 m | 20 m | | |
| 62.100 – 62.300 | 200 m | 20 m | | |
| 63.00 – 63.900 | 900 m | 20 m | | |
| 64.600 – 65.800 | 1200 m | 20 m | | |
| 66.100 – 66.900 | 800 m | 20 m | | |
| 68.100 – 68.300 | 200 m | 20 m | | |
| 70.700 – 71.100 | 400 m | 20 m | | |
| 73.00 – 74.00 | 1000 m | 20 m | | |
| 74.500 – 75.00 | 500 m | 20 m | | |
| Total | 7050 m | 20 m | 12 m | 84600 |
| Khulo Region | | | | |
| 75.00 – 76.700 | 1700 m | 20 m | 12 m | |
| 80.00 – 80.200 | 200 m | 20 m | 12 m | |
| 85.800 – 87.00 | 1200m | 20 m | 12 m | |
| 89.00 – 89.500 | 500 m | 20 m | 12 m | |
| 90.00 – 90.200 | 200 m | 20 m | 12 m | |
| 88.100 – 88.300 | 200 m | 20 m | 12 m | |

| Km benchmarks (km) | Crossed Wood Section Length (m) | Road Embankment Total Width | Cut Width of Road Extension (m) | Cut Wood Area (sq.m) |
|---------------------------|--|------------------------------------|--|-----------------------------|
| 101.900 – 102.200 | 300 m | | | |
| Total | 4300 m | 20 m | 12 m | 51600 |
| Adigeni Region | | | | |
| 115.100 – 126.100 | 11000 m | 20 m | 12 m | |
| 126.500 – 127.500 | 1000 m | 20 m | 12 m | |
| 131.500 – 132. | 500 m | 20 m | 12 m | |
| Total | 12500 | 20 m | 12 m | 150000 |
| Total | 24650 | 20M m | 12 m | 295800 |

Total Area sq.m

295800

Total Area ha

29,6 ha

1 ha Restoration Average Price

17000 gel

Restoration Total Price

503 200 gel

Table 6.6 Option 3. Existing Route with Tunnel 95+200 – 120+400

Road Bed Width 10,5 – 12m ; To Settlements Narrows to Existing Width (6-8m)

Location Line width – on ave. 20m

| Km benchmarks (km) | Crossed Wood Section Length (m) | Road Embankment Total Width | Cut Width of Road Extension (m) | CamoWrili tyis farTi (kv.m.) |
|-------------------------|---------------------------------|-----------------------------|---------------------------------|------------------------------|
| Kedi Region | | | | |
| 54.100 – 54.900 | 800 m | 20 m | 12 m – 14 m | 9600 |
| | 800 m | | | |
| Shuakhevi Region | | | | |
| 58.250 – 59.800 | 1500 m | 20 m | | |
| 60.100 – 60.200 | 100 m | 20 m | | |
| 61.00 – 61..250 | 250 m | 20 m | | |
| 62.100 – 62.300 | 200 m | 20 m | | |
| 63.00 – 63.900 | 900 m | 20 m | | |
| 64.600 – 65.800 | 1200 m | 20 m | | |
| 66.100 – 66.900 | 800 m | 20 m | | |
| 68.100 – 68.300 | 200 m | 20 m | | |
| 70.700 – 71.100 | 400 m | 20 m | | |
| 73.00 – 74.00 | 1000 m | 20 m | | |
| 74.500 – 75.00 | 500 m | 20 m | | |
| Total | 7050 m | 20 m | 12 m | 84600 |
| Khulo Region | | | | |
| 75.00 – 76.700 | 1700 m | 20 m | 12 m | |
| 80.00 – 80.200 | 200 m | 20 m | 12 m | |
| 85.800 – 87.00 | 1200 m | 20 m | 12 m | |
| 89.00 – 89.500 | 500 m | 20 m | 12 m | |

| Km benchmarks (km) | Crossed Wood Section Lenght (m) | Road Embankment Total Width | Cut Width of Road Extension (m) | CamoWrili tyis farTi (kv.m.) |
|---------------------------------------|--|--|--|---|
| 90.00 – 90.200 | 200m | 20 m | 12 m | |
| 88.100 – 88.300 | 200 m | 20 m | 12 m | |
| Total | 4000 m | 20 m | 12 m | 48000 |
| Adigeni Region | | | | |
| 120.400 – 126.100 | 5700 m | 20 m | 12 m | |
| 126.500 – 127.500 | 1000 m | 20 m | 12 m | |
| 131.500 – 132. | 500 m | 20 m | 12 m | |
| Total | 7200 | 20 m | 12 m | 86400 |
| Total | 19050 m | 20 m | 12 m | 228600 |
| Total Area sq.m | | | | |
| 228600 | | | | |
| Total Area ha | | | | |
| 22,9 ha | | | | |
| 1 ha Restoration Average Price | | Restoration Total Price | | |
| 17000 gel | | 389 300 gel | | |

6.10. Social Evaluation of Feasible Options

Major components of project impact project land acquisition and resettlement s. The relevant calculations are given below. We should note that the difference between options 1 and 2 are almost negligible. Option 3 has somewhat reduced resettlement impacts, but this difference is not radical, because the tunnel, through which it becomes necessary to reduce the purchase of private land, mostly runs through uninhabited areas. It should be noted that the decrease in housing-related economic profit is significantly less than the costs associated with the construction of the tunnel.

Other social factors are important and should be considered at a later stage - the environmental and social impact assessment. Future studies are needed on the issues of the requirements set forth in the section below.

Table 6.6 Option 3. Existing Route without Tunnel

Road Bed Width 10,5 – 12m ; Settlements Narrows to Existing Width (6-8m)
 Location Line width – on ave. 20m

Kedi Region

| Facility 456 Type | Unit | Unit Average Price in Region | Compensation Dependent Amount | | Compensation Sum Amount (GEL) |
|--|--------------|------------------------------|-------------------------------|--------|-------------------------------|
| Compensation Land | Sq. m | | 3593.567 | | 24445 Gel |
| Agricultural Land from Here | Sq. m | 3 Gel | 5% | 179.7 | 540 Gel |
| Non-Agricultural Land from Here | Sq. m | 7 Gel | 95% | 3414.3 | 23905 Gel |
| 1 Strayed House | 1 House | 8500 Gel | 1 House/Shed | | 8500 Gel |
| 2 Strayed House | 1 House | 17000 Gel | | | |
| Other buildings | Building | 6000 Gel | 1 Shed, | | 6000 Gel |
| | Iron Fence | 4000 Gel | 9 Stake/Wood Fence; | | 9000 Gel |
| | Wooden Fence | 1000 Gel | | | |
| Fruit Trees | Unit | 240 Gel | 70 | | 16800 Gel |
| Required Compensation Amount for Land Purchases for Highway | | | | | 64745 Gel |

Shuakhevi Region

| Facility Type | Unit | Unit Average Price in Region | Compensation Dependent Amount | Compensation Sum Amount (GEL) |
|-----------------------|--------------|------------------------------|---|-------------------------------|
| Compensation Land | Sq. m | | 53004.06 | 349828 lari |
| Agricultural Land | Sq. m | 3 Gel | 10% 5300.4 | 15900 Gel |
| Non-Agricultural Land | Sq. m | 7 Gel | 90% 47703.6 | 333928 Gel |
| 1 Strayed House | 1 House | 8500 Gel | 1 | 8500 Gel |
| 2 Strayed House | 1 House | 17000 Gel | | |
| Other buildings | Building | 6000 Gel | 3 old military base bldg. 1 Five strayed home or barrack | |
| | Café/Dining | 30000 Gel | 2 New Café/Dining | 60000 Gel |
| | | 6000 Gel | 2 Trade Points, | 12000 Gel |
| | Iron Fence | 4000 Gel | 1 Iron Fence, | 4000 Gel |
| | Wooden Fence | 1000 Gel | 90 Wooden Fence, | 90000 Gel |
| | | 3000 Gel | 1 Small Petrol Station | 30000 Gel |
| | | | 3 Booth/Shed | 9000 Gel |
| | | | B | |
| | | | 1 Two Strayed Home with Shop | 20000 Gel |
| Fruit Trees | Unit | 240 Gel | 360 | 86400 Gel |

Required Compensation Amount of Land Purchase for Highway 634 745 Gel

KKhulo Region

| Facility Type | Unit | Unit Average Price in Region | Compensation Dependent Amount | Compensation Sum Amount (GEL) |
|--|--------------|------------------------------|--------------------------------|-------------------------------|
| Compensation Land | Sq. m | | 206480.2 | 2188688 lari |
| Agricultural Land | Sq. m | 5 Gel | 20% 41296 | 206480 Gel |
| Non-Agricultural Land | Sq. m | 12 Gel | 80% 165184 | 1982208 Gel |
| 1 Strayed House | 1 House | 17000 Gel | 10 | 170000 Gel |
| 2 Strayed House | 1 House | 34000 Gel | 1 Two strayed Garage | 34000 Gel |
| Other buildings | Building | 4000 Gel | 9 Shed/Auxiliary Building | 36000 Gel |
| | Iron Fence | 4000 Gel | | |
| | Wooden Fence | 1000 Gel | 140 Fence | 140000 Gel |
| | | | 2 Cafes, 1 Shop; | 100000 Gel |
| | | | 2 Petrol Stations, Transferred | 50000 Gel |
| Fruit Trees | Unit | 240 Gel | 500 | 120000 Gel |
| Other | | | | |
| Required Compensation Amount of Land Purchase for Highway | | | | 2838688 Gel |

Adigeni Region

| Facility Type | Unit | Unit Average Price in Region | Compensation Dependent Amount | | Compensation Sum Amount (GEL) |
|--|--------------|------------------------------|-------------------------------|----------|-------------------------------|
| Compensation Land | Sq. m | | 19934.77 | | 99674 lari |
| Agricultural Land | Sq. m | 2 Gel | 25% | 4983.75 | 9968 Gel |
| Non-Agricultural Land | Sq. m | 6 Gel | 75% | 14951.25 | 89706 Gel |
| 1 Strayed House | 1 House | 27000 Gel | | | |
| 2 Strayed House | 1 House | 42000 Gel | | | |
| Other buildings | Building | 6000 Gel | | | |
| | Iron Fence | 4000 Gel | | | |
| | Wooden Fence | 1000 Gel | 35 Wooden Fence | | 35000 Gel |
| Fruit Trees | Unit | 240 Gel | 140 | | 33600 Gel |
| Other | | | | | |
| Required Compensation Amount of Land Purchase for Highway | | | | | 168274 Gel |

Option 1. Existing Route without Tunnel

Required Compensation Approximate Amount of Land Purchase and Restoration **3 741 435 Gel**

Damaged Forest Rehabilitation Price

| | | |
|---------------|--------------------------------|-------------------------|
| Total Area ha | 1 ha Restoration Average Price | Restoration Total Price |
| 29,6 ha | 17000 Gel | 503 200 Gel |

Option 2. Existing Route without Tunnel

Road Bed Width 9,5 – 12m ; To Settlements Narrows to Existing Width (6-8m)

Location Line width – on ave. 19m

Kedi Region

| Object Type | Unit | Unit Average Price in Region | Compensation Dependent Amount | Compensation Sum Amount (GEL) |
|-----------------------|--------------|------------------------------|-------------------------------|-------------------------------|
| Compensation Land | Sq. m | | 3593.567 | 22000 Gel |
| Agricultural Land | Sq. m | 3 Gel | 5% 179.7 | 540 Gel |
| Non-Agricultural Land | Sq. m | 7 Gel | 95% 3414.3 | 23905 Gel |
| 1 Strayed House | 1 House | 8500 Gel | 1 House/Shed | 8500 Gel |
| 2 Strayed House | 1 House | 17000 Gel | | |
| Other buildings | Building | 6000 Gel | 1 Shed, | 6000 Gel |
| | Iron Fence | 4000 Gel | 9 Stake/Wood Fence; | 9000 Gel |
| | Wooden Fence | 1000 Gel | | |

| | | | | |
|--|------|---------|----|------------------|
| Fruit Trees | Unit | 240 Gel | 70 | 16800 Gel |
| Required Compensation Amount of Land Purchase for Highway | | | | 62300 Gel |

Shuakhevi Region

| Facility Type | Unit | Unit Average Price in Region | Compensation Dependent Amount | Compensation Sum Amount (GEL) |
|-------------------------|--------------|------------------------------|--|-------------------------------|
| Compensation Land | Sq. m | | 53004.06 | 349828 Gel |
| | | | | 314845 Gel |
| Agricultural Land | Sq. m | 3 Gel | 10% 5300.4 | 15900 Gel |
| Non-Agricultural Land \ | Sq. m | 7 Gel | 90% 47703.6 | 333928 Gel |
| 1 Strayed House | 1 House | 8500 Gel | 1 | 8500 Gel |
| 2 Strayed House | 1 House | 17000 Gel | | |
| Other buildings | Building | 6000 Gel | 3 old military base bldg 1 Five strayed barrack | |
| | Café/Dining | 30000 Gel | 2 New Café/Dining | 60000 Gel |
| | Trade Point | 6000 Gel | 2 Trade Point, | 12000 Gel |
| | Iron Fence | 4000 Gel | 1 Iron Fence, | 4000 Gel |
| | Wooden Fence | 1000 Gel | 90 Wooden Fence, | 90000 Gel |

| | | | | |
|-------------|------|----------|-------------------------------|-----------|
| | | | | 30000 Gel |
| | | | 1 Small Petrol Station | |
| | | 3000 Gel | | 9000 Gel |
| | | | 3 Booth/Shed | |
| | | | | 20000 Gel |
| | | | 1 Two strayed House with Shop | |
| Fruit Trees | Unit | 240 Gel | 360 | 86400 Gel |

Khulo Region

| Object Type | Unit | Unit Average Price in Region | Compensation Dependent Amount | | Compensation Sum Amount (GEL) |
|---------------------------------|--------------|------------------------------|--------------------------------|--------|-------------------------------|
| Compensation Land | Sq. m | | 206480.2 | | 1969819 Gel |
| Agricultural Land from Here | Sq. m | 5 Gel | 20% | 41296 | 206480 Gel |
| Non-Agricultural Land from Here | Sq. m | 12 Gel | 80% | 165184 | 1982208 Gel |
| 1 Strayed House | 1 House | 17000 Gel | 10 | | 170000 Gel |
| 2 Strayed House | 1 House | 34000 Gel | 1 Two strayed Garage | | 34000 Gel |
| Other buildings | Building | 4000 Gel | 9 Shed/Auxiliary Building | | 36000 Gel |
| | Iron Fence | 4000 Gel | 140 Fence | | |
| | Wooden Fence | 1000 Gel | 2 Cafes, 1 Shop; | | 140000 Gel |
| | | | 2 Petrol Stations, Transferred | | 100000 Gel |

| | | | | |
|-------------|------|---------|-----|------------|
| Fruit Trees | Unit | 240 Gel | 500 | 50000 Gel |
| Other | | | | 120000 Gel |

Required Compensation Amount of Land Purchase for Highway 2619819 Gel

Adigeni Region

| Object Type | Unit | Unit Average Price in Region | Compensation Dependent Amount | | Compensation Sum Amount (GEL) |
|---------------------------------|--------------|------------------------------|-------------------------------|----------|-------------------------------|
| Compensation Land | Sq. m | | 19934.77 | | 89706 Gel |
| Agricultural Land from Here | Sq. m | 2 Gel | 25% | 4983.75 | 9968 Gel |
| Non-Agricultural Land from Here | Sq. m | 6 Gel | 75% | 14951.25 | 89706 Gel |
| 1 Strayed House | 1 House | 27000 Gel | | | |
| 2 Strayed House | 1 House | 42000 Gel | | | |
| Other buildings | Building | 6000 Gel | | | |
| | Iron Fence | 4000 Gel | | | |
| | Wooden Fence | 1000 Gel | 35 Wooden Fence | | 35000 Gel |
| Fruit Trees | Unit | 240 Gel | 140 | | 33600 Gel |
| Other | | | | | |

Required Compensation Amount of Land Purchase for Highway 158306 Gel

Option 1. Existing Route without Tunnel

3 475 170 Gel

Required Compensation Approximate Amount of Land Purchase and Restoration
Damaged Forest Rehabilitation Price

Total Area ha
29,6 ha

1 ha Restoration Average Price
17000 Gel

Restoration Total Price
503 200 Gel

Table 6.8 Option 3. Existing Route with Tunnel km 95+200 – 120+400

Road Embankment Width 10,5 – 12m ; To Settlements Narrows to Existing Width (6-8m)

Location Line width – on ave. 20m

Kedi Region

| Object Type | Unit | Unit Average Price in Region | Compensation Dependent Amount | | Compensation Sum Amount (GEL) |
|--|--------------|------------------------------|-------------------------------|--------|-------------------------------|
| Compensation Land | Sq. m | | 3593.567 | | 24445 Gel |
| Agricultural Land from Here | Sq. m | 3 Gel | 5% | 179.7 | 540 Gel |
| Non-Agricultural Land from Here | Sq. m | 7 Gel | 95% | 3414.3 | 23905 Gel |
| 1 Strayed House | 1 House | 8500 Gel | 1 House/Shed | | 8500 Gel |
| 2 Strayed House | 1 House | 17000 Gel | | | |
| Other buildings | Building | 6000 Gel | 1 Shed, | | 6000 Gel |
| | Iron Fence | 4000 Gel | 9 Stake/Wood Fence; | | 9000 Gel |
| | Wooden Fence | 1000 Gel | | | |
| Fruit Trees | Unit | 240 Gel | 70 | | 16800 Gel |
| Required Compensation Amount of Land Purchase for Highway | | | | | 64745 Gel |

Shuakhevi Region

| Object Type | Unit | Unit Average Price in Region | Compensation Dependent Amount | | Compensation Sum Amount (GEL) |
|---------------------------------|--------------|------------------------------|-----------------------------------|---------|-------------------------------|
| Compensation Land | Sq. m | | 53004.06 | | 349828 Gel |
| Agricultural Land from Here | Sq. m | 3 Gel | 10% | 5300.4 | 15900 Gel |
| Non-Agricultural Land from Here | Sq. m | 7 Gel | 90% | 47703.6 | 333928 Gel |
| 1 Strayed House | 1 House | 8500 Gel | 1 | | 8500 Gel |
| 2 Strayed House | 1 House | 17000 Gel | | | |
| Other buildings | Building | 6000 Gel | 3 old military base bldg . | | |
| | Café/Dining | 30000 Gel | 1 Five strayed house and barrack, | | |
| | Trade Point | 6000 Gel | 2 New Café/Dining | | |
| | | | 2 Trade Points, | | 60000 Gel |
| | | | | | 12000 Gel |
| | Iron Fence | 4000 Gel | 1 Iron Fence, | | |
| | | | | | 4000 Gel |
| | Wooden Fence | 1000 Gel | 90 Wooden Fence, | | |
| | | | | | 90000 Gel |
| | | | 1 Small Petrol Station | | |
| | | | | | 30000 Gel |
| | | 3000 Gel | 3 Booth / Shed | | |
| | | | | | 9000 Gel |
| | | | 1 two strayed house with shop | | |
| | | | | | 20000 Gel |
| Fruit Trees | UUnit | 240 Gel | 360 | | 86400 Gel |

Required Compensation Amount of Land Purchase for Highway 669728 Gel

Khulo Region

| Object Type | Unit | Unit Average Price in Region | Compensation Dependent Amount | Compensation Sum Amount (GEL) |
|--|--------------|------------------------------|--------------------------------|-------------------------------|
| Compensation Land | Sq. m | | 129120 Sq. m | 1368672 Gel |
| Agricultural Land from Here | Sq. m | 5 Gel | 20% 25824 | 129120 Gel |
| Non-Agricultural Land from Here | Sq. m | 12 Gel | 80% 103296 | 1239552 Gel |
| 1 Strayed House | 1 House | 17000 Gel | 7 | 119000 Gel |
| 2 Strayed House | 1 House | 34000 Gel | | |
| Other buildings | Buiding | 4000 Gel | 8 Shed/Auxiliary Building | 32000 Gel |
| | Iron Fence | 4000 Gel | | |
| | Wooden Fence | 1000 Gel | 120 Fence | 120000 Gel |
| | | | 2 Cafe, 1 Shop; | 100000 Gel |
| | | | 2 Petrol Stations, Transferred | 50000 Gel |
| Fruit Trees | Unit | 240 Gel | 430 | 103200 Gel |
| Other | | | | |
| Required Compensation Amount of Land Purchase for Highway | | | | 1892872 Gel |

Adigeni Region

| Facility Type | Unit | Unit Average Price in Region | Compensation Dependent Amount | | Compensation Sum Amount (GEL) |
|--|--------------|------------------------------|-------------------------------|----------|---------------------------------|
| Compensation Land | Sq. m | | 19934.77 | | 99674 Gel |
| Agricultural Land from Here | Sq. m | 2 Gel | 25% | 4983.75 | Agricultural Land from Here |
| Non-Agricultural Land from Here | Sq. m | 6 Gel | 75% | 14951.25 | Non-Agricultural Land from Here |
| 1 Strayed House | 1 House | 27000 Gel | | | |
| 2 Strayed House | 1 House | 42000 Gel | | | |
| Other buildings | Building | 6000 Gel | | | |
| | Iron Fence | 4000 Gel | | | |
| | Wooden Fence | 1000 Gel | 35 Wooden Fence | | 35000 Gel |
| Fruit Trees | Unit | 240 Gel | 140 | | 33600 Gel |
| Other | | | | | |
| Required Compensation Amount of Land Purchase for Highway | | | | | 168274 Gel |
| <i>Trade 6.9 Option 3. Existing Route with Tunnel km 95+200 – 120+400</i> | | | | | 2 795 619 Gel |
| Required Compensation Approximate Amount of Land Purchase and Restoration | | | | | |

Damaged Forest Rehabilitation Price

Damaged Forest Rehabilitation Price

Total Area ha
22,9 ha

1 ha Restoration Average Price
17000 lari

Restoration Total Price
389 300 lari

7. Expected Impact on Environment

7.1. Short Review of Expected Environmental Impact

Screening of project environmental impact will be implemented and the activities will be summarized. Expected impacts are discussed according to below phases. Analysis on design phase imply what kind of potential impacts exist and which of them should be foreseen when designing.

Table 7.1. Environmental Impacts – Projecting and Preconstruction Phase

| | Potential Impact | Remarks |
|---|--|--|
| 1 | <p>Destruction of natural landscape (terrain, soil, vegetation, ecosystems, habitats and wild nature) in terms of motorway corridor vending for access roads, quarry districts, landfills, constructions camps.</p> <p>- sensitive ecosystems and territory of special importance; - Territory of archeologic and cultural significance; - Existing land use and economic activities; -Household and agricultural land;</p> | Preferred route was selected as a result of alternatives analysis (see. P. 6 Analysing Alternatives) |
| 2 | Location of quarry landfills, concrete and/or asphalt mixings, equipment, workers' camps, fuel and other materials storage areas and equipment yards. | Dust/air pollution, water pollution, landscape degradation, impact on water ecosystem depends on selection of location of districts. Final choice is on construction contractor. |
| 3 | Soil erosion – temporary and perpetual drainage system design, retaining walls, berms and bulks, anti-erosion engineering measures and implementation of rehabilitation plans. | Relevant project is necessary for potential erosion and secondary impact reduction, as landscape worsening and increase of sediments in rivers, potentially low level of road asphaltting. Anti-erosive measures are foreseen in the project. |
| 4 | Noise and emission caused by movement. | Movement related noise and emission is a significant problem only in populated areas. Also on territories, where household plots are adjacent to the road. Hence the project implies rehabilitation of the existing road, additional impacts are not expected and neither are necessary additional measures. |
| 5 | Bridges, viaduct, communications | Adequate design of river hydrological and riverbed |

| | Potential Impact | Remarks |
|---|---|--|
| | and constructions protecting from flooding. | processes (washing depths, foreseeing the coast literal erosion) . |
| 6 | Districts of geologic danger; hazardous geodynamic processes. | In the project is described in details hazardous geodynamic processes happening along the design road. It is planned to take measures for stabilizing water grainage and anti-erosion slope stabilization. |

Table 7.2. Environmental Impacts – Construction Phase

| # | Potential Impacts during Constructions | yes/no strength | Location |
|---|---|-----------------|---|
| 1 | Destruction of natural landscapes (Terrain, soil, vegetative cover, ecosystems, habitats and wild nature) in motorway corridor. | Yes Average | Whole route Significant facilities: forest stands on road expansion districts. Approximately 3000 trees will be cut down and about 7 ha shrubbery |
| 2 | Destruction of natural landscapes (Terrain, soil, vegetative cover, ecosystems, habitats and wild nature) on access roads, quarries, landfills, construction camps and equipment yards. | Yes Average | Constructor contractor should precisely define plots for quarries, landfills, construction camps and equipment storage |
| 3 | Landslides, mudflows and other massive relocation on excavated roads, that will be caused by constructions. | Average risk | In the project is described in details hazardous geodynamic processes happening along the design road. It is planned to take measures for stabilizing water grainage and anti-erosion slope stabilization.s |
| 4 | Erosion enforced by freezing and filling and temporary covering of natural drainages with | Non-significant | Earthen mound |

| # | Potential Impacts during Constructions | yes/no strength | Location |
|----|---|------------------------|--|
| | sediments; soil erosion caused by streams from open or closed drainage channels under the road. | | |
| 5 | Increase of sediments in rivers, result of enforced erosion after constructions and road excavations, filling and landfills; deteriorating of water quality and increased sediments, impacts on water quality and fish reproduction | Yes Non-significant | Rivers – Adjatistskali, Satsikhuri, Diakonidze Tabakhmelistskali, |
| 6 | Construction impact on water ecosystems of rivers and streams crossed by the motorway | Non-significant | Rivers – Adjatistskali, Satsikhuri, Diakonidze Tabakhmelistskali, |
| 7 | Pollution of soil and water with fuel, dirt, and paints during construction on road corridor territory, access roads, constructions camps and asphalt mix locations. | Yes Non-significant | access roads and constructions camps should be defined on construction stage by the contractor |
| 8 | Poor sanitary conditions in camps and construction sites, disposal of solid waste (canalization, sanitary, waste management) | Yes Average | should be defined on construction stage by the contractor |
| 9 | Construction waste along the corridor and garbage along the road | Yes Average | On the whole route |
| 10 | Air pollution by transport movement during construction on populated areas, which are crossed by road, especially in cities and densely in populated villages. Local dust | Yes Non-significant | Everywhere where construction equipment will pass populated areas. |
| 11 | Air pollution during paving concrete and asphalt | Yes Average | Supplier and contractor will point out locations. |
| 12 | Noise pollution as a result of construction equipment movement, mostly on the areas where motorway crosses the populated area, such as denselt populated villages. Local noise. | Yes Non-significant | dasaxlebul punqtebTan |
| 13 | Poaching by locals | No or non-significant | Rivers – Adjatistskali, Satsikhuri, Diakonidze Tabakhmelistskali, |
| 14 | Creation of suitable condition temporarily for mosquitos carrying illnesses, e.g. ponds on sunny places, ponds on quarries, etc. that will support mosquito reproduction. Re-pollution with biological materials (e.g. Jilekhi) after | Yes non-significant | Whole route |

| # | Potential Impacts during Constructions | yes/no strength | Location |
|----|---|---------------------------------------|--|
| | earthworks near the burials (e.g. non-reported burials) | | |
| 15 | Health danger caused by noise, emissions, dust, that will cause movement of equipment | Yes Average non- significant | At the populated areas |
| 16 | Impact on archeologic locations | Yes | On the whole route, especially on Zarzma district |
| 17 | Dangers related to movement, when construction includes existing roads. | Yes non- significant | On the districts of construction roads and acting motorways |
| 18 | Accident danger, that is related to movement and transport, potential danger of spilling of toxic substabces, explosions and fatality | Yes non- significant | The whole route and especially construction affects on the existing population |

Table 7.3 Potential Environment Impact Type – Construction Stage

| Activity | Impact | Impact Type | | | | | | | |
|---|--|-------------|------------|----------|----------|------------|--------------|-----------|--------|
| | | Direct | Non-Direct | Positive | Negative | Reversible | Irreversible | Temporary | Wastes |
| Ground cleaning and straightening in utilization corridor | Landscapes and habitats degradation, erosion | + | | | + | | + | | + |
| | Emissions | + | | | + | + | | + | |
| | Noise, Vibration | + | | | + | + | | + | |
| | Ground pollution and /or waste generation | | + | | + | + | | + | |
| | Ground and surface water pollution | | + | | + | + | | + | |
| New road construction, surface | Landscapes and habitats degradation, erosion | | | | | | | | |
| | Emissions | + | | | + | + | | + | |

| Activity | Impact | Impact Type | | | | | | | |
|---|--|-------------|------------|----------|----------|------------|--------------|-----------|--------|
| | | Direct | Non-Direct | Positive | Negative | Reversible | Irreversible | Temporary | Wastes |
| pavement | Noise, Vibration | + | | | + | + | | + | |
| | Ground pollution and /or waste generation | | + | | + | + | | + | |
| | Ground and surface water pollution | | + | | + | + | | + | |
| Quarry operation | Landscapes and habitats degradation, erosion | + | | | + | | + | | + |
| | Emissions | + | | | + | + | | + | |
| | Noise, Vibration | + | | | + | + | | + | |
| | Ground pollution and /or waste generation | | + | | + | + | | + | |
| | Ground and surface water pollution | + | | | + | + | | + | |
| Transportation of sand and gravel from quarry, building material delivery. | Landscapes and habitats degradation, erosion | | | | | | | | |
| | Emissions | + | | | + | + | | + | |
| | Noise, Vibration | + | | | + | + | | + | |
| | Ground pollution and /or waste generation | | + | | + | + | | + | |
| | Ground and surface water pollution | | + | | + | + | | + | |
| Old surface section collapse in the process of existing road rehabilitation | Landscapes and habitats degradation, erosion | | | | | | | | |
| | Emissions | + | | | + | + | | + | |
| | Noise, Vibration | + | | | + | + | | + | |
| | Ground pollution and /or waste generation | | + | | + | + | | + | |
| | Ground and surface water pollution | | + | | + | + | | + | |
| Extra ground and wastes placement | Landscapes and habitats degradation, erosion | + | | | + | + | | + | |
| | Emissions | + | | | + | + | | + | |
| | Noise, Vibration | + | | | + | + | | + | |

| Activity | Impact | Impact Type | | | | | | | |
|----------|---|-------------|------------|----------|----------|------------|--------------|-----------|--------|
| | | Direct | Non-Direct | Positive | Negative | Reversible | Irreversible | Temporary | Wastes |
| | Ground pollution and /or waste generation | | + | | + | + | | + | |
| | Ground and surface water pollution | | + | | + | + | | + | |

Table 7.4. Environmental impacts – Exploitation Phase

| # | Functioning Phase Motorway Rehabilitation Project Potential Longterm Results (Physical factors – impact of movement and accidents) | Yes/No Severeness | Zone |
|---|--|--------------------------|---|
| 1 | Air pollution caused by increased use of motorway in future | Yes non-significant | Whole route. Though the road will pass far from populated areas, is should still meet the standards of Environment Ministry |
| 2 | Noise pollution caused by using of motorway in the future | Yes Average Increasing | Whole route. Though the road will pass far from populated areas, is should still meet the standards of Environment Ministry |
| 3 | Water wuality worsening caused by increased dustiness in the direction of water units | Yes non-significant | Whole route. |
| 4 | Road edge garbage | Yes Average | Along the road, on the whole length |
| 5 | Soil and water pollution with fuel, paint, construction equipment after repair works and exploitation process – as a result of leaking from vehicles | Yes Minor | Along the road, on the whole length |

| # | Functioning Phase Motorway Rehabilitation Project Potential Longterm Results (Physical factors – impact of movement and accidents) | Yes/No Severeness | Zone |
|---|---|--------------------------|--|
| 6 | Impact on expected accidents in exploitation phase | Yes/No Severeness | |
| 7 | Risk of motorway accidents is conditioned by motorway transport movement, that can cause leaking of toxic materials, detonation of explosives, physical damage or fatality. (see “Management of Hazardous Materials”) (see “Public Health and Safety”). | Yes Average | In populated points RoW on whole length |

Table 7.5. Type of Potential Impact on Environment – Exploitation Stage

| Activities/Factor | Impact | Impact Type | | | | | | | |
|--|--|-------------|----------|----------|----------|------------|--------------|-----------|-------|
| | | Direct | indirect | Positive | Negative | Reversible | Irreversible | Temporary | Waste |
| Physical Existence of Linear Structure | Landscapes and habitats degradation, erosion | + | | | | | + | | + |
| | Emissions | | | | | | | | |
| | Noise, Vibration | | | | | | | | |
| | Ground pollution and /or waste generation | | | | | | | | |
| | Ground and surface water pollution | | | | | | | | |
| Transport movement | Landscapes and habitats degradation, erosion | | | | | | | | |
| | Emissions | + | | | + | | | | + |
| | Noise, Vibration | + | | | + | | | | + |
| | Ground pollution and /or waste generation | | + | | + | + | | + | |

| | | | | | | | | | |
|--------------|--|---|---|---|---|---|--|---|---|
| | Ground and surface water pollution | | + | | + | + | | + | |
| Repair works | Landscapes and habitats degradation, erosion | + | | + | | | | | |
| | Emissions | + | | | + | | | | + |
| | Noise, Vibration | + | | | + | | | | + |
| | Ground pollution and /or waste generation | | + | | + | + | | + | |
| | Ground and surface water pollution | | + | | + | + | | + | |
| Accidents | Landscapes and habitats degradation, erosion | | + | | + | + | | + | |
| | Emissions | | + | | + | + | | + | |
| | Noise, Vibration | | | | | | | | |
| | Ground pollution and /or waste generation | | + | | + | + | | + | |
| | Ground and surface water pollution | | + | | + | + | | + | |

7.2. Specific Type of Environmental Impact

Specific environmental impacts reviewed in this chapter are meant to be the most typical and important impacts, that is characterized to the road projects generally. Total summary of the project impact is given in paragraph 7.1, and general impacts related to construction activities are described in paragraph 7.3. here we emphasize the specific issues, which are more suitable to the project and some of them require not only qualitative, but – quantitative analysis.

7.2.1. Impact related to Emissions in Ambient Air

Impact related to emissions in ambient air and relevant mitigating measures are related to those important issues, which are typical for motorway designing. Emissions related to constructions and quantitative evaluation of dust creation is given in **Annex 3**. The road construction process on measure of protecting construction districts from hazardous emissions and dust are discussed in paragraph 8.1.1.4. and in paragraph 8.1.1.11. – auxiliary construction facilities complex districts and water protection issues.

Considering that the present project implies rehabilitation/reconstruction of and recovery of road cover, road exploitation process on emissions should be positive, as on the roads covered with asphalt as a result of vehicle movement is created relatively less dust and

also, emission resulting from fuel burning also decrease when the vehicle engine speed is regulated on paved road.

7.2.2. Noise Related to Motorway Construction and Exploitation

Construction phase – it is considered that noise related to construction does not exceed 160 m. motorway will be constructed far away from urban population. There are no ecologically sensitive territories, that will be disturbed by the construction noises. According to Georgian legislation, 60dB noise is of accepted average significance for the populated areas on road and construction districts. This means that populated areas will not be harmed with the noise (60dB noise level will be in 50 metres area from construction district). Studying of noise background and impact are discussed in Annex 5.

Exploitation phase – noise related to movement will not affect in the radius of 160 meters from the motorway. Noise level in 80 meters radius is in acceptable norm. Before 2030 impact alarming increase is not expected. Literally, project implementation will cause reduction of damage caused by noise because of improving road technical characteristics and cover.

7.3. Potential impact Related to Construction

7.3.1. Pollution and Waste

Not proper treatment of construction materials, storage, usage and disposal, also construction waste might create danger of water/soil pollutions on construction and warehouse districts. Not proper treatment of equipment and fuel use might cause pollution of soil/water.

7.3.1.1. Waste Related to Construction

Waste classification

Apart from spoil disposal, during road construction will be created the following types of waste:

Code 15 – packing waste, absorbent, cleaning textiles, filters and protective clothing waste;

Code 16 – Waste that is not foreseen in other points;

Code 17 – Construction and destruction waste (also includes road work waste from polluted areas);

Code 20 – municipal waste and similar commercial, industrial and institutional waste, that also includes minor quantity of collected waste.

Household waste

Is expected as hazardous, so non-hazardous waste generation, mostly:

Kitchen organic waste (non-hazardous) -code: 20 01 08;

Paper, carton (non-hazardous) -code: 20 01 01;

Glass (non-hazardous) -code: 20 01 02;

Plastic (non-hazardous) -code: 20 01 03;

Septic tank sediment (hazardous) - code : 20 03 04

Koç residuals (considering from facility specifics they might be hazardous and non-hazardous as well) - code: 20 03 03;

Medical waste (hazardous) - code: 20 01 31;

Mixed municipal waste - code: 20 03 01;

Fluorescent pipes (hazardous) - code: 20 01 21.

Final disposal of household waste will happen based on agreements made with municipal sanitary cleaning services and licensed contractors. Household waste will be moved to municipal landfills (borough Zarmas and Akhaltsikhe landfills).

Non-hazardous industrial waste:

Paper and carton packaging materials - code: 15 01 01;

Plastic packaging materials - code: 15 01 02;

Wooden packaging material - code: 15 01 03;

Metal packaging material - Code: 15 01 04;

Defective, out of order equipment and their parts - code: 16 02 14;

Mixed metals - code: 17 04 07;

Hazardous Construction Waste;

Glass, plastic, wood, that contains or consists of hazardous substances - code: 17 02 04;

Metal waste, that are polluted with hazardous materials – code: 17 04 09

Soil and stones which contain hazardous chemical substances - code: 17 05 03;

Packaging materials which contain hazardous chemical waste and/or are contaminated with hazardous chemical substances - code: 15 01 11;

Absorbents, filter materials, (including oil filters), cleaning textiles and protecting clothing, which are contaminated with hazardous chemical substances - code: 15 02 02;

Oil filters - code: 16 01 07;

Defective, out of order hazardous equipment and their parts - code: 16 02 10; 16 02 11; 16 02 12; 16 02 13;

Inert Construction Waste

As a rule, large part of waste is produced during construction and is related to waste generation in sites, also inert materials produced as a result of dismantling constructions. Major part of waste is composed of bulk – mix of rocky clastic and excessive grounds formed after slope fall, that are not used for construction and disposal. Total amount of disposed waste composes - 130 767m³.

In the construction process is expected to form various types of waste. Major facilities creating waste are: construction districts and construction camps. Less quantity is expected to gather (polluted soil) along the access and heavy equipment route.

Contractor will select waste disposal locations. Offer of EIE team can be found in paragraph 8.1.1.3.

Table 7.6 Expected Generation of Waste

| Waste Type | Waste Class | Expected Quantity (by indicating unit) | Waste Management | Alternative Options of Management | Responsible Person(s) |
|---|---------------|--|---|--|---------------------------|
| Household Waste | Non-hazardous | 80-100 m ³ In year | Will be given to contractor for disposing on landfill. | Separation may happen on-site and several types of waste (paper, glass, plastic) handing to contractor for recycling or reusing purpose, | Constructor Contractor |
| Office waste (plastic and glass bottles, stationary waste and others) | Non-hazardous | 10-15 m ³ In year | Will be administered to contractor for disposing on landfill | Separation may happen on-site and several types of waste (paper, glass, plastic) handing to contractor for recycling or reusing purpose | Constructor Contractor |
| Drainage Waste | Hazardous | 1500 m ³ in year | Washing of mentioned waters is done on drainage system, based on agreement | | Constructor Contractor |
| Light bulbs out of order □ | Hazardous | 50-70 | | 1.to be returned to the supplier 2.light bulbs to be administered to the contractor for recovery | Constructor Contractor |
| Printer Cartridges | Hazardous | 2-3 in a year | 3-4 times happens secondary charging. Then it is administered to the contractor | 1.to be returned to the supplier 2.light bulbs to be administered to the contractor for recycling | Constructor Contractor |

| | | | | | |
|--|---------------|---|--|--|---------------------------|
| | | | for disposing at the landfill | | |
| Medical Waste | Hazardous | 0.1kg In a year | administered to the contractor for disposing at the landfill | To be handed to a contractor for destruction | Constructor Contractor |
| Damaged or an expired instruments | Non-hazardous | 1-2m ³ In a year | administered to the contractor for disposing at the landfill | | Constructor Contractor |
| Means of private protection and clothes. | arasaSi Si | 1 m ³ | administered to the contractor for disposing at the landfill | | Constructor Contractor |
| Textiles contaminated by fuel and absorbants | Hazardous | Quantity depends on fuel leak scale 1 m ³ in a year | 2. is collected in plastic and metal containers and their temporary storing takes place. | 1. is administered to contractor for destruction. 2. is administered to contractor for warehousing. | Constructor Contractor |
| Cut down trees | Non-hazardous | | Is administered to local governancies | Is administered to schools and kindergartens | Constructor Contractor |

In construction camps waste generation and management details are described in Annex 1.

7.3.1.2. Hazardous Geological Processes, Soil Erosion, Soil Pollution

Hazardous geological processes developed along the motorway are described in details in chapter 4, by indicating relevant pikets. As a short resume we will summarize here that on Khulo-Goderdzi crossing road section are described 10 landslide districts and mudflow valleys. Mitigating measure are described in chapter 8.

7.3.1.3. Superficial and Ground Water Pollution

Water Pollution

Water pollution reasons are different, that include:

Leaking of fuel, oil or other hazardous substances, especially on vehicle or machinery fuel during refillment.

Suspended sediments in runoff waters;

Washing of transport means and equipment and affecting on river/channel coast or bottom and when passing of machinery equipments.

Secondary pollution after exposure of polluted ground.

Leaked polluting substances relatively quickly move in direction of water bed or river. After running into water, holding it might become difficult and it might flow into lower part (flow with water and pollute large area of water). Hence, in case of water pollution emergency measures are of vital importance.

On construction site (line) after excavating soil upper layer, the bottom gets exposed, that can cause during rainstorms significant increase of runoffs. River Rioni is the main recipient of such affect.

7.3.1.4. Risk of Secondary Biological Pollution and Spread of Hazardous Illnesses

The risk of contaminating soil with biological materials or water secondary pollution, personnel and neighbouring residents as well when executing works near burials (non-registered among them), e.g. Jilekhi burial, is quite high.

7.3.1.5. Losses of Humus Layer of the Soil as a Result of Soil Layer Excavation.

Loss of fertile layer due to mix of excavated soil humus upper and lower layers

Washing of soil due to wrong storage and recovery operations;

Runoff of sediments in watersheds/rivers/channels;

Soil pollution.

7.3.2. Affect on Flora

Large part of affected landscape is highly transformed because of existing road. Despite this, on the planned territory are common partially degraded forest and natural landscape minor plots, which may be affected. These are partially degraded tree stands adjacent to the road. About 3000 trees and 7 ha shrubbery are subject to cutting down.

During construction Works overall affect on flora is expected with following volume:

Table 7.7

"Batumi-Akhhaltsikhe Motorway Goderdzi Pass Section Rehabilitation Project"

| Cutting of Trees | | |
|---|-------------|--------------|
| Cutting of trees with the diameter 8cm <D <16 cm | unit | 1 100 |
| Cutting of trees with the diameter riT 16cm <D <24 cm | unit | 900 |
| Cutting of trees with the diameter 24cm <D >32 cm | unit | 715 |
| Cutting of trees with the diameter D>32 cm | unit | 370 |

7.3.3. Impact on Fauna

The project implies widening of existing road, thus, there will not happen additional fragmentation of habitats and creation of new barriers, that could become reason for interrupting animal migration. Generally, the motorway is characterized with the following impacts:

Impact on fauna – that may be related to contamination of rivers with fuel and cement or concrete (wrong treatment of fuel; washing of vehicles in rivers; concrete works for bridge construction), and also erosion of slopes, slots and bulks.

Destruction of bat nests in some old buildings and when cleaning trees with hollows;

Disturbance of protected wild bird nests;

Cases of poaching by constructors;

The below districts are vulnerable towards road construction:

All crossing of the river:

Impact: water pollution with fuel (old), also with garbage and waste. Ecological receptors represent all groups of water animals, especially – endemic and species protected by legislation, as – Colchis crab, Dragonfly larva and fish (Freshwater and anadromous);

Increased water strength on river crossings. Ecological receptors are presented by all hydrobiont groups, especially – fish (Freshwater and anadromous) during reproduction and and pollywog.

Minor districts of natural landscapes (forest stands, herbaceous cover and shrubbery along construction corridor) on adjacent territories of the road. These districts might represent shelter for the representatvies of wild nature and maintains valuable part of regional biodiversity.

Impact:

During preconstruction cleaning works (tree cutting etc.) destructing of shelters and nests. Ecological receptor birds (mostly – sparrows not protected by law) and bats (from which two three species are enlisted in red list);

Disturbing of animals during reproduction in reproduction (breeding) places (some of the birds leave nests, even with already abandoned nestlings);

Impact:

Increase of water turbidity during fish migration in river.

7.3.4. Protected Areas

The nearest protected areas close to the road are Mtirala National Park and Kintrishi protected area, which are located south-east from the road. The closest distance is about 5-5.5 km.

7.3.5. Landscape

The significant changes of the valued landscape are not foreseen in the project. However, some impact will be carried out in an area where land is needed to be cleaned up on the natural landscape of small sections, which are considered vulnerable areas referred in paragraph 7.3.2. Existing licensed quarries and mines are proposed as material suppliers in order to avoid a new impact on the landscape.

7.3.6. Water use

Water is necessary for the care and protection measures of the works (water tanks). The amount of water needed is not of large volume and appropriate sources exist near to the project sites (the river. Dzindza; groundwater resources). Removing water for the purpose of work construction and camps functioning can be obtained from the surface water sources or ground water sources (wells). To obtain the surface water, water abstraction permission is not necessary, but it is necessary to fill special forms in order to proof that removal of surface water (includes removal of the volume) conditions correspondents to the technical standards (technical standards approved by the Ministry of Environment Order No. 745, 13.11.2008). Abstraction of ground water for the purpose of the functioning of construction camp needs license for the ground water usage (According to the Law on "Licenses and Permits", 2008, Article 7). Pouring of wastewater discharges into surface water needs the development of special needs, in particular - the maximum permissible discharge limits, which must be agreed with the Ministry of Environment and which defines the limits of pollutants in wastewater discharges as prescribed concentrations. Agreed indicators (limits) are defined for each specific unit in accordance with surface water sanitation standards. Surface water sanitation norms are general normative, which are issued by Ministry of Health and Social Affairs, and the discharging limits are calculated for each surface water body pollution source.

7.3.7. Impact on archaeological sites

In general, land cleaning, grading and excavation is connected to the risk of the damage of underground archeological treasures. Famous Archeological sites on the project area have been identified during the highway construction in the Soviet Period. According to preliminary research, the most anticipated archeological treasures are represented on the territories of Beshumi, Danisparauli, Paksadze surrounding area. Nevertheless, it is possible that during the construction, archaeological artifacts may be found in other segments of the road. Therefore, the great attention and archeological supervision is needed during the rehabilitation works of those roads, where the road should be expanded. At the moment the Roads Department in collaboration with the National Agency for Cultural Heritage of the Ministry of Culture is pursuing archaeological research on the project area for the construction permission.

7.3.8. Transportation Impacts

Heavy freight cars for the transportation of inert materials are necessary for construction within the corridor. Different types of impact is anticipated in this regard:

- Noise and vibration impacts;
- Corks (discomfort);
- Air pollution (dust, emissions);
- Mud on the roads;

Fueling, maintenance and cleaning of the vehicle, and the associated risks of contamination of soil and water.

7.3.9. Congestion

Heavy truck intense movement within the construction corridor is needed for necessary amount of inert materials transportation. Construction sites presents some risks for the safety of the population, and therefore the necessary safety rules should be maintained. Local traffic may be subjected under the effects of project transportation activities. The effect is temporary, minor and manageable. The long-term effect on the local movement should be positive.

7.3.10. Environmental impacts associated with the construction camps

The construction contractor will take decisions related to the construction of auxiliary facilities (structure, composition, location, design, etc.). Nevertheless, on the different sections of Φ -60 route with the regard of construction activities arrangement experience and with the fact that represented project involves not a full-scale construction work, but also the road rehabilitation / reconstruction, we suppose that the auxiliary facility complex will be built, including construction camp for 50 workers to stay (approx. 0.75 ha), transports and equipment yard for approximately 25 vehicles and heavy construction machinery (approx. 1 ha) (bulldozers, excavators, cranes, etc.), and Concrete and asphalt-concrete plant (approx. 1 ha).

The exact location will be selected by the construction contractor. Camp, construction and exploitation of the potential impacts are summarized below:

- Topsoil's (humus layer of the soil) potential damage;
- Fuel storage and refueling resulting from pollution;
- Waste and waste water management.

In the EIA chapter 8.1.1.11 connecting to mitigation measures, we describe the design and operation of the above-mentioned auxiliary facilities during the applicable procedures and conditions as well as the optimal location options.

7.3.11. Impact related to Asphalt-concrete plant and gravel macerators

The way will be paved with asphalt concrete. Asphalt-concrete plants and gravel crushing sections of the direct impacts include landscape degradation, emissions, dust, and noise and so on. Gravel and other supporting materials necessary for the production of concrete will be purchased by licensed operators.

Potential pollution of rivers with waste bitumen also considered to be a significant impact. Crushing infrastructure, as a rule, is characterized by the emission of dust and noise impacts.

If construction contractor will make a decision, about its bituminous concrete plant installation and operation, he has to prepare and take the appropriate EIA Environmental Impact Permit.

Asphalt industry related mitigation measures are discussed in Section 8.1.11.

8. Mitigation and Environmental Management Plan

8.1. Mitigation Measures

8.1.1. Mitigation measures related to construction

8.1.1.1. Prevention of hazardous geological processes

The project is composed with the regard of 7 magnitude seismic zone conditions and is appropriate with the terms of the seismic hazards.

The project road crosses 10 districts of the landslide and mudflow ravines. Bridges and culverts are designed with the regard of river costs and sediment mass.

For the mitigation of landslide processes the project aims to arrange drainage system on every landslide station to remove surface water and to implement anti erosion activities. (Fixing slopes with geotextile and berms).

8.1.1.2. Pollution prevention and waste management:

Paragraph 8.1.1.11. Discusses protection issues of air and water on the complex areas of supporting construction facilities.

In annex 2 there is more specific description of water resource protection measures in construction camps.

Hereinafter there is a description of measures to protect water and soil from the pollution on the construction sites.

Water / soil pollution. To prevent water and soil pollution at the construction site specific mitigation measures are necessary to be obtained:

To forbid vehicle movement within the river, and if this cannot be fully implemented, it is necessary to check vehicles regularly on leak of fuel and lubricating oil.

Contractors are required to use properly lubricating oil, fuel and solvents. It is prohibited to locate fuel and lubricant tanks at a distance of 50 meters from ponds, wells and the river bed or ravines. If there is a stationary tank, all the tanks must be placed in the concrete foundation (stone or concrete bounded reservoir) whose volume (capacity) is at least 110% of the maximum capacity of the tank. If in a protective reservoir there is a more than one tank placed, the capacity of the system should be 100% of the biggest tank or 25% of their full capacity depending on whichever is greater. Protective reservoir should be waterproof and should not have drainage pipes or defects, which violates its impermeability. In such bounded area (reservoir) collected rain water is drained and flows into out of the drainage system or the soil, provided it is not contaminated. In the case of spilled oil, spilled fuel must be collected, and the contaminated area must be treated sorbent: sawdust, straw or thatched.

Fuel dosing (TAP) device with all guns should be checked for leaks and constantly need to be controlled; their design must allow possibility of closing, when they are not used.

It is unacceptable to store fuel on the wetland territory or refuel transport vehicle or equipment from the distance less than 50 meters from the reservoir, river, channel, out of the well, or gorge. During the fuel filling it is not allowed to leave the vehicle unattended. On the construction sites, during the oil filling of the vehicle or equipment it is necessary to use filling (dissolving) napkins and / or use a straw to minimize oil spill on the ground. Such diapers and/or straw will lay on the ground before the fueling up of vehicles or equipment. Removal of contaminated soil layer will reduce or prevent immediately the risk of contamination of groundwater and surface water. It is necessary to remove, store and process sorbents and contaminated soil layer as a hazardous wastes. In the case of significant scale spills (leaks) it becomes necessary to inform about the incident the person who is in charge and to stop work until the elimination of the risk of contamination. During the fuel filling of vehicles and equipment it is necessary to use appropriate equipment used for this purpose (e.g., a suitable size of nozzles) and the work should be performed only by skilled and trained personnel (operators). In order to avoid equipment refueling malfunctions caused by leakage, systematic examination of fuel supply equipment is necessary to be performed systematically. Equipment and facilities must be insulated and protected in order to prevent theft and vandalism. All moving equipment, which means, for example: Cranes, compressors, generators, bulldozers, excavators and others. And storage tanks, should be used during the work and repaired if necessary to minimize the probability of a leak- spills of materials. The daily check of equipment (vehicles technical service procedure) is necessary in order to avoid the threat of a spill-leak. Vehicle repairs, cleaning, removal of lubricating oil and lubricants and other maintenance work must be performed on a hard (sustainable) field and not on a mole. It is prohibited to arrange the repair site of vehicles or equipment less than 50 meters from the reservoir, a well from a ravine. It is unacceptable less than 50 meters radius from the reservoir, river, channel, out of the well, the valley, the river bed of the river or on the

wetlands or wetland areas to keep potentially hazardous materials or to fill moving equipment with oil or to perform repairing activities. During the construction of erosion control measures are necessary in order to avoid the increased amounts of sediment runoff. Also, the contractor shall ensure storage of excavated soil, the soil humus layer and subsoil in such a way as to minimize the run-off of the sediments in the surface waters. Contractors are required to take appropriate measures and cover land coating materials area with appropriate covering materials and try to use the soil for storage from which water doesn't flows flawless to the reservoirs. In case, if there is a risk of contamination of surface water body (river Dzinda) by washed way sediments from the construction site, it becomes necessary to maintain effective measures to prevent possible contamination, which includes :

- To use barriers of precipitation spread;
- To use a straw to throw them out of the water (to change direction) and to filter;
- Ricks (embankment) and the use of the channel system, to avoid flow of contaminated water in the river / basin;
- Use of containment / sedimentation lagoon. It is recommended to use a natural sedimentation process and not use flukkunant accelerate sedimentation, after which it is possible to clean water run.

This is especially important during the pumped water discharging into the river from excavations.

It is unacceptable to get into a river, the reservoir, the pool and to get into a ditch the bitumen, wet cement and/or concrete. Concrete plant needs to be located at least 100 meters away from the river violet. During the bridge construction erosion and sediment traps should be organized. On the working areas there is no expected to have an adverse effect on groundwater. Ground water depth from the surface area to the Vakisi freeway consists of approximately 5 Ms. Slope waters are located slightly high and needs the drainage.

8.1.1.3. Construction waste management

Possible waste types and quantities are described in p. 7.3.1.1.

Waste generation formation and management details are discussed in Annex 1.

Inert construction waste management

In general, the best option to prevent the emergence of waste formation is to reduce their volume and hazard. The next good option is to re-use waste, the main bulk of the waste is-cutting off the slopes and rocky road expansion arising from falls, and the combination of excess ground, which is not used for the construction and placement of subject. The total amount of the dumps is 130 767 m³.

In July 16-17, 2015 the on-spot inspection was performed in Khulo - Municipal road along both sides of the road, during the construction expected accumulation of inert waste and for the purpose of selection of their placement in the areas, within the framework of which the GPS coordinates and photo materials have been shoot in the following places:

#1. The free territory on the left side of the road before joining the Goderdzi pass, 10-150 degree slope can be used for the placement of fill. X- 0292199; Y- 4611553; H-2004 m.

The mentioned area is owned by the state, agricultural (pasture), in the area there was no any destination in previous years, 500 meters from the territory there are wooden houses (Oda) of local inhabitants, where residents from Khulo municipality villages are living there seasonally. And in 1 km there is a Goderdzi Pass, where there are hotel and shopping facilities, and „Goderzi" resort trail in 2 kilometers. The selected area is covered with grasses, it is possible to meet medical grasses as well, there are not tress in the particular area, and it is used for grazing by population.



Picture. 8.1.



Picture. 8.2.



Picture. 8.3.

Decades ago area enjoyed softwood lumber, but it was cut by the population years ago and due to the frequent cattle grazing the emergence of natural wood will not happen, mainly coniferous (spruce, fir) wood rejoiced. The area is inhabited by wild animals: wolves, bears, jackals, foxes, rabbits, squirrels and other.

The advantage of # 1 station for the placement of residual inert material and agricultural camp is that it is close to the motorway, far from the surface water objects, from forests and forest fund lands and protected areas, the road fits easily, 600 meters from the mentioned point there is a possibility to locate camp and parking. All kind of communication necessary for the camp is available (power station, the cellular network, the source of drinking water, a passenger bus transportation). After the Household waste water collection arrangement (the arrangement of sediment) it can be discharged into the ravine or in nature.

2 at the end of the road on the left side of Bodzauri.

The place can be used for inert waste (bulk) placing X- 0291464; Y- 4612020; H-1841 m.



Picture. 8.4.



Picture. 8.5.



Picture 8.6.

The station is a state property, agricultural land (pasture). In Soviet times there were located breeding farms seasonally, which is no longer available at this period. It was dismantling. The selected site is covered with grasses. The relief is slope, where the upper part has 20-300 degrees slope, but the lower part of the slope is straight and quite a large amount of mass can be stored. The area is naturally, but the road is partially damaged and due to lack of surface water disorganized collection system the small-case landslides occur often. The variety of trees and plants of Sochi fall near the area, as a result of non-system logging from the population it has been cut down. The area is away from rivers and surface waters, from the forest recourses and protected lands. The area is located beside the road. The area can be used for the location of inert waste. Now the territory is used as a grazing area by the population.

3. Near the so-called Sasadilo Settlement from the river runoff from Goderdzi pass there are accumulated river waste- X- 0291216; Y- 4613085; H-1697 m.



Picture. 8.7.



Picture. 8.8.



Picture 8.9.

The area is state property and can be used for inert material gaining. But there is need to study it in detail from license issuing authority, since it is located in „Goderzi fossil forest "near the monument to the inorganic nature and therefore need to be specified to use it because they do not occur in a natural reserve within the boundaries of the district. The river itself originates from Goderzi pass and collects surface water source and in the case of the abundant precipitation increases and collects a large amount of inert mass.

4.after the village Danisparauli, 2 km towards the Goderdzi pass direction, in the so-called Sasadilo settlement, on the left side of the road, there is accumulated a large number of river (which flows from the green lake area) sediments, which can be used as a career farming. (The area is owned by the Khulo Municipality). X-0291023; Y- 4613332; H-1680 m.



Picture. 8.10.



Picture. 8.11.



Picture. 8.12.

The territory of the area is 9 hectares, it is property of the state, for agricultural purposes (grazing), there is no located any kind of objects near the area, though in the Soviet period there was planned to build farming construction, there was even a foundation, but because of the system's collapse it wasn't built, farms split and there was need of it anymore. The selected site is covered with grasses, but in some cases medical plants can be found (nego, plantain and other) population uses it as a hay in some cases, no trees in the area. The selected area is natural, the surface is straight, there have not been registered any erosion and flows and the risk is very low, this kind of event haven't been displayed during the 100 years. In the area there is vicinity of wild animals: bears, wolves, jackals, foxes, rabbits, squirrels and other.

The advantage is that it's close to the motorway, 5km from the area there is a resort "Goderdzi" administration. The area is far from surface water, forests and forest lands and protected areas, it is along the main road and in any weather conditions it is possible to enter and exit. The area is available for the camping. Camp is equipped with all the necessary equipment (electrical power supply lines; surface water source; cellular and other means), after the organized collection of household wastewater (settling arrangement) it is possible to discharge it into the ravine or in nature. It possible to arrange inert materials district #3 on the opposite side. At the moment, population uses this site as a livestock.

#5. After the so-called village Shuasopeli it is possible to arrange sediments and additional facilities. X- 0288743; Y- 4613103; H-1406 m.



Picture 8.13.



Picture. 8.14.

The mentioned area is the state property, agricultural land (pasture) covered with the grass. The tree plants is not found. The area is located beside the road, along the valley. The area can be used as an inert waste placement, as well as for the construction camp placement, since 3 years ago bridge construction company arranged agricultural district in this area. It is 200-250 meters away from the population, it is provided with all necessary communications (electrical power, cellular devices, and surface water). It should be mentioned that 600 meters from the agricultural site along the so-called Safrekhidi, landslide and mudflow processes developed over the years, particularly, from the upper plateau soil it is collapsing regularly, in the case of precipitation landslide processes are developing. The area is transformed, during the landslide processes pine wood spur facts occur, but for the camp formation it is not a risks, because its distance is more than 600 meters.

In the case of object placement, after the organized collection of agricultural household water (sediment arrangement) it can be discharged into the reservoir.

#6. Before the arrival in the village Rike, at the end of the village Sapnistave, on the left side of the road, it is possible to place inert waste. X- 0286143; Y- 4613257; H-1216 m.



Picture 8.15.



Picture 8.16



Picture. 8.17

The beside territory of the mentioned point is a state property, for the agricultural purpose. It is covered with grass (shrub), bushes, trees and hedges. The area is located near the road, along the river Adjaratskali - 300 meters away from the bed, the slope is 20 degree. Area can be used for inert waste.

#7. Before the arrival in the village Dioknisi, on the road it is possible to place inert wastes, approximately the area is 1500 m². X- 0282052; Y- 4612432; H-982 m.



Picture. 8.18.



Picture. 8.19.



Picture. 8.19.

The area falls within state forest land category. Covered partly mainly with alder trees and shrubs. Territory is not used by the population and is located along the road. It can be used for inert waste.

#8. At the bridge of village Paksadzeebi, on the opposite of petrol station in the river Adjaristskali it is possible to place inert waste. X- 0280720; Y- 4613659; H-853 m.



Picture. 8.20.



Picture. 8.21.



Picture. 8.22.

The mentioned area is state property, non-agricultural land category, near the district there is a petrol station and two shopping booths, which will not interfere with the formation of parking and camp. There is all necessary equipment needed for the formation of agricultural camp (power lines, cellular connections, the use of surface water, passenger transport services), all kind of communications, object placement territory is non-agricultural land, which is state property, trees do not grow in the area. 500 meters away from the site local residents are living.

The advantage is that it is close to the road, and far from the surface water from 100- 150 meters, from the forest, forest funds and protected areas, the population doesn't use this territory and it is free destination area. After the organized collection of household waste waters (sedimentation) it is possible or discharge it into nearby surface water body.

The dumps and inert materials shall be protected by the following rules:

It should be agreed with the local authorities by the building contractor how to place inert waste.

Permit residents to use the extra stones, which can be reused later. It is possible to arrange access to the file with the permit of appropriate local government bodies and after the consultation of the public members.

Disposal of waste and the stones is a building contractor's obligation and related expense should be incurred by the construction contractor.

Construction Waste Management

On the Work stations the waste should be collecting in special containers.

Waste must be removed from the working area of the nearby settlements of local governments by the relevant services in the specified places. Waste should be used for the special service provider organizations ("cleaning" organizations, etc.), which produce municipal waste disposal in landfills. Waste management procedures for camps are developed as a separate document and is given in Appendix 7.

Staff who will be in charge with hazardous and non-hazardous waste operations (including their location), is required to undergo training on the following issues:

- Waste Management (waste work to be done);

- Waste (c) processing; and
- Temporary placement of waste.

Incineration of waste on the site is not allowed except for trees / shrubs thin branches, which are recommended to burn in order to prevent the multiplication of pests.

Hazardous construction waste

By the Local legislation (Labor, Health and Social Affairs of Georgia # 36 / N of 24.02.2003) a small amount of hazardous waste can be placed in municipal landfills. Hazardous waste is a major part of the Ministry of Environment and local authorities could be mandated. The construction contractor will collect hydrocarbon wastes, which includes lubricants, to further secure the transportation outside the district, re-use, treatment or temporary storage in the areas, and then – in the places approved by the Ministry of Environment or for the transmission from the licensed operators (eg. the “Orderly”), who has the environmental permit to operate hazardous waste.

Used Biological Pollution Prevention

There are tombs (including unregistered) near the place (e.g. Anthrax pits) during the land works there is a risk of infection of people living nearby and personnel as well as re-pollution of water and soil with biological materials. Such risk is very low, but it should be taken into consideration. Suspension of work in case of burials. Ministry of Agriculture "Food Safety, Veterinary and Plant Protection Service" veterinary supervision department is responsible for the complex process of implementation of sanitary measures in the case of detecting unregistered burials. In the case of Suspicious discovery of the graves information should be provided immediately to the Veterinary Department by the construction contractor (environmental specialist in the field) and by the monitoring entity.

Procedures that should be followed by the building contractor and STD:

Suspension of work in case of burials. Inviting local representatives of the Veterinary Department, an investigation before resuming work. If necessary - disinfection financial aid.

8.1.1.4. Noise, dust and emissions

Settlements will not be under the significant influence of a construction-related emissions. Nevertheless, heavy vehicles emissions used in the construction should be managed with appropriate care and using good quality fuel. Engine work in non-operating mode should be banned.

The more significant impact is associated with the emission of dust, which is very difficult to calculate, but it is clear that the land works and gravel and other inert materials transportation from the open quarries generate dust inconvenience. This represents a temporary impact and work areas should be relaxed with periodic irrigation.

With the rough calculations of Construction-related noise the noise impact will be beyond the 60 - 100 m radius. The temporary increase of noise level in a 300 m radius of the construction area is an acceptable exposure. The houses are not located close to the road.

These minor impacts can be mitigated with good engine care practice and with the prevention of engine work on non-operating mode. The only recommended restriction in this case is devices causing high sound, such as crushing, residential zone and installations out of the works banning of the night works on the roadside near the village. Night works can be carried out without prejudice to other areas.

The care of all transport vehicles will be provided in such way that their noise and emissions will not be worrying for the workers and local populations. Rehabilitation works near the settlement will be carried out only during the day to minimize the impact. All vehicles will be checked and repaired if necessary to eliminate parts of the damage due to increased noise levels. All vehicles will be checked and repaired if necessary to eliminate increase noise due to damage of the parts.

Regular maintenance is necessary to reduce emissions from diesel engines, for example fuel injectors cleaning. Systematic care will be of a high standards to ensure the safety of the transport and reduction of the emissions and noise. The maintenance of all the plants is necessary to ensure its normal work and reduction of potential contamination.

The fueling of the transport will be carried out in such way that it will prevent emission of volatile organic compounds, by means of fuel tanks and pumps and special pumps (fuel storage will not be used to open containers).

If required, in the dry conditions or where will be originated or where it is expected to originate a large amount of dust, mitigation measures will be performed with the construction manager.

Mitigation measures will include the following:

Land soaking from water cisterns, which will be equipped with spray or other technical means; For this purpose it will be necessary for at least two tanks, but the construction contractor should not be limited to that data, and, if necessary use more of the cistern;

Building and overlapping of open warehouses; And

The use of Pre-defined leading routes and speed limitations of vehicles. Materials should be transported on the construction are on busy hours;

Materials for transportation should be covered with tarpaulin/ and should be wetted to reduce dust. Construction site will be watered if necessary. Mounting equipment will be supplied to workers if necessary. All vehicles will be checked and repaired if necessary due to defective parts, to avoid emissions.

Such measures will be taken, if human or animal receptors are located 300 meters from the corridor.

8.1.1.5. Soil protection and erosion control measures

Protection of humus soil

Contractor will not perform any job on the humus soil if the following circumstances appear:

Soil layer is frozen;

During the rain or snow;

Soil layer is soaked with water;

Storage of humus soil (storage)

Protection of humus soil happens by the regulations of "topsoil removal, storage, use and cultivation of the" technical requirements. Layer of humus soil are kept no more than 2 m high embankments (clusters), which does not exceed slope angle of 45 degrees. In addition, following should be taken into consideration:

Soil storage areas shall be selected in that way, not to happen their compaction during the vehicle movements and their contamination with other materials;

The heaps of soil layer must be separated from the lower soil layers;

Unacceptable to store soil layer stacks, if there is the threat of flooding and soil washing;

In order to protect humus soil layer from the washing, it is not allowed to store soil stacking less than 25 meters from the river/water flows (with the consideration of specific location of the topography)

In the case of the soil piles experiencing significant erosion, the contractor is required to apply the appropriate corrective actions (e.g. The use of surface-deposit for covering up). The contractor shall take appropriate measures to protect soil embankments from flooding and water leaching by arranging berms (protective embankments) or similar means around the place, which is needed.

The oversight of humus layer of soil is necessary and in any adverse circumstances corrective measures are necessary to be taken:

In the case of anaerobic conditions – clod the topsoil embankments or make ventilation holes in clusters;

During the erosion – set up temporary protective fencing rainfall.

On the site of permanent facilities cut soil layer will be used for the construction of the corridor to restore the soil layer which is damaged by the project work grazing. The soil layer in the areas which won't be restored, there will be an initial condition and distributed in the surrounding area. The road corridor cut soil layer will be used after the end of repairing works of the corridor. Humus layer of the soil is being restored isolated from the recovery of subsoil and attention is needed not to mix these different soils. Soil humus layer recovery is sufficient to restore the fertility of the land from its original characteristics, the conclusion is based on the visual inspection of the soil layer and comparison of restored site and surrounding land. The contractor plans soil layer recovery operations in such way that the first layer of soil to recover from the most distant clusters through a soil layer at the station and the recovery operation is gradually moving in the direction towards the stored stacks thereby avoiding unnecessary movement of vehicles on the already recovered soil layer. Then harrow of soil layer will happen where it will be necessary where it is considered appropriate to the plants to thrive.

Subsoil storage (storage)

Subsoils are kept as no more than 3m tall stacks, and their angle does not exceed 600 degrees. In addition, the following should be taken into consideration:

subsoil storage areas shall be selected in that way, to ensure that compaction vehicle movements and their contamination with other materials does not harm the soil;

Subsoil piles must be separated from the soil humus.

In case, if subsoil is experiencing significant erosion, the contractor is required to apply corrective actions (eg. For use in clusters on the surface).

Temporary anti-erosion measures (during the construction)

Measures by which contractor will provide the road corridor and other facilities and nearby "hill" with the protection from the erosion before the full restoration, are described in this section. Temporary anti-erosion measures are used if it is necessary; In addition, special attention is paid to the following: the construction work, which increases the intensity of slope erosion and subsequently increase of rainfall runoff in rivers/canals. Temporary anti-erosion are applied to that point, until the condition of slopes will stabilize. The goal of temporary anti-erosion measures are:

- Reducing the flow of surface water;
- Water flow speed reduction to the permissible indicator;
- Disposal of the water using a protective dams;
- avoidance/ reduction of rainfall flush from the construction sites to the reservoirs
- barriers erected with straw stacks in the areas that are in need of protection from precipitation;

8.1.1.6. The final restoration of work sites

All sections of the working area (except sections, which are constantly engaged with other facilities) must be restored to its original condition (topography, soil and vegetation). District recultivation becomes relevant by the requirements of regulation about "topsoil removal, storage, use and cultivation". If necessary, it is necessary to carry out erosion control measures: in terms of erosion control, vegetation, drainage, berms and other auxiliary engineering structures. Restoration of humus layer of the soil is sufficient to restore grass as the project doesn't involve a large number of cut of trees and shrubs, thus re-vegetation will be an important component.

8.1.1.7. Landscape restore and flora protection

As it has been showed in the paragraph 4.4.2, based on the fields survey, in the design corridor sensitive areas have been identified: Basically it is partially degraded groves in the vicinity of the road.

The total impact on the flora is expected to be volume of:

Cut down of forest and destruction – about 3.000 trees;

cutting down the bushes and uprooted - 7 hectares;

To compensate the damage of the proposed cut of each tree or bush, or endemic species included in „Georgia’s red list“ for this exchange to plant 10 new tree (this applies in particular trees, a number of which could fall under the influence).

The path crosses the forest plot of land between two outlying districts.

Other areas of the road are transformed into strong landscapes and have no ecological value.

To protect sensitive habitat, the following steps are necessary:

selected and adjusted (attached) row pre-survey of construction corridor by building contractor, in order to carry out exact quantity of species in the red book as well as exact description and recordings of all felling trees

selection of all felling trees (to rule out other logging)

statutory description of PAP stands, which are necessary for planning of compensation arrangements and for the implementation of forest land change category.

The mentioned measures should be included in all construction contracts, particularly, in the contract attached to the environmental management plan, as it is the contractor’s liability.

Building contractor and STD, on the basis of pre-research, to do their utmost to minimize the risk of damage to the species included in the Red List to minimize the risk of damage and exact details of the route, by all means to avoid protected plants. Within the framework of selected construction corridor pre-construction survey will be carried out, in order to prepare the accurate inventory of the affected species. Removal of plant species included in the red list from their natural environment should be performed by the law of Georgia on the Red list and Red Book. Felling of trees should be carried out with the all procedures necessary for changing the land category.

Changing rules and procedures of the State Forest Fund for forest use is determined by the resolution of the Government of August 20, 2010 # 242 Resolution of the Government of June 1, 2011 # 228 resolution, plus Chapter V -

The use of state forest for special purposes

The decision for The special rights of the forest use on the state forest area, as well as special permission for forest cutting decision the decision was made by the Ministry of Environment and Natural Resources with the agreement of the other concerned agencies.

For the special-purpose forest use right in the state forest area, the Department of Roads Environment should submit an application to the Ministry of Environment and Natural Resources. The application should contain the list of following attached documents:

The special motivation for the necessity of forest use, the purpose and time frame for this usage.

For private legal entities and individual entrepreneurs - extract of natural persons, Entrepreneurs (non-commercial) legal entities, a copy of their ID card or passport. For Public legal entities - verified copy of founding documents;

For the special purpose usage of forest, for the selected area measures of drawing coordinate system, which must be certified by the person drawing of measurements;

The document (if any) copy, by which activities, it is essential to implement necessary forest use;

The reasoning why it is necessary to cut forest

The information of the species included in red book on the selected area

The decision about state forest use for special purpose is issued by the Minister with the individual administrative act, based on which managing body of the State Forest Fund signs an agreement with the interested party about special use of forest and acceptance-passing act for selected area.

8.2. Information on mechanisms set in Georgian legislation concerning regulation of the compensatory actions for taking from the wild the plants included in the Red List of Georgia

8.2.1. Red List of Georgia

According to the legislation of Georgian (subparagraph (A) of paragraph (1) of Article 1 of Law of Georgia on Red List and Red Book of Georgia), the Red List of Georgia is the list of endangered wild animal and plant species on the territory of Georgia. Accordingly, endangered wild animal and plant species spreaded around Georgia are included in the Red List. The Red List of Georgia is approved by the Resolution N190 of the Government of Georgia on “Approving of the Red List of Georgia” from February 20, 2014. The Red List includes conditions and protection status categorization for each specie that (the indications included in the Red List of Georgia) has the same meaning as the categories and criteria defined in the Red List of the International Union for Conservation of Nature (IUCN Red List Categories and Criteria, Version 3.1, 2001) and in the recommendations of the IUCN for Regional and National Lists (IUCN Guidelines for National and Regional Red Lists, 2003), namely:

CR (Critically Endangered) – taxon facing a very high risk of extinction;

EN (Endangered) - taxon facing extinction;

VU (Vulnerable) – vulnerable taxon;

RE (Regionally extinct) – extinct on the national level.

Plants included in the Red List of Georgia: 36 species are categorized as VU (Vulnerable) – vulnerable taxon; 18 species as EN (Endangered) - taxon facing extinction; 2 species as CR (Critically Endangered) – taxon facing a very high risk of extinction.

8.2.2. Law of Georgia on Georgia’s Red List and Red Book

Issues on protection and using endangered species (Red List species) as well as on the need of their restoration is included in the Law of Georgia on “Red List and Red Book of Georgia”.

Special cases, when taking such species from the wild is permitted, are determined under Article 24 of the Law, according to which:

1. Taking endangered wild plants or their parts (from the natural environment) is permitted only for the following special cases:

a) Recovering and reproduction in natural conditions (cultivation);

b) Cultivation in dendrological and botanical gardens and parks;

- c) Cultivation under artificial conditions for agricultural purposes;
 - d) Scientific purposes;
 - e) Sanitary cutting with the view of improving forest sanitary condition;
 - f) Implementing important state and public projects;
 - g) If the naturally broken, defected, invaded dry and withering plants included in the Red List of Georgia are grown on the territory of the State Forest Fund;
 - h) If the naturally broken, defected, invaded dry and withering plants included in the Red List of Georgia are grown in the traditionally used zones of the National Park, in certain prohibited areas and on the territory of protected landscape;
 - i) Safe exploitation of existing factories and infrastructure;
2. Taking endangered wild plants or their parts (recovering from the natural environment) for agricultural purposes, with the view of cultivation in artificial conditions is allowed only if the wild plant is cultivated artificially.
- 2¹. The written consent on taking endangered wild plants or their parts (recovering from the natural environment) in the cases considered under subsection (a)-(d) and (i) of the section 1 of this Article is issued by the Ministry of Environment and Natural Resources Protection of Georgia.
- 2². The decision on taking (recovering from the natural environment) wild plants and their parts endangered due to sanitary cutting in the cases considered under subsection (e) of section 1 of this Article, is made by the relevant authorities defined under Articles 15 and 16 of the Forest Code of Georgia.
- 2³. The decision on taking (recovering from the natural environment) endangered wild plants and their parts in cases considered under subsection (f) of section 1 of this Article, is made by the Government of Georgia.
3. The decision on taking (recovering from the natural environment) endangered wild plants and their parts in cases considered under subsections (g) and (h) of section 1 of this Article is made by the authorities, within their competence, defined under Articles 15 and 16 of the Forest Code of Georgia.

Note: *Authorities defined under Articles 15 and 16 of the Forest Code of Georgia are: According to Article 15, protected territories and their resources of the state forest fund shall be managed by **LEPL Agency of Protected Areas** of the Ministry of Environment and Natural Resources Protection of Georgia*

According to Article 16:

*1. The state forest fund, except forests of local importance, protected areas of the state forest fund and forest fund in territories of the Autonomous Republics of Abkhazia and Adjara, shall be managed by the **National Forestry Agency**.*

*2. Forests of local importance shall be managed by **self-governing units** through appropriate agencies within the scope of the authority granted by the legislation of Georgia and in compliance with the requirements defined by this Code.*

*3. Forest fund in the territories of the Autonomous Republics Abkhazia and Ajara shall be managed by **appropriate agencies of the Autonomous Republics Abkhazia and Ajara**.*

Article 20 of the Law is about taking endangered species, namely: according to the section 1 of this Article, “measures of taking endangered species includes all the activities carried out for taking and maintaining these species as well as their habitat”. According to the section 3 of this Article, “measures of taking endangered wild plant species includes their protection with biological means (drugs), *artificial cultivation and conservation of these species in natural conditions*”.

This Law does not define the responsibility on compensation measures for damages caused by taking endangered plants from the wild. Taking Red List plants from the wild causes damages while their condition gets worse, the number reduces. Accordingly, the relevant compensation – recovering measures shall be planned and implemented. Therefore, compensation issues are regulated by other legal acts of Georgia (see below). In some cases (when the compensation issue is not regulated by any other legal act), the obligation on compensation activities regarding the damages caused by taking of Red List plants from the wild is defined in the Decree of the Government of Georgia on “Recovering the Red List Plants from the Wild”, or in the consent letter of the Ministry of Environment and Natural Resources Protection of Georgia. This mainly refers to taking Red List plants from the wild for the following purposes:

For implementing projects of state and society importance;

For security measures while exploitation of existing factories and infrastructure.

8.2.3. Other legal acts regulating conservation and restoration activities:

Code of Georgia and subsequent regulations

The Forest Code of Georgia sets legal grounds for conducting tending, protection, restoration, and use of the Georgian Forest Fund and its resources

According to the subsection (c) of section 2 of Article 24 on “Planning Benefits of the State Forest Fund” of the Code, planning benefits of the state forest fund includes forest maintenance, restoration and afforestation measures.

According to section 1 of Article 95 on “Restoration of the Georgian Forest Fund and Its Objectives” of Chapter XXVIII on “Forest Restoration” of this Code, restoration of the Georgian Forest Fund is a multi-year cycle of activities, carried out with the purpose of restoration and afforestation of the bare land plots under the forest fund or the open stands of the forest fund; while according to section 4, one of the forest restoration means includes thinning or removing underbrush in order to stimulate forests natural regeneration as well as carrying out tending, protecting, cleaning, planting, and sowing activities in the managed forests, forest edges, and subalpine open woodlands.

Rule of Forest Use (approved by the Resolution of the Government of Georgia N242 on “Approving Rule of Forest Use”, from August 20, 2010, proceeding from Forest Code)

The aim of this rule is to determine the rule of forest use in the territory of the state forest fund, including the amount of compensation fee for using the forest fund for special purposes (Article 1).

By the Resolution of the Government of Georgia N425 from August 17, 2015, the changes were made to the Resolution of the Government of Georgia on “Rule of Forest Use” (N242

20.08.2010), which defines payment obligation as well as fee amount (according to the agreement concluded with the Forest Management Agency) for using the forest fund for a special purpose (in case when there is no land withdraw from the forest fund while using). Moreover, the fee and payment obligation are defined for the plants subjected to cutting in this territory; while the double price is defined for the plants of Red List. The mentioned amount of money shall be used by management agency for forestry measures, including for implementation of forest restoration activities. Persons who have received a consent on taking Red List species from the wild before present Resolution entered into force and are obliged to present a certain compensation actions package, remain the right to address the Ministry for changing the mentioned obligation to paying the amount.

The mentioned is described in the Resolution of the Government of Georgia on “Approving Rule of Forest Use” (N242 20.08.2010):

Article 27⁴ defines all required documentation for obtaining special right for using the state forest fund for special purposes. It includes information about woody plant species protected in Red List that grow in the areas defined for state forest fund special use (subunit (d) of section 1 of the mentioned Article).

According to the sections 5 and 5¹ of this Article:

“Section 5. In the cases of using the state forest fund for special purposes for hydro-system, pipelines, roads, power, communications, channels operation, construction, reconstruction (rehabilitation), dismantling or for any necessary design or/and engineering-geological works as well as for exploration and/or extraction of entrails, for conducting oil and gas operations, for implementing infrastructure projects of state and/or public importance, the forest user is obliged to pay annual compensation fee, based on the provisions of the agreement concluded with management agency, in accordance with Table 2 of Annex 7 of this Rule (see below). In addition, for the purposes defined by the same section of the same Article, in the cases of cutting woody plants, if necessary, a forest user is also obliged to pay a compensation fee in accordance with Table 1 of Annex 7 of this Rule (see below). In the cases of cutting woody plant species protected in Red List of Georgia, the amount of the compensation fee is double. The compensation fee is used by the managing agency for ensuring the goals and functions concerning implementation of forestry activities (including forest maintenance, restoration and protection as well as forest management, accounting/inventory and fire prevention measures)”.

„Section 5¹. The compensation fee defined by section 5 of this Article for using the state forest fund for special purposes shall be payed annually, in accordance with the terms defined for special use. In case of cutting woody plants, if necessary, for purposes set in the same section of the same Article, a forest user shall pay a compensation fee before cutting – according to the woody resource volume marked in the woodcutting area”.

Forest users, who have been obliged to carry out compensation measures for using of forest fund for special purposes before this Resolution enters into force, remain the right to pay compensation fee defined in section 5 of Article 27⁴ of this Resolution instead of implementing the above-mentioned compensation measure, about which he/she shall address the managing agency in written within 3 months before this Resolution enters into force.

Forest users who have started implementation of compensation measures for using of forest fund for special purposes and decided to pay compensation fee defined in section 5 of Article 27⁴ of this Resolution, shall pay the amount fully despite the costs carried for implementation of compensation measures.

Rule on Calculation of Compensation Fee for Using Foest Fund for Special Purposes (including VAT)

Table 8.1

| Amount (in GEL) for 1 m ³ according to the groups | | | | | | |
|--|-----------------------------|--|---|--|--|--|
| N ^o | Volume m ³ | I group taxus baccata, box-tree, juniper, zelkova, walnut | II group oak, chestnuttree, ash-tree, elm, mulberry tree, maple, lime-tree, pyrus, pistacia mutica | III group beech, hornbeam, acacia, celtis, ostrya | IV group pine-tree, fir-tree, sitver-fir, cedar, cypress, cryptomeria, thuja | V group carpinus orientalis, plane tree, othe forest woody species |
| 1 | Amount for 1 m ³ | 80 | 75 | 73 | 70 | 60 |

Table №2

| N ^o | Area | Annual basic amount (GEL) |
|----------------|---|------------------------------|
| 1 | to 500 m ² | 250 |
| 2 | from 500 m ² to 1000 m ² | 500 |
| 3 | from 1000 m ² to 5000 m ² | 800 |
| 4 | from 5000 m ² to 1,0 Ha | 1200 |
| 5 | from 1 Ha | 0,12 for each m ² |

According to transitional provisions of the Resolution, section 5 of Article 274 does not apply on using state forest fund for special purposes with the view of carrying out activities defined under the agreements concluded in accordance with the Resolution of the Government of Georgia №1483 on “Electrification of the Village Mutso of Dushety Municipality” of August 26, 2014, the Resolution of the Government of Georgia №1196 on “Implementing Measures for Electrification of Some Villages” of July 3, 2014, the Resolution of the Government of Georgia №1017 on “Implementing Measures for Electrification of Some Villages” of June 9, 2014, the Resolution of the Government of Georgia №812 on “Implementing Measures for Electrification of Some Villages” of May 8, 2014, the Resolution of the Government of Georgia №405 on “Implementing Measures for

Electrification of Some Villages” of March 12, 2014, the Resolution of the Government of Georgia №1193 on “Implementing State Procurement by the Ministry of Energy of Georgia by Means of Simplified Procurement” of July 3, 2014, the Resolution of the Government of Georgia №2024 on “Implementing State Procurement by the Ministry of Energy of Georgia by Means of Simplified Procurement” of November 7, 2014, the Resolution of the Government of Georgia №1883 on “Implementing State Procurement by the Ministry of Energy of Georgia by Means of Simplified Procurement” of October 20, 2014, the Resolution of the Government of Georgia №1929 on “Amending the Resolution of the Government of Georgia №1196 on “Implementing Measures for Electrification of Some Villages” of July 3, 2014” of October 28, 2014, the Resolution of the Government of Georgia №1923 on “Implementing State Procurement by the Ministry of Energy of Georgia by Means of Simplified Procurement” of October 27, 2014.

The obligation of carrying out compensatory actions set under the Resolution does not apply to the companies owning electrical network defined under Article 272, in relation to the issues (section 11 of Article 272) on special cutting in protected areas set under the Resolution of the Government of Georgia №366 on “Electric Network Linear Facilities Protecting Rule and Defining its Protection Zones” from December 24, 2013; Also, to persons owning pipelines (oil, oil products, natural gas as well as their transformation products) and/or company owning the licence for natural gas or oil transformation in relation to the issues (section 12, Article 272) on special cutting in the protected areas set under the Resolution of the Government of Georgia №365 on “Pipelines (oil, oil products, natural gas as well as their transformation products) Protection Rule and Defining its Protection Zones” from December 24, 2013. According to the Resolution, these issues on special cutting, except delivery of cut wood, are regulated by the above-mentioned Resolutions of the Government (№366 and №365).

Full addition of sections 1¹ and 1² of Article 27² are presented below:

„1¹. On the 35 degrees downhill entered into the boundaries of the state forest fund, including state forest protected areas (except those protected categories and zones, where forest use is prohibited by the legislation), the issues on a special cutting, except cut timber delivery, carried out by the electric network owner companies on a protected areas specified under the Resolution of the Government of Georgia №366 on “Electricity Grid Linear Facilities Protection Procedures and Their Protection Zones” from December 24, 2013 , are regulated by the Resolution of the Government of Georgian №366 on “Electricity Grid Linear Facilities Protection Rules and Protection zones” from December 24, 2013.”

„1². On the 35 degrees downhill entered into the boundaries of the state forest fund, including state forest protected areas (except those protected categories and zones, where forest use is prohibited by the legislation), the issues on a special cutting, except cut timber delivery, carried out by the owner of pipelines (oil, petroleum products, crude oil and accompanying natural gas and their transformation products) and pipelines related facilities or/and by the company (operator) which holds the license of transportation of natural gas and oil, on a protected areas specified under the Resolution of the Government

of Georgia №365 on “Approving Pipelines (oil, petroleum products, crude oil and accompanying natural gas and their transformation products) Protection Rules and Determining Their Protection Zones” from December 24, 2013, are regulated by the Resolution of the Government of Georgia №365 on “Approving Pipelines (oil, petroleum products, crude oil and accompanying natural gas and their transformation products) Protection Rules and Determining Their Protection Zones” from December 24, 2013.

In the cases defined under Article 27² of the Resolution, for compensation of environmental damage caused by taking Red List plants from the wild, the compensation mechanisms were defined by the Resolution of Georgia (the Resolution of the Government of Georgia N1535 on “Compensation Measures for Taking Plants included in Red List of Georgia from the Wild” from September 5, 2014).

8.2.4. Order of the Government of Georgia №1535 on “Carrying out Measures to Compensate the Act of Taking Plants of the Red List of Georgia from the Natural Environment” from September 5, 2014

According to Section 3 of the Order, “in the framework of safe functioning of protected zones of electric network linear facilities and pipelines, the financing of compensation and mitigation measures for causing damages to the environment by taking the plants of the Red List of Georgia from the environment shall be carried out within the assignments granted to the Ministry of Environment and Natural Resources Protection of Georgia under the Law of Georgia on “State Budget of Georgia 2015”. Moreover, according to this Order, the Ministry of Environment and Natural Resources Protection of Georgia is obliged to develop the “Program on Renewing of Plant Species included in the Red List of Georgia”; Also, the Ministry of Environment and Natural Resources Protection of Georgia and the Ministry of Finance of Georgia are obliged to take into consideration the funds necessary for funding the mentioned program while developing the State Budget Project 2015.

Compensation of the damages caused by taking plants of the Red List of Georgia from the environment by issuing permission on environmental impact assessment and relevant ecological experts’ decision

The number of infrastructural projects has increased during the last years, the implementation of which needs environmental impact assessment and relevant permission for which the report on project’s impact on the environment shall be presented to the Ministry of Environment and Natural Resources Protection of Georgia for discussion and preparation of an ecological experts’ decision. In case of positive decision, the relevant permission is issued.

In many cases, the implementation of the mentioned projects causes damages to biodiversity, including to the plants of the Red List of Georgia. Therefore, along with the other measures, compensatory measures are considered by the legislation as well.

The legislation of Georgia includes the information on carrying out environmental impact assessment (EIA) as well as on the data that should be included in EIA Report. Among

them are the following: “the Environmental Impact Assessment Report shall assist the agency, which is carrying out the ecological expertise, to assess properly the decision concerning the project with the point of view of its ecological safety; to examine its compliance with the laws and limitations; to prepare a decision on readability of the information received during the assessment of environmental impact and on correctness of a decision design prepared based on the mentioned information” (Provision on environmental impact assessment is approved by the Order №31 of the Ministry of Environment and Natural Resources Protection of Georgia from May 15, 2013).

According to the section 2 of Article 5, environmental impact assessment passes some stages that are connected to each other. At one of the stages, ***proposed compensation measures shall be defined***. According to the subsection (f) of section 2 of Article 6, an Environmental Impact Assessment Report, along with the other, should include “means for preventing and reducing negative impact on the environment and health as well as ***define compensation means, if necessary***”.

The Ministry, after ecological examination of the presented EIA Report, shall issue an ecological experts’ decision/permission on environmental impact, the implementation of which is compulsory. In the cases if taking the Red List plants from the wild is inevitable for carrying out the activities and no compensation measure is defined for the damages caused by such action, one of conditions of the conclusion/permission shall specify the requirement for delivering compensation package.

8.3. Protection of Biological Resources

8.3.1. Introduction

With the view of protecting biodiversity, as well as preventing/minimizing damages to biodiversity by using biological resources or carryin out other activities, the following mechanisms operates in Georgia:

Rules on using biological resources, which are defined by various legal acts, as well as, by conditions of licenses and permits on using resources.

Restrictions on using biological resources in the framework of obtaining limited amount (quotas);

Environmental impact assessment, ecological expertise and environmental impact permission for the activities set by the Law;

State control on environment protection which includes monitoring of environmental legislation implementation and controlling its protection, including implementation of provisions of permissions and licences and controlling protection of biodiversity rules; as well as, revealing, preventing and suppressing law violation in this field;

Liability for damages caused to biodiversity and damage compensation system.

However, it should be noted that the above-mentioned mechanisms are not perfect, for example, the limitation of using biological resources in the framework of limited obtained volume (quotas), with a few exceptions, does not apply towards unwoody plant resources. The Red List of Georgia does not include many rare, endemic species and grasses the number of which is reducing. The system of compensation of damages caused to biodiversity shall be improved as well. The Forest Code of Georgia regulates plants

protection issues only on the territories that are under the rule of agencies defined by Articles 15 and 16 of the Code (see above Chapter 1) and does not cover municipal, state and private territories, except of the plants included in the Red List of Georgia regarding which the protective issues are regulated by the Law of Georgia on Red List and Red Book (see information above – Chapter 1); many legal acts are adopted concerning the plants (Resolution of the Government of Georgia (N241) on “Rule of Forest Protection and Restoration” from August, 2010, according to which restoration and cultivation of forest shall be made in accordance with the requirements of biodiversity protection. It should be noted, that according to the mentioned Resolution, the priority is given to the local species typical for the specific environmental conditions. Moreover, other legal acts are developed in this regard; however, there are many issues that still need to be improved, etc.

It should be mentioned that in 2014 the updated “Biodiversity Strategy and Action Plan of Georgia for 2014-2020” was adopted which considers prevention measures for the above-mentioned and other defects.

Regarding the protection of the plant and animal species included in the Red List of Georgia, the Law of Georgia on “Red List and Red Book of Georgia” (Article 10) specifies the following:

Any action, including hunting, crafting, obtaining (taking from the natural environment), cutting and mowing, which can lead to reducing the number of threatened species or to worsening their habitats and living conditions, is forbidden, except of the special cases defined under this law, the Law of Georgia on Wildlife and other legislation and legal acts of Georgia.

It is important to take into consideration the harmful anthropogenic influence on endangered species during the process of environmental impact permission while preparing ecological experts’ decision; carrying out important, maintenance and special cutting and/or preparing and implementing of forestry measure, in accordance with the Forest Code of Georgia.

Using fertilizers, chemicals and plant protection means, as well as planning and implementation of activities which may directly or indirectly lead to the destruction, reduction of endangered species and worsening their habitats and living conditions.

8.3.2. Protection of Plants

Plant protection activities defined under the legislation are presented above, namely, the aforementioned compensation mechanisms (Chapter 1), as well as environmental impact assessment mechanisms apply to the use of herbal resources (timber resources is meant).

The main governing law in the field of plant protection is the Forest Code of Georgia, which regulates legal relations concerning maintenance, protection, restoration and use of forest fund of Georgia and its resources.

According to the Law of Georgia on “Red List and Red Book of Georgia” (Article 12), any action which can lead to destroying and/or reducing the number of threatened species is forbidden. Cutting of endangered wild plants or planning and implementing of forestry activities that can cause damages to endangered wild plants species are forbidden on the

forest fund territories (except of the special cases set under Article 24 of the Law that considers permission for taking such species from the wild. See information above: subsection 2, Article 1).

8.3.2.1. Protection of Fauna

Construction stage:

Potential impact on ichthyofauna is associated with the possible pollution of river Adjaristskali by increased rainfall due to increased number of land works and not reasonable management of oil and waste. Accordingly, the above-discussed measures against erosion and pollution are considered as ichthyofauna decreasing measures. Generally, it is believed that for reducing the impact on ichthyofauna building of the bridges in the relevant areas shall be planned in the season that is insensitive for the most sensitive species of ichthyofaunal. In our case, the sensitive specie is trout; however, planned bridge areas are less sensitive for trout. Accordingly, strict seasonal restrictions for construction are not established, however, it is recommended to minimize the process of bridge construction in autumn.

It is important to implement pre-building detailed research around the chosen root in order to determine the existence of birds' nests and animals in the construction corridor.

The territory subjected to reconstruction, especially near a sensitive area, bridges and hospitals, shall be studied before starting the recovery of a root in order to determine footprints of bats, owls, raptors, sailing and water birds' nests, tits, otters and other big or small predator mammals. The nests of birds protected by the law should be determined. Touching of such nests is forbidden from April to July.

Mitigation measures should be carried out in order to prevent low level or small-scale impact on bats during deconstruction of old bridges. A preliminary examination of the old bridges is quite important and in case of discovering bats settlement, the special measures should be carried out for banishing them (mainly acoustic).

Artificial shelters shall be arranged (in 100-300m) instead of the birds' and animals' shelters that are located in the trees subjected to cutting.

Pits, trenches and similar elements shall be fenced by barriers in order to prevent the failure of an animal into it, for example using big ribbon of visible color to a certain species or any flat material for small animals: iron, polyethylene, etc. Long boards or logs should be placed into holes or trenches at night in order to enable small animals to come out. Pits and trenches shall be checked before filling with soil.

Noise, dust and emissions reduction measures, as well as poaching prevention measures from workers side shall be included in the EMP, as mitigation measures.

Plants will be covered with dust, which can affect the food base and the reproduction of vertebrate and invertebrate species (Яблоков, Остроумов 1985); This impact is limited by immediate surrounding area of the road. During construction described measures above of dust reduction should be carried out (watering; covering materials, etc.).

Fire prevention and fire protection procedures shall include the specific risks of forest fires. Proper equipment and management systems shall be provided.

Legal act that regulates animal protection issues and usage of its resources is the Law of Georgia on Wildlife, the aim of which is to ensure the wildlife, its habitat protection and restoration, species diversity and genetic resources preservation, sustainability and creation relevant conditions for sustainable development; as well as to ensure state regulations on usage of wildlife objects. However, it should be noted that articles of this law, which applies to usage of animal resources (concerning issuing hunting and fishing licenses) are regulated by the relevant resolutions of the Government of Georgia.

According to the law (Article 17), any activity on irrigation and water supply areas that affects the wildlife, the habitat environment of wild animals, reproduction areas and survival conditions, shall be carried out in accordance with the requirements necessary to ensure their protection. Also, the law requires the following: while designing, locating, constructing of settlements, enterprises, buildings and other objects; improving of existed technologies as well as introducing the new ones; taking into agricultural circulation of uncultivated lands, wetlands, coastal and shrubs territories; land-reclamation; using the forest; conducting geological-exploration works; mineral extraction; determining pastures and moving areas for agricultural animals; developing tourist routs and arranging resting places for the society, the relevant measures shall be considered and implemented in order to ensure preservation of animal habitats and reproduction areas as well as of water supply roads and drinking water areas. Also, integrity of areas that have special value for normal existence of wild animals shall be ensured as well. While designing, locating, constructing highways, pipelines and other routes, communication lines or canals, dams and other hydraulic structures as well as while determining pasture and cropland areas, the relevant measures shall be developed and implemented in order to ensure preservation of roads for animal movement and leading to the water supply, as well as of reproduction, survival and drinking water areas.

Issues on animal protection and impact prevention are described in legal acts regulating environmental impact assessment and issuing environmental impact permissions. Environmental impact assessment includes revealing and describing direct and indirect impact, including on plants and animals, in the context of planned activities as well as studying of its results (Article 3 of provision on environmental impact assessment – approved by the order №31 of the Ministry of Environment and Natural Resources Protection of Georgia from May 15, 2013). Information regarding animals and compensative measures is provided below; see Article 1, section 4.

8.4. Animals included in the Red List of Georgia

Currently the Red List of Georgia includes 139 species of fauna (29 species of mammals, 35 species of birds, 11 species of reptiles, 2 species of amphibians, 14 species of fish): 43 species have granted the category of “endangered” or “critical endangered”. Many animal species existed on the territory of Georgia are in danger globally.

The Law of Georgia on Wildlife specifies protection measures for endangered animal species (Article 20), according to which:

With the view of assessing conditions and granting protection status to the endangered animal species, sub-species or other taxonomic units (herein and after taxon), the Red List and Red Book of Georgia is established.

Assessing conditions of and granting protection status to endangered animal species is conducted according to the following categories:

- a) Extinct Taxon (Extinct - EX). Taxon is considered as extinct when the last one is dead.
- b) Taxon Extinct in the Wild (Extinct in the Wild - EW). Taxon is considered as extinct in the wild when it is known that the individual of such specie remains only in captivity;
- c) Critically Endangered Taxon (Critically Endangered - CR). Taxon is in a critically endangered condition when it is threaten to be a big danger in the near future;
- d) Endangered Taxon (Endangered - EN). Taxon which is not in critically endangered condition but can be endangered in the near future;
- e) Vulnerable Taxon (Vulnerable - VU). Taxon is not in endangered condition but can be endangered in the future;
- f) Lower Risk Taxon (Lower Risk - LR). Taxon does not satisfy the criteria for being in endangered and vulnerable categories. This taxon can be divided into three sub-categories:
 - f.a.) Conservation Dependent Taxon (Conservation Dependent - CD);
 - f.b.) Taxon Near Threatened (Near Threatened - NT). Taxon which is not close to Conservation Dependent but is near to Vulnerable;
 - f.c.) Less Concern Taxon (Less Concern - LC). Taxon which is close neither to Conservation Dependent nor to Vulnerable;
- g) Data Deficient Taxon (Data Deficient - DD). Taxon about which the existed information is insufficient for direct or indirect assessment of endanger risk;
 - h) Not Evaluated Taxon (Not Evaluated - NE). If its categorization of a taxon can not be possible.

Any action, which can lead to the destruction of endangered animal species or their reduction, or violation of their habitats, reproduction areas, survival areas, roads of migration and leading to the water supply as well as drinking water areas, is punished by the law.

Issues on protection of endangered animal species (included in the Red List of Georgia) are specified in the Law of Georgia on “Red list and Red Book of Georgia” and almost repeats the requirements regarding this area set in the Law of Georgia on Wildlife, namely: any action which can lead to the destruction of endangered animal species or their reduction, or violetion of their habitats, reproduction areas, survival areas, roads of migration and leading to the water supply as well as drinking water areas, is forbidden.

Taking endangered wild animals (taking from the wild) is allowed only in special cases - for saving, healing, restoring population or scientific purposes, which is carried out by the written consent of the Ministry of Environment and Natural Resources (such consent may

contain certain restrictions and/or conditions for taking endangered wild animals (taking from the wild) (Article 22 of the Law).

8.4.1. Protection of Cultural Heritage

Despite the fact that the impact of the project is restricted by existed roads, and construction square is not located near any famous monument of archaeological area, there is always a risk for destruction of archaeological layers during the building process (however, it is unlikely). In order to prevent such risk, the archaeological supervision is required during excavation works. Supervision procedures and other necessary measures should be agreed with the Ministry of Culture when receiving a construction permit, in accordance to the permit issuance rules. According to the Article 14 of the Law of Georgia on Cultural Heritage, permits regarding the quarry works, as well as construction of objects of special purposes, are issued by the authorized agency based on positive decision made by the Ministry of Culture and Monument Protection of Georgia. This report shall be grounded on an archaeological research that is carried out by the organization which wants to conduct excavation works. The organization conducting excavation works shall submit to the Ministry the documentations of archaeological research carried out on the territory. This preliminary study shall include site research and laboratory activities. In case of discovering archaeological object, the report on archaeological study carried out on the study area shall contain the following information:

- a) Archaeological layers detailed site study and a list of objects that have been found by the means of modern methodology;
- b) Recommendations on conservation problems of identified objects and planning of construction activities based on archaeological studies conducted on the territory of the project. According to established practice, the archaeological research shall be conducted in the framework of detailed design agreement, on the stage of receiving construction permit.

On the stage of construction, the archaeological monitoring shall be provided by a contractor, under a supervision of the Ministry of Culture, Monument Protection and Sport. The required budget for archaeological supervision and other agreed activities shall be included into the assessment of construction activities.

Procedures to be used in case of Discovering Archaeological Artifacts

The construction contractor is obliged to engage one specialized archaeologist (Archaeological supervisor), who thoroughly knows his work, for conducting daily monitoring of excavation works. The best practice is to discuss the selected candidate for this job with the Ministry of Culture and Monument Protection.

The Ministry of Culture and Monument Protection has the right to nominate a person or a company for periodic supervision of the construction activities, however such practice is used only in exclusive cases of sensitive projects.

The archaeological supervisor shall conduct daily monitoring of all construction sites where the excavation works (land cleaning activities, soil profiling, excavation, etc.) are scheduled in accordance with the time-table.

In addition, the archaeological supervisor shall instruct the workers to notify him/her immediately about accidental discovery of potential archaeological relics.

In case of discovering cultural objects of potential archaeological value, namely artifacts, the following steps should be taken:

1. Personnel who is working on the construction area is obliged to stop working immediately and notify an archaeological supervisor about the discovery.
2. An Archaeological supervisor shall notify the chief engineer of the district about the mentioned and require to stop all the works in the area. An archaeological supervisor performs the inspection of a discovery as well as of a site where the discovery took place.
3. In the cases, if the discovery has no potential archaeological value, an archaeological supervisor shall notify the chief engineer about it and require continuance of the works. The relevant record about such fact shall be made in the Record Book.
4. In the cases, if this discovery is assessed as a potential archaeological relics, an archaeological supervisor is obliged to notify about it the chief engineer of construction contractor and an environmental specialist of the MDF (as well as supervisor company/engineer), and require to stop construction works immediately as well as notify the Ministry of Culture and Monument Protection about an incident.
5. The chief engineer of the construction contractor shall notify the MDF about work termination and require immediate engaging of the Ministry of Culture and Monument Protection.
6. The Ministry of Culture and Monument Protection appoints an expert or a group of experts and carries out all necessary archeological works for identification of a problem at the area.
7. In simple cases, after taking out moving artifacts, fixating materials or carrying out other necessary activities, the experts of the Ministry of Culture and Monument Protection shall make a decision on restoration of the suspended construction works.
8. In special emergency cases when valuable and spatially scattered objects are discovered, the Ministry of Culture and Monument Protection has a right to require a relocation of location area by moving it to a safe distance from the archaeological site.

8.4.2. Healthcare and Security

It is important to follow all safety regulations, industrial sanitation and fire safety measures and regulations while performing works, as well as while providing trainings to the staff. The contractor is obliged to provide training on security measures to the personnel before starting the works.

The vehicles must have a small turning radius, shall be equipped with a sound and lighting signs, which must be in working condition. The parking place should be fenced and equipped with an emergency stop red signs in daytime, while with a red light signs at night.

Personnel working on the roads shall be equipped with special uniforms and shoes. It is necessary to follow general safety regulations, such as fencing the working site and carrying out various security measures. The contractor is obliged to provide special shelter to the workers in unfavorable weather conditions.

Alternative exits should be provided for vehicles and pedestrians. The proper lighting and signs should be provided as well.

The contractor is responsible for carrying out works in accordance with labor legislation, safety and sanitary requirements.

8.4.3. Complex of supportive construction facilities

With the view of organizing effective activities, arranging of supportive facilities and buildings is quite important. The complex of supportive facilities includes asphalt-concrete factory and construction camp with car service. According to the principles of international construction contracts, designing and construction of the mentioned objects is a prerogative of the contractor, and therefore, these components shall not be included in the major project of the road reconstruction.

An organization implementing the project (Roads Department) and the Ministry of Environment and Natural Resources Protection shall control the contractor to prepare all legal documentation required by the Georgian legislation as well as to face all conditions required by technical regulations in the process of defining the location for a construction camp and preparing its project.

The Roads Department is obliged to prepare and submit to the Ministry of Environment and Natural Resources Protection all necessary environment protection documentation regarding building and exploitation of supportive construction objects after the contractor prepares relevant project documentation concerning the project on reconstruction and construction of Batumi-Akhaltzikhe road.

Projects of asphalt-concrete factory, camp and other supportive facilities as well as their operation conditions shall be in compliance with the regulatory documents principles and guidelines presented below:

Designing at the selected area must be done in accordance with the following Georgian normative documents:

Resolution of the Government of Georgia №57 on “Rule of Issuing Construction Permits and Permission Conditions” from March 24, 2009;

Order of the Minister of Economic Development of Georgia №1-1/1254 on “Approving Main Provisions Regulating the Use of Populated Areas and Settlement” from July 8, 2009;”

Order of the Minister of Economic Development of Georgia №1-1/1251 on “Using Norms, Rules and other Documentation of Technical Regulations Applicable till 1992 in the Field of Technical Supervision and Construction on the Territory of Georgia” from February 18, 2010;

Resolution of the Government of Georgia №425 on “Approving Technical Regulations for Protection Georgian Surface Waters from Pollution” from December 31, 2013.

Law of Georgia on “Regulation and Engineering Protection of Georgian Sea, Reservoirs and Banks of Rivers” (№4131 from December 27, 2006), taking into consideration the amendments made in 2008 and 2011.

СНиП2.07.01.–89 “Construction of the City“;

СНиП2.08.02.–89 „Public Buildings and Facilities“;

СНиП2.09.03.–85 “Industrial Facilities“;

СНиП2.09.04.–87 “Administrative and Residential Buildings “

For all objects, where existence of stationary emission sources in atmospheric air or discharging wastewater in the surface water objects will be considered, the regulations on limits of waste allowable in atmospheric air and regulations on limits of polluting materials allowable in surface water facilities will be developed and agreed with the Ministry of Environment and Natural Resources Protection.

Asphalt-concrete Factory

Decision on construction of asphalt-concrete factory or procurement of finished asphalt from a producer will be made by a contractor.

In the case of deciding a construction of an asphalt-concrete factory, a contractor shall prepare all relevant documentation on environmental impact assessment and obtain an environmental impact permit for operating the facility.

A mixer line, reservoirs and inert materials warehouses will be located on the territory of asphalt-concrete factory

The regulations on limits of the wastes allowable in atmospheric air of the factory and on polluting materials allowable in surface water objects will be developed and agreed with the relevant agency.

The following requirements of legal documents shall be considered while arraigning the facility:

- СНиП2.09.03.–85 “Industrial Buildings“;
- Law of Georgia on “Atmospheric Air Protection“;

Resolution of the Government of Georgia №42 on “Approving Technical Regulations for Inventory of Stationary Sources of Air Pollution” from 2014 and Resolution of the Government of Georgia №408 on “Approving Technical Regulations for Calculation Standards of Limited Wastes of Harmful Substances in the Air” from December 31, 2013.

Construction Camp

Before arranging the construction camp the drinking water supply shall be provided. It is possible to arrange tubular or shaft wells on selected areas and supply the camp with underground fresh water, for which the license on taking groundwater is required in accordance with the legislation.

A reservoir can be provided on the territory, from which camp facilities will be supplied with water.

Wastewater can be gathered by a sewage system organized on the territory of the camp while its withdrawal from the territory can be organized through common collector.

Wastewater will be polluted with organic substances, therefore it needs biological purification. Technically more simple facility, namely a septic tank, shall be built for wastewater purification, as well.

Septic is a facility, which provides mechanical, biological purification of wastewater, as well as almost its mineralization. After crossing the septic, the wastewater undergoes disinfection and flows into surface water facility.

Remaining containers will be placed on the territory of the camp for collecting household waste. Removal of the waste will be carried out according to the agreement concluded with the local services.

The following requirements of the legal documents shall be considered while arranging the facility:

Law of Georgia on Water;

Law of Georgia on Entrails;

Law of Georgia on Licenses and Permits;

Resolution of the Government of Georgia №17 on “Approving Technical Regulations on Environment Protection” from January 3, 2014;

Construction Standards and Rules (January 7, 2009) – “Outside Networks and Facilities of Water Supply and Sewerage”

sanwdan 2.1.4. 000 – 00 „Drinking Water and Water Supply for Populated Areas“

sn da w 2.04.01–85 „Regulations for Internal Water Network and Sewage“

sn da w 3.0.01–85 „Internal Sanitary-Technical Systems“

sn 496–77 „Temporar Instructions for Designing Facilities for Purification of Surface Wastewater“

While choosing the construction camp, it is possible to discuss the sites, which were proposed for placing inert waste. In all cases, the decision about the mentioned is made by a construction company.

Car Service

Car service includes parking places and service boxes for the equipment used for road construction.

The bins for collecting vehicle parts shall be provided on the territory of the service boxes, namely, metal boxes for oily parts, storages for damaged tires and other plastic and rubber parts; the mentioned remaining shall be removed from the territory in accordance with an agreement concluded with the local services. Plastic reservoirs shall be provided for replaced oil and other oil products remaining; a contractor is obliged to remove the mentioned remaining from the territory and provide its neutralization.

With the view of preventing expected risk of pollution of the soil and water reservoirs with oil products, the parking lot area shall be leveled and the system of wastewater collection shall be established.

There is a risk of pollution wastewater with weighted substances and oil products, therefore the system of oil products holder shall be provided for wastewater.

The wastewater amount will be calculated using the following formula:

$$Q=10 \times F \times H \times K$$

Where: Q – Wastewater volume m³/day (m³/year)

F – Area (Hectare)

H – Rainfall (mm), received in accordance with existed literature.

K- Coefficient, which depends on cover type.

A cleaner facility shall be calculated in accordance with wastewater volume.

The following requirements of normative documents shall be taken into consideration while arranging the facility:

Law of Georgia on Water;

sn 496–77 "Provisional Regulations for Designing a Surface Wastewater Clearing Facilities”

СНП2.11.04.–85 – "Underground Storage Facilities for Oil, Oil Products and Liquid Gas"; Order of the Minister of Economic Development N1-1/2935 on “Approving Security Measures for Gas Stations and Gas Complexes” from December 8, 2008.

Choosing a location and size of a camp is a contractor's prerogative and responsibility, however, it is necessary to take into consideration the workers' interaction with the environment and the local population.

The following category of remaining is expected to be formed while exploitation of the facility:

Household garbage;

Office remaining (paper, cartridges, lamps, etc.);

Packaging (wood, paper, etc.);

Oily cloths, filters, absorbent pads;

Oily soil;

Polymer waste;

Medical waste.

The number of household garbage generated during factory operation depends on the number of personnel. According to the preliminary data, about 200 people will be employed. Taking into consideration the accepted norms, each worker produces 0.70 m³ of household garbage annually. According to the above-mentioned, the annual amount of household remaining will be: $0.70 * 200 = 140 \text{ m}^3$. Closed containers for household remaining shall be provided in the facilities. Removing and throwing away the remaining will be provided in accordance with agreement concluded with a municipal cleaning service.

Oily remaining and other hazardous remaining are temporarily placed in the factory area in accordance with environmental and hygienic requirements, after that its collection is transferred to an organization, which has received appropriate environmental permit for processing/locating/ neutralizing of such remaining.

Wood packaging will be delivered to the local population for further use.

Management and monitoring of the remaining formed at the facility (classification, inventory, segregation, collection, storage, transfer and transportation) shall be provided in accordance with the principles, procedures and rules described in Annex 3.

Quantitative assessments and mitigation measures (model) regarding water supply and sewerage at a construction camp and car service areas are given in Annex 2.

Plan for managing remaining/waste of a camp construction is presented in Annex 1. Brief summary is presented below.

The following category of remaining is expected to be formed while exploitation of the facility:

Household garbage;

Office remaining (paper, cartridges, lamps, etc.);

Packaging (wood, paper, etc.);

Oily cloths, filters, absorbent pads;

Oily soil;

Polymer waste;
Medical waste.

The number of household garbage generated during factory operation depends on the number of personnel. According to the preliminary data, about 200 people will be employed. Taking into consideration the accepted norms, each worker produces 0.70 m³ of household garbage annually. According to the above-mentioned, the annual amount of household remaining will be: $0.70 * 200 = 140 \text{ m}^3$. Closed containers for household remaining shall be provided in the facilities. Removing and throwing away the remaining will be provided in accordance with agreement concluded with a municipal cleaning service.

Oily remaining and other hazardous remaining are temporarily placed in the factory area in accordance with environmental and hygienic requirements, after that its collection is transferred to an organization, which has received appropriate environmental permit for processing/locating/ neutralizing of such remaining.

Wood packaging will be delivered to the local population for further use.

Management and monitoring of the remaining formed at the facility (classification, inventory, segregation, collection, storage, transfer and transportation) shall be provided in accordance with the principles, procedures and rules described in Annex 7.

8.4.4. Summary

The construction contractor's obligation to comply with environmental management requirements, which are described in this EIA, shall be included in the terms of the contract (for example, the EIA or EMP may be attached to the contract and become its integral part).

The construction contractor is obliged to appoint an environmental specialist for managing environmental issues and developing a contractor's implementation plan (based on the present EMP) with detailed descriptions of activities (schedule, staff involved, necessary resources, etc.).

The compensation program for cut trees shall be designed after final determination of a construction corridor and inventory of the trees within the corridor, based on the agreement with the Ministry of Environment and Natural Resources Protection.

Only legally registered providers with relevant permits and licenses shall be used. This applies to operators of quarries and other construction materials suppliers. Verification of compliance with conditions of the permits and licenses is the only method which is available for the project and by which the mitigation of impacts regarding the provider's activities will be available. If the company decides to use its own quarries, the appropriate license shall be obtained from the Ministry of Environment and Natural Resources Protection. The construction contractor remains the right to install concrete mixing factory for producing concrete necessary for a project. A concrete factory does not require preparation of a separate EIA, however, factory project and activities concerning concrete production shall comply with the requirements of technical regulations.

8.4.5. Mitigation of long-term and exploitation impacts

Here we want to consider the mitigation measures to be implemented in the operational stage. The majority of these measures (mainly repair and maintenance work) should carry out the Road Department by the state budget funds, loans, grants and funds obtained from other financial sources.

Erosion and land stability control and landscaping. The road department to ensure permanent control of erosion and land stability and permanent monitoring of landscape restoration after construction works have been completed, as well as handling timely corrective actions. Corrective actions include, but are not limited to care for drainage systems and take required anti-erosion measures (berms, vegetation, etc.).

Roadside litter and fuel contamination. The road department coordinates activities of local government agencies and private companies and provides proper installation and operation of support facilities and services (fuel stations, waste management services).

Emissions into the air, noise and pollution during the repair work. Traffic Department should consider the position of Environment in the maintenance contracts and carry out the monitoring of their performance.

Landscaping. In long-term perspective and across the entire route the traffic department should plan the development of roadside zone with relevant landscaping strategy. Should be considered the visual and aesthetic, as well as aspects of emissions screening.

Fauna protection. Road exploitation waste impact has permanent nature, but it can be partially mitigated by the following measures:

- Subways for small animals;
- arrange boxes for bats to compensate cut trees and destroyed buildings;

Use of modern sewage treatment system for road rushed water.

Traffic and transport-related emergency prevention and mitigation, which can cause spill of toxic materials, health damage or death. Emergency preparedness. Road Department with the help of Ministry of Internal Affairs officers (Department of Emergency Management) provides the appropriate legislative base and designs emergency plans for transportation regulation of hazardous materials. The measures system may include, but is not limited to the following:

- Security measures and emergency response plan and implementation for extensive damage caused by accidental spills;
- Establishment of separate routes for Carriers of hazardous materials;
- Shipping regulations of Poisonous materials in order to reduce the risk;
- Ban of transportation of poisonous waste through environmentally sensitive area.

The abovementioned measures and plans should be developed according to Georgia law on "hazardous substances" and the Ministry of Environmental Protection standards of "the use, transportation and storage of chemical substances." As additional material can also be used regulations of other countries (eg. Russian Minister of Transport Order No. 73, issued on 08.08.1995, changed in 1999).

Avoiding spread of human, animal and plant diseases. The Customs Service, and the National Center for Disease Control and National Center of Medical Statistic, and Food Safety, National Service of Veterinary and Plant Protection of the Ministry of Agriculture are responsible for avoiding spread of human, animal and plant diseases, that can be caused by transportation of people and goods.

8.5. Monitoring and enforcement

Institutional framework of the GMG implementation

Construction contractor is obliged for GMG implementation and good practice of construction. To fulfill this obligation contractor must have at least one environmental specialist, who fully understands the GMG recommendations and professionally integrates proposed mitigation measures in the daily activities.

Technical supervisor appointed by the Road Department is in charge of fieldwork and supervision of the construction area, as well as ensuring conformance with the design and quality of works. It is also authorized by the contractor to follow the execution of the GMG, discover any deviation from the proposed works, also conduct works at any stage to identify unforeseen environmental issues

Road Department ensures general environmental compliance at the expense of technical supervisor and the contractors' quality work. Road Department also interacts with the World Bank, ensures exchange of all environmental information, as well as the environmental supervision from the World Bank.

Environmental Protection Inspectorate has no obligation of routine monitoring, but it has an authority in case of necessity carry out inspection of environmental permit conditions and licenses for exploitation of quarries.

GMG performance reporting

Contractor environmental specialist will prepare monthly reports on the GMG performance. These reports should include information on main types of the activities, carried out during the reporting period, about any cleaning / permits / licenses, which became necessary for this work, about mitigation measures, as well as environmental issues emerged in relations with suppliers, local authorities, affected communities and so forth. Contractor Monthly reports must be submitted to the technical supervisor and Road Department.

Technical supervisor prepares monthly reports on the implementation of the GMG and the implementation of environmental requirements by the contractor. These reports should be based on the contractor's reports and analysis of their contents. Technical supervisor assess how accurate is the factual information in the contractor's report, fill in the gaps and assess the adequacy of mitigation measures used by the contractor. Technical supervisor stresses on any discrepancy with GMG, highlights issues filed by contractor or detected by supervisor and develops proposals for corrective actions.

Road Department ensures that monthly reports of contractor and technical supervision on the implementation GMG and the contractor's environmental activities is timely sent to environmental specialists within the Road Department, after entering department's administration. In case of international donor funding of the project, department's environmental specialists submit quarterly reports about the environmental compliance of the construction works to the donor organization. Such reports shall contain information on all the identified violations of the measures taken to eliminate such violations. Road Department informs the World Bank on an important environmental issue at any time, despite regular reporting schedule.

GMG violation corrections

Road Department, as a client of the construction work, will be responsible for the fulfillment of agreement's terms by the contractor, which include the implementation of the GMG. Minor violation, which leads to temporary, but reversible damage, the contractor will be given 48 hours to rectify the problem and restore the environment. If the restoration work is satisfactory for that period, other measures will not be accepted. If the situation cannot be remedied within this period, the Road Department will hire another contractor to manufacture the restoration work, and subtracts the value of these works is the offending contractor further payment. For violation, which would result long-term or irreversible damage, is provided a financial penalty of 1% of the contract price in addition to the cost of the restoration work.

Institutional capabilities of Road Department

Inside the Road Department, in Technical Policy Department exists Environment Division. Now, in addition to the head of the department, here works two environmental specialists, who had onjob training at the Road Department in the framework of World Bank's technical assistance. Current environmental opportunities of the Road Department need further strengthening in order to ensure full environmental compliance within the project. While the daily control of the quality of works will be retained by the engineering supervisor, the Road Department must have adequate staff to supervise the work of technical supervisor and to develop solutions to the issues that might be triggered by the supervisor at the Road Department.

8.6. The cost of implementation

The cost of environmental activities, related to construction activities, should be included in the building contract.

The construction contractor must take into account the cost of 10 hectares of forest cut works. At the same time, SGD has to negotiate with the Ministry of Environment on the forest compensation program. Compensation cost is included in the GMG budget.

Additional archaeological studies may be required for the construction permit. Corresponding costs should be considered in the budget.

Some of the anticipated costs of the GZSH and GMG small related to public consultations. Road Department covers it.

If the damage species of "the Red List", this species should be provided with compensation planting ratio of 1:10, so that, instead of 1 to cut the tree should be planted 10 trees.

Certain costs associated with the hiring of environmental and health professionals, and is about 60 000 GEL each year.

8.7. Environmental Management Plan (matrix)

Construction Phase

Measures to mitigate impacts stations / liability values Period blob implementation of liability denial-of-monitoring Severity

The destruction of the natural landscape (relief, soil, vegetation, ecosystems, habitats and wildlife) route corridor.

| Impacts | Section | Mitigation Measures / Values | Period | Implementation Responsibility | Monitoring Responsibility |
|---|---|--|---|---|---|
| <p>The destruction of the natural landscape (relief, soil, vegetation, ecosystems, habitats and wildlife) in the route corridor. Activities: land clearing, soil removal and excavations.</p> | <p>Road widening and minor correction of route places.</p> | <p>After accurately setting out the Corridor, before land clearing works have started, will be conducted preliminary research to avoid the damage of fauna (bats dwellings verification; to check the nests in corridor). Should be cut down 3000 trees and 7 hectares of bushes. Should Compensation Programe shoule be agreed with the Ministry of Environment. In the holes or trenches will be left sticks to help small mammals out. Soil humus layer (Topsoil) storage will be implemented in practice, described below and stored Topsoil will be used for restoration and planting. Cut of Red listed species (oak) should be compensated with the planting ratio of 1:10;</p> | <p>Prior to land clearing works. During excavation. Planting plan development prior to the construction works. The implementation of commencement before the end. From land clearing to the recovery.</p> | <p>Construction Contractor.</p> | <p>Road Department Inspection of Environmental Protection^[1]</p> |
| <p>Destruction of the natural landscape (relief, soil, vegetation, ecosystems, habitats and wildlife) on access roads, quarries, waste disposal areas, construction camps and equipment yards.</p> | <p>Camps; Quarries mentioned in the project; Waste disposal, construction camps and equipment yards;</p> | <p>Preliminary research in order to avoid damage on the flora and fauna; If it is not possible to avoid impact on rare or protected flora species, should be planned and implemented the program of planting; In the holes or trenches will be left sticks to help small mammals out. Soil humus layer (Topsoil) storage will be implemented in practice, described below and stored Topsoil will be</p> | <p>Prior to land clearing works. During excavation. From land clearing to the recovery. After construction is complete.</p> | <p>The design and construction company.</p> | <p>Road Department Inspection of Environmental Protection</p> |

| Impacts | Section | Mitigation Measures / Values | Period | Implementation Responsibility | Monitoring Responsibility |
|---|--|--|---------------------|-------------------------------|--|
| | | used for restoration and planting. Should be developed and implemented greening plan; | | | |
| River bank lateral erosion. | Rivers – Acharistskali, Satsikhuri, Diakonidze, Tabakhemistskali | Coastal Protection dam and gabion project is included in the project documents. Construction of protective facilities according to the project. | During construction | Construction Contractor. | Road Department Inspection of Environmental Protection |
| Erosion processes activated by the new road grooves and temporary fill of natural drainage by sediments. Soil erosion below Road embankment caused by concentrated flow from closed and open drains. | On the whole section of the road. | Temporary or permanent anti-erosion measures will be taken according to the detailed project (temporary drainage, bio-mattress or geo-textile coverings, berms, etc.). Following measures will be implemented to mitigate the impact of the sediment: - Move the land only in dry periods; - Protection the most vulnerable areas of soil with mulching; - Protection drainage channels by berms, straw or fabric barriers; - Installation of the sediment collector. To mitigate the erosion caused by the construction, should be used following measures: - Built on the proper size rain water channels; - Drainage pipes will be designed to avoid the cascading effect; - Will be provided rotational drainage structures; - Water intake surface should be lined with stone and concrete. | During construction | Construction Contractor. | Road Department Inspection of Environmental Protection |

| Impacts | Section | Mitigation Measures / Values | Period | Implementation Responsibility | Monitoring Responsibility |
|--|---|--|--|-------------------------------|--|
| Erosion affected rivers increased suspended sediment on construction sites and new sections of road, inert materials and waste disposal sites; Deterioration of water quality and sediment increase. | Rivers – Acharistskali, Satsikhuri, Diakonidze, Tabakhemistskali | Mitigation strategy: to temporary avoid with anti-erosion measures, such as temporary drainage, sediment temporary collectors and temporary holding ponds and so forth. Protection of vulnerable surfaces with the cloth; Arrangement of holding ponds for reduction of the sediment before discharged in water bodies. | During construction . | Construction Contractor. | Road Department Inspection of Environmental Protection |
| Loss of humus topsoil due to improper storage. Construction work will affect fertile soil layer, which is rich with substances for plants and crops. | On the whole section: On the road sections. | The contractor will carry out the following: The removal of soil humus layer of 15 cm depth and storage in piles, with a height not exceeding 2 m, while the slope - 1: 2; Distribution of soil humus layer in order to maintain its physical-chemical and biological properties. Stored topsoil will be used in the affected districts and the proposed planting lanes; Monitoring of soil humus layer embankments, in case of any negative condition, taking corrective measures, such as: Anaerobic condition - overturn of embankments or to create ventilation holes into the bunds; Erosion - temporary protective silt barriers around the embankments. | During construction : From topsoil removal till the recovery. | Construction Contractor. | Road Department Inspection of Environmental Protection |
| Soil and surface water contamination by oil, lubricants, fuel and paint in the corridor, | Soil – Over the whole route; | Contractor shall ensure following: Preparation of violation response procedures and | During construction . | Construction Contractor. | Road Department Inspection of Environmental |

| Impacts | Section | Mitigation Measures / Values | Period | Implementation Responsibility | Monitoring Responsibility |
|---|--|---|--------|-------------------------------|---------------------------|
| <p>bridges and equipment yards as a result of the construction work and construction equipment; Materials used in the construction are potential source of contamination. Improper treatment and storage of fuel, lubricants, chemicals and hazardous materials, as well as their potential spills could harm the environment and health of construction workers.</p> | <p>Rivers – Acharistskali, Satsikhuri, Diakonidze, Tabakhemistskali</p> | <p>submission of plan to the Road Department for approval; Training of Construction personnel in the fuel treatment and spilling control procedures; Storage Hazardous materials on piles, sealed in plastic sheet on the distance of at least 100 meters from water bodies. Hazardous waste should not be stored in the following places: For 100 meter distance from Rioni or other rivers or a valley banks; For 500 meters Residential areas, cultural or archaeological sites; Ecologically sensitive zones 1,2 3 and 4a; On the construction sites, during the fueling will be used absorbent pads and/or straw in order to minimize spilling risk. These pads and straw will be arranged before the start of fueling. Groundwater and surface water pollution risk will be reduced or eliminated by immediately removing contaminated land. Contaminated soil and adsorbents will be removed, stored and processed as hazardous waste. In case of any significant infringement, message will be sent to the person in charge, work will be suspended until the elimination of the risk of contamination. Fueling always will be carried out with the</p> | | | <p>Protection</p> |

| Impacts | Section | Mitigation Measures / Values | Period | Implementation Responsibility | Monitoring Responsibility |
|--|----------------------|---|---|--|---|
| | | proper equipment (eg. Corresponding size of nozzles), and only experienced and qualified persons. | | | |
| <p>Construction waste along the corridor:</p> <p>Excess soil and stones, dilapidated structures, packaging and so forth.</p> <p>Damaged asphalt;</p> <p>Concrete and metal structures.</p> | Construction sites. | <p>Assess and, if necessary, develop a location plan for the residual inert materials and stones.</p> <p>Provision of waste disposal agreed with the local authorities;</p> <p>transfer surplus stones which remain after use to local population;</p> <p>Any waste will be placed on the nearest landfill agreed with local authorities. The primary goal is not to damage the valuable landscape or soil or other environmentally vulnerable items.</p> <p>Shoveling asphalt should be used again.</p> <p>Shoveling metal structures should be submitted as a scrap.</p> <p>Personnel who will be involved in hazardous and non-hazardous waste treatment, will undergo special training in the following areas: Waste treatment; Waste sterilizing; And Waste storage</p> <p>Any kind of waste incineration on the site is prohibited, except for cut trees and bushes and small branches that it is better to be burned to prevent the spread of parasites.</p> | <p>Mobilization Stage.</p> <p>During construction</p> <p>During construction</p> <p>Mobilization Phase and construction stage</p> | Design and Construction Company Construction Contractor | Road Department Inspection of Environmental Protection |
| Construction vehicles and equipment emissions, which cause | Over the whole route | - Level of emissions of all construction and transport equipment | During construction | Construction Contractor | Road Department |

| Impacts | Section | Mitigation Measures / Values | Period | Implementation Responsibility | Monitoring Responsibility |
|--|--|---|---------------------|-------------------------------|---------------------------|
| air pollution | The villages along the road | <p>should correspond to the standards.</p> <ul style="list-style-type: none"> - Any crusher and concrete crushing plant will be located outside the settlements. - Will be protected engine maintenance schedule and standards of care and conditions. - All vehicles and plant will be stored in such a way that emissions do not cause discomfort to the workers and the local population. - Will be provided regular maintenance of diesel engine in order to ensure minimization of emissions, for example, cleaning of fuel injectors. Routine care should be consistent with the highest standards to ensure the safety of vehicles and to minimize emissions. - Fueling vehicles will be carried out so as to avoid volatile organic compounds emissions from residual fuel through the use of muzzle and pump and covered reservoirs (open containers will not be used to store the fuel). | | | |
| <p>Dust at construction sites, material storage areas and access roads.</p> <p>Dust is inconvenient, that has impact on environment and on the health of workers and locals.</p> | <p>Over the whole route.</p> <p>The villages along the road.</p> | <ul style="list-style-type: none"> - All measures will be taken to minimize dust layer, spill the water from laying factories and mobile crushing plants and other retention measures; - On dry weathers, the inert materials and sand transport vehicles will be covered with a tarpaulin. | During construction | Construction Contractor | Road Department |

| Impacts | Section | Mitigation Measures / Values | Period | Implementation Responsibility | Monitoring Responsibility |
|--|------------------------------|--|-------------------------|---------------------------------------|--|
| | | Construction sites and local roads according to the needs will be watered; - Workers will be provided with the necessary equipment, for example on the quarries and during the stones crushing; - Using defined shipping routes and the use of a speed limit for traffic management through proper planning; - Overlap of construction materials and storage areas. | | | |
| Noise pollution caused by vehicles during the construction in the settlements, which is crossed by the highway, especially - urban areas and densely populated villages. Local noise. | The villages along the road. | Mufflers use on the equipment. Routine care should be consistent with the highest standards ensure vehicles to be safe and in order to reduce the corresponding noise emissions. All parts on site will be tested regularly, to be rectified and to reduce the noise level. Night work should be prohibited near the settlements. | During construction | Construction Contractor | Road Department |
| Disease-bearing vectors - temporary creation of mosquitoes breeding habitat, for example, water pools standing on Sunny places. These pools can be on open and closed quarries and others. It creates favorable conditions for mosquitoes and other disease vectors. | Over the whole route. | To get rid of all ponds until the spring. Relief and landscape recovery. | During construction | Construction Contractor. | Road Department. |
| The impact on archaeological sites and excavations. | Over the whole route. | Constant monitoring of the land clearing works and excavations. To stop the construction | Prior to construction ; | Archeologist from CAS Construction | Road Department Ministry of Culture |

| Impacts | Section | Mitigation Measures / Values | Period | Implementation Responsibility | Monitoring Responsibility |
|--|------------------------------|--|---|-------------------------------|---------------------------|
| | | works in case of the archaeological discovery. Conduct necessary archaeological work before continuation of construction. Conservation. | During construction | Contractor | |
| Biological re-contamination during the soil works on excavation of the graves and the proximity of the disease (eg. Anthrax unregistered burials). | Over the whole route. | Constant monitoring of land clearing and excavation works, To stop construction of the discovery of the fossils. Notify local Service of the Veterinary Department. Veterinary treatment before resuming works. | During construction | Construction Contractor | Road Department |
| Driving conditions on risky areas in which the construction crosses local roads. | The villages along the road. | Placement of proper marking and safety signs on the roads, including lighting. Instruction for drivers. | During construction | Construction Contractor | Road Department |
| The final recovery and long-term erosion control measures. | Over the whole route. | On all construction sites (except for those places where will be the road and supporting infrastructure) should be restored the original condition (relief, topsoil, vegetation cover). To improve the route it is necessary to cut down very small number of shrubs, saving topsoil is enough to restore natural grass cover. | | Construction Contractor | Road Department |
| Tree-cutting plan and the compensation program. | In the forests | Compensatory planting program should be agreed with the National Forestry Agency of the Ministry of Environment and Natural Resources. Our proposal is plant proportion of 1:10 (one cut wood in exchange for planting a seedling 10) in case of Red List species and the proportion of 1: 2 in other cases. Should be protected | Developed prior to construction Implemented after the completion | Construction Contractor | Road Department |

| Impacts | Section | Mitigation Measures / Values | Period | Implementation Responsibility | Monitoring Responsibility |
|---|--|---|---------------------|-------------------------------|---|
| | | procedures of removal from the natural environment of the Red Book species and removal of land from forestry fund. | | | |
| Traffic related accident risks, which may lead to leakage of poisonous substances, explosives activation, damage or destruction of life (see the World Bank's environmental source books: "Hazardous Materials Management" section) (See "public health and safety" section). | Over the whole route | Proper marking and safety signs on the roads, including lighting. Instruction of drivers; - security measures and emergency response plan development and implementation as a result of damage caused by spills; - Allocation of special routes for transportation of hazardous materials; - Regulation of Construction transport, in order not to interfere with normal movement; - Ban of Toxic waste shipment to the environmentally vulnerable districts and settlements. | | Construction Contractor | Road Department |
| Quarries Quarries operated for road embankments, bridges and access for construction, land degradation and potential risk of soil loss. potential impact of increased exploitation of Quarries on the ichthyofauna, ground waters and the landscape. | Presumably, rivers - Acharistskali, Satsikhuri, Diakonidze, Tabakhemistskali | Inert materials will be extracted from existing mines, which are equipped with the proper license. Control of licenses (licenses are issued with reference to the operation limits and restoration obligations). In case of Sachorpenos there will be new quarry and the appropriate licenses will be obtained from the Ministry of Environment and Natural Resources. Measures will be taken for the conservation of soil. After the closure of the quarry, there will be carried out restoration of | During construction | Construction Contractor | Road Department Inspection of Environmental Protection |

| Impacts | Section | Mitigation Measures / Values | Period | Implementation Responsibility | Monitoring Responsibility |
|--|--------------------------------|--|---------------------|-------------------------------|---|
| | | the soil according to license conditions. Traffic control on the quarries. From the beginning should be prevented crossing of water bodies, spilling of oil or fuel, should be checked functionality of vehicles. | | | |
| Bituminous concrete plant. | Place of the plant deployment. | The contract shall be concluded only with a licensed provider who has the necessary environmental permits. If the construction contractor decides to install and use their own plants, should be prepare and taken the EIA Environmental Impact Permit. | During construction | Construction Contractor | Road Department |
| Construction camps Potential impacts associated with the construction and use of the camp, can be summarized as follows: During the construction of the camp to get rid of vegetation cover; Topsoil potential damage; Fuel storage and pollution in connection of refueling services; Sewage-related pollution; Waste Management. | Camps | Waste Management best practice for construction camps (see. Annex 7); The project will be carried out by P. 8.1.1.13 set standards and regulations; The construction workers live in nearby villages rented places. In case of large camps and residential zone, domestic sewage should be according the standards; Pollution prevention measures: a proper arrangement of fueling, waste management; Keeping the soil humus layers in compliance with all conditions; Humus soil layers and vegetation cover recovery. | During construction | Construction Contractor | Road Department Inspection of Environmental Protection |

Exploitation Phase

| Impacts | Section | Mitigation Measures / Values | Period | Implementation Responsibility | Monitoring Responsibility |
|--|--|---|--|--|---|
| The long-term degradation of natural landscape (relief, soil, vegetation cover, ecosystems, habitats and wildlife) on the access roads, quarries, waste disposal areas, construction camps and equipment yards. | Camps; Quarries. | Landscape restoration to the natural condition (as far as possible). Landscape and vegetation cover restoration, greening, mitigation of visual impacts, recovery of neighborhoods in original condition, as far as possible. | Completion of construction works. | Construction Contractor In long-term perspective – Road Department. | Road Department Inspection of Environmental Protection |
| The new road grooves activated erosion and temporary fill of natural drainage roads with sediments. Soil erosion below the road embankment from concentrated flow of closed and open drains. Character of the impact: long-term. Terrain, drainage conditions, land clearing can cause intensification slow, but steady process of erosions. | Over the whole route. | Mitigation strategy: long-term improvement; Landscape relief and recovery; The long-term drainage and anti-erosion system installation. - The terrain, soil and vegetation cover recovery; - Implementation of long-term drainage systems and permanent monitoring; - Installation of sediment catchment; greening of Eroded surface shortest possible period of time; - Increase the number of drainage pipes; - Locate the drain pipes to prevent the cascading effect; - Finish receiving surface with stone and concrete; - Long-term monitoring and maintenance | Construction stage. After construction. | Construction Contractor In long-term perspective – Road Department. | Road Department Inspection of Environmental Protection |
| Board view of landscape mounds and deep grooves, with inert materials and careers. Scar landscape (the road grooves, and activated by the landslides and loss and so forth. Board view). | The new road sections. | - Save and / or recovery of roadside vegetation cover; - To merge with the landscape during architectural design; - Greening fragmented surface. | Construction stage Post-construction maintenance. | Construction Contractor In long-term perspective – Road Department. | Road Department Inspection of Environmental Protection |
| Erosion affected rivers increased suspended sediment on construction sites and | Rivers – Acharistskali, Satsikhuri, | Mitigation strategy: long-term improvement Landscape and relief recovery; long-term | | Construction Contractor In long-term perspective – Road | Road Department Inspection of |

| Impacts | Section | Mitigation Measures / Values | Period | Implementation Responsibility | Monitoring Responsibility |
|---|--------------------------------|---|-----------------------------------|--|--------------------------------------|
| new sections of road, disposal inert materials and waste on sites; Deterioration of water quality and sediment increase The impact of the character: the long-term. Terrain, drainage conditions, land clearing can cause intensification slow, but steady erosions. | Dikonidze Tabakhmelistskali | drainage systems and anti-erosion system installation; Terrain, soil and vegetation cover recovery. Eroded surface greenery in shortest possible period of time. | | Department. | Environmental Protection |
| Soil and water pollution by oil, lubricants, fuel and paint along the route. | Over the whole route | Oil traps set on the big bridges (Bridge # 1 and # 2); Provide a fuel refilling standard stations and repair shops on track. | After completion of construction. | In long-term perspective – Road Department. | Road Department |
| Air pollution from the mobile asphalt plants during the repair works. | Over the whole route | Implementation and exploitation of air pollution control equipment. | During repair works | Road Department oversees contractor for repair work | Road Department |
| Air pollution caused by traffic in urban areas, which is crossed by the highway, especially the friendly city areas and densely populated villages. Local dust. | The villages along the road. | Air quality and traffic-related emissions monitoring (including vehicle emissions inspection); Development policies and standards for limiting movement-related emissions (fuel quality standard, etc.); Fulfill engine maintenance schedules and standards (or use of alternative fuel) in order to reduce air pollution; Roadside greening for protection and mitigation nearby villages from the impact of emissions. | | Construction Contractor In long-term perspective – Road Department. | Ministry of Environmental Protection |
| Noise pollution caused by road traffic in urban areas, which is crossed by the highway, especially the friendly city areas and densely populated villages. | The villages along the road | High impermeable walls - made of wood or stone / brick; Fulfillment of engine care schedule and standards; Roadside greening for protection and mitigation | | Construction Contractor In long-term perspective – Road Department. | Ministry of Environmental Protection |

| Impacts | Section | Mitigation Measures / Values | Period | Implementation Responsibility | Monitoring Responsibility |
|---|------------------------------|---|--------------------------|---|---|
| | | nearby villages from the impact of emissions; Public transport and traffic management improvements. | | | |
| Roadside litter | Over the whole route | For the development of Location infrastructure; Support of anti-trash laws and standards. | | Local Government and Road Department ensures relevant infrastructure, and the regional offices of the Ministry of Environment regional offices oversee compliance requirements. | Road Department Inspection of Environmental Protection |
| New routes of causing vectors dislocation for Human and animal disease. Development of corridor for spread if diseases, parasites, weeds and other undesirable organisms. | Over the whole route | Creation of plant and animal sanitation and appropriate control stations (not locally in the project, but also to control the entire route). | During the exploitation. | Customs services, Sanitary Supervision Inspection of the Ministry of Health and Food Safety, Veterinary and Plant Protection National Service of the Ministry of Agriculture. | Road Department |
| Threat to health caused by traffic generated and transported dust. | Over the whole route | Minimal impact on asphalt-surfaced routes. Dust control is possible with water splashing. | During the exploitation. | Road Department | Road Department |
| Increase the travel time from home to field, creating obstacles. | The villages along the road. | Nodes arranging (each about 3 km) softened these potential impacts. See RAP. | During design | Construction Contractor | Road Department |
| Traffic related accident risks, which may lead to leakage of poisonous substances, explosives activation, damage or destruction of life (see the World Bank's environmental source books: "Hazardous Materials Management" section) (See "public health and safety" section). The accidents caused by increased traffic. | Over the whole route | Creation of legislation and law enforcement mechanisms on Hazardous materials transportation. preparedness for Emergency situations, sector (Road Department) and national response plans to prepare and implement on emergency situations, in regards of the natural and technogenic threats (prepared by the Ministry of Internal Affairs, 2006); | During the exploitation | Ministry of Environmental Protection Ministry of Internal Affairs Road Department | Road Department |

| Impacts | Section | Mitigation Measures / Values | Period | Implementation Responsibility | Monitoring Responsibility |
|---------|---------|---|--------|-------------------------------|---------------------------|
| | | <ul style="list-style-type: none"> • Development and implementation of security measures, emergency response plan for damage localization caused by the spills; • development special rout for hazardous materials shipping; • transportation regulation of toxic substances to reduce the risk; • Prohibition of toxic waste transportation through the environmentally sensitive areas. | | | |

8.8. Environmental Monitoring Plan (matrix)

Construction Phase

| Phase | What? (Option that should be monitored) | Where? (place where parameter monitoring is implemented) | How? (How parameter is monitored. / Type of monitoring equipment/?) | When? (When parameter is monitored – measuring frequency or systematically) | Why? (Why should be the parameter monitored (the answer is not mandatory)) | Cost | Responsible Organization |
|------------------------------|--|---|--|--|---|---------------------------------|--|
| Materials supply | Official confirmation or a valid license. | Supplier of materials (asphalt, cement and gravel). | Inspection | Before materials delivery agreement is signed. | To ensure the protection of health Requirements . | Not used | Plant operator; Construction Contractor; Road Department Supervisor agency |
| Materials delivery according | Trucks should be covered / dampened. | Construction site and access | Oversight | Check during working | Ensure Health requirements, | Minimum Supervision included in | Construction Contractor; Road |

| Phase | What? (Option that should be monitored) | Where? (place where parameter monitoring is implemented) | How? (How parameter is monitored. / Type of monitoring equipment/?) | When? (When parameter is monitored – measuring frequency or systematically) | Why? (Why should be the parameter monitored (the answer is not mandatory)) | Cost | Responsible Organization |
|--|---|--|--|--|--|--|--|
| to the determined schedule and route. | Materials transported is connected with dust and emissions. | road | | hours without prior notice. | the safety and reduction of impediment to the movement. | contracts. | Department Supervisor agency |
| Getting rid of Topsoil Stage. The ultimate recovery. | Topsoil storage. Recovery. Erosion control. The destruction of the landscape; Visual impacts. | Construction Site | Oversight | Periodic (without prior notice check during working hours); From Topsoil removal until the end of works. | Compliance with Construction standards, environmental standards and GMG requirements. | Minimum Supervision included in contracts. | Construction Contractor; Road Department Supervisor agency |
| Construction Works | Noise levels; Equipment. | Construction Site | Check; Compliance Monitoring (engine maintenance, use of Mufflers, night work restrictions and other GMG requirements). The noise measuring device. | Periodic (once a month); Only in case of complaints. | Ensure protection of Health requirements. General construction equipment functionality and restriction near settlements, except essential works on stations is only effective way to control noise. | Minimum Supervision included in contracts. | Construction Contractor; Road Department Supervisor agency; Supervisory agency of the Ministry of Environment Protection |
| Construction works | Vibration | Construction site | Oversight | check during working hours | Ensure protection of Health requirements. | Minimum Supervision included in contracts. | Construction contractor; Oversight Agency |

| Phase | What? (Option that should be monitored) | Where? (place where parameter monitoring is implemented) | How? (How parameter is monitored. / Type of monitoring equipment/?) | When? (When parameter is monitored – measuring frequency or systematically) | Why? (Why should be the parameter monitored (the answer is not mandatory)) | Cost | Responsible Organization |
|---------------------------------------|--|---|---|---|--|--|--|
| | | | | without prior notice. | | | |
| Construction works | Dust and air pollution (particulate matter, suspended solids, volatile heavy metal particles). | At the construction site or near. | Visually | During the materials supply and periodically on dry season during construction. | Ensure protection of Health requirements. In compliance with Environmental regulations and regulation. | Minimum Supervision included in contracts. | Construction Contractor; Road Department Supervisor agency |
| During the entire construction works. | Safety of traffic / Transport / pedestrian access visibility / appropriate signs | Construction site | Observation | Weekly in the evening | Ensuring compliance. | Minimum Supervision included in contracts. | Construction Contractor; Road Department Supervisor agency |
| During the entire construction works | Materials and waste storage, treatment, utilization. Water and soil quality (suspended solids, oil, etc.). | Materials and waste storage areas; Flow station; Material storage areas; Washed area. | Observation | Materials supply and periodically during the construction (average once a week), especially during precipitation (rain / snow / etc.) | ensuring Pollution reduction; compliance with Construction standards, environmental and GMG standards. | Minimum Supervision included in contracts. | Construction Contractor; Road Department Supervisor agency |
| During the entire construction works | Waste Management | All of the construction site; Camps. | Observation. | Weekly | Ensuring Pollution reduction; Compliance with Construction | Minimum Supervision included in contracts. | Construction Contractor; Road Department Supervisor agency |

| Phase | What? (Option that should be monitored) | Where? (place where parameter monitoring is implemented) | How? (How parameter is monitored. / Type of monitoring equipment/?) | When? (When parameter is monitored – measuring frequency or systematically) | Why? (Why should be the parameter monitored (the answer is not mandatory)) | Cost | Responsible Organization |
|--------------------------------------|---|---|---|--|--|--|--|
| | | | | | standards, environmental and GMG standards. | | |
| During the entire construction works | Equipment maintenance and fueling; Water and soil quality (suspended solids, oil, fuel, etc.). | Equipment maintenance and refueling infrastructure; From flow stations; Material storage areas. | Observation | Materials supply and periodically during the construction (average once a week), especially during precipitation (rain / snow / etc.). | Ensuring Pollution Reduction. | Minimum Supervision included in contracts. | Construction Contractor; Road Department Supervisor agency |
| During the entire construction works | Impact of archaeological sites and artifacts. | Earthworks on all districts. | Observation | Permanent / daily | Ensuring cultural heritage protection. | Minimum | Construction Contractor; Supervisory agency |
| During the entire construction works | Biological Re-contamination during ground works, in the vicinity ground hidden of infectious lesions (eg. Anthrax). | Earthworks on all districts. | Observation | Permanent / daily | Health care provision. | Minimum Supervision included in contracts. | Construction Field Officer; Road Department Supervisor agency; Veterinary Department |
| During the entire construction works | protection of Infrastructure elements. | Power lines, pipelines crossing. | Observation | Respective areas during construction. | Ensuring protection of Infrastructure . | Minimum Supervision included in contracts. | Construction Contractor; Road Department Supervisor agency |
| During construction | Compensatory planting program. | Areas, agreed with the Ministry of Environm | Observation | During construction | Compensation of Damages to flora and landscape. | Minimum Supervision included in contracts. | Construction Contractor; Road Department Supervisor agency |

| Phase | What? (Option that should be monitored) | Where? (place where parameter monitoring is implemented) | How? (How parameter is monitored. / Type of monitoring equipment/?) | When? (When parameter is monitored – measuring frequency or systematically) | Why? (Why should be the parameter monitored (the answer is not mandatory)) | Cost | Responsible Organization |
|--------------------------------------|--|---|--|--|---|--|--|
| | | ental Protection | | | | | Ministry of Environmental Protection |
| During construction | Building site recovery | Construction sites, road route, quarries, camps. | Observation | During the construction, on the concrete sections after the construction. | Recovery of the construction sites, which are not under the corridor. | | Construction Contractor; Road Department Supervisor agency |
| During construction | Waste disposal | Construction sites, road route, quarries, camps. | Observation | During the construction, on the concrete sections after the construction. | Ensuring Pollution prevention and landscape protection. | | Construction Contractor; Road Department Supervisor agency |
| During the entire construction works | Remedies of Personal protection. Health issues Arrangement for Transport side track. | Construction sites | Inspection | Inspection without prior notice. | Ensuing with compliance with healthcare requirements. | Minimum Supervision included in contracts. | Construction Contractor; Road Department Supervisor agency |

The exploitation phase

| Phase | What? (Option that should be monitored) | Where? (place where should be implemented parameter monitoring) | How? (How should the parameter be monitored./ Type of monitoring equipment/?) | When? (When should the parameter should be monitored – measuring frequency or systematically) | Why? (Why should be the parameter monitored (the answer is not mandatory)) | Cost | Responsible Organization |
|--------------------------------|--|--|--|--|---|----------|--------------------------|
| During the entire exploitation | The long-term degradation of the natural | Over the whole route | Observation | Quarterly | ensuring erosion protection | Not used | Road Department is |

| Phase | What? (Option that should be monitored) | Where? (place where should be implemented parameter monitoring) | How? (How should the parameter be monitored./ Type of monitoring equipment/?) | When? (When should the parameter should be monitored – measuring frequency or systematically) | Why? (Why should be the parameter monitored (the answer is not mandatory)) | Cost | Responsible Organization |
|--------------------------------|---|--|--|--|---|---------|--|
| n | landscape of highway strips and the surrounding slopes. Development of landslides, falling stones and other dangerous natural processes. Visual impacts. Drainage regime change, erosion, vegetation cover degradation. | | | | n, recovery and mitigation of visual impacts. | | personally responsible for engineering and environmental monitoring. |
| During the entire exploitation | Increase of weighted average sediment in erosion affected flows. | Near rivers | Observation | Quarterly | Ensuring the Water protection. | Minimal | Field Officer of Road Department |
| During the entire exploitation | Air pollution from asphalt factories and during repair time. | Over the whole route | Observation; Factory maintenance checkup. | Once, before the repair works start. | Pollution Reduction | Minimal | |
| During the entire exploitation | Waste and pollution routine management; Roadside litter and minor fuel contamination. | Over the whole route | Observation | Monthly | Waste management and pollution reduction. | Minimal | Field Officer of Road Department |
| During the entire exploitation | Air pollution caused by road traffic. | Near the settlements. | Observation; Sampling / analysis. | Quarterly / Annual | Pollution Reduction | Minimal | Ministry of Environment Protection |
| During the entire exploitation | Air pollution caused by road traffic. | Near the settlements | | Quarterly / Annual | Noise protection and | Minimal | Ministry of Environment |

| Phase | What? (Option that should be monitored) | Where? (place where should be implemented parameter monitoring) | How? (How should the parameter be monitored./ Type of monitoring equipment/?) | When? (When should the parameter should be monitored – measuring frequency or systematically) | Why? (Why should be the parameter monitored (the answer is not mandatory)) | Cost | Responsible Organization |
|---|---|---|---|---|--|-------------|---|
| n | | | | | compliance with healthcare requirements. | | Protection |
| During the entire exploitation; Pay particular attention during Epidemiology and plant disease outbreaks. | Plant / veterinary and sanitary measures. | Special points | Inspection of Cargo certificates; Special Procedures. | | To avoid the spread of diseases. | Minimal | Plant Protection Inspection |
| During the entire exploitation | Emergency situations preparedness. | Emergency response offices; Simulation-Training. | Emergency response offices; Simulation-Training. | Annual | Emergency situations preparedness; Rescue operations; Pollution Reduction. | Minimal | Ministry of Environment Protection Ministry of Internal Affairs Road Department |

9. Public Consultations

9.1. Georgian Legislation and Requirements

In April, 2000 Georgia ratified the Aarhus Convention. The mentioned Convention grants the public rights regarding access to information, public participation and access to justice, in governmental decision-making processes on matters concerning the local, national and transboundary environment. It focuses on interactions between the public and public authorities.

The Law of Georgian on "Environmental Impact Permit" (2008) establishes procedures for consultation in the EIA process and sets out the terms for public review and consultation, in particular:

1. Developers shall be obliged to arrange a public review of the EIA reports before they are submitted to a permit issuing administrative body (and in the case if the activity needs the construction permit, developers shall be obliged to arrange a public review of the EIA reports before a permit issuing administrative body initiates the second stage procedure for issuing a construction permit as defined under the Law of Georgia on Licenses and Permits).
2. To arrange a public review of the EIA reports developers shall be obliged to publish the information about their planned activities. The information must be published in a central periodic print media and in a periodic print media (if any) existing within the administrative territory of a self-governing unit where the activity is planned to be implemented
3. The information about the planned activity must include:
 - a) Goals, name and location of the planned activity;
 - b) The address where members of the public shall have access to the documents related to the planned activity (including EIA report);
 - c) The deadline for submitting opinions of the public members;
 - d) The time and place for a public review of an EIA report.
4. A developer shall be obliged to:
 - a) Submit the hard and soft copies of the EIA report, within one week after the information on the planned activity is published in a print media, to a permit issuing administrative body (and in the cases defined in Article 4(3) of this Law, to a construction permit issuing administrative body as well);
 - b) Receive and review, within 45 days after information on the planned activity is published, comments and opinions submitted in writing by the members of public;
 - c) Arrange, at the earliest 50 days and at the latest 60 days after the information on the planned activity is published, a public review of an EIA report concerning its planned activity;
 - d) Ensure that written invitations to the public review of the EIA report are sent to the representatives of appropriate local self-governing bodies, the Ministry, the Ministry for Economy and Sustainable Development of Georgia, and other interested administrative bodies.

5. Any member of public may attend a public review of an EIA report.
6. The public review of an EIA report shall be arranged in the administrative center of a self-governing unit where the activity is to be implemented.

Under the 7th article of the Law:

1. Developers shall, within 5 (five) days after the public review of an EIA report, be obliged to prepare a protocol of the results of the EIA report public review to reflect in detail the comments and opinions expressed during the public review. The protocol shall be signed by the developers (or their authorized representatives) and the representatives of appropriate local self-governing bodies, the Ministry and the Ministry for Economy and Sustainable Development of Georgia (if they have attended the public review of the EIA report).
2. Developers shall review the written comments and opinions of the public members and shall take account of their arguments in the course of finalizing the EIA report.
3. If developers fail to take account of the comments and opinions of the public members, the developers shall be obliged to provide a written substantiation for disregarding the comments and opinions, and to ensure that the substantiation is sent the author (authors) of the comments. The developers must submit this written substantiation (along with relevant written comments and opinions) together with a protocol of the results of the EIA report public review and the EIA Report to the permit issuing administrative body (and in the cases defined in Article 4(3) of this Law – to the construction permit issuing administrative body). The documents referred to in this paragraph shall constitute an integral part of the EIA report.
4. After arranging a public review of the EIA report, preparing a protocol of the review results, and finalizing the EIA report, the developers shall be authorized to submit, within one year, an application to the permit issuing administrative body for a permit (or a construction permit) under the procedures established by this Law and the legislation of Georgia.

9.2. Comments on the Notes from the Ministry of Environment and Natural Resources Protection

| Note | Comment |
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| <p>1. The section 1.2 of the EIA report states that „in compliance with the FIDIC's "red" contract form, the project developer and the project company hired by is have to prepare a detailed design documentation of the basic project object (in our case - road and road infrastructure). As for the auxiliary facilities maintenance projects to be used by the developer contractors, this issue does not fall within the competence of the project implementing organization or project organization and auxiliary facilities projects are not prepared at a major construction permit stage. Auxiliary facilities (construction camp, access roads</p> | <p>The note is taken into account. The Amendment is made (Chapter 1.2 p. 12)</p> |

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| <p>to the facilities during the construction, concrete or asphalt-concrete factories, etc.) project preparation and obtaining the relevant permits are the construction contractor's obligation. According to the FIDIC's "yellow" contract form (Design and Build, i.e. the design and construction contract), the project implementing organizations and it hired project organization prepare the basic design of the main object only, while the finalization of the final detail project, as well as preparation of the auxiliary facilities project and the construction is the building contractor's prerogative." The submitted information should be amended, since according to the current legislation, responsible for the documentation submitted for a public review as well as for the environmental expertise to the Ministry is a construction contractor or any other physical and/or legal entity. Consequently, responsibility for fulfilment of the obligations contemplated in the mitigation measures, conclusions and recommendations of the EIA report to be submitted to the ecological expertise, as well as all the accompanying documentation should be taken by the developer. The entire text of the documents must be written in the first person and should clearly indicate that all of the obligations are undertaken directly by the developer, not the contractor and / or any other organization;</p> | |
| <p>2. The 3rd chapter of the EIA report "Legal Framework " should present the list of legislative and normative acts instead of 12 pages. In addition, the ecological expertise in the mentioned document should contain the updated codified versions of the legislative and normative acts with all the change in them.</p> | <p>The note is taken into account. The Amendment is made</p> |
| <p>3. The EIA report submitted to the ecological expertise should review the possible emergency response issues in case of inactivation of geodynamic processes , which also should be reflected in the emergency response plan</p> | <p>The EIA provides for the description of the road the rehabilitation related geological risks and such risks mitigation principles (the main methods and monitoring). The Roads Department ensures that in each worksite the geological risk avoidance schemes will be developed by the building contractor.</p> |
| <p>4. The EIA report indicates that bulk soil volume is 130767 m³; however, it does not indicate where to locate the bulk. Accordingly, the EIA report submitted for the ecological expertise should indicate the territory necessary for placement of the soil landfill, with indication the issues related to its safe management;</p> | <p>The note is taken into account. The Amendment is made</p> <p>The areas recommended for placement of the soil and inert construction materials are described in the chapter (8.1.1.3)</p> <p>Eventually the area for placement of waste and in particular the soil is selected by the construction contractor in coordination with the local authorities.</p> |

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| <p>5. The EIA report submitted to the ecological expertise should indicate the project-affected agricultural, both private and state land spaces, in particular: land category, soil conditions, soil capacity, the measures to be taken etc.;</p> | <p>The note is taken into account. The Amendment is made</p> <p>Data about soil conditions and soil capacity are provided for in the soil description (chapter 4.3.1), while the category of the affected land is described in the social impact chapter (P. 5.3).</p> |
| <p>6. The EIA report submitted to the ecological expertise should include the information on the quantities of waste according to their types and categories. The mentioned issue should be reflected in the waste management plan as well;</p> | <p>The note is taken into account. The Amendment is made; See the annex 1 (Waste Management Plan) and the EIA chapters 7.3.1.1 and 8.1.1.2</p> |
| <p>7. Noting the adverse weather conditions that might take place during road construction (high winds) and the dust capabilities, the climate part of the environmental impact assessment report should give the number of average days with strong winds (> 15 m/s);</p> | <p>The note is taken into account. The Amendment is made;</p> |
| <p>8. The climate part of the EIA report states that "along the power line corridor the characteristics of the snow cover are significantly changed;" It is not clear, because the EIA report focuses on the road construction. Therefore, these issues must be clarified;</p> | <p>The note is taken into account. The Amendment is made;</p> |
| <p>9. The climate part of the EIA report states should be amended in terms of numeration of the indicated tables</p> | <p>The note is taken into account. The Amendment is made;</p> |
| <p>10. The 4.1.2 sub-section of the EIA report (air emission) provides with the hazardous substances emission old data, which should be updated; also the textual part of this sub-section should be corrected in stylistic and content terms</p> | <p>The note is taken into account. The Amendment is made</p> <p>The data of 2010 and 2016 are submitted instead of 2007.</p> |
| <p>11. EIA report indicates that it is available to operate stationary sources of contamination of variety types of air. Therefore, the EIA report submitted to the ecological expertise should be accompanied by the appropriate air-protection documentation established by the legislation.</p> | <p>During the implementation of the international donor organizations funded linear infrastructure systems projects, design, contracting, procurement, and construction is carried out in compliance with the international engineering and construction rules and schemes, it is clearly defined the project implementing organization, design organization and construction contractor competences. The obligation of the project implementing organization and its hired project company is to prepare the main project subject (in our case - road and road infrastructure) detailed design documentation. As for the technical project of the auxiliary construction facilities to be used by a building contractor, this issue this issue does not fall within the competence of the project implementing organization or project organization and auxiliary construction facilities project is</p> |

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| | <p>prepared at the major construction permit stage. Development of the project for access roads to the auxiliary facilities (construction camp, access road to the construction facilities, concrete or asphalt-concrete factories, etc.) and obtaining the relevant construction permits is within the responsibility of the construction contractor. In this organized process it is impossible to submit along with the environmental impact assessment the standard documentation for the auxiliary construction facilities.</p> <p>Within the EIA it is possible to reflect only the basic principles, the expected impacts qualitative and semi-quantitative assessments and general situational model, while the accurate and detailed quantitative assessments and preparation of the standard documentation shall be stated as an obligation of the construction contractor. This obligation must be clearly focused in the contract executed by and between the project implementing organization and the construction contractor, and construction permit must reflect the condition of the permit for the Roads Department. The Roads Department undertakes to provide a building contractor with all necessary means for his/her activities; the air-protection documentation shall be developed for all stationary facilities as envisaged by the legislation of Georgia.</p> |
| <p>12. According to the EIA report (p. 165), during the project implementation it will be necessary to cut down 3000 tree roots and 7 hectares of bush, but it does not specify the exact number and species of the trees to be cut down. Also, it appears from the report that it may be required cutting down the plants enlisted in the Red List (eg.: <i>Quercus pontica</i>, <i>Betula medwedewii</i>, walnut <i>Juglans egia</i>). Therefore, the EIA report submitted to the ecological expertise must give in details the number and species of the plants; in addition, given that the project area is the area of animal species enlisted in the Red List, it is necessary to present the information on biodiversity impact according to the particular species;</p> | <p>Labeling of the trees and plants to be cut down and identification of their exact number is further stage related directly to the traffic-engineering activities, which is beyond the scope of the environmental assessment and shall not be reflected in the "EIA" report. Although some information on the essence and the state of biodiversity within the scopes of the project corridor are to be submitted in the "EIA" report, but not the species of the trees to be cut down and the number of those; pre-determination of the mentioned – before the setting of the operational engineering action plan – is practical impossibility. It must be stressed at the same time, that the EIA report relevant chapters (4.7.2. Flora, Appendix 3.6. Flora) set in details the affected flora and vegetation quantitative and qualitative evaluation and inventory of forest land and timber volume rate</p> <p>As for the submission of the information about the biodiversity according to the specific species, the Road Department undertakes to review this issue in details in the biodiversity management and monitoring plan, which will be developed at a later</p> |

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| | stage; |
| 13. The EIA report does not give clear information whether the field studies of the project area were carried out during the process of preparation of information about animal wildlife dissemination. Therefore, this issue should be specified in the EIA report submitted to the ecological expertise; | Field zoological studies were undertaken in 2013. Summary is reflected in the EIA main text. The survey report is presented in a separate appendix (Appendix 5) |
| 14. In order to reduce the negative impact on Ichthyofauna the works to be carried out at the river crossing should be performed in the period insensitive for ikhtiofauna; | This fair request was included from the very beginning in the EIA and is repeated at several locations to increase the visibility (Section 8.1.1.8). |
| 15. Environmental monitoring plan must fully take into account the biodiversity monitoring issues. In case of the necessity after the monitoring further mitigation / compensation measures should be developed; | Observations on biodiversity will be described in details in the biodiversity monitoring plan, which will be developed at a later stage. Further, based on the results identified, it will be developed additional mitigation / compensation measures and submitted to the Ministry of Environment and Natural Resources Protection. |
| 16. p. 121 - The options of the term "Alpine" should be clarified and amended; | "Creation of the subalpine forests is widely participated by the range of options of a mountain forest formations: <i>Fagus orientalis</i> , <i>Fagus orientalis</i> , <i>Abies nordmanniana</i> , <i>Picea orientalis</i> , <i>Pinus sosnowskyi</i> ..It is relatively limited the birch (<i>Betula litwinowii</i>) and <i>Acer trautvetteri</i> . The subalpine zone is quite widely represented with Pontus oak (<i>Quercus pontica</i>) and Medvedev's birch (<i>Betula medwedewi</i>) crooked forests, the upper border of which reaches sometimes 2300-2400 meters. The district subalpine forests quality is very high (the relic formations and associations abundance). Accordingly, the context of the options of a term "alpine" is correct and shall not be modified. |
| 17. In pages 112-115-117 – on the basis of botanical surveys, which indicate the sensitive areas identified by a "Drude" method, it is impossible to determine the extent of degraded forest stands (forest degradation is not seen in the photos). On this basis, forest description should be conducted according to the legislation, the resolution of June 17, 2013 of the Government of Georgia on "Accounting, Planning and Monitoring", which provides the possibility to determine the values and the condition of forests; | There is no direct connection between the "Drude method" and the sensitive areas (habitats). "Drude method" is applied by the botanists in order to identify quantitative ratio between the plant species within one habitats (phytocenoses) framework, and a sensitive habitats may be considered the habitats, phytocenoses and groves, where the concentrations of any kind of plant species are featured. As for the law on "Accounting, Planning and Monitoring Procedure", of course the latter does not require to apply the "Drude method", but this law, which was adopted on the basis of the government's resolution of June 17, 2013, is designated for forest-industrial and agricultural system regulations, forest proper |

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| | functioning and not the environmental examination related activities normalization (another question is the extent to which this law meets its purpose). |
| 18. The page 230 states that "during the construction works the overall impact on flora is expected in the following volume: forest cut down and destroy - about 3,000 trees and bushes -7 ha", but it is not indicated the species and the number of the plants to be cut down; therefore, this issue should be clarified; | In the relevant chapters of the EIA report (4.7.2 – Flora; annex #3.6 – Flora) the qualitative and quantitative assessment of flora and fauna under the indicated impact is given in details as well as they provide for the groves inventory and the wood volume. |
| 19. p. 264 - Mitigation "Trees cutting plan and the compensation program" should be agreed with the National Forestry Agency of the Ministry of Environment and Natural Resources Protection in compliance with the legislation applicable for that period and not with the Resources Management Agency of the Ministry of Energy and the Ministry of Environment as indicated in the EIA report; | We agree with the comments and accordingly the text will be adjusted in the EIA report. Of course, the "tree cutting plan and the compensation program" to be implemented within the scopes of state forest fund should be agreed with the departmental institution, which is currently responsible for the management of this fund. |
| 20. In the EIA report, storm water sewage system will be arranged within the bridge leveling system, it submit the drain water receiving camera measures calculations. However, it does not focus on the storm water treatment system for prevention of the discharge of contaminated water into the river without cleaning in case of appearing hazardous substances (oil, etc.) on the surface of the bridge. Therefore, this should be reflected in the EIA report submitted to the ecological expertise; | The note is taken into account. The Amendment is made: Annex #4 p.3.2 |
| 21. In the list of the treatment Plant YCBM20 technical parameters (p. 318), petroleum hydrocarbons concentration should be "0.3 mg / l" and not "0.3 g / l"; | The note is taken into account. The Amendment is made |
| 22. In the subsection - "Wastewater treatment and discharge" (p. 322) the list of 1-4 should contain the dimension unit "mg / l" and not "mm / l", while the paragraph 1 should contain the term «weighted particles" and not "weighted hydrocarbons"; | The note is taken into account. The Amendment is made |
| 23. The EIA report states that for the use of the camera the license is obtained from the Ministry of Energy (p. 242). This should be corrected, since the issuance of the license is regulated by the LEPL National Environmental Protection Agency of the Ministry of Environment and Natural Resources Protection; | The note is taken into account. The Amendment is made |
| 24. In the EIA report, the formula of the allowable concentration of pollutants in waste water (4) (p. 286) in the brackets is wrong, therefore, it should be clarified; | The note is taken into account. The Amendment is made |
| 25. The results of calculations of emissions during construction equipment operation are presented in Table | This project is the rehabilitation of the road and not the new road construction project in the new |

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| <p>11 (p. 333). Concentrations of the hazardous substances created in the atmospheric air in the near population are not represented, however, it is submitted the conclusion that there will be no impact on the population. Accordingly, it must be noted the basis for this conclusion;</p> | <p>location. The road surface is significantly damaged and traffic in this way is much more related to dust and emissions generation than the one that takes place on the normal road. Rehabilitation and restoration of the road surface results in reduction of dust emissions caused by traffic to the level characteristic to the normal paved roads.</p> |
| <p>26. In the EIA report, the noise level dimension unit should be "dB" and not "d"; the time interval should be "7:00 - 23:00" and not "7 AM - 11 PM "(p. 61);</p> | <p>The note is taken into account. The Amendment is made</p> <p>The mechanical error made during printing is corrected and the unit of noise is specified dB.</p> |
| <p>27. In the EIA report, the subsection "Air emissions-related impacts" provides for the terms "hazardous waste" (p. 209) and "harmful waste" (p. 302). The terms should be amended, as they are commonly used in relation to waste;</p> | <p>Page 174 as well as the post page 265 and the annex #1 relate to the waste management (chapter 7.3.1) and it focuses specifically on waste.</p> |
| <p>28. In the technical summary annexed to the EIA annexed (p. 112) it is used the dimensioning units "inch", "feet". This should be corrected; Georgian approved the International System of Units (SI) uses the "meter";</p> | <p>Technical summary is an explanatory note, prepared for technical expertise, project approval and construction permits. This document is prepared according to the standards of Georgian legislation and the requirements of engineering and international standards and no such notice is received from the Ministry of Economy. Environmental Consultant is not authorized to make changes to this purely technical document, which is submitted by the engineering design team.</p> |
| <p>29. In the EIA report it should be amended different data on the number of employees: 240-241 pages indicates 200 people, while 314 page shows 100 people ";</p> | <p>The note is taken into account. The Amendment is made.</p> |
| <p>30. In the EIA report it should be amended the value of survey route seismicity, since in number of cases it is indicated "7" points (p-p 220-336), and in some cases - "7-8" points (p 84);</p> | <p>The note is taken into account. The Amendment is made.</p> |

9.3. Consultative Meeting Minutes

Construction of Batumi (Angisa) - Akhaltsikhe road – Khulo- Goderzi (80 km - 110 km) section (Lot 1) of national significance

Minute of Public Hearing of the Environmental Impact Assessment

On July 24, 2015 at 14:00 the public hearing of the Environmental Impact Assessment document in terms of the project “Construction of Batumi (Angisa) - Akhaltsikhe road - Khulo - Goderzi (km 80 - km 110) section of National Significance” was held in Khulo settlement; the hearing was attended by the representatives of Khulo Municipal Government officials, City council members, youth council members, residents of the villages, as well as Mr. Gia Latsabidze, the representative of the Ministry of Environment and Natural Resources of Georgia and Mrs. Luiza Bibashvili and Mr. Gia Sopadze, the representatives of the Road Department. Mr. Gia Alaverdashvili, the representative of the foundation “World Experience for Georgia”) presented the project’s EIA document and talked about the details; he reviewed the environmental and general technical - economic aspects related to the proposed section rehabilitation. At the end of the report the questions given by the region authorities and the residents were responded by the speaker as well as Mr. Gia Sopadze and Mr. Giorgi Latsabidze.

| | Question | Answer |
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| 1 | When will the construction start? The whole region is looking forward to the the road rehabilitation. | Mr. Gia sopadze: Rehabilitation and construction works are planned to be initiated for fall. Prior to that all the procedures prescribed by law should be completed. |
| 2 | What will be the width of the road in Khulo settlement? | Mr. Gia Aladashvili : In Khulo settlement the width of the road will be 6 m, more is not possible; the rest of the roads will be 9m wide. |
| 3 | ----- : During the HPP tunnel construction there was withdrawn the blown up tainted soil and placed at the river bed. Is it possible to throw bulk land formed during the road construction on the bulk contaminated with the explosives in order to minimize the damage? | Mr. Giorgi Latsabidze: The company in charge of the HPP construction had a serious violation and at this stage the case has been launched. They will be charged to eliminate the violation and pay a fine. The bulk of the land formed during the construction should be thrown on the place duly designated for this purpose and agreed with the relevant authorities. |
| 4 | ----- The population is dissatisfied with the violations that take place during the HPP construction. Whom we should apply to in if such a thing happens during the road construction? | Mr. Gia Sopadze: In case of reveal of any violation during the road construction in the first place you have to apply to the supervisor. The mechanism for making complaints is determined. The dispute is ordinarily settled finally by a court. Of course it is better to fix the violations in time. |

| | | |
|---|--|---|
| 5 | ----- : Will be the local population employed for construction? | Mr. Gia Aladashvili: Certain number of workers from the local residents with the appropriate qualifications will be employed. The EIA document gives the definition regarding this issue. |
| 6 | Mr. Giorgi Latsabidze: What about the extent of mudflow and landslide areas hazard? | Mr. Gia Aladashvili: Dangers from mudflow and landslide areas which are represented in a large number on the road is described in the EIA and the measures defined in the technical regulations should be strictly observed by a contractor during construction works. |
| 7 | ----- : Will the road be functioning in winter or will it be closed? | Mr. Gia Sopadze: Along with the development of a ski resort in Beshumi the road permanent cleaning works are also planned in the near future; the special technique will be designated with this purpose for the pass. |
| | | |

List of the EIA Review Aattendees in Khulo
(List of the individuals and signatures)

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| Photo 9.1. |
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| Photo 9.2. |
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| Photo 9.3. |
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| Photo 9.4. |
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Annex 1

Waste Management Plan for Camps and Support Facilities

1. Purpose of the Waste Management Plan and document structure

1.1 Goals and Objectives

Waste Management Plan aims to provide the dispose of the hazardous and non-hazardous waste originated in the main building and functional facilities envisaged by the project in compliance with the principles adopted by the EU countries, the requirements envisaged by the European Bank for Reconstruction and Development (EBRD) guidelines and the legislation of Georgia (Waste Management Code of 26.12.2014), resulting in the prevention or minimizing the effects of the environment contamination with waste (soil, water, facilities, air).

The main object at the roads construction stage, which is the place of generation of the different types of waste is the builders of the camp, which includes the local office, equipment storage and construction equipment maintenance as well as the refueling infrastructure and bituminous concrete plant (if the construction and operation of the plant is envisaged by the project). Accordingly, the present waste management plan covers the issues of waste disposal in the territory of the builders' camp and the support facilities at a construction phase.

The present waste management plan is quite elaborated plan, but it is still a framework document, which should be used at a later stage in order to prepare the "waste management plans". The final "waste management plan" related to the construction will be prepared by the construction contractor. For this it will be sufficient to remain only the components relevant to the construction camp from the framework document submitted and specification of some details (eg. specific individuals in charge of the waste management; the list of the waste Operators with whom the relevant contracts are signed and the copies of the contracts as an attachments). As noted above, a building contractor, if necessary, will also develop and coordinate with local municipalities the bulk soil placement plan. The 2nd paragraph of the plan reviews the Georgia's legislation on waste management and the relevant EU directives as well as the basic principles and requirements which are adopted as guidelines for the European Union and the European Bank for Reconstruction and Development Bank (EBRD) with the purpose to eliminate the pollution caused by the waste. It also describes the institutional system in Georgia, which is responsible for waste management and monitoring.

The 3rd paragraph – in compliance with the requirements of the waste management - formulates the proponent - "Roads Department (STD)" – Policy in the Waste Management Field and the Instructions on the organization of administrative structure. The 4th paragraph provides with the characterization of the types and volumes of the waste generated during the construction process and the waste management activities.

The 5th paragraph provides with the general description of the waste management procedures

2. Applicable Law of Georgia in the Waste Management Field and the Requirements of the European Union and the European Bank for Reconstruction and Development

2.1 Georgian Legislation in the Field of Waste Management Waste Management Code, 26.12.2014

The purpose of the Code:

The purpose of the Code is to provide for the legal conditions for the implementation of measures aiming at prevention of generation of waste and increased re-use, for environmentally-sound treatment of waste, including recycling and extraction of secondary raw materials and generation of energy from waste, as well as safe disposal of waste.

(2) The objective of this Law is to lay down measures to protect the environment and human health by preventing or reducing the adverse impacts of the generation and management of waste and by reducing overall impacts of resource use and improving the efficiency of such use.

The objective of this Code is to protect the environment and human health:
By preventing or reducing the adverse impacts of the generation;
Creating the waste management effective mechanisms.

Article 4 Waste management hierarchy

(1) Waste management policy and legislation in Georgia is based on the following priority order:

- a) Prevention;
- b) Re-use;
- c) Re-cycling;
- d) Recovery of any other type including energy;
- e) Placement.

2. In determination of specific commandments in relation to the waste management hierarchy envisaged by the first part of this article the following must be taken into account:

- a) Environmental benefits;
- b) The technical feasibility with using the best available techniques;
- c) The economic feasibility.

Article 7 - General requirements related to waste management

1. The collection, transportation and treatment of waste shall be carried out according to its type, characteristics and composition, without preventing its further recovery.

2. The collection, transportation and treatment of waste shall exclude environmental pollution and harmful effects on human health to the maximum extent possible.
3. In the case of environmental pollution resulting from the transportation of waste, the waste transporter shall ensure the implementation of cleaning activities.
4. A waste producer and a waste holder shall treat their waste on their own or transfer it for collection, transportation and treatment to persons entitled to carry out such activities according to this Code and other legislative and subordinate normative acts of Georgia.
5. Where waste has been transferred for recovery or disposal, the responsibility of the original waste producer and/or waste holder shall remain in force until recovery or disposal of waste is completed.
6. Persons who collect or transport waste shall transfer it for treatment to appropriate facilities having an appropriate permit or registration.
7. A waste transporter shall, before transporting hazardous waste, obtain an admission certificate for a means of transport to transport waste, whereas the driver of a means of transport shall have the above certificate with him when transporting hazardous waste (the relevant law shall be developed and effective in 2016).
8. Waste may not be burnt outside an incinerator that does not have an appropriate permit.
9. Conditions for waste incineration and co-incineration shall be defined by an ordinance of the Government of Georgia

Article 14 - Company waste management plan

1. Natural or legal persons who annually produce more than 200 tons of non-hazardous waste or more than 1 000 tons of inert waste, or any amount of hazardous waste, shall prepare a company waste management plan until December 31, 2016. The plan shall generally include:
 - a) Information about waste generated (in particular about its origin, and types, composition and amount of waste defined in the List of Waste);
 - b) Information on the measures to be taken for the prevention of waste generation and its recovery, especially in the case of hazardous waste;
 - c) A description of the method for separation of waste generated, in particular of hazardous waste, from the other waste;
 - d) Methods and conditions for the temporary storage of waste;
 - e) Waste treatment methods applied and/or information on persons to whom waste is transferred for further treatment.
2. A company waste management plan shall be submitted to the Ministry. The Minister of Environment and Natural Resources Protection of Georgia shall determine the procedure for the consideration and approval of the plan. If so requested, the plan shall be made available to the municipalities concerned and to other persons.

3. A company waste management plan shall be revised every three years or when there are substantial changes in the types and quantities of waste generated, or in processes of waste treatment.

Article 15 - Environmental manager

1. The persons determined in Article 14 of this Code shall nominate an environmental manager. Information about such nomination (in particular, the name and surname of the environmental manager) shall be immediately provided to the Ministry.

2. The waste related duties of an environmental manager shall be the following:

- a) To draft and update the waste management plan of the company;
- b) To organize the implementation of the waste management plan of the company;
- c) To supervise internal compliance with legal requirements of the legislation of Georgia on waste management.
- d) To submit the inventory of the types of waste to the Ministry of Environment Protection to August 1, 2016 under the 426 (17.08.2015) Resolution of the Government of Georgia.
- e) To provide the Ministry with the information on the number, location and volume of the temporarily stored hazardous waste (if the total weight of hazardous waste does not exceed 2 tonnes).
- f) To obtain the necessary permission from the Ministry for a temporary storage of hazardous waste (if the total weight of hazardous waste is from 2 to 10 tons).
- g) To obtain the environmental permits for hazardous waste temporary accommodation (if the total weight of hazardous waste exceeds 10 tons).

3. The responsibility of an environmental manager under paragraph 2 of this article does not limit the liability of a company for complying with relevant requirements of this Code and subordinate normative acts based thereon.

The Law of Georgia Import and Transit of Waste to the Territory of Georgia, 1996.

The mentioned law regulates only the transportation of the waste at the border crossing and it is not related to the recycling and management of it. Essentially the same issue is focused by the Basel Convention on "Transboundary Movements of Hazardous Wastes and Their Disposal Controls" which was ratified by the Parliament of Georgia.

At the same time it is known that the Georgia intends the European integration and the country has to perfect its legislation with this purpose in accordance with the EU recommendations.

Waste management rules are defined by the following standard acts of the Ministry of Labour, Health and Social Affairs of Georgia:

- #64 Resolution of the Government of Georgia: "Technical Regulation on Collection, Storage of Medical Treatment-Rehabilitation Facilities and Approval of Waste Neutralization Sanitary Rules" - January 15, 2014 (registration code: 300160070.10.003.017682);

- #426 Resolution of the Government of Georgia: “Determination and Classification of the List of Waste according to Types and Characteristics” - August 17, 2015 (registration code: 300230000.10.003.018812);
- #421 Resolution of the Government of Georgia: Approval of Technical Regulation for Landfill Arrangement, Operation, Closure and Further Maintenance” – August 14, 2015 (registration code: 300160070.10.003.018807).

2.2 European Directives on Waste Management

Waste Management

Waste management is guided by the EU directives: (i) Waste Management Framework Directive - 2008/98 / EC; and (ii) Hazardous Wastes Management Directive 91/156 / EEC.

According to the mentioned Directives, the “Waste” means a substance or an object which is thrown by a holder or is intended to do. The Directives is aimed at protection of human health, the environment and of natural resources from the waste pollution, obtaining the secondary raw materials and requires the activities related to the waste processing and disposal to be permitted by the competent authorities.

According to the Waste Framework Directive, the EU member states are required to ensure the prevention or minimization of waste generation, their safety and promote the establishment of clean technologies, improvement of technical product quality and waste disposal equipment. In addition, they are required to promote the recycling of waste (including the gaining energy purposes) and to prohibit uncontrolled dumping of waste. With the help of the other member states they are required to ensure the support the development of a network of waste processing facilities and with this purpose to use the best technologies that are not related to too much cost.

Hazardous Waste Management

According to the article 1(4) of the EU 91/689 / EEC Directive in the field of the hazardous waste management it is necessary to achieve greater harmonization. In order to develop a common definition of a hazardous waste the mentioned article lists the wastes that may be classified as hazardous waste, as well as their components and properties. According to the Directive the place of the use of the hazardous substances must be defined and registered, while in case of the collection, transportation and storage of such substances they should be provided with the label in compliance with the EU standards. In addition to the national competent authorities are required to verify the manufacturers and the recipient facilities of hazardous waste as well as their carrier vehicles.

2.3 EBRD Requirements

Pollution Prevention and Mitigation

Pollution prevention and reduction is the leading issues for the sustainable development agenda, in this regard the EBRD-funded projects must meet the internationally recognized rules. Pollution impact on the environment and related

issues should be considered in all economic activities, ranging from the elementary level such as the device emissions and the impact on regional and global levels.

The EBRD as the European Environment principles signing party shall:

- During the process of implementation of the activities funded by it to support the adoption of the preliminary precautionary principle, the principle of prevention, the principle of priority recognition of elimination of environmental damage immediately at the source of pollutants and the principle of imposing the payment for contamination.
- Request the compliance with the European Union relevant environmental standards and particularly industrial production, also the standards related to the water and waste management, air and soil pollution, labor and health protection and nature protection as far as they can be used within the scopes of the project (hereinafter referred to as the "EU requirements").

It is believed that pollution prevention and reduction EU environmental requirements has been developed using the high-efficiency methods, not without the mandatory usage requirement to any specific technique or technology or the technical characteristics of installation in consideration of its geographical location and the local environmental conditions, the ultimate goal of which is to protect the environment effectively.

Waste Management

The client would avoid or minimize hazardous and non-hazardous waste materials generation and to the extent possible reduce their harmful effect. If waste generation cannot be avoided the client will manage the waste reuse or recycling or use waste as a source of energy. If the waste cannot be recycled or re-used the client will process, destruct or dispose it by the environmentally friendly method. If the generated waste is considered hazardous waste the client shall identify the commercially acceptable alternatives in terms of the waste disposal in an environmentally friendly way, taking into account the cross-border movement limitations. In case if the waste disposal is carried out by third parties, the client will work with a reputable contractor official companies which are licensed by the appropriate regulatory agencies.

2.4 The Basic Principles of Waste Management

According to the Waste Management Code the waste management should be implemented in compliance with the following principles:

- Waste management hierarchy;
- Preliminary precautionary principle adoption;
- The principle "Polluter Pays";
- Proximity principle;
- The principle of self-reliance.

Each of the above-mentioned principle is discussed below.

- a) Preliminary precautionary principle adoption – means the adoption of the measures in order to avoid damage to the environment caused by waste, even if there is no scientifically proven data.
- b) The principle “Polluter Pays”- waste generating person or owner must pay for waste prevention, recovery and disposal-related costs, including monitoring, follow-up care measures and environmental restoration costs;
- c) Proximity principle - waste treatment and disposal should be undertaken in the nearest processing facilities, bearing the environmental protection and economic efficiency in mind;
- d) The principle of self-reliance - municipal integrated and adequate network of disposal or recovery facilities are established and operated.

2.5 Institutional System in Georgia, Responsible for Waste Management and Monitoring

State Agencies Responsibilities

The Ministry of Environment and Natural Resources Protection is the main agency in charge of development and implementation of the state policy in the field of waste management and handling. The competence of the Ministry of Environment and Natural Resources Protection covers the following:

- a) Development and implementation of the unified state policy for waste management;
- b) Waste governmental accounting and data bases;
- c) Development of the national strategy for waste management and biodegradable municipal waste strategy;
- d) Development of the national waste management plan, coordination of its implementation and reporting;
- e) Issue permits for the waste management related activities and registration;
- f) Support the waste prevention, separation, re-use and recycling activities;
- g) Implementation of the waste management related state control.

The Ministry of Labour, Health and Social Affairs along with the Ministry of Environment and Natural Resources Protection regulates and controls medical waste management in compliance with the rules set out in the relevant legislation.

The Ministry of Agriculture along with the Ministry of Environment and Natural Resources Protection regulates and supervises the management of animal waste in compliance with the rules set out in the relevant legislation.

The relevant agency under the Ministry of Economy and Sustainable Development issues the certificate for approval of the vehicle for shipment of a hazardous waste.

The Ministry of Labour, Health and Social Affairs along with the Ministry of Finance regulate the cross-border transportation of waste.

Solid waste management is a matter of national, regional and local concern in Georgia. The Government of Georgia has identified solid waste disposal as an acute problem and recently begun reforming the existing waste management system. Consequently, in line

with this reform, on April 24, 2012 the new state-owned Solid Waste Management (SWM) Company of Georgia was established under the Ministry of Regional Development and Infrastructure. The government holds 100 % shares of the company. The company implements solid waste management actions with respect to landfills in Georgia, excluding the City of Tbilisi and the Autonomous Republic of Adjara.

The goals of the Company are as follows:

Reduced environmental impact from waste and waste treatment;

Avoiding and minimization of waste generation, especially organic waste and hazardous waste;

Reduced amount of waste landfilled, especially organic waste and hazardous waste;

Reduced numbers of active dump sites and gradually closure of dump sites non-compliant with EC-directives;

Treatment of waste accepted at the landfill in a sustainable, environmentally safe and cost efficient manner;

Development of landfills into waste treatment facilities comprising waste sorting activities for facilitating reuse, recycling and energy recovery of the waste prior to landfilling;

A good occupational safety and working environment for staff working within waste management;

Increased public awareness on sustainable solid waste management;

Well-functioning cooperation and exchange of expertise between the Company and the municipalities;

Well established, close links with the pertinent stakeholders, including ministries, local municipalities and other administrations and entities responsible for different parts of the SWM system;

Compliance with EC directives within the SWM field.

The company's mission:

- making improvements to the existing waste landfills;

- Perfection of the company-owned landfills and commissioned regulation thereof;

- Dump sites/landfills disposable waste accounting system;

- Dump sites/landfills management in an acceptable way with respect to the environment, worker's safety and human health, including technical and infrastructural measures;

- New regional sanitary landfills and waste transfer stations definition;

- High-risk landfills remediation and closure;

- Company's employees qualification raising in a variety of issues related to waste management, including technical, economic, administrative and legal issues;

- Effective cost recovery system;

- Ensuring separation, processing and recycling at a source and the implementation of the re-use mechanism in cooperation with the municipalities.

3. The project proponent policy in the field of waste and administrative structure

3.1 In the framework of the project the organizations responsible for waste management

Batumi-Akhaltzikhe road construction falls under the competence of the Road Department (RD). The RD at the stage of project implementation will hire an engineering / construction company, which will carry out the construction work. Accordingly, the organizations responsible for the waste management at the construction stage are the construction contractor and the RD. Essentially the RD supervises the activities carried out by the construction contractor and ensuring the satisfaction of all the environmental demands, including a waste management plan development and implementation by the contractor.

3.2 Policy on waste management

All organizations within the frames of the project responsible for the waste management intend to carry out the management of waste generated during their activities in compliance with the with the requirements of the guidelines of the legislation of Georgia, the basic principles of the European Union, the EBRD and the best international practices.

The companies' waste management system must comply with the above mentioned international requirements to the extent that it depends on the efforts of the company and within the scopes that allows the Georgia-based waste management facilities (waste recycling, re-use, treatment and disposal facilities).

In implementation of the waste management system the company is guided by the priorities of the following hierarchical scheme:

- Waste management hierarchy;
- Adoption of the precautionary principle making;
- The principle of "Polluter Pays";
- The proximity principle;
- The principle of self-reliance.

The whole waste management structure as well as temporary waste disposal sites and equipment should ensure the minimization of the contamination of the environment and accordingly the enterprise personnel and public health protection.

3.3 Instructions for the administrative structure organization

Management system hierarchical structure (flowchart)

General scheme of distribution of the responsibilities for implementation of the measures envisaged by the plan

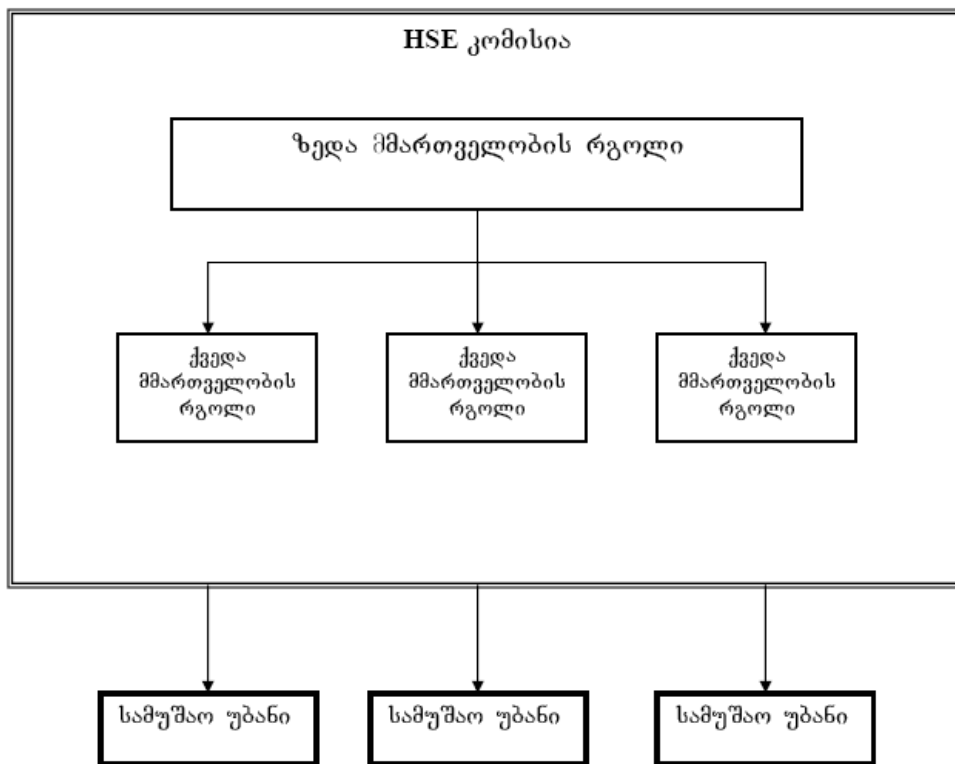
1. The management is responsible for:
 - Waste inventory sheet approval;

- Provision with the equipment, inventory and resources necessary for the waste management;
- Compliance with the requirements of the environmental protection legislation of Georgia during the process of the management of waste generated as a result of industrial activities;

2. The staff of the company, which is engaged in the field of waste management, is responsible for:

- Failure to fulfill waste collection, storage, transportation and other conditions, which is included in the waste management plan;
- Placement of waste in the unauthorized areas;
- Violation of the waste generation, processing, use and location norms, rules and accounting regulations;
- Provision with the incomplete, inaccurate documentation (information) on the waste management or refusal to provide with such information;
- Waste transfer without the relevant documents;
- Failure to fulfill the waste management plan requirements by the subordinate staff.

In general terms, for the company, environmental, health and safety management system, which includes waste management issues should be organized as follows:



(HSE Commission; Upper Managerial circle; Lower managerial circle, Working area).

For development of the management plans and implementation of those the responsibility is charged to the health and labor safety and environmental commission (generally - HSE Commission), the upper management level of which are the the company-wide responsible persons for the mentioned issues (company's management-level representatives), while the lower management levels are those responsible for implementation of the mentioned plans in each working site of the project territory. The Commission is an informal functional group, whose daily routine activities are managed by the environmental and social protection service (formal structure) or officer (in case of a development company). The company's head and upper-level managers will discuss and coordinate the plans, procedures and specific decisions developed and prepared by the environmental and social protection service.

In the RD unified management system, the responsible specialist for a routine control the environment protection and waste management is Ms. L.Bubashvili (Environmental Specialist). Senior level manager, will discuss and prepares the issues for agreement with the head of the company - the Head of the Environment and Accommodation Department – Mr. G.Sopadze; the daily routine monitoring in a working site is managed by the company's supervisory environmental specialist employed by the RD. The upper circle of management in the development company structure consists of the company's manager, chief engineer and the person company-wide responsible for environmental protection. The environmental officers assigned to the work sites carry out waste management at the site.

HSE commission's upper management unit competence covers the following:

- Company's environmental (in particular waste management) policies and action plans development and periodic update;
- Provide adequate material base (building facilities and the proper arrangement of the necessary equipment);
- Signing the contract with external contractors;
- Staff training and staff awareness (HSE plans and instructions provided requirements) - development and organization of the training programs. Training will be generally provided to the Commission lower level, which in turn provides training to the personnel in each working site;
- Control over compliance with the requirements envisaged by the HSE plans and instructions at all levels of the company, which is achieved by direct inspection as well as through the control by the Commission's lower.
- In case of inconsistencies - planning and implementation of corrective and preventive measures and control thereof;
- The planned results achievement analysis; maintenance and improvement of results;
- Management of relevant documentation, which should include:

- The minutes of the Commission's regular meetings (at least twice a year and the extraordinary - if necessary) which include plans review and approval, plans renewal, planned results achievement analysis and improvement measures;
- The HSE developed and approved in the form of a document - policy, risk analysis and action plans;
- The instructions set out in the action plans;
- Training programs;
- Trainings records book, which indicates the subject of training and title, individuals conducting the training, the training date;
- The monitoring and audits and the corrective actions taken (magazine)
- The book containing the records related to the implemented monitoring, audits and the planned corrective action results;
- Attachment (control checklists; trainings confirming checklists).

Duties of the individuals responsible for individual objects (construction sites; ancillary facilities):

- Company's environmental Company (in particular waste management) policies and action plans familiarization;
- Informing the management about the purchase, construction, repair or update facilities and equipment necessary for waste management;
- Staff training and staff awareness (HSE plans and instructions provided requirements)
 - development and organization of the training programs. Training will be generally provided to the Commission lower level, which in turn provides training to the personnel in each working site;
- Daily brief instructions before the start of the works;
- Control over compliance with the requirements envisaged by the HSE plans and instructions in the respective working sites;
- Recording of the inconsistencies and planning and implementation of corrective and preventive measures;
- Maintenance and improvement of the planned results achievement analysis;
- Management of the relevant documentation and storage. The list of documents should include:
 - Instructions provided for in the action plans for specific working sites;
 - Training programs designed for the specific working sites;
 - The book for trainings with indication of the subject of training and title, individuals in charge of organization of training and attendance at it; the date of training;
 - Daily brief instruction certifying records (logs);
 - The planned monitoring and corrective actions evidencing records (log);
 - Corrective actions implementation inspection records (log);
 - Attachment (control checklists; trainings confirming checklists).

Training on treatment of waste:

All employees who have access to any dangerous or harmless waste, shall attend the special training - training in the following areas:

- The proper segregation rules and procedures;
- Mandatory care system and rule for correct execution of documentation;
- Waste handling (personal protective equipment use) including waste collection in the administrative building;
- Waste treatment;
- Waste storage.

The rules for treatment waste, especially hazardous waste, should be specific to each kind in of waste. When possible – they should be exhibited in places of their origin and temporary storage areas on the stands.

Waste flow documentation and management

Hazardous waste generation in different work sites and their accumulation in the warehouse should be recorded and documented in the warehouse operations special journal.

The total amount of non-hazardous waste control may be too general. It does not require the management of special documentation. It is sufficient to sign a contract with a specialized contractor who is in charge of waste removal from the project sites territory. The contract will reflect the frequency of waste removal from the territory.

4. Management of Waste generated during Construction Process

Construction waste

Improper handling of construction materials (storage, use, disposal), as well as the waste generated in process of the construction, could become a water / soil contamination cause in a construction sites, as well as in the materials dumping sites. Wrong handling of the equipment and fueling can cause primary contamination of soil and the contaminated soil and the clothes used for cleaning of these places, if the adsorbents become hazardous waste, improper management of which can lead to the soil or water facilities secondary pollution.

In general, main mass of the waste generated during the construction process is created by the inert construction waste - cut soil and weathered rocks bulk, also building materials waste - which are not used for construction purposes and are the subject of placement.

During the construction it is expected the generation of different types of waste. The main waste generation objects are: construction sites and construction camps. Generation of waste in small quantities is expected (contaminated soil) on the access roads and the routes of heavy traffic.

Waste classification

During the construction of the highway following groups of waste shall be generated (waste groups are provided for in compliance with the requirements of the "Waste Management Code"):

- Code 15 - packaging waste, absorbent, cleaning cloths, filters and protective clothing waste;
- Code 16 - waste which is not provided for in other areas;
- Code 17 - Construction and dismantle waste (including road works, waste from contaminated sites);
- Code 20 - Municipal waste and similar commercial, industrial and waste facilities, which also include a small amount of the collected amount of waste.

If a building contractor, after obtaining the appropriate permission, will open the own pit there will be additionally generated the waste of the following groups: waste generating from the geological-exploration works /excavation, mining works, minerals and quarries mechanical processing and further processing (code 01) . The estimated transmission capacity of the mentioned waste and their management ways will be discussed at the stage of the appropriate permit in the environmental impact assessment report.

Inert construction waste - in general, the main mass of the waste generated in the process of infrastructure construction is created by the inert construction waste - soil and stones (code: 17 05 04), soil (code: 17 05 06), as well as cement, bricks, tiles and ceramics (Code: 17, 01) - which is not used for construction purposes and subjects to the placement.

The total number of inert construction waste arising from the construction of a section of the highway project, is smaller than those accumulated during the civil works of any other type of infrastructure or the territory. Highway construction, especially – in the plain area, does not require arranging the trenches and large-scale works. The main objectives is the arrangement of the foundations of the towers – the soil withdrawn from the places excavated in this area will be used to strengthen the foundations of towers and for compression. Placement of small bulk is not a problem:

- a) If necessary, the population should be given the right to use the inert material temporarily placed in bulk;
- b) Inert bulk may be placed in the solid waste landfills and used to cover the municipal solid waste layer;
- c) The inert bulk may be used by local municipalities to strengthen the erosive gorges and slopes and riverbanks.

Household waste (code: 20)

It is anticipated the generation of hazardous, non-hazardous household waste, mainly:

- Kitchen organic waste (non-hazardous) - code: 20 01 08;
- Paper, cardboard (non-hazardous) - code: 20 01 01;
- Glass (non-hazardous)-code: 20 01 02;
- Plastic (non-hazardous) - code: 20 01 03;

- Septic tank sediment (dangerous) - code: 20 03 04
- Bushes/trees residuals (according to the specifics of the object it can be both hazardous and non-hazardous) - code: 20 03 03;
- Medical waste (hazardous) - code: 20 01 31;
- Mixed municipal waste - code: 20 03 01;
- Fluorescent tubes (dangerous) - code: 20 01 21.

For a household waste management it will be installed waste collection containers in the construction sites and landfill polygons, from which the waste will be transferred to temporary storage sites. Temporary waste storage yards will be arranged in the camps, construction sites of the supplementary facilities and, possibly, in a few additional districts along the highway route (the exact place will be selected by the contractor). It is convenient to arrange temporary storage places in the construction sites near administrative-territorial centers. The places for temporary disposal should be organized in observation of the sanitary rules: large size (1.1 - 2 m³) special containers should be placed on the impermeable concrete mats on the, which will have a closely tight-fitting lid. It is preferably to cover the area for a rain. Area shall be maintained in clean conditions; waste must be taken regularly for the final place (at least - once a week).

Household waste will be finally placed on the basis of a contract executed with the licensed contractors and the municipal sanitary cleaning services of. Household waste will be transferred to municipal landfills: Norio and Rustavi municipal waste landfills.

Non-hazardous construction waste:

- Paper and cardboard packing material - code: 15 01 01;
- Plastic packing material - code: 15 01 02;
- Wood packaging material - code: 15 01 03;
- Metal packing material - code: 15 01 04;
- Defective, malfunctioning equipment and parts - code: 16 02 14;
- Mixed metals - code: 17 04 07;

Non-hazardous construction waste is subjected to the same kind of management procedures, as those designated for the domestic waste generated during the construction: collection in the containers at construction sites, temporary storage in the camps and the substation and final disposal in the landfill polygons.

Hazardous construction waste;

- Glass, plastic tree, consisting of or containing dangerous substances - code: 17 02 04;
- Metallic wastes contaminated with dangerous substances - code: 17 04 09
- Soil and stones containing dangerous chemicals - code: 17 05 03;
- Packaging materials that contain hazardous chemicals of rubbish and / or contaminated with dangerous chemicals - code: 15 01 11;
- Absorbents, filter materials (including oil filters), cleaning cloths and protective clothing, which are contaminated with dangerous chemicals - code: 15 02 02;

- Oil filters - code: 16 01 07;
- Defective, malfunctioning equipment and parts contaminated with dangerous substances - code: 16 02 10; 16 02 11; 16 02 12; 16 02 13;

The listed hazardous waste does not belong to the class of high hazard. Georgia already operates operating several companies that have licenses to operate hazardous waste. The construction contractor will collect the waste of fuel and lubricants, and place them appropriately in the places arranged for temporary storage. Pads, which accommodate residual oil and paint containers, should be of a waterproof material (concrete or metal tank). District must be equipped with absorbent. This waste final disposal shall be organized in compliance with the rules duly agreed with the Ministry of Environment and Natural Resources Protection in the agreed objects or – on the basis of the appropriate contract – it will be transferred for allocation to a licensed operator (eg. "Hospital" Ltd), which has a hazardous waste permit for operation.

Waste management infrastructure in the region

The project is located on the highway in Isani-Samgori district administration area. Region 2 is at the dump, which can be used by the project: Tbilisi (Norio waste polygon) and Rustavi landfill.

Table 7.2. Types of construction waste, the expected volume and management procedures

| Inert construction waste | | | | | |
|-------------------------------------|---|-------------------------|--------------------|--|--|
| Waste code | Name | Expected volumes | Waste class | Waste management | Waste operator organizations and place of disposal or utilization |
| 17 05 04 17 05 06 17 01 | Soil and stones; Soil; Cement, bricks, tiles and ceramics. | | Non-hazardous | a) If necessary, the population should be given the right to use the inert material temporarily placed in bulk b) Inert bulk can be placed in an a solid waste landfills and used for covering the municipal solid waste layer c) the bulk of the inert material can be used by local municipalities for strengthening erosion gullies, slopes and riverbanks. | Shall be disposed at the nearest municipal landfill |
| 15 01 04; 16 02 14; 17 04 07. | Metal packaging materials; Defective, malfunctioning equipment and parts Mixed metals | 10-15 ton | Non-hazardous | Transferred to the contractor or sold as scrap | |
| 15 01 03 | Wood packaging material | 40-50 m ³ | Non-hazardous | Transferred to a local authority for re-use (distributed among kindergartens and schools) | |
| 15 01 01; 15 01 02. | Paper and cardboard packaging material; Plastic packaging material | 30-40 m ³ | Non-hazardous | Transferred to a licensed contractor for re-use | |
| 15 02 03 | Personal protection means and clothes | 3-4 m ³ | Non-hazardous | Transferred to the local cleaning services | Shall be disposed at a landfill |
| Hazardous Construction Waste | | | | | |

| Code | Type | Expected volumes | Waste class | Waste management | Waste operator, organizations and place of disposal or utilization |
|----------------------------------|---|--|-------------|---|--|
| 13 | Waste oils | 2000-3000 litre | Hazardous | Transferred to licensed contractor. | |
| 17 05 03 17 05 05 17 05 07 | Soil and stones containing hazardous chemical substances; Soil, which contain hazardous chemical substances; Roald mangonel, which contains dangerous chemicals | Small amounts | Hazardous | Transferred to a licensed contractor for bioremediation | |
| 15 02 02 | Cloth contaminated with fuel oil/paint | 1-2 m ³ | Hazardous | Transferred to a licensed contractor for further management | |
| 15 02 02 | Adsorbents contaminated, that are used for cleaning of fuel spilled | In case of small spills - 0.1 m ³ ; in case of large spills - see the emergency management plan | | | |
| 16 20 13 | Contaminated malfunctioning construction equipment details | 10-15 m ³ | Hazardous | Transferred to a licensed contractor | |
| 17 04 09 | Metallic wastes that are contaminated with dangerous substances (residual paint cans and brushes); | 10-15 m ³ | Hazardous | Transferred to a licensed contractor | |
| 15 02 03 | Contaminated personal protective equipment and clothing | 8-10 m ³ | Hazardous | Transferred to a licensed contractor | |
| 16 06 01 | Accumulators | 15-20 unit | Hazardous | Transferred to a licensed contractor | |
| Household Waste | | | | | |
| Code | Type | Expected volumes | Waste class | Waste management | Waste operator, organizations and place of disposal or utilization |

| Hazardous Construction Waste | | | | | |
|---|--|-----------------------|-------------------------|--|---|
| Code | Type | Expected volumes | Waste class | Waste management | Waste operator, organizations and place of disposal or utilization |
| 20 01 08 | Kitchen organic waste; | 19 600 m ³ | Non-hazardous | Transferred to a local cleaning service | Landfill disposal |
| 20 01 01; 20 01 02: 20 01 03; | Paper, cardboard; Glass; Small plastic waste | 10 m ³ | Non-hazardous/Hazardous | Transferred to a licensed contractor | Non-hazardous waste shall be placed in landfill. Dangerous (cartridges, malfunctioning equipment) waste is the subject to appropriate management. |
| 20 01 01; 20 01 02: 20 03 99 | Glass bottles; Small plastic bottles; Municipal waste that is not designated to the mentioned category | 20000-25000 unit | Non-hazardous | Transferred to a licensed contractor for further treatment or for re-use | |
| Not regulated by the Waste Management Code of Georgia | Sewage waste | 1400000 litre | Non-hazardous | Will be discharged into the central wastewater | |
| 20 03 03 | Residuals | 200 m ³ | Non-hazardous/Hazardous | Transferred to a local cleaning service organizations | |
| 20 01 21 | Malfunctioning lamps | 50-100 | Hazardous | Transferred to a licensed subcontractor | |
| 20 01 32 | Medications | 0.5 m ³ | Hazardous | Transferred to a licensed subcontractor | |

5. Waste Management Procedures

5.1 General requirements for the safe treatment of waste:

1. An employee who is engaged in the field of waste management (collection, storage, transportation, and acceptance/delivery) must have undergone appropriate training on labor protection and occupational safety issues.
2. The staff shall be provided with special uniforms, footwear and personal protective equipment; if necessary, the personnel clothes are subject to special treatment, especially after performing the hazardous waste-related operations.
3. The staff should be able to render the first aid in case of poisoning or injury during handling waste;
4. A person who has not taken the proper training, has no overalls shall not be allowed to the work; he/she shall not be allowed in case of any sign of illnesses.
5. No placement of waste in excess to the established standards shall be admitted to the waste collection site; it is forbidden to place waste near the source of spark and heat;
6. In case of placement of several kinds of waste together the issue of their compatibility will be taken into account;
7. In the industrial waste accumulation areas it is not allowed to store any foreign objects, personal clothing, overalls, individual protection means; also it is strictly forbidden a food intake.
8. At dealing with industrial waste one has to observe personal hygiene norms, it is necessary to wash hands before eating and after it with soap and warm water;
9. In case of any sign of poisoning, the work must be stopped and the person must apply to the nearest medical center and notify about this to the head of a structural unit;
10. The places for collection of fire-hazardous waste should be equipped with firefighting equipment. In places of this type it is strictly forbidden to smoke or use an open fire.
11. The staff should be aware of the properties of the waste and firefighting rules. Burning liquid or easily inflammable fuels can be extinguished with extinguishers, sand or asbestos fabric;
12. Extinguish of a burning solvent with water is prohibited.

5.2 Procedures and rules for waste management

The present section describes the measures and rules to be observed for waste management purposes (processing and/or before the disposal). Management measures are reviewed in accordance with the following priorities.

Classification of waste

Further management of waste significantly depends on classification of waste at the place of its origin. Segregation of waste in accordance with its types, comply with requirements of its storage and finally, processing / disposal – all the above listed require the relevant classification of waste.

Determination of category of waste, sample taking, verification, testing or laboratory analysis are required for implementation of classification of waste in accordance with the standards of European Union and for ascertaining the following issues :

Category of given waste – hazardous, non-hazardous or category of inert waste ;

The methods for waste disposal.

An individual responsible for waste management for classification of waste will:

Use the temporary inventory list of waste describing the wide spectrum of the types of expected waste ;

In case the given type of the waste is not inserted into the inventory list of the waste, other additional methods will be used for the purposes of classification of waste ;

In case the common methods are not comprehensive for classification of waste, the samples of the waste will be tested through laboratory methods in order to maintain the classification of waste in accordance with the below given table.

Definitions for waste classification

| Classification of waste | Definitions |
|-------------------------|---|
| Inert | waste that does not undergo any significant physical, chemical or biological changes: does not dissolve, burn, or come in any other chemical or physical reaction, biodegrade or affect other material in a manner that will cause environmental pollution or damage to human health; |
| Hazardous | waste with one or more characteristics under Annex III of this Code; |
| Nonhazardous | waste that does not fall under the definition of 'hazardous waste'. |

Making inventory

After classification of waste that has to determine the potential hazardous content of waste, the individual responsible for inventory making, will compose the inventory list including the following information:

Sources and flows of waste;

Description of waste flows and their classification; in particular, whether the given waste is hazardous or not;

Rules for storage of waste, if required;

Methods of disposal of contractors;

Quantitative data of waste – on annual, quarterly or monthly basis, whatever is required.

Inventory records are made by the individuals responsible for waste management annually or during the relevant amendments. The copies of inventory lists of waste should be presented to the leadership of the industry. The above mentioned records can be updated only by the individuals who had attended the special trainings in the field of the use of inventory list.

Primary inventory of waste

Part 1

Information on waste generator

Company:

(name, registration number)

Representative:

(name, position, contact details)

Legal address:

(region, municipality, city, street, phone number, fax, E-mail)

Place of waste generation:

(region, municipality, city, street, phone number, fax, E-mail)

Point of contact at the place of waste generation:

.....

(name, position, contact details)

Brief description of the activities of waste generator

.....

Brief description of waste

Part 2

List of waste originated at object

| Waste code | Name of waste | Hazardous (yes / no) | Hazard characteristics | Operations of placement / restoration | Code of Bazel Convention (Y) |
|------------|---------------|----------------------|------------------------|---------------------------------------|------------------------------|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Correct inventory of waste is necessary for determination of the following issues:

Type of processing is required (if it is required) for the mentioned waste;

Method of disposal of the waste (in particular, need of means of self protection and or any other similar needs);

The methods of storage of such waste (if such is required);

Method of final processing / disposal.

The purpose of inventory making, including the label affixing, is to maintain the delivery of sufficient information and thus to ensure the final secure disposal of waste.

Segregation and collection of waste

Special containers should be placed nearby the district of waste generation.

Segregation of waste at the places of waste generation and its collection in corresponding containers should take place.

After completion of activities the waste is originated and collected at different units and the mentioned is the subject to registration, collection, temporary storage, take out, abatement, processing or placement.

The method of separated collection of household waste should be organized and implemented at the object in accordance with the category and hazard of the waste.

The following is the subject to segregated collection and storage:

Household waste;

Industrial waste take out of which is not prohibited to the polygon of household waste (in particular, paronite, rubber remnants, plastic household object, wooden and paper, timber and sawdust products, polyethylene pipes, remnants of glass-paper and others);

Objects and materials containing the quick-silver;

Lead-containing waste;

Waste of chemical substances;

Lubricated duster clothes, filters of used respirators;

Waste of petroleum products, including the remnants accumulated in sinkers;

Used industrial oils, lubricants;

Materials used during the liquidation activities of accidental leakage of petroleum products;

Polluted soil and sand;

scrap-iron, waste of welding electrodes;

Used rubber hoses, used tyres;

Used waste of lead accumulators;

Waste of dyes and barrels of dyes;


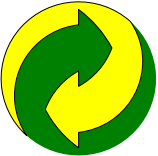






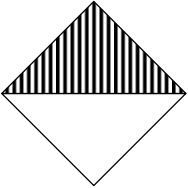

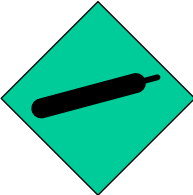





Medical waste.

Label affixing

Individuals responsible for waste management are obliged to maintain the labelling of waste containers in order to enable the determination and detailed description of its content. The above mentioned is required for observation of security measures by foreigner personal during the disposal of the waste. The waste the type of which is not indicated on the label is considered as hazardous waste and is the subject to the above mentioned classification.

Onsite all types of containers (collecting boxes, boxes with rollers, barrels and etc.) should be labelled in order to determine the type of the waste that can be placed in such containers. Old labels should be removed in order to avoid any misunderstanding.

Informational and warning signs

| | | | |
|--|---|---|--|
|  <p>Smoking is prohibited</p> |  <p>Subject to processing</p> |  <p>For household waste</p> |  <p>Inflammable</p> |
|  <p>Dangerously explosive substance and product</p> |  <p>Toxic air and substance</p> |  <p>Easily inflammable air and mixture</p> |  <p>Easily inflammable solid substance</p> |
|  <p>Other hazardous substances and products</p> |  <p>Self-inflammable substance</p> |  <p>Non-toxic air</p> |  <p>Dangerous during the water influence</p> |
|  <p>Danger of infection</p> |  <p>Oxidizer substance</p> |  <p>Corrosive substance</p> |  <p>Radioactive substance</p> |

Waste storage

The waste should remain onsite for a minimum time and it should be taken out as soon as possible for further processing and disposal purposes.

The places intended for waste storage should be inserted on the relevant plan of the site. The following should be excluded during the storage of the waste :

Accidental leakage or outflow, pollution of ground or underground water, break of containers at the result of accidental crush, contact with air during the secondary packing and/or use of covers ;

Corrosion or wear of containers as by environment (through the method of shelter maintenance), so by the waste itself; in this respect the containers durable against the specific type of waste should be selected, in particular, the accumulators of motor vehicles should be placed on anticorrosive plastic plates ;

Theft due to unsafe placement of waste within the frameworks of secured perimeter of object.

Containers of waste should correspond with the size, shape, content and hazard of waste to be stored. Only the containers in good order should be used. The covers of the containers should be in closable condition or another cover should be used. Use of containers that can react upon the content or from where the hazardous substance can be leaked is prohibited.

All hazardous materials should be strictly segregated from other waste. Only type of waste can be placed in one container only. Solid and liquid waste should not be mixed together.

Storage or collection of waste at the territory of plant for a long term is permissible only in following cases :

Waste is used for further technological cycle for the purpose of their complete utilization ;

Due to nonexistence of customer, etc.

Due to physical-chemical and toxicological features of waste and their components their temporary storage is permissible :

At industrial or auxiliary premise (warehouse, store-room) ;

At temporary non-stationary warehouse ;

At opened square.

The places for temporary warehousing of waste at the territory of object is determined during the procedure of inventory making for waste and it should comply the following requirements :

The cover of square should be solid (concrete, asphalt-concrete or concrete tiles) ;

Fencing and stacking should be arranged alongside the whole perimeter of the square in order to avoid the transfer of solid substance into the sewerage system or soil ;

The square should have easy driveways for motor vehicles ;

Effective storage of waste should be arranged in order to protect it from influence of atmospheric precipitates and wind (stalls, placement of waste into packages, containers and etc.) ;

The following conditions should be ensured while the temporary storage of waste at non-stationary warehouses and at square: the possibility of transfer of waste into the sewage or on soil.

Temporary storage of hazardous waste is possible in stationary warehouse. The special warehouse facility should be allocated at the object for the above mentioned purpose and the

mentioned facility should be arranged through observation of the requirements of environmental protection, in particular:

Floor and walls of the facility should be incrustrated by ceramic tiles;

The ceiling should be painted by anti-moisture dye;

The warehouse should be equipped by the following:

Exhausting ventilation system;

Wash-stand and faucet for irrigation – wash of the territory;

S-trap.

Metal lattices should be arranged on doors and windows;

Arrangement of storage racks and shelves is required for waste placement;

Placement of waste is permissible only in case of packing in hermetic containers having the corresponding marking.

Take out of hazardous waste from the territory of plant and its further management should be implemented by the organization having the relevant permit for the above mentioned activity.

Waste transmission

Transmission of waste should be registered by the way of filling the « form on transmission of waste ». In each separate case the following information should be inserted into the above mentioned form:

Date and time of transmission ;

Description of waste indicating the quantity ;

Information on waste producers ;

Information on carrier ;

Information of recipient ;

Signatures of representatives of carrier and recipient.

Completed form of waste transmission should be attached to the way bill from the place or object of waste production to the place of waste disposal, or to the equipment of sewage processing equipment, crematory, landfill or others.

Each form of waste transmission should contain the full description, content, production process, package method of waste, total quantity of transferred waste and other relevant information.

Form on waste transmission should be filled in three copies. Formal procedure of waste transmission is as follows :

Form on waste disposal is signed by authorized individuals and sub-contractor responsible for take out and transportation of waste ;

Upper copy (first copy) is remained and stored at the site ;

Other copies (two copies) are attached to the waste up to the place of their abatement or placement ;

At the point of receipt the carrier is obliged to get the signature of corresponding authorized individual. It also should be mentioned that the waste had been received at the point of destination ;

Afterwards the second copy remains at the place of receipt ;

Third copy is remained at carrier who takes it to the office. For the date of next take out of waste the carrier takes the third copy of the above mentioned form to the place of waste generation ;

Third copy remains at the place of waste generation and is stored together with the first copy of the form ;

The third copy is photocopied at the place of waste generation and together with reporting on fulfilment of obligations it is sent to the unit of environment protection.

Completed forms of waste transmission are stored during the validity term of the contract.

Responsible individual is obliged not to issue the waste and not sign the form on its transmission if he/she has the sufficient ground to consider that the waste could not reach the destination point.

Form on waste transmission

| # | Information on waste generator | Information on waste carrier | Information on waste recipient | Waste content | Generation method / place | Type of package |
|---|--------------------------------|------------------------------|--------------------------------|---------------|---------------------------|-----------------|
| | | | | | | |

| # | Type of waste | Quantity of waste | Duration of waste accumulation | Number and name of the vehicle used for transportation of the waste | Signature of driver | Time of take out of waste from the place of its generation | Time of receipt of waste at the point of destination | Signature of individual – generator of waste | Signature of recipient of the waste |
|---|---------------|-------------------|--------------------------------|---|---------------------|--|--|--|-------------------------------------|
| | | | | | | | | | |

Waste generator organization _____ LS

Waste recipient organization _____ LS

(is filled in three copies, one remains at generator, second – at driver, third - at the recipient of waste. After transportation of the waste the third copy is returned by the driver to the waste generator)

Transportation of waste

Transportation of waste should be accomplished by the observation of safety measures established for transportation of sanitary, environmental and hazardous load. Load/unload of waste and all operations related with its transportation should be mechanized and hermetic at possible extent.

Loss and dissemination of waste during the transportation should be excluded. During the placement of hazardous waste at the temporary warehouse the accompanying individual should possess the corresponding document – “request for takeout of hazardous waste” certified by the leadership of the plant. Carrier of the waste should maintain the transport, loading and transportation of hazardous waste as intended, by the observation of sanitary, environmental and safety measures. Cleaning, washing and abatement of the vehicle should be carried out upon the completion of the operation. The vehicle used for transportation of waste should have the corresponding warning sign.

Waste subject to secondary processing have to be taken outside the territory of plant by the relevant contractor company, on the basis of preliminary concluded agreement.

Household waste is collected at the special containers placed at the territory of plant and take out is accomplished by the Cleaning Municipal Department, on the basis of corresponding agreement and in accordance with drawn up schedule.

Workers employed for transportation (drivers and workers) had to attend the relevant trainings.

The following types of risks are related with load transportation:

Traffic accidents;

Dissemination or leakage of load;

Improper loading of vehicle.

the following is required in order to avoid the above mentioned:

systematic verification of technical condition of the vehicle and observation of movement speed;

Verification of leakproofness of containers;

Tonnage of the vehicle should be envisaged during its loading procedure in order to avoid the overload of the vehicle;

Liquid-proof capacious geomembrane should spread on the body of the vehicle that will maintain the retention of the waste at the body of the vehicle in case of its accidental spill or spread over.

If notwithstanding the above mentioned security measures, at the results of accidental situation the environment was polluted anyway, the driver will immediately contact the leadership of the object and the latter on its behalf should carry out the relevant measures in accordance with the accidental situation response plan by the help of rescue group.

Management monitoring

During collection, storage, transportation, use, abatement and placement of industrial waste the valid ecological, epidemiological and safety technical norms and rules should be observed.

Generation, placement, abatement and take out of waste is registered in the special registry. Quantity of taken out or utilized waste should be documented.

An individual responsible for waste disposal should carry out the systematic control of the following :

Fitness of containers for waste collection ;

Presence of labels of the containers ;

Conditions of the squares intended for temporary placement of waste ;

Quantity of collected waste and its correspondence with established norms (visual control) ;

Observation of periodicity of take out of waste from territory ;

Fulfilment of requirements of ecological safety and security techniques.

Indicators for maintenance of effective management of waste

As it was already mentioned, different types of waste can be originated at the site. Rules established for waste management should be observed in order to maintain the proper management of waste. Take out / placement of the waste should be implemented in accordance with the established order and through observation of norms / rules valid in Georgia.

| | |
|----------------------------|--|
| Potential influence | Pollution or littering of territory due to improper management of waste. |
| Sources | Packing material; Other construction waste; Waste accumulated during the land works; Use and storage of fuel; Repair of equipment; Household waste. |
| Purpose | Maintenance of take out of waste in time and by the established rules; Evasion of loss caused to environment at the result of waste influence. |
| Activity / control | Maintenance of compliance with relevant legislative and regulating requirements; allocation of special place for temporary warehousing of waste at the territory; Dumpling of waste by the observation of relevant legislative requirements; Separation of hazardous and non-hazardous waste; Take out of waste to landfill; Repeated use of waste (if such is possible); Block up of driveways and motor roads should be avoided. |
| Indicator of effectiveness | Non-existence of claims; Non-existence of garbage and waste collected during the technical services; Non-existence of the trace of hazardous waste and leakage (in particular, petroleum, fuel and etc.). |

| | |
|---|---|
| Monitoring | Monitoring the procedures of placement-take out of waste; Regular monitoring of collection-take out of waste; Registration / keeping the relevant records; Registration of records in regard of the claims and response in case of necessity. |
| Corrective activities / reporting | Corrective measures should be taken upon the determination of problem or receipt of a claim; All the irrelevancies / violations of established norms are registered by the leader of the Works; In case of necessity the authorized individual at the square will notify in regard of the occurrence the relevant leader. |
| Responsible individual | Superintendent of works |
| Responsibility for monitoring / execution | Leadership of plant |

Information on waste generated during the exploitation of object

Generation of following categories of waste is expectable during the exploitation period of the object :

Organic waste of kitchen (non-hazardous) – code 20 01 08 ;

Paper, cardboard (non-hazardous) – code 20 01 01 ;

Glass (non-hazardous) – code 20 01 02 ;

Plastic (non-dangerous) – code 20 01 03 ;

Sediment of septic tank (hazardous) – code 20 03 04 ;

Swept waste in streets (due to the specifications of the object the waste can be hazardous, as well as non-hazardous) – code 20 03 03 ;

Medical waste (hazardous) – code 20 01 31 ;

Mixed municipal waste (hazardous) – code 20 03 01 ;

Fluorescent pipes (hazardous) – code 20 01 21.

Quantity of household waste generated at construction stage depends on the number of the service staff. According to the preliminary information approximately 200 individuals will be employed on the object. Pursuant to the obtained norms, at average 0,70 m³ of household waste is generated per employee a year. Considering the above mentioned, the annual quantity of generated household waste should be $0.70 \times 100 = 70 \text{ m}^3$. Placement of closed containers at the object is considered for household waste. Take out and placement of waste and landfill will be carried out by the Cleaning Municipal Department, on the basis of corresponding agreement.

Mass polluted with petroleum product, also other hazardous waste will be temporary placed at the territory of plant by the observation of environmental and hygienic terms and for further processing / placement / abatement, it will be transferred to the organization having the relevant permit for environment influence in accordance with accumulation.

Wooden package material will be transferred to the local population for further utilization purposes.

Management and monitoring of waste generated on site (classification, inventory making, segregation, collection, storage, transfer and transportation) will be carried out in accordance with the principles, procedures and rules given above.

Annex 2

Water resources protection measures in camping

Introduction

In accordance with the Georgian Law on “Permit for influence on environment” (2007) the project on limited permissible lowering (LPL) should be elaborated for the sited subjected to ecological expertise, including the auxiliary objects used for construction of motor roads, as are asphalt-concrete plants, concrete plants and construction camps. Limited permissible lowering (LPL) norms for pollutants of the object of surface waters are determined as the maximum mass of pollutants existed in drainage that can be lowered in given section of water object during the time unit envisaging the retention of its quality. Exact determination of the location of the object, preparation of general plan with indications on all technological nodes and elements on plan, data of generation of pollutions of sources, correct coordinates of lowering into the object of surface water and hydrological data of the surface water itself are required for elaboration of the project for LPL norms.

During implementation of the projects of linear infrastructural systems financed by the international donor organizations the projecting, contracting, procurement and construction are carried out in accordance with the internationally adopted engineering, construction rules and schemes, in particular, pursuant to the so called “Red” and “Yellow” contract forms of FIDIC. In accordance with the “Red” and “Yellow” contract forms of FIDIC the competencies of project implementing organization, projecting organization and construction contractor are dissociated distinctly.

In accordance with the “Red” contract form of FIDIC, the project implementing organization and the projecting organization hired by it are obliged to prepare detailed project documentation of basic projecting object (in this case, road and traffic infrastructure).

As regards the technical project of auxiliary construction object intended for further use of construction contractor, the mentioned issue doesn't fall within the competence of projecting organization and the project of auxiliary construction object is not prepared on the stage of obtaining the relevant permit for construction of basic object. Preparation of the project of auxiliary construction object (construction camp, driveways to construction object, asphalt-concrete plants or concrete plants, etc.) and obtaining the relevant permissions are considered as the obligation of the construction contractor.

In accordance with the “Yellow” contract form of FIDIC (Design and Build, i.e. the contract of projecting and construction), only the basic contract of the main object is prepared by the project implementing organization and the projecting organization hired by it and completion of final detailed project and further construction is the prerogative of the construction contractor.

Thus, in both cases the contract is drawn up with the construction contractor only after the issuance of permit on construction, i.e. the issuance of construction permit and conclusion of ecological expertise and related environmental documentation is issued earlier the preparation of project of construction object by the construction contractor (normative for limited permissible lowering in surface waters, normative for limited permissible diffusion in atmospheric air and etc.). Accordingly, pursuant to the “red” and “Yellow” contract forms of FIDIC, presentation of LPL and LPD normative documents together with document on

evaluation of influence on environment for auxiliary objects is impossible during the organized process. Within the frameworks of evaluation of influence on environment, only the reflection of main principles, qualitative and semi-qualitative evaluation of expected influences and common model situation is possible, whereas the necessity for preparation of LPL and LPD normative documents and exact and detailed evaluation will be mentioned within the evaluation of influence on environment as the obligation of construction contractor. The above mentioned obligation should be accented in the contract concluded between the project implementing organization and construction contractor and within the construction permission it should be mentioned as the license term.

Taking into consideration all the above mentioned, the data, calculations and recommendations given within the evaluation of influence on environment serve for reflection of the scenario of common model situation and presumable influence and not for preparation of final, site-specific evaluation and normative documents.

Presented model describes the aspect of water supply and sewage system for typical construction camps that is provided for placement of approximately 50 workers and construction equipment. The unit for fuel up, technical maintenance and wash of equipment is foreseen at the square for equipment.

Herewith we should underline that the above mentioned corresponds with the worst case scenario as in our case we can suppose that the personnel will be accommodated not in the camp but in rented residencies in roadside villages and countries.

Evaluations and recommendations given within the evaluation of influence on environment, as well as the LPL and LPD to be prepared at the preconstruction period should be based on effective standards and norms.

Traffic Department undertakes the obligation to maintain the implementation of all obligatory environmental documents in regard of construction of construction objects and their exploitation after the contractor maintains the preparation of the relevant projecting documentation for reconstruction and construction project of Batumi-Akhaltzikhe motor road and its presentation to the Ministry of Natural Resources of Georgia.

Water supply and sewage system

Water supply

During the construction phase the quantity of needed drinkable-industrial water will be determined in accordance with the number of the workers. According to the above given model situation the number of the workers should not exceed 50 individuals.

During the working day - 25 litres of drinkable water is foreseen per one worker, thus, the expenditure of drinkable water in accordance with the construction object will be as follows:

Camp of workers 50 individuals

$50 \times 25 \times 365 = 456,25 \text{ m}^3 \text{ per year} : 365 = 1,25 \text{ m}^3 \text{ per day} : 24 = 0,052 \text{ m}^3 \text{ per hour}$

Repair plant for automobile construction equipment (3 employees)

$3 \times 25 \times 250 = 18,75 \text{ m}^3 \text{ per year} : 250 = 0,075 \text{ m}^3 \text{ per day} : 24 = 0,003125 \text{ m}^3 \text{ per hour}$

Drinkable-industrial water should be used in shower and determined volume of washing water per 1 wet corner is envisaged in quantity of 500 l/day (0,5 m³/per day). In the camp 4 showers are envisaged for 53 individuals, i.e. 4X500X365 = 730 m³per year and 2 m³/per day.

total quantity of drinkable-industrial water used during the construction phase will amount to

1204,75 m³/per year = 3,325m³/per day.

Technological water supply

For industrial purposes the water will be used at the construction site at the object of corresponding infrastructure, including the parking lots of automobiles and equipment. During the course of construction works the technical water will be used for washing f automobiles and transport means. The technical water will be obtained from the river Acharistskali or underground water will be used (in case of underground water the relevant license should be obtained).

Technical maintenance of transport means and construction equipment that should be used on construction site will be carried out at the parking lot situated on the territory of construction camp where the car-washing facility will be arranged. 10 units of construction equipment and transport mean can be washed at the camp per day. Volume of the water required for washing of one transport mean amounts to 350 litres. Considering 250 business days per year the volume of water necessary for washing of transport means in construction camps will amount to:

10 units per day

10X350X250 = 875m³/per year, 3,5m³/per day, 0,44 m³/per hour,

Construction phase of industrial fecal and industrial sewage waters

Volume of industrial-fecal sewage water is determined by the quantity of water acceptable and used in accordance with project calculation minus 5% of loss.

In accordance with the above mentioned calculation the expenditure of industrial-fecal sewage water can be seen in the Table #

Volume of lowering of industrial-sewage waters of construction phase

Table 2

| Positio n № | Name of Object | Name of surface water | # of lowering source | Volume of lowering m ³ /24hr | Volume of lowered waver m ³ /year | Note |
|-------------------|--------------------|--------------------------|----------------------------|---|---|------|
| 1 | Constructors' Camp | Riv. Acharistskali | 1 | 3,16 | 1144.5 | |

Maximum hourly expenditure of industrial sewage water envisaging the coefficient of hourly irregularities q_{max}, K- coefficient of hourly irregularities = 3

$$q_{\max} = 3,16 \text{ m}^3/\text{per day} : 24 \times 3 = 0,395 \text{ m}^3/\text{hr}$$

Technological sewage water

Basic industrial sewage waters are generated during the construction works at the time of washing of automobiles and mobile heavy equipment and the YCB-M-20 cleaning installation is envisaged for the above mentioned purposes.

Quantitative data of the industrial sewage water of construction phase

Table #

| Position № | Name of Object | Name of surface water | # of lowering source | Volume of lowering m ³ /24hr | Volume of lowered water m ³ /year | Note |
|------------|--------------------|-----------------------|----------------------|---|--|--------|
| 1 | Constructors' Camp | Riv. Acharistskali | 1 | 0,42 | 3,33 | 831,73 |

YCB-M-20 cleaning installation is recommended for cleaning of petroleum carbohydrate and solid particles of industrial-technological and flow waters. In accordance with the technical documentation the effectiveness of the above mentioned installation amounts to 99,8% and the concentration of petroleum carbohydrate after the cleaning procedure doesn't exceed 0,3 mg/l and concentration of solid particles – 60 mg/l.

The principle of cleaning order of flow and industrial water by the use of regulating volumes (reservoirs) and accumulation of the flow of first 30 minutes, and staging cleaning during 16 hours after completion of 8 hours working day, are envisaged technologically.

The installation of biocycle type is envisaged by the project for cleaning of industrial-fecal waters. According to the catalogue data the above mentioned installation is constructed for different number of customers.

Flow water dumping

In accordance with the project decisions made in regard of the section of the project on water supply and sewage, all industrial squares of the object are equipped with flow water sewage systems and drained water is cleaned in the corresponding cleaning facility together with technological water, at different times of day. In accordance with technical parameters and features of the object the dimensions of drained areas and categories of surface processing slightly differs from each other and therefore the quantitative and qualitative features are also different. Cleaned flow and industrial-technological flow waters will be flown into the river Acharistskali in accordance with the location of the objects.

In accordance with the method materials of international organizations the quantitative features of flow water for less problematic drained industrial squares are calculated by the following formula:

$$Q = 10 \times F \times N \times K \quad (1)$$

Where Q- expenditure of flow waters in specific period of time in m³.

F – drained area in n² or ha.

N – quantity of precipitates mg/year.

Quantity of atmospheric precipitation for the place of object placement in average longstanding regime amounts to 1228 mm, whereas the daily maximum of precipitation amounts to 133 mm.

K – coefficient depended on the type of cover

In accordance with the technological prescription the projecting objects are maintained with different types of covers. Quantitative parameters of flow waters are calculated in accordance with the (1) formula:

Constructors' Camp - $K=0,9$ $F=0,11$ ha

$Q_{\text{average annual}}=10 \times 0,9 \times 0,11 \text{ha} \times 1228 \text{mm} = 1215,72 \text{ m}^3/\text{year}$

$Q_{\text{daily}}=10 \times 0,9 \times 0,11 \text{ha} \times 133 \text{mm} = 131,67 \text{ m}^3/\text{daily}$

Repair workshop for automobiles and mobile heavy equipment

$K=0,9$, $F=0,04$

$Q_{\text{an.}}=501,84 \text{m}^3/\text{year}$

$Q_{\text{daily}}=59,76 \text{m}^3/\text{daily}$

YC-M-20 installation will be used for cleaning of rain water and vehicle washing facility water.

Total expenditure of flow water of cleaning facility: Q_{annual} , Q_{daily} (2) In accordance with the above mentioned and pursuant to the technological regulations, during 8 hours working day the flow waters of automobile washing facility will be cleaned at the cleaning facilities, but in case of rain the flow waters accumulated in reservoirs will be cleaned within the period of 16 hours. In this respect the reports in regard of the water to be cleaned are provided separately.

Thus, maximum expenditure of flow waters to be cleaned amounts to:

1. $Q_1=164,34:24 \times 1 = 6,8475 \text{m}^3/\text{hr}$

2. $Q_2=59,76:24 \times 1 = 2,49 \text{m}^3/\text{hr}$

Cleaning and drain of flow water

Cleaning of industrial-fecal water

Use of cleaning facility of "Biotal" type having the relevant productivity is envisaged by the project for cleaning of industrial-fecal waters. As it was already mentioned above, total biological cleaning of industrial-fecal waters corresponds with the volume of the flow waters calculated in accordance with the objects including the quantitative and qualitative features of its content.

Envisaging the requirements of Georgia, European Union and other international organizations the normative for drain of cleaned water into the surface water are as follows:

For weighted particles (L. P. C.)

$C_{\text{weighted particles}} = 25 \text{ mgl}$

Biological requirement of oxygen – B. R. O. – $C_{\text{B.R.O}} = 25 \text{mm/l}$

Chemical requirement of oxygen – C. R. O. – $C_{C.R.O}$ 25mm/l

Total nitrogen – $C_{total\ nitrogen}$ 15mm/l

Total phosphorus $C_{total\ phosphorus}$ 5mg/l

Method for calculation of limited permissible lowering (emission) norms for separate pollutants

Limited permissible lowering norm for separate pollutant of all categories of water are determined by the following formula:

$$L.P.L. = q C_{L.P.L.}$$

Where q – is the adopted expenditure of drain water in m^3/hr

$C_{L.P.L.}$ – is the concentration of pollutant in drain water in mg/l (gr/m^3)

Determination of permissible concentration of pollutants into the drain water ($C_{L.P.L.}$)

In case the drain water is flown into the section of the surface water that is considered as the protected zone in accordance with the Directive of European Parliament and European Union N 2000/60/EC dated October 23, 2000 on Water Policy, i.e.

Is considered for water intake, for water supply of population;

Is intended for protection of economically important water species;

Is intended for relaxation of population – limited permissible lowering norms are determined for each indicator in accordance with the background concentration within the water object, limited permissible concentration of substances in water and their ability for assimilation.

In mentioned case the concentrations of pollutants $C_{L.P.L.}$ in drain water is calculated in accordance with the dilution made after the flow of the drain water into the water object.

The following formulas are used:

□ in regard of the weighted particles:

$$C_{b.g.b} = p \left(\frac{a \cdot Q}{q} + 1 \right) + C_g \quad (2)$$

Where a – is the coefficient showing the level of dilution and mixture of drain and river waters (coefficient for dilution maintenance).

Q – calculation expenditure in river m^3/sec (ultimate average monthly expenditure with 95% maintenance of average annual richness of the river is obtained).

q – maximum expenditure of drain water in m^3/sec .

P - possible increase of weighted particles in river after the flow of drain water in mg/l , determined under the “rules on protection of surface water from pollution”.

C_B – background concentration of weighted particles in river in mg/l.

□ For biological requirements of oxygen (OBR_{06}):

$$C_{\text{гдг}} = \frac{a \cdot Q(C_t - C_r \cdot 10^{-kt})}{q \cdot 10^{kt}} + \frac{C_t}{10^{-kt}} \quad (3)$$

Where C_t - limited permissible indicator of OBR_{sr} in calculation section after mixing the river water with drain water, given in mg/l.

C_r - is the background index in river in mg/l.

10^{-kt} - is the coefficient determining the speed of rust of organic substances in water object.

□ In regard of other pollutants:

$$C_{\text{в.г.б}} = \frac{a \cdot Q}{q} (C_{\text{г}} - C_{\text{г}}) + C_{\text{г}} \quad (4)$$

Where $CL.P.L$ - is the limited permissible concentration of pollutants in accordance with the category of water object in mg/l.

C_B – is the background concentration of pollutant existed in object in mg/l.

In accordance with the formula of I. Rodziller:

$$a = \frac{1 - \beta}{1 + \frac{Q}{q} \cdot \beta} \quad (5)$$

Where β – is the intermediate coefficient and is determined by the following formula:

$$\beta = e^{-\alpha\sqrt[3]{L}} \quad (6)$$

L – is the distance from the place of drain water up to the calculation section alongside the flow of the river in meters.

α - is the coefficient for hydraulic factors of mixture and is determined through the following formula:

$$\alpha = \ell \cdot i \sqrt[3]{\frac{E}{q}} \quad (7)$$

ℓ – is the coefficient depended on the place of the inflow of drain water in river. In case of inflow at the bank it amounts to 1.0, and in case of inflow into the place of maximum speed – to 1.5.

i – is the coefficient of curvature of the river and amounts to:

$$i = \frac{L_{\text{в}}}{L_{\text{бв}}} \quad (8)$$

$L_{\text{в}}$ - is the distance from the place of inflow of drain water up to the calculation section, towards the flow of the river in meters.

$L_{\text{бв}}$ – shortest distance between the above mentioned two points.

E - is the coefficient of turbulence diffusivity and amounts to: :

$$E = \frac{V_{\text{ave}} H_{\text{ave}}}{200}$$

V_{ave} , H_{ave} – average speed and depth of the river at the calculation section

n – is the multiplicity of dilution of drain waters in river and is determined by the following formula:

$$n = \frac{aQ + q}{q}$$

Where a – is the coefficient for maintenance of dilution.

Q - is the calculation expenditure of river in m^3/sec (ultimate average monthly expenditure with 95% maintenance of average annual richness of the river is obtained).

q – is the expenditure of drain waters in m^3/sec .

In case the background concentration of pollutants in water exceeds the limited permissible concentration determined for surface waters, the norms of LPL are determined on the level of the mentioned limited permissible concentration.

In case the actual number of pollutants flown together with water consumption of drain water is less than calculated LPL, the actual inflow will be considered as the norm for LPL.

Concentration of pollutants during the inflow of drain water within the frameworks of populated points should not exceed the limited permissible concentrations determined for the reservoir of corresponding type. The norms of LPL are determined in accordance with the above mentioned requirements.

Control for observation of LPL norms

Implementation of environmental monitoring is planned for the exploitation process. Monitoring of drain water quality will be carried out by the industrial laboratory.

The analysis of the following ingredients will be made once a month:

- weighted particles;
- petroleum products;
- pH.

The analysis of the following ingredients will be made on a quarterly basis:

- OBR5;
- total phosphorus;
- total nitrogen.

Water consumer is obliged to:

- Keep the initial registration of water consumption in accordance with the established norms;
- Present the correct information in regard of drain waters and its content to the Ministry of Environment of Georgia.
- In case of exceed of the level of permissible lowering of drain waters, simultaneously with the measures carried out for correction of the above mentioned situation, the coordinator of the plant in environmental issues (responsible individual) should immediately notify the Ministry of Environment of Georgia in this regard. The reasons of violation as well as the measures carried out for correction of the referred violation should be mentioned within the above mentioned information. The mentioned should also include the extreme levels of pollution of related water and accidental situations.

Annex 3

Emission of hazardous substances related with construction operations in atmospheric air

During the construction operations carried out in regard of the project the following diffusions are expected into the atmospheric air:

Diffusion of engines of mobile equipment (bulldozers, cranes, excavators, compressors);
Dust due to the earthworks and movement of equipment on ground.

During the functioning of construction machinery (excavator, bulldozer, crane, etc.) the emission of nonorganic dust is calculated in accordance with the (Methodical manual [3]) and emissions related with engine functioning are accomplished in accordance with the (Methodical manual [1]). List of machinery used during the construction process is given below in Table 1. Majority of the machinery is operating on diesel. Effective normative documentation and reference literature are also used for calculation of emission of construction machinery. Calculation of maximum single diffusion and total annual emissions or total emissions of the project is possible on the basis of the tables given within the reference documentation.

List of machinery used during the construction process is given below in Table 1. During the construction process the mentioned machinery makes contribution to diffusion of hazardous substances, especially of dust into the air

Table 1. machinery used during the construction process

| № | Type of equipment and minimal features | Minimum number of necessary equipment |
|---|--|---------------------------------------|
| 1 | Bulldozer with scarifier | 4 |
| 2 | Autograder | 2 |
| 3 | Truck excavator | 1 |
| 4 | Dump truck | 6 |
| 5 | Concrete mixer | 3 |
| 6 | Water cistern with pulveriser | 2 |
| 7 | Crane | 1 |

Emissions related with engine functioning

Maximum single diffusion is calculated in 30 seconds interval when the machinery is working in all possible regimes.

In accordance with the regimes the above mentioned interval includes the following:

Movement of machinery without load (deadheading of excavator, movement for further loading, etc.) is characterized by ($t_{mov.}$);

Movement of machinery in load regime is characterized by time (t_{load});

Idle movement (engine is working without movement of machinery, stop of the point of excavator, etc.) is characterized by time (t_{idle});

Duration of periods depend on specificity of work and type of machinery. The following meanings are generally adopted[2]:

Table 2. Regime intervals

| Name of working intervals | $T_{mov.}$ | $T_{load.}$ | $T_{idle.}$ |
|---------------------------|------------|-------------|-------------|
| Time in minutes | 15 | 11 | 4 |

Single maximum meaning of certain pollutant diffused from the engines of operating machinery is calculated in regard of the evaluation of atmospheric air pollution by the following formula:

$$G_i = \sum[(M_{mov} \times t_{mov}) + 1,3(M_{load} \times t_{load}) + (idle_i \times t_{idle})] / (30 \times 60) \text{ g/sec.}$$

Where:

M_{mov} – and M_{idle} – is the feature of specific emissions of road-construction machinery during the movement and idle regime [1];

$1,3 M_{load}$ – is the feature of specific emissions of road-construction machinery during the load regime, it should be also envisaged that during the increase of the load the fuel expenditure also increases.

Maximum power of the vehicles and machinery used during the construction (listed above) doesn't exceed 100 kW and therefore 61-100 kW is given within the table. Characteristics of special emission of road vehicles in accordance with [1].

Table 3. Specific emission of pollutants during the operation of machinery (g/min)

| Vehicle category | Nominal power of diesel engine, kW | Specific emission of pollutants during the operation of machinery (g/min) | | | | |
|--|------------------------------------|---|-------------|---------------|------|-----------------|
| | | Carbon oxide | Hydrocarbon | Nitrous oxide | soot | Sulfurous oxide |
| 4 | 61↔100 | 1,29 | 0,43 | 2,47 | 0,27 | 0,19 |
| Specific emission of pollutions at the time of idle regime (g/min) | | | | | | |
| 4 | 61↔100 | 2,40 | 0,30 | 0,48 | 0,06 | 0,097 |

On the basis of the above given data the sources of atmospheric pollution were identified, whereas the expected emission is calculated on the basis of effective normative documentation and reference literature.

Single maximum meanings of diffusions:

$$G(\text{CO}) = [(M_{\text{mov}}(\text{CO}) \times t_{\text{mov}}(\text{CO})) + 1,3(M_{\text{load}}(\text{CO}) \times t_{\text{load}}(\text{CO})) + (M_{\text{idle}}(\text{CO}) \times t_{\text{idle}}(\text{CO}))] / (30 \times 60) = (1,29 \times 15) + 1,3(1,29 \times 11) + (2,4 \times 4) / (30 \times 60) = 0.026 \text{ g/sec};$$

$$G(\text{CH}) = [(M_{\text{mov}}(\text{CH}) \times t_{\text{mov}}(\text{CH})) + 1,3(M_{\text{load}}(\text{CH}) \times t_{\text{load}}(\text{CH})) + (M_{\text{idle}}(\text{CH}) \times t_{\text{idle}}(\text{CH}))] / (30 \times 60) = (0,43 \times 15) + 1,3(0,43 \times 11) + (0,3 \times 4) / (30 \times 60) = 0.0076 \text{ g/sec};$$

$$G(\text{soot}) = [(M_{\text{mov}}(\text{soot}) \times t_{\text{mov}}(\text{soot})) + 1,3(M_{\text{load}}(\text{soot}) \times t_{\text{load}}(\text{soot})) + (M_{\text{idle}}(\text{soot}) \times t_{\text{idle}}(\text{soot}))] / (30 \times 60) = (0,27 \times 15) + 1,3(0,27 \times 11) + (0,06 \times 4) / (30 \times 60) = 0.0045 \text{ g/sec};$$

$$G(\text{SO}_2) = [(M_{\text{mov}}(\text{SO}_2) \times t_{\text{mov}}(\text{SO}_2)) + 1,3(M_{\text{load}}(\text{SO}_2) \times t_{\text{load}}(\text{SO}_2)) + (M_{\text{idle}}(\text{SO}_2) \times t_{\text{idle}}(\text{SO}_2))] / (30 \times 60) = (0,19 \times 15) + 1,3(0,19 \times 11) + (0,097 \times 4) / (30 \times 60) = 0.0033 \text{ g/sec};$$

$$G(\text{NO}_x) = [(M_{\text{mov}}(\text{NO}_x) \times t_{\text{mov}}(\text{NO}_x)) + 1,3(M_{\text{load}}(\text{NO}_x) \times t_{\text{load}}(\text{NO}_x)) + (M_{\text{idle}}(\text{NO}_x) \times t_{\text{idle}}(\text{NO}_x))] / (30 \times 60) = (2,47 \times 15) + 1,3(2,47 \times 11) + (0,48 \times 4) / (30 \times 60) = 0.041 \text{ g/sec};$$

(In accordance with the methodical indications and envisaging the coefficient of transformation of nitrous oxide the quantity of nitrous dioxide and oxide is calculated in accordance with the determined coefficients ($\text{NO}_2 = 0,8$; $\text{NO} = 0,13$);

Thus, we will get

$$\text{NO}_2 = 0.041 \times 0,8 = 0,0328 \text{ g/sec}; \text{NO} = 0.041 \times 0,13 = 0,0053 \text{ g/sec};$$

During the above mentioned time the construction machinery should not be used equally.

Approximate load of different construction machinery is given below. Relevant total diffusions throughout the project are calculated accordingly and are given as the annual diffusion.

Coefficient for transfer of annual diffusions:

| Name of object | quantity | Hour per day | Days in total | coefficient |
|----------------|----------|--------------|---------------|-------------|
| auto grader | 2 | 3 | 40 | 0,864 |
| crane 16 t | 1 | 3 | 40 | 0.432 |
| excavator | 1 | 4 | 60 | 0,864 |
| bulldozer | 4 | 5 | 50 | 3,6 |
| Concrete mixer | 3 | 7 | 60 | 4,536 |
| self loader | 6 | 7 | 60 | 9,072 |
| auto cistern | 2 | 7 | 20 | 1,008 |

Table 4. Results of calculations of maximum and total emissions in regard of excavator

| Substance code | Name of substance | Maximum diffusion (g/sec) | Total diffusion (t/year) |
|----------------|--------------------------------------|---------------------------|--------------------------|
| 337 | Carbon Oxide (CO) | 0,0260 | 0,022464 |
| 330 | Sulphuric dioxide (SO ₂) | 0,0033 | 0,0028512 |
| 328 | Soot (C) | 0,0045 | 0,003888 |
| 301 | Nitric Dioxide (NO ₂) | 0,0328 | 0,0283392 |
| 304 | Nitric oxide (NO) | 0,0053 | 0,0045792 |
| 2732 | HHydrocarbon (CH) | 0,0076 | 0,0065664 |

Exploitation of 1 excavator is planned during the construction process and the above mentioned quantity is envisaged for calculation of emission of the whole period $1 \times (3600 \text{sec} \times 240 \text{hr} / 10^6) = 0,864$

Table 5. Results of calculations of maximum and total emissions in regard of bulldozer

| Substance code | Name of substance | Maximum diffusion (g/sec) | Total diffusion (t/year) |
|----------------|--------------------------------------|---------------------------|--------------------------|
| 337 | Carbon Oxide (CO) | 0,0260 | 0,0936 |
| 330 | Sulphuric dioxide (SO ₂) | 0,0033 | 0,01188 |
| 328 | Soot (C) | 0,0045 | 0,0162 |
| 301 | Nitric Dioxide (NO ₂) | 0,0328 | 0,11808 |
| 304 | Nitric oxide (NO) | 0,0053 | 0,01908 |
| 2732 | HHydrocarbon (CH) | 0,0076 | 0,02736 |

Exploitation of 4 bulldozers is planned during the construction process and the above mentioned quantity is envisaged for calculation of emission of the whole period $14 \times (3600\text{sec} \times 250\text{hr}/10^6) = 3,6$

Table 6. Results of calculations of maximum and total emissions in regard of crane

| Substance code | Name of substance | Maximum diffusion (g/sec) | Total diffusion (t/year) |
|----------------|--------------------------------------|---------------------------|--------------------------|
| 337 | Carbon Oxide (CO) | 0,0260 | 0.011232 |
| 330 | Sulphuric dioxide (SO ₂) | 0,0033 | 0.0014256 |
| 328 | Soot (C) | 0,0045 | 0.001944 |
| 301 | Nitric Dioxide (NO ₂) | 0,0328 | 0.0141696 |
| 304 | Nitric oxide (NO) | 0,0053 | 0.0022896 |
| 2732 | HHydrocarbon (CH) | 0,0076 | 0.0032832 |

Exploitation of 1 crane is planned during the construction process and the above mentioned quantity is envisaged for calculation of emission of the whole period $1 \times (3600\text{sec} \times 120\text{hr}/10^6) = 0,432$

Table 7. Results of calculations of maximum and total emissions in regard of selfloader (coefficient 9,072)

| Substance code | Name of substance | Maximum diffusion (g/sec) | Total diffusion (t/year) |
|----------------|--------------------------------------|---------------------------|--------------------------|
| 337 | Carbon Oxide (CO) | 0,0260 | 0,235872 |
| 330 | Sulphuric dioxide (SO ₂) | 0,0033 | 0,0299376 |
| 328 | Soot (C) | 0,0045 | 0,040824 |
| 301 | Nitric Dioxide (NO ₂) | 0,0328 | 0,2975616 |
| 304 | Nitric oxide (NO) | 0,0053 | 0,0480816 |
| 2732 | Hydrocarbon (CH) | 0,0076 | 0,0689472 |

Exploitation of 6 self loaders is planned during the construction process and the above mentioned quantity is envisaged for calculation of emission of the whole period $6 \times (3600\text{sec} \times 420\text{hr}/10^6) = 9.072$

Table 8. Results of calculations of maximum and total emissions in regard of auto cistern (coefficient 1,008)

| Substance code | Name of substance | Maximum diffusion (g/sec) | Total diffusion (t/year) |
|----------------|--------------------------------------|---------------------------|--------------------------|
| 337 | Carbon Oxide (CO) | 0,0260 | 0.026208 |
| 330 | Sulphuric dioxide (SO ₂) | 0,0033 | 0.0033264 |
| 328 | Soot (C) | 0,0045 | 0.004536 |
| 301 | Nitric Dioxide (NO ₂) | 0,0328 | 0.0330624 |
| 304 | Nitric oxide (NO) | 0,0053 | 0.0053424 |
| 2732 | Hydrocarbon (CH) | 0,0076 | 0.0076608 |

Exploitation of 2 auto cisterns is planned during the construction process and the above mentioned quantity is envisaged for calculation of emission of the whole period $2 \times (3600\text{sec} \times 140\text{hr}/10^6) = 1,008$

Table 9. Results of calculations of maximum and total emissions in regard of autograder (coefficient 0,864)

| Substance code | Name of substance | Maximum diffusion (g/sec) | Total diffusion (t/year) |
|----------------|--------------------------------------|---------------------------|--------------------------|
| 337 | Carbon Oxide (CO) | 0,0260 | 0,022464 |
| 330 | Sulphuric dioxide (SO ₂) | 0,0033 | 0,0028512 |
| 328 | Soot (C) | 0,0045 | 0,003888 |
| 301 | Nitric Dioxide (NO ₂) | 0,0328 | 0,0283392 |
| 304 | Nitric oxide (NO) | 0,0053 | 0,0045792 |
| 2732 | Hydrocarbon (CH) | 0,0076 | 0,0065664 |

Exploitation of 2 auto graders is planned during the construction process and the above mentioned quantity is envisaged for calculation of emission of the whole period $2 \times (3600\text{sec} \times 120\text{hr}/10^6) = 0,864$

Table 10. Results of calculations of maximum and total emissions in regard of concrete mixer (4,536)

| Substance code | Name of substance | Maximum diffusion (g/sec) | Total diffusion (t/year) |
|----------------|--------------------------------------|---------------------------|--------------------------|
| 337 | Carbon Oxide (CO) | 0,0260 | 0,117936 |
| 330 | Sulphuric dioxide (SO ₂) | 0,0033 | 0,0149688 |
| 328 | Soot (C) | 0,0045 | 0,020412 |
| 301 | Nitric Dioxide (NO ₂) | 0,0328 | 0,1487808 |
| 304 | Nitric oxide (NO) | 0,0053 | 0,0240408 |
| 2732 | Hydrocarbon (CH) | 0,0076 | 0,0344736 |

Exploitation of 3 concrete mixers is planned during the construction process and the above mentioned quantity is envisaged for calculation of emission of the whole period $3 \times (3600\text{sec} \times 420\text{hr}/10^6) = 4,536$

Emissions of nonorganic dust during the operation of construction equipment

Excavator on the basis of tractor – volume of bagger 0,5 m³, width of excavation – 4,25 m, activity radius – 5,3 m, time of working cycle – 30 sec, engine power – 50 kW (68 horse power).

Evaluation of nonorganic dust during the excavation works

Calculation formula, initial data

Type of machinery : excavator with one bagger

Hardness of rock : rock f=2

Total diffusion of dust during the operation of the excavator with one bagger is determined by the following formula :

$$M = Q_{ex} \times (3,6 \times E \times K_{ex} / T_{ec}) \times T \times N_r \times K_1 \times K_2 \times 10^{-3} \times N); \text{ t/year};$$

Where :

Q_{ex} = is the specific emission of dust from 1m³ overloaded material, g/m³ (3,1);

E – is the volue of the bagger (m³ 0,5)

K_{ex} = 0,6 (direct bagger – rock with hardness 2,7 t/m³)

T_{ec} – is the time of excavator cycle, sec. (30)

K_1 = 1.20 – coefficient envisaging the wind speed (2,1 – 5 m/sec)

K_2 = 1,0 coefficient envisaging the humidity of material (humidity: 5,1-7,0%);

T = 4 hours, net time of operation per day;

N_r = 60– number of business days per year (in projecting terms)

N = 1 – number of simultaneously working machinery

by the inclusion of the above mentioned data we will have the following result:

$$M = 3,1 \times (3,6 \times 0,5 \times 0,6 / 30) \times 4 \times 60 \times 1,2 \times 1,0 \times 10^{-3} \times 1 = 0,0321408 \text{ t/year};$$

Maximum single diffusion of dust during the operation of the excavator with one bagger is determined by the following formula :

$$G = Q_{ex} \times E \times K_{ex} \times K_1 \times K_2 \times N / T_{ec}, \text{ g/sec}$$

by the inclusion of the above mentioned data we will have the following result:

$$G = 3,1 \times 0,5 \times 0,6 \times 1,2 \times 1,0 \times 1 / 30 = 0,037 \text{ g/sec}$$

Bulldozer works

Calculation formula, initial data

Type of machinery : bulldozer with power ≤100kW;

Hardness of rock : rock f=2

Total diffusion of nonorganic dust during the operation of the bulldozer is determined by the following formula :

$$M = Q_{bul} \times (3,6 \times G_m \times V \times T \times N_r \times 10^{-3} \times K_1 \times K_2 \times N) / (T_{bc} \times K_p), \text{ t/year};$$

Where :

Q_{bul} – is the specific emission of dust from 1t of material to be transported, g/t (0.66)

G_m – hardness of the rock t/m³ (2.70)

V – volume of movement prism (m³) (2);

T_{bc} – time of bulldozer cycle, sec (80)

K_p – 1,5 hardness of rock (hardness of rock 2.70 t/m³)

K_1 = 1.2 – coefficient depended on wind (2.5 m/sec)

K_2 = 1.0 – coefficient depended on humidity of material (5,1-7%)

T = 5 hours, net time of operation per day

N_r = 50 - number of business days per year

$N = 4$ – number of simultaneously working machinery

by the inclusion of the above mentioned data we will have the following result:

$$M = 0,66 \times (3,6 \times 2,7 \times 2 \times 5 \times 50 \times 10^{-3} \times 1,2 \times 1,0 \times 4) / 80 \times 1,5 = 0,128304 \text{ t/year}$$

Maximum single diffusion of dust during the operation of the bulldozer is determined by the following formula :

$$G = (Q_{bul} \times G_m \times V \times K_1 \times K_2 \times N) / (T_{bc} \times K_p);$$

by the inclusion of the above mentioned data we will have the following result:

$$G = (0,66 \times 2,7 \times 2 \times 1,2 \times 1,0 \times 4) / (80 \times 1,5) = 0,14 \text{ g/sec};$$

Table 11. total emissions during the exploitation of all construction machinery

| Name of source | Substance | Code | Emission t/year |
|---|-------------------|------|-----------------|
| 1 | 2 | 3 | 4 |
| 4 bulldozers, 1 excavator, 6 autoloading, 2 water cisterns with diffuser 2 auto graders and 1 crane 3 concrete mixers | Nonorganic dust | 2902 | 0,1604448 |
| | Nitric Dioxide | 301 | 0,6683328 |
| | Nitric oxide | 304 | 0,1079928 |
| | Soot | 328 | 0,091692 |
| | Sulphuric dioxide | 330 | 0,0672408 |
| | Carbon Oxide | 337 | 0,529776 |
| | hydrocarbons | 2732 | 0,1548576 |

The intensity of the above mentioned total data and maximum single diffusions of emissions can not influence the population.

References:

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“Методика расчёта выделений (выбросов) загрязняющих веществ в атмосферу при сварочных работах (на основе удельных показателей)”. НИИ АТМОСФЕРА, Санкт-Петербург, 1997 год. ("Methods of Calculating of Discharging (Emissions) Pollutants into the Atmosphere during Welding (on the basis of specific indicators).” SRI Atmosphere, St. Petersburg, 1997).

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Annex 4

Response plan in case of emergency situations

Construction of road of interstate importance, Zarzma-Goderdzi section of Batumi (Angisa) – Akhaltsikhe motor road (lot 2)

Abbreviations and contractions

| | |
|-----|--------------------------------------|
| CC | Construction contractor / contractor |
| EIA | Environmental influence assessment |
| EMP | Environmental management plan |
| ERP | Emergency response plan |
| GoG | Government of Georgia |
| RoW | Row of alienation |
| SC | Supervisor consultant / engineer |

1. Review of possible scenario of emergency situations

Geologic risks

Project is implemented by the appreciation of 7 scored seismic zones and it corresponds with seismic risks.

Projecting road crosses 10 landslide sections and downpour ravines. Bridges and culverts are arranged through appreciation of expenditures and mass of sediments of rivers.

For mitigation of landslide processes the arrangement of drainage systems at all landslide section is envisaged by the project in order to remove the surface waters and carry out the anti-erosive activities (affixing of slopes by the use of geotextile and berms).

Construction works of high risk

No explosion works, use of toxic or radioactive substances or any other risky activities are envisaged by the project.

Construction works of average and low risk

Construction works of low risks that can cause the emergency situation (1 stage, in accordance with the 3 staged system of international classification⁴) is mainly related with spill of fuel and risk of environmental pollution (mainly, surface water, ground waters and soil).

⁴ Incident of 1st stage: situation of local importance that can be regulated through the resources of the operator company. Incident of 2nd stage – emergency situation, for regulation of such emergency situation together with the resources of operating company the resources of the local administration should also be included. Incident of 3rd stage – emergency situation of national and international importance and utilization of national and international resources will be required for correction of such situation,

Low influence is expected from the fuel up areas for machinery and automobile park of construction camps as in such cases the fuel tanks have small size and no relevant leakage of pollutants is expected.

Incidents having average and low risks can be related with exploitation of construction camp :

Incidents having average risks can be related with spill of fuel or fire at the areas of technical maintenance or repair of machinery in construction camps.

Incidents having low risks – leakage of fuel from damaged machinery at the construction sites.

2. Measures for prevention and response to emergency situations

2.1 Measures for preventing the possible pollution during the construction works and response in case of pollution:

Preventive measures:

Contractors are obliged to ensure the correct use of lubricant materials, fuel and solvents. Placement of the cisterns of lubricant materials and fuel at distance of 50 meters or less from pounds, wells and river-bed is prohibited. In case of existence of stationery cisterns all the cisterns should be placed on the concrete base (in the reservoir built by the concrete or fenced cistern). The volume of such cistern is at minimum 110% of the cistern. In case of placement of more than one cistern in the protective cistern the volume of the system should amount to 110% of the volume of smallest cistern or 25% of their volume, whichever is greater. Protective reservoir should be waterproof, it should not have drainage pipes or defects violating its leakproofness. Rain water accumulated in such fenced area (reservoir) will be pumped out and flown in external drainage system or on ground, if the latter is not polluted. In case of spill of petroleum the spilled fuel should be collected and polluted area should be processed by the use of sorbents: sawdust, sand and straw. all attachments of fuel dosage (filling) should be checked against leakage and should be continuously controlled; their design should have the possibility of lock when it is not used. Storage of fuel or fuel up of a transport mean or equipment at the distance of less than 50 meters from pound, river, channel, well or ravine is inadmissible. Leaving of transport mean inattentively during the fuel up procedure is inadmissible.

During the fuel up of the transport mean at the construction site the use of absorbent (suction) insertions and/or straw is important in order to decrease the possibility of spill of the fuel on ground to maximum extent. The above mentioned insertions or straw will be laid on the ground before the fuel up of the transport mean or machinery. Immediate removal of polluted ground layer will decrease or evade the risk of pollution of ground waters and surface waters. In case of spill (leakage) of considerable amount of fuel the responsible individual should be immediately notified and the relevant activities should be ceased till the eradication of pollution risk. During the fuel up of a transport mean or machinery the use of special applications (i.e. attachment of relevant size) is obligatory. Mentioned work should be carried out only by the trained personnel (operators). Systematic verification of the equipment of fuel up is required in order to avoid the leakage caused by the damaged equipment of fuel up. Equipment and storage rooms should be isolated and protected in order to prevent the theft and vandalism. All mobile equipment, including cranes,

compressors, generators, bulldozers, excavators and others and storage cisterns should be used during the work and repaired in case of necessity so that to decrease the possibility of spill-leakage of materials to minimum. Annual verification of the equipment is necessary (procedure of technical service of transport mean) in order to prevent the danger of spill-leakage of materials. Removal of lubricants, cleaning, repair and other works of technical services of transport means should be carried out on solid (stable) ground and not on the earth embankment. Arrangement of repair workshop of transport means and equipment at the distance of less than 50 meters from pond, river, channel, well or ravine is inadmissible. Storage of potentially hazardous materials or fuel up of a mobile equipment or conduction of repair works of transport means at the distance no less than 50 meters from pond, river, channel, well, ravine, boggy or wetland territory is inadmissible.

In case of observation of all the above mentioned terms the possibility (and accordingly the risks) of the risk of second stage is significantly decreased.

2.2. Response measures of leakage:

Response measures on leakage of the pollutants imply the depressant operation for pollution diffusion and operations of site cleaning and disposal of polluted waste.

Construction contractor will be equipped by the depressant mean intended for spilled substance:

Absorbent pillows

Sand bags

Stacks of hay or straw

Machinery for arrangement of earth embankment
and so on

Construction contractor will be equipped by the mean intended for cleaning of spilled substance:

Absorbent pillows

Pumps and skimmers

Auto cisterns to which the spilled substance can be pumped

Construction machinery: bulldozers, excavators

2.3. Fire prevention and response measures

Envisaging the facilities and fuel reservoirs of the enterprise, fire preventing water system with 210 m³ faucet, conventional reservoir of clean water and foamgenerator equipment are provided within the project. Projecting expenditure of fire preventing water amounts to 0,27 m³/hr. Concentrations of expected pollution of fire preventing water and results of its cleaning are conformable with the requirements of sewage system.

In addition, 3 standard fire fighting stands will be arranged at the section of transformers and control building of fleet of camp and filling station area. Fire extinguisher, the box with sand and water bucket will be provided at the above mentioned stands.

Facilities should conform with the requirements of fire security and be equipped with relevant fire fighting equipment.

Corresponding standards and norms

ILO OSH 2001 guidelines;

Безопасность труда и охрана здоровья в строительстве. Руководство МОТ Женева, Международное бюро труда, 1992

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STATE STANDARD 12.3.046-91

STATE STANDARD 12.1.018-93 (1996)

STATE STANDARD 12.4.009-83 (1996)

STANDARD OPERATING PROCEDURES ON PROTECTION OF WORKERS -
BATTERY TECHNICIANS- 66-21-95

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STATE STANDARD 12.3.003-86 (2000)

STANDARD OPERATING PROCEDURES ON PROTECTION OF WORKERS -
BATTERY TECHNICIANS-66-20-93*

STATE STANDARD 12.3.036-84 (2001)

STANDARD OPERATING PROCEDURES ON PROTECTION OF WORKERS -
BATTERY TECHNICIANS- 66-06-93 (с изм. 1 1995)

Actions to be taken in case of fire

In case of fire setting or observation of fire signs each employee is obliged to:

Notify the fire guard in this regard by the use of mobile or fixed phone, also to provide it with the information on address of fire setting and his family name;
Take all appropriate measures for evacuation of people and extinguish the fire.

Heads of enterprises and authorised individuals are obliged to:

Notify the fire guard, leadership of the object and duty groups in regard of the fire;
In case the life of people is endangered to take all appropriate measures for their rescue;
Switch off the electricity (except the fire fighting systems) and switch off the ventilation systems at emergency and adjacent rooms;
Stop all works at the object except the works related with fire fighting activities;
Evacuate the personnel not involved in fire fighting activities to the safe distance;
Guide the fire fighting activities till arrival of detachment of firemen;
Maintain the observation of security measures by the personnel involved in fire fighting activities;
Ensure the protection of material valuables and evacuation together with firefighting activities;
Meet the detachment of firemen and show them the nearest way to the body of fire;
Provide the firemen with the information in regard of motor vehicles, explosive and inflammable hazardous substances existed at the territory of enterprise as it is necessary for safe work of fire-fighters.

3 Structure of response to emergency situation:

Implementation of preventive measures is supported by the existence of effective environmental management system within the structure of construction contractor and system of effective supervision within the structure of the Department of Motor Roads.

Department of Motor Roads will carry out the supervision :

through hired supervisory company

there is the Service of Environment Protection and Accommodation of the Department of Motor Roads

Construction contractor and management structure should include :

Project manager

Specialist of environmental protection and social protection

Specialist of security and labour protection

3.1 Functions and obligations with the frameworks of responses to fuel leakage:

Project manager

Project manager should have the initial obligation for fulfilment of response plan. He/she is also obliged to notify the observer-consultant in regard of any emergency situation that can be generated during the course of rehabilitation works.

Manager of environmental protection and social protection

Manager of environmental protection and social protection is the main point of contact in case of emergency situation. He/she is obliged to carry out the responsive procedure to leakage, cleaning activities, also segregation of waste and its take out if necessary.

Personnel of construction contractor

Personnel of construction contractor is obliged to notify the authorized individuals in case of emergency situation generated during the course of the rehabilitation activities.

Contractor responsible for emergency situations

Construction contractor may have the sub-contractor who will be responsible for response to emergency situations.

Due to construction scale, all potential incidents reviewed within the present document require the response of 1st stage and it is conformable with qualification of personnel and existed means of the working place.

In case of great scale spill requiring additional external resources and work force, the construction contractor will hire the contractor having the corresponding experience, but probability of necessity for such contractor is quite low.

Response level and additional needs are as follows:

Supervisor of work area will make the initial review of work area:

| Row | Review of work area | Action |
|-------|---|---|
| Row 1 | Should be settled locally | Stop of spill sources Localization of spilled fuel Notification to the Service of Environmental Protection and Accommodation Notification to the supervisor - consultant |
| Row 2 | Additional resourced are required | Stop of spill sources Localization of spilled fuel Notification to the Service of Environmental Protection and Accommodation Notification to the supervisor - consultant Notification to the regional / district agencies |
| Row3 | Requires support of regional and central agencies | Stop of spill sources Localization of spilled fuel Notification to the Service of Environmental Protection and Accommodation Notification to the supervisor – consultant |

| | | |
|--|--|---|
| | | Notification of the Agency (Department) of Emergency Situations of the Ministry of Internal Affairs of Georgia and involvement into the response measures in case of necessity. |
|--|--|---|

Equipment necessary for response to spill:

Auto cistern - 1

Absorbent pillows (2 set per one construction site and – sets for fleet and 10-10 sets for the territory of asphalt-concrete plant)

Sand bags (nearby the surface waters)

Pump (skimmers) for collection of spilled fuel – 1

Fire extinguisher means (per working area)

Empty bags for package of polluted absorbents and materials

Preliminarily selected area nearby the camp for temporary placement of polluted materials

3.2 Measures intended for prevention of possible pollution during the operation of motor road and reaction to spill:

3.2.1. Preventive measures:

In general one could say that transportation of toxic substances and hazardous waste is regulated by the legislation and relevant normative acts. Normative acts need the further improvement but enhancement of the mechanisms of control is more important.

As regard the specific project, conduction of preventive measures is required : nearby the river Supsa where the system of meliorative channels (km 51,000 – 51,750) is also intensive. Installation of cleaning system is also envisaged by the project : avoidance of water from roadway is accomplished through arrangement of drainage system and water accumulated from the above mentioned system is flown into the cleaning tanks envisaged at the both sides of roadbed foreseen for cleaning of the flow from petroleum by the mechanical method (3rd stage), afterwards, finally cleaned water is flown into the relief.

3.3. Functions and obligations in case of fire setting (the occasion of substation is implied but the scheme is also actual for the situation of construction camps)

In case of fire setting or observation of fire signs all employees are obliged to:

Notify the fire guard in this regard by the use of mobile or fixed phone, also to provide it with the information on address of fire setting and his family name;
Take all appropriate measures for evacuation of people and extinguish the fire.

Heads of enterprises and authorised individuals are obliged to:

Notify the fire guard, leadership of the object and duty groups in regard of the fire;
In case the life of people is endangered to take all appropriate measures for their rescue;
Switch off the electricity (except the fire fighting systems) and switch off the ventilation systems at emergency and adjacent rooms;
Stop all works at the object except the works related with fire fighting activities;
Evacuate the personnel not involved in fire fighting activities to the safe distance;
Guide the fire fighting activities till arrival of detachment of firemen;
Maintain the observation of security measures by the personnel involved in fire fighting activities;
Ensure the protection of material valuables and evacuation together with fire fighting activities;
Meet the detachment of firemen and show them the nearest way to the body of fire;
Provide the firemen with the information in regard of motor vehicles, explosive and inflammable hazardous substances existed at the territory of enterprise as it is necessary for safe work of fire-fighters.

4. Response to incident

Personnel (of construction company) is obliged to evade the occurrences of pollution and in case of origination of such incident to take all appropriate measures.

Procedure of incident response is summarized as follows:

Cessation of spill

Localization of leaked liquid

Notification to relevant agencies (Agency of Management of Emergency Situations of the Ministry of Internal Affairs of Georgia)

Localization of the source of pollution, cessation of leakage and evasion of further spill should be made immediately.

Cover the leaked liquid with absorbent material in order to evade its distribution.

Notify the Department of Safety, Environment, Social Protection and Health Care in regard of the incident and forward the written internal document. Used absorbent material should be disposed as the hazardous waste.

5. Notification in regard of incident

Personnel of construction contractor and sub-contractors will be strictly warned in regard of the evasion of pollution, spill and response situations during the review of emergency situations.

Personnel involved into the project are obliged to evade the pollution and is authorized to take urgent measures and carry out effective activities in order to prevent such incidents.

First stages of response measures are:

Cessation of spill

Localization of leaked liquid

Notification to relevant bodies

In case of accident, leakage and pollution, warning of people by the phone is necessary:

Manager of environment and social protection

Manager of health care and safety

Project manager

Manager of environment and social protection or project manager will notify the supervisor consultant in this regard and in accordance with the nature and scale of the incident will make decision about the necessity of additional support.

In case of significant incidents the manager of environment and social protection will notify the regulating individuals, land owners and local administration (regional agencies responsible for emergency situations) and also interested groups.

After effective prevention of the incident the meeting will be held:

reason of incident

types of implemented activities and procedures

Necessary type of improvement

Type of activities to be implemented, date of implementation and responsible individual.

6. Training

Testing of response to emergency situations should be implemented periodically and improvement should be made in accordance with the experience. The records will be recorded in the office of the contractor.

7. Financial statement

Employed personnel is responsible for registration of information in regard of the spill (scale of the leakage has no importance). Official record should be presented to the supervisor-contractor by the use of the form of report (for additional details please see the healthcare and security plan).

In case of emergency please contact:

Project manager –

Manager of environment and social protection –
Manager of healthcare and safety –
Fire – rescue service – 112
Police – 122
emergency ambulance – 113
Service of emergency situations - 112