Adjaristskali Georgia LLC

Project on Relocation of Batumi (Angisa) - Akhaltsikhe Intrastate Highway Section on Khulo Municipality

Environmental Impact Assessment Report

(Draft version)

Executor

Ltd Gamma Consulting

Director V. Gvakharia

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1 Introduction

1.1 General Overview

This document is the Environmental Impact Assessment (EIA) report prepared for the project on relocation of Batumi (Angisa) - Akhaltsikhe intrastate highway section on Khulo Municipality (including the bridge on Ghorjomi River). The length of the section under reconstruction is 1.2 km, including: length of the proposed bridge is 144 m, length of the first section of the proposed road (on the right side of Ghorjomi River bridge) is 600 m, while the length of the second section of the road (left side of Ghorjomi River bridge) is 450 m.

This section of the road needs to be relocated due to on-going construction works of Shuakhevi HPP. In particular: Existing road and Ghorjomi River Bridge are likely to be flooded by Didadjara dam of Shuakhevi HPP. Therefore, relocation of this section at a higher elevation and construction of a new bridge is required. According to the requirements of ecological expertise conclusion for Shuakhevi HPP project, issued by the Ministry of Environment and Natural Resources Protection of Georgia, implementing company (LLC "Adjaristskali Georgia") is obliged to prepare environmental impact assessment on relocation of the road.

The Environmental Impact Assessment (EIA) report was prepared by Ltd Gamma Consulting, ordered by Adjaristskali Georgia LLC.

The contact information of the client and the consulting company is provided in Table 1.1.1.

Table 1.1.1.

Executor Company	Adjaristskali Georgia LLC
Legal address of the company	Irakli Abashidze Street N6, Batumi, Georgia
Address of the project area	Khulo Municipality, Autonomous Republic of Adjara
Type of the activity	Relocation (reconstruction) of 1.2 km long section of the intrastate road (including the bridge)
Contact information of Adjaristskali Georgia LLC	
E-mail	nino.gagua@agl.com.ge
Contact person	Nino Gagua
Contact phone number	555 95 95 10
Consulting company	Ltd Gamma Consulting

Director of Ltd gamma Consulting	Vakhtang Gvakharia
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1.2 Basis for Preparation of EIA Report

The basis for preparation of EIA report is the Law of Georgia on Environmental Permit. Under the Article 4, Paragraph 1, subparagraph "j" of the Law, "construction of international and intrastate highways and railways, and bridges and underway crossings over them, as well as structures for engineering protection of highways, railways and their territories is subject to ecological examination." Under the second clause of the same Law, "construction related to the types of activities defined in paragraph 1 of this article, or replacement of current production technology with a different technology resulting in a change of operation conditions shall also be considered to be an activity subject to ecological examination."

Given that the design road and Ghorjomi Bridge are of intrastate importance, its relocation should be implemented in accordance with the requirements of ecological examination conclusion.

The ecological expertise conclusion is issued by the Ministry of Environment and Natural Resources Protection of Georgia on the basis of ecological expertise conclusion of Environmental Impact Assessment (EIA) Report.

1.3 Objectives of EIA Report

During the preparation of the report, scoping procedure has been conducted in order to determine the issues to be considered in the environmental impact assessment process. Parameters of the project that are important in environmental terms have been established. In particular, major environmental issues to be considered during the survey have been determined.

Based on the above mentioned, a group of specialists of Gamma Consulting Ltd has studied the following issues: project on the relocation of the road, environmental and social baseline characteristics of its corridor and adjacent areas, potential sources of environmental impact (during the reconstruction-construction and operation phases), types and targets of these sources, scale of the impact. Environmental Impact Assessment report has been prepared on the basis of obtained information and in accordance with the requirements of Georgian Legislation.

The report includes the description of sources and types of potential impact on environment and human health, impacts of potential, qualitative and quantitative characterization of these impacts and preventive measures. In addition, relevant legal aspects and environmental baseline conditions of the project area are described and conclusions and recommendations are provided.

2 Legislative Framework

Georgian legislation comprises the Constitution, environmental laws, international agreements, subordinate legislation, normative acts, presidential orders and governmental decrees, ministerial orders, instructions and regulations. Georgia is signatory to a number of international, including environmental conventions.

2.1 Environmental Legislation of Georgia

The following environmental laws of Georgia should be considered during the environmental impact assessment process (see Table 2.1.1.)

Table 2.1.1. List of Environmental Laws of Georgia

Year	Law	Registration code	Amended
1994	Law of Georgia on Soil Protection	370.010.000.05.001.000.080	14/06/2011
1994	Law of Georgia on Roads	310.090.000.05.001.000.089	24/12/2013
1995	Constitution of Georgia	010.010.000.01.001.000.116	04/10/2013
1996	Law of Georgia on Protected Areas	360.050.000.05.001.000.127	27/09/2013
1996	Law of Georgia on Environmental Protection	360.000.000.05.001.000.184	06/09/2013
1996	Law on Georgia Mineral Resources	380.000.000.05.001.000.140	21/03/2014
1997	Law of Georgia on Wildlife	410.000.000.05.001.000.186	06/09/2013
1997	Law of Georgia on Water	400.000.000.05.001.000.253	06/09/2013
1999	Law of Georgia on Protection of Atmospheric Air	420.000.000.05.001.000.595	05/02/2014
1999	Law of Georgia on Compensation for Harm Caused by Hazardous Substances	040.160.050.05.001.000.671	06/06/2003
2003	Law of Georgia on Red List and Red Book of Georgia	360.060.000.05.001.001.297	06/09/2013
2003	Law of Georgia on the Conservation of Soils and Restoration and Improvement of Their Fertility	370.010.000.05.001.001.274	19/04/2013
2005	Law of Georgia on Licenses and Permits	300.310.000.05.001.001.914	20/02/2014
2006	Law of Georgia on Regulation and Engineering Protection of the Seashores, Reservoirs and River Banks	330.130.000.11.116.005.130	27/12/2006
2007	Law of Georgia on Ecological Examination	360.130.000.05.001.003.079	25/03/2013
2007	Law of Georgia on Environmental Permit	360.160.000.05.001.003.078	06/02/2014
2007	Law of Georgia on Public Health	470.000.000.05.001.002.920	13/12/2013
2007	Law of Georgia on Cultural Heritage	450.030.000.05.001.002.815	25/09/2013
2007	Law of Georgia on Recognition of Property Rights of the Parcels of Land Possessed (Used) by Natural Persons and Legal Entities	370.060.000.05.001.003.003	20/09/2013
2014	Waste Management Code of Georgia	360160000.05.001.017608	12/01/2015

2.2 Environmental Standards of Georgia

The following environmental standards have been used in the process of evaluating the quality of environmental objects (soil, water, air). (See Table 2.2.).

Table 2.2. List of Environmental Standards

Year	Name of Normative Document	Registration code
31/12/2013	Technical Regulation – "Protection of Surface Water Contamination", approved by the decree №425 of the Government of Georgia.	300160070.10.003.017650
03/01/2014	Technical Regulation - "The unfavourable weather conditions for Protection of Environment", approved by the decree №8 of the Government of Georgia.	300160070.10.003.017603
06/01/2014	Technical Regulation - "Method for inventory of Stationary Sources of Air Pollution", approved by the decree №42 of the Government of Georgia.	300160070.10.003.017588
31/12/2013	Technical Regulation – "determination of index values of air contamination for extremely contaminated, highly contaminated, contaminated and not contaminated regions according to the calculated index values and levels of air contamination with pollutants", approved by the Decree №448 of the Government of Georgia.	300160070.10.003.017617
03/01/2014	Environmental Technical Regulation – approved by the decree №17 of the Government of Georgia.	300160070.10.003.017608
14/01/2014	Technical Regulation - "Environmental Damage Determination (calculation) Method", approved by the decree №54 of the Government of Georgia.	300160070.10.003.017673
31/12/2013	Technical Regulation – "Methods of calculating the actual amount of emissions according to instrumental methods for determining the actual amount of emissions in ambient air from stationary sources of pollution, list of special measuring and controlling equipment for determining the actual amount of emissions in ambient air from stationary sources of pollution and technological processes from stationary pollution sources," approved by the order №435 of the Government of Georgia	300160070.10.003.017660
31/12/2013	Technical Regulation - provisions on "Determining Levels of Soil Fertility " and "Soil Conservation and Fertility Monitoring", approved by the decree №415 of the Government of Georgia.	300160070.10.003.017618
31/12/2013	Technical Regulation - "Topsoil Removal, Storage, Use and Cultivation", approved by the decree №424 of the Government of Georgia.	300160070.10.003.017647
15/01/2014	Technical Regulation – "Maximum Allowed Concentrations of harmful substances at work places", approved by the order №70 of the Government of Georgia	300160070.10.003.017688
15/01/2014	Technical Regulation on "Drinking Water", approved by the decree №58 of the Government of Georgia.	300160070.10.003.017676
31/12/2013	Technical Regulation - "water protection zones of small rivers in Georgia", approved by the decree №445 of the Government of Georgia.	300160070.10.003.017646
31/12/2013	Technical Regulation - "water protection zones", approved by the decree №440 of the Government of Georgia.	300160070.10.003.017640
03/01/2014	Technical Regulation - "sanitary rules of water sampling", approved by the decree №26 of the Government of Georgia.	300160070.10.003.017615

2.3 International Agreements

Georgia is signatory to many international conventions and agreements, including:

- **Protection of nature and biodiversity:**
  - The Convention on Biological Diversity, Rio de Janeiro, 1992;
  - The Convention on Wetlands of International Importance especially as Waterfowl Habitat Areas, Ramsar 1971;
  - The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), Washington, 1973;
  - The Convention on the Conservation of Migratory Species of Wild Animals, (Bonn Convention), 1983
- **Climate change:**
  - United Nations Framework Convention on Climate Change, New York, 1994;
  - The Montreal Protocol on Substances that Deplete the Ozone Layer, Montreal, 1987;
  - Vienna Convention for the Protection of the Ozone Layer, 1985;
  - Kyoto Protocol, Kyoto, 1997;
  - The United Nations Convention to Combat Desertification, Paris, 1994.
- **Pollution and environmental hazards:**
  - The European and Mediterranean Major Hazards Agreement, 1987.
- **Cultural Heritage:**
  - Convention on the Protection of Cultural Heritage of Europe;
  - Convention on the Protection of the Archaeological Heritage of Europe.
- **Public information:**
  - Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (Aarhus Convention, 1998).

3 Project Alternatives

Based on the requirements of Environmental legislation of Georgia, various alternative options should be considered in EIA report. As it was mentioned in introduction of the EIA report, proposed road and bridge are already under construction/reconstruction and major part of works are already implemented, namely: Bridge piers are arranged and relocation of the first section of the road is already launched. Therefore, detailed discussion of alternatives is meaningless.

3.1 No-Action Alternative

In case of no-action alternative, on-going activities for relocation of the road will be stopped, which is unjustified from socio-economic and environmental point of view.

At present, considering the implemented activities, negative environmental impacts are partly realized. In case of termination of on-going works, arranged infrastructure should be dismantled, which will be related to additional impacts, including formation of large amount of construction waste and issues related to their disposal.

In case of no-action alternative, the issue of unlimited movement on Batumi (Angisa)-Akhaltsikhe interstate highway will remain unresolved, which will hamper infrastructure and socio-economic development of the region.

On this basis, rejection of the project is unacceptable. Continuation of works is possible under the decision made by the administrative authority of issuing construction permit. It should be noted that Department of Roads of the Ministry of Regional Development and Infrastructure of Georgia is not opposed to the continuation of works for the relocation of the road and bridge (see Annex 1).

3.2 Alternative Locations for the Arrangement of Road and Ghorjomi River Bridge

Selection of other alternative locations for the arrangement of the road and bridge is virtually a refusal to continuation of construction works. There are no other alternatives to be considered. Given scheme is the most acceptable alternative from environmental, as well as from the scale of construction works and road length.

3.3 Pavement Alternatives

Alternatives of road pavement are: Arrangement of asphalt pavement or reinforced concrete pavement. Arrangement of compacted soil pavement on interstate roads is not justified.

There is no significant difference between these two alternatives from environmental point of view. It should be noted only that the concrete pavement requires a relatively higher volume of inert materials, which is noteworthy in terms of the impact on local resources. Disadvantage of asphalt concrete pavement is the use of pollution sources, such as bitumen during the construction works.

Based on the consultations, it was decided that asphalt pavement should be arranged within the project corridor, similar to all of the remaining part of the road.

4 Description of the Project

4.1 General Overview

Estimating documentation for relocation works of interstate Batumi (Angisa) – Akhaltsikhe road section (1.2 km) going through Khulo region area is elaborated by Ltd. "Absolut Service" on the basis of agreement signed on October 10, 2013.

Design documentation is elaborated on the basis of top geodesic and engineer-geological data provided by Client.

In November 2013 by Ltd. "Absolut Service" specialists were carried out field works, by the means of Leica Total Station in UTW WG-84 coordinates system were carried out planning the additional relief indexes, on this basis were placed on record required for construction fixed points with absolute marks. During the field works existing situation was studied in details, was determined the probability of expected difficulties during the construction period, which was taken into account during determination of the optimal location of project road.

Data processing were carried out by the means of highways projects automate system Indoor CAD-8.0. At the same time were determined works volumes and types, was elaborated road plan, longitudinal and cross-sections, construction layers of road topping, work drawings for pipes and reference walls, was composed the cost estimate documentation.

4.2 Brief Description of Project Corridor

The project road is located on the right bank of Adjaristskali River at an altitude of 757 m above sea level (pk0+00). It is directed towards south-east and separates from the existing road. Slope on the left side should be partially cut for the arrangement of a new road embankment.

On the left side of the corridor from pk1+40 to pk1+60 privately owned land plots are fenced, where several metal tanks are stored (this land plot has been purchased and tanks have been removed from the area).

Existing power transmission line will be crossed from pk1+00 to pk2+00.

The corridor turns to the north from pk2+00.

The project corridor runs to north-east from pk2+00 to pk6+00. Elevation of the corridor increases up to 787 m above sea level. The left side slope should be cut within this section. Gabions should be arranged in several sections on the right side.

From pk5+80 to pk5+90, joins existing road from the left side.

The corridor joins the design bridge from pk6+00.

Proposed bridge is directed towards north-west south east, up to pk7+44.

After the bridge, from pk7+44 to pk12+02 the corridor passes on rocky slope. Maximum elevation is 806 m above sea level. This section of the corridor is distinguished with vegetation density. The corridor here crosses several privately owned land plots.

At pk10+80 it joins the existing road.

Layout scheme of the project road (including Ghorjomi Bridge) is given in Figure 4.2.1., while the plan is given in Figure 4.2.2. The old road is marked on these drawings as well.

As it was mentioned, part of the works is already implemented. Photos reflecting the current state are given below.

Picture 4.2.1. Current state of the project corridor

Bridge piers

Project road corridor from pk0+00 to pk6+00

Road corridor from pk7+60 to pk12+02

Road corridor from pk7+60 to pk12+02

Figure 4.2.1. Layout scheme of the project road and bridge

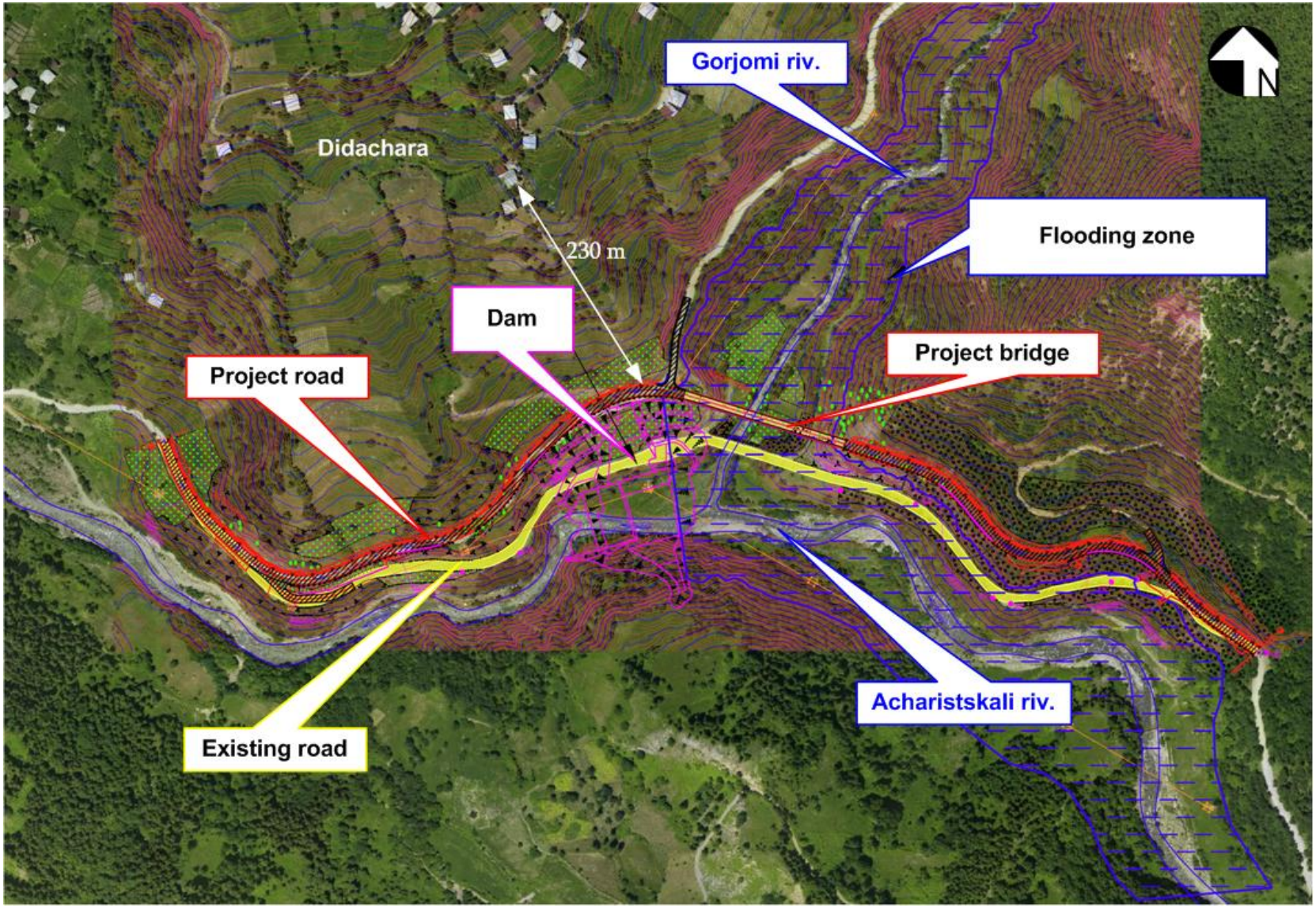
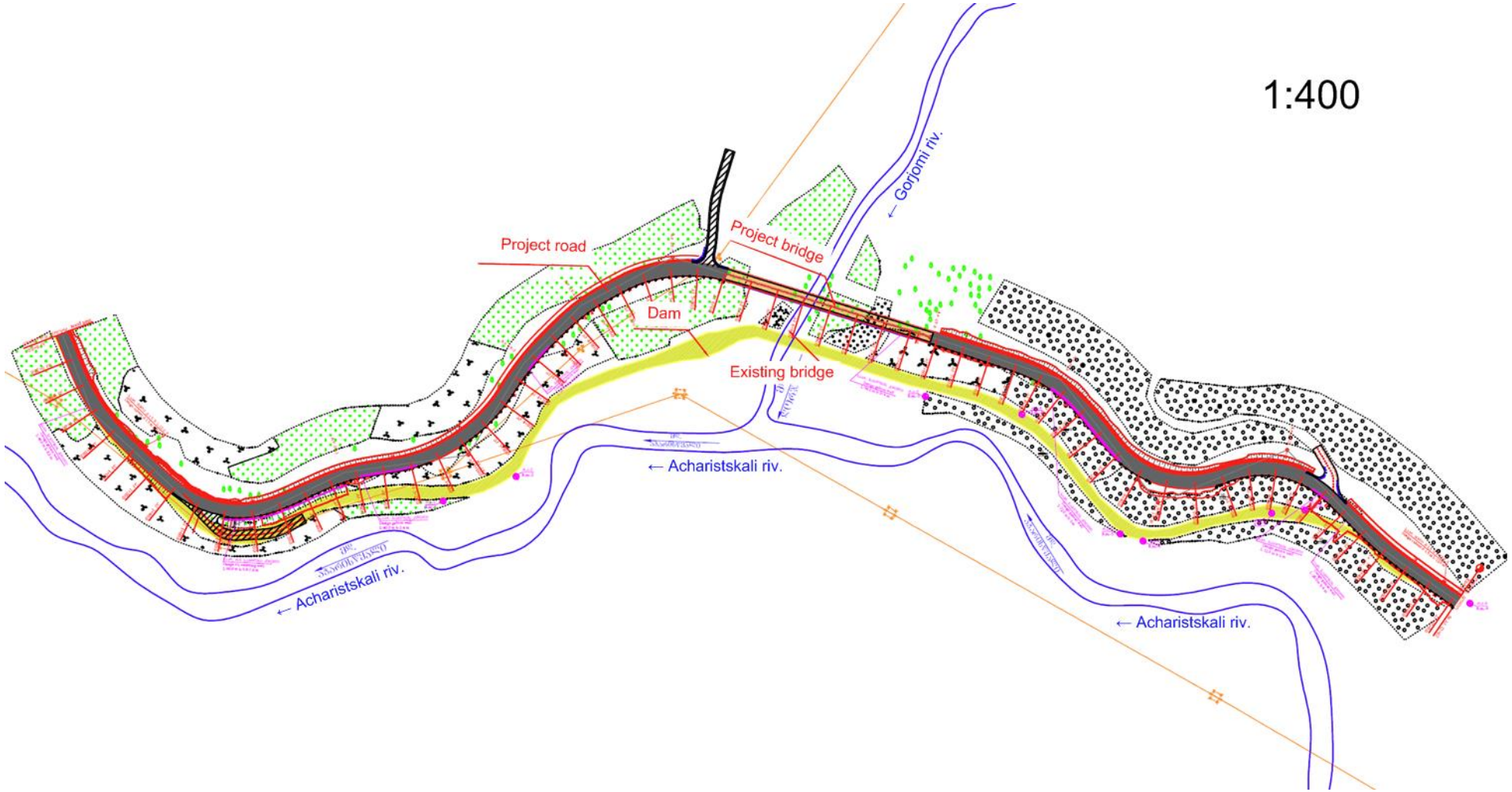


Figure 4.2.2. General plan of the project road and bridge



4.3 Design Road Plan

Design road section, according to project is 1202 l.m. In the frame of the mentioned road section baseline includes 12 turning angles. Some of them are settled out with clotoidal curves and construction of virages provides widening. Route optimal fits landscape, this will provide minimal volume of earthworks and accordingly most of plantation will be preserved.

Design road plan will provide safe traffic for 15m length heavy transport with 40 km/h design speed.

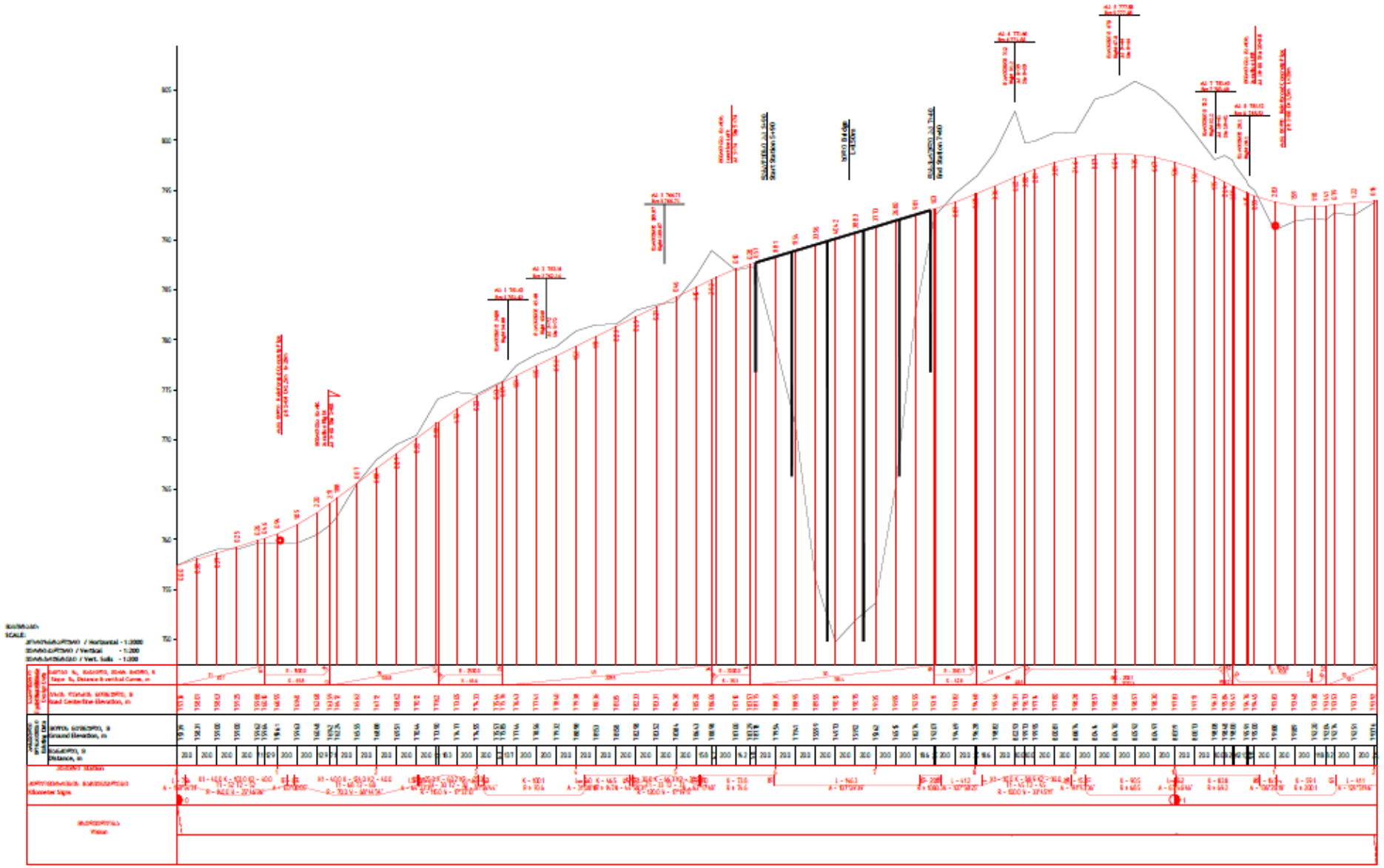
4.4 Profile of the Road

Longitudinal profile of the project road meets all requirements of active regulations. Longitudinal slope maximum is 8%. The minimal radius of vertical concave curve is 1000m; the minimal radius of vertical convex curve is 1000 m.

The red marks on the longitudinal profile belong to the baseline. Route is fixed with check points in absolute marks. Check points are constructed on concreted rebars. The detailed data is given in bench fixing table, besides this check points location is shown on situational plan.

Profile of the road is given in Figure 4.4.1.

Figure 4.4.1.



4.5 Roadbed

The project road roadbed width is 9-11 m, besides this on some road sections its presented with additional widening, which will give possibility to construct in future additional line for heavy transport (in case of increasing traffic intensity). Besides this, mentioned widening provides possibility to utilize snow from the carriageway.

The project road mainly goes through difficult mountainous relief. The project road is curved and from its left side encroaches the mountain, while from the right side on some road sections the gabion walls construction is required. Also is required to cut off bushes and small trees. At the same time is required construction of trapezium shape ditches along entire road section.

From pk 6+00 to pk 7+50 should be constructed reinforced-concrete bridge.

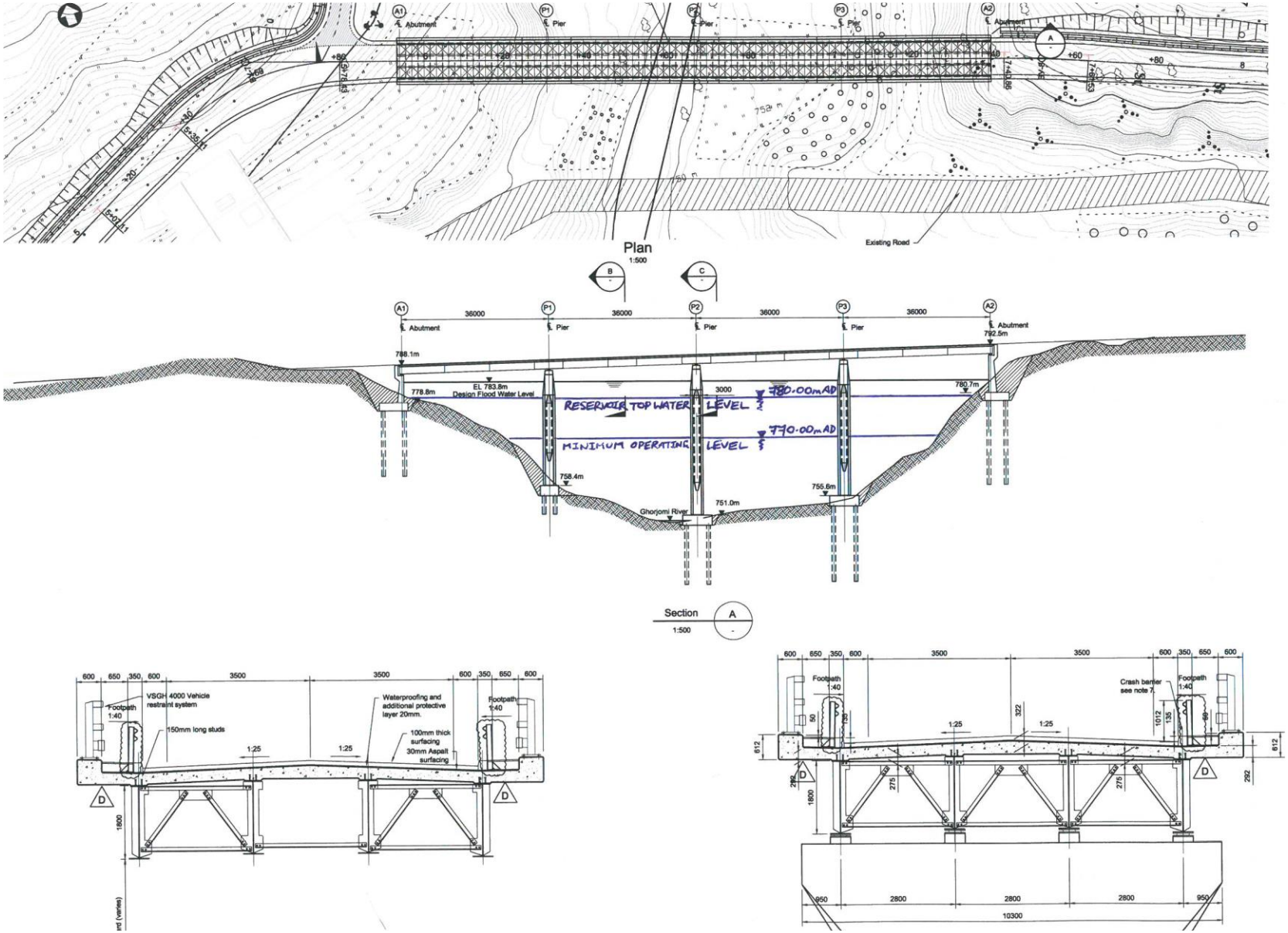
4.6 Design Bridge

The length of the proposed bridge will be 144 m, carriageway width – 7 m. Bridge span length will be 36m. Three piers will be arranged. Elevation of the bridge surface will be between 788,1-792,5 m.

It should be noted that after the completion of Didadjara dam construction, the design reservoir will be under the proposed bridge. Construction of the bridge is designed, so that its lower part will be higher than maximum flood elevation of the reservoir, namely: the minimum flood elevation of the reservoir is 770 m, while the maximum flood level is 784 m. therefore, distance between the reservoir surface and lower part of the bridge will be minimum 4 m and thus, there is no risk of bridge damage.

Profile of the design bridge and minimum and maximum flood elevations of the reservoir are given in Figure 4.6.1.

Figure 4.6.1.


Plan
1:500
Abutment
Pier
Existing Road
Section
1:500
36000
788.1m
778.8m
El. 783.8m
Design Flood Water Level
RESERVOIR TOP WATER LEVEL
770.00mAD
MINIMUM OPERATING LEVEL
770.00mAD
758.4m
751.0m
755.6m
780.7m
792.5m
Ghorjomi River
VSGH 4000 Vehicle restraint system
150mm long studs
Waterproofing and additional protective layer 20mm.
100mm thick surfacing
30mm Aspalt surfacing
Footpath 1:40
Crash barrier see note 7.
1:25
10300

4.7 Road Structures

Two water conduit pipes should be constructed on the project road section. First pipe is located on pk 1+04, the second one – on pk 11+88. Mentioned pipes are capital type from reinforced concrete with diameter d-1.5 m and they have concrete gantry walls. Inlet head has concrete well, while outlet head has concrete wings. Outlet head in addition is fixed with apron, which provides measures of anti-washout.

The right side of the road pk 1+80 – pk 2+70 entertained reinforced-concrete retaining wall, the total length 90 l.m.

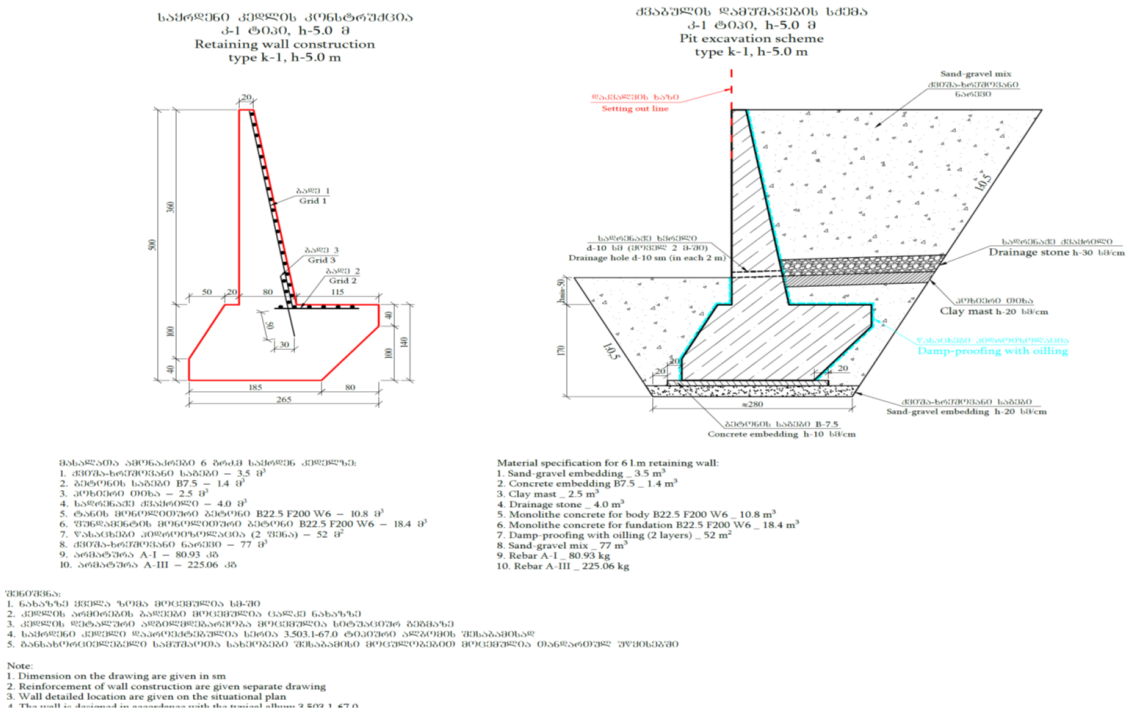
Besides this on project road should be constructed lower gabion reference walls with maximal height 5 m (see Figure 4.5.1.). From pk 4+60 to pk 5+92 on the right side of the road, after implementing the dam design works, in case of need, should be constructed reference wall (its size and location will be determined during dam construction works, that is why in this project are not included reference walls construction works).

Scope of reinforcing works to be implemented within the proposed corridor is given in Table 4.7.1. Design of reference walls and development scheme are given in Figure 4.7.1.

Table 4.7.1.

№	From (pk)	To (pk)	Length, m	Area, m^2	Road side	Reinforcement Type
1	0+00	2+00	200	500	On the left	Rock fall Protective Grid
2	2+00	5+70	270	4510	On the left	Hydro-seeding and harden
3	7+40	10+00	260	2320	On the left	Rock fall Protective Grid
4	10+00	12+00	200	1960	On the left	Hydro-seeding and harden
Total			**1032**	**10935**	On the left	

Figure 4.7.1.

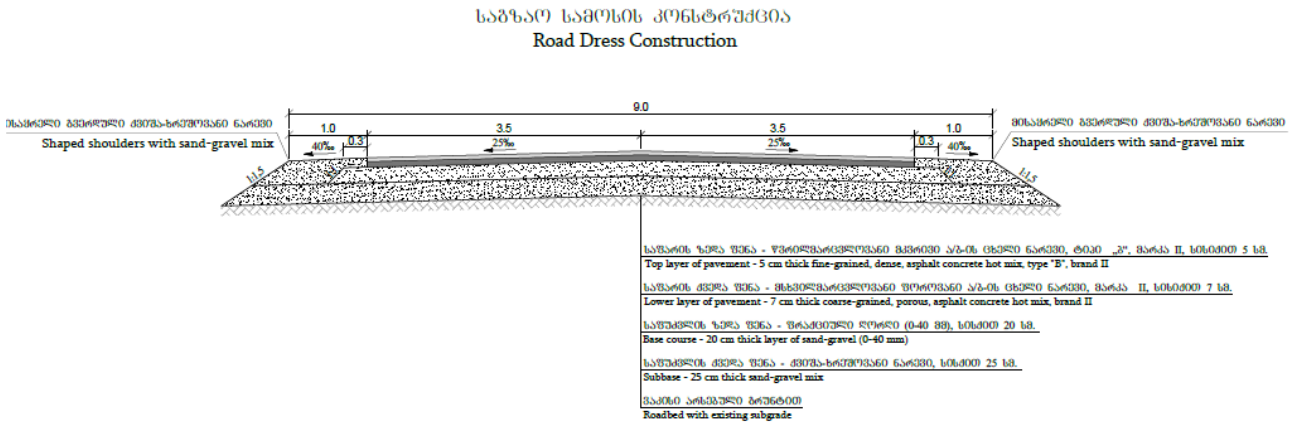


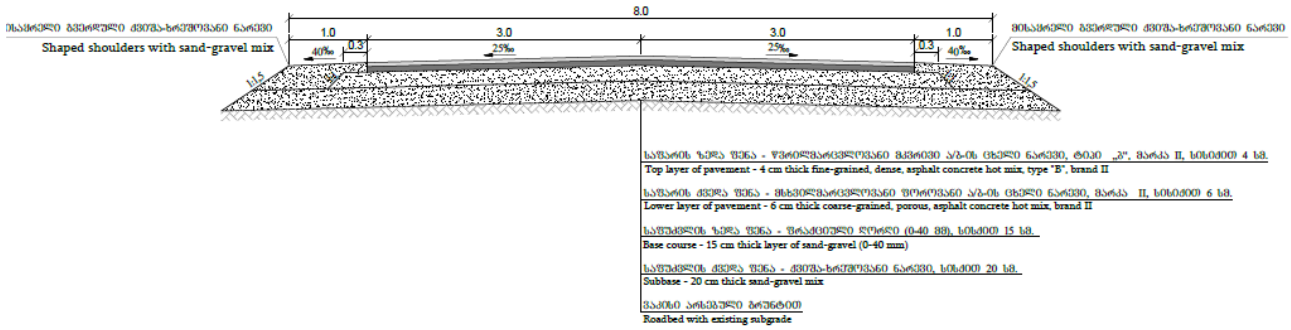
4.8 Road Pavement

On entire project road should be provided capital road topping with asphalt-concrete pavement. Carriageway width along road is 7-9 m. On some curves should be constructed virages with relevant widening.

Road pavement construction is given in Figure 4.8.1.

Figure 4.8.1.



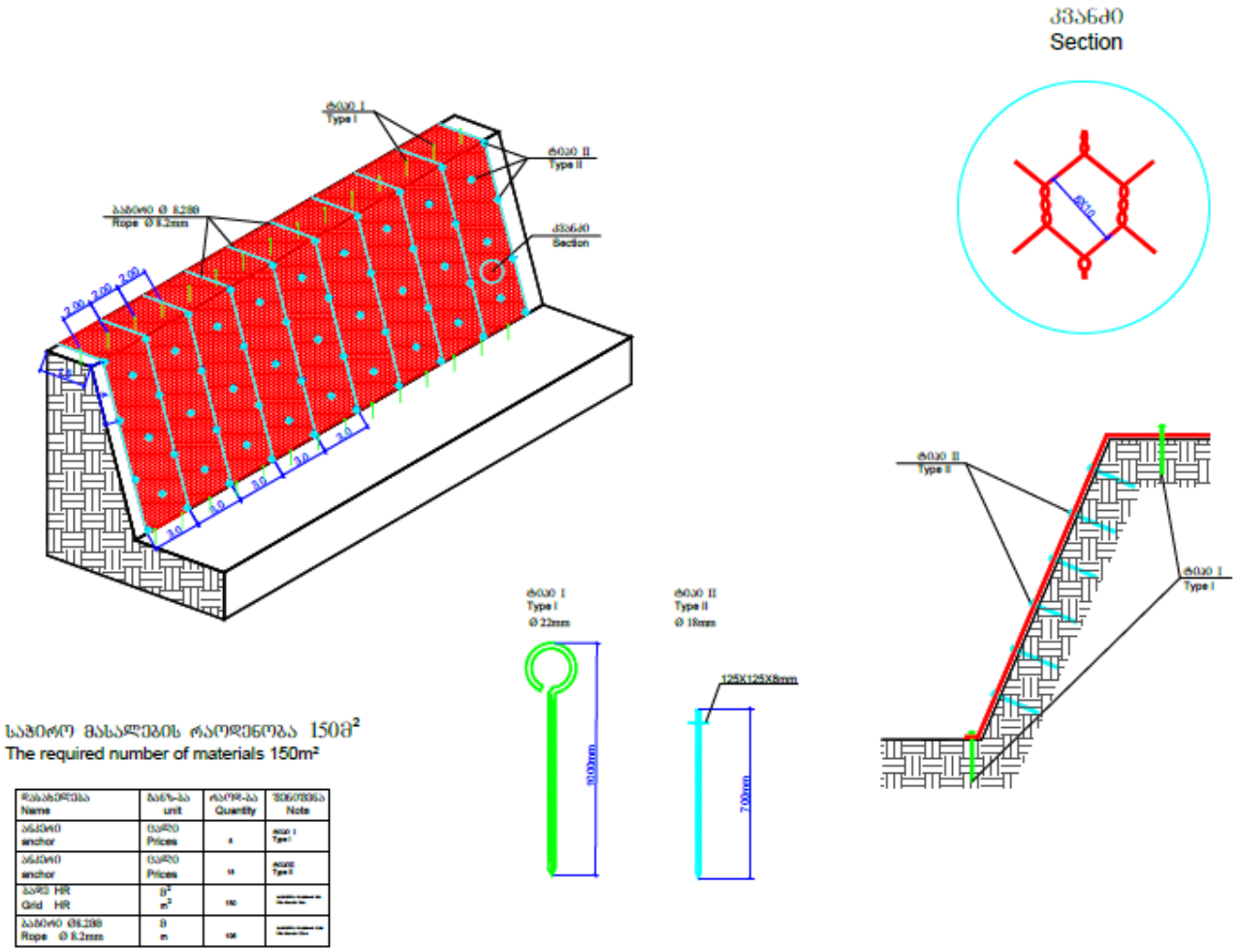


4.9 Road Accessory and Arrangement

On the project road should be constructed 3 junctions, installation of road signs and carriageway marking - for providing traffic organization and safety. Besides this, project provides installation of curved metal boundary and plastic guiding piles.

On the road left side should be installed anti-stone fall metal grid, which is fixed on the slope with rock bolts (see Figure 4.9.1.). To protect slope from washing out should be provided plant formation (grass). Also, for compensation punching-out trees new ones should be planted.

Figure 4.9.1.



4.10 Organization of Construction Works

4.10.1 General Overview

Construction works of the proposed road and bridge may be divided into two phases:

1. Preparatory works – prior to the main works, organizational and technical issues should be resolved in order to ensure proper implementation of construction works. Preparatory works include: mobilization of temporary infrastructure required for construction works; Route recovery and strengthening; Punching-out of existing bushes and trees; Compensation of the damage of population caused by lost land plots. As it was noted, part of the infrastructure is already arranged and therefore, preparatory works are almost implemented;
2. Major works – including: construction of the remained part of bridge structures; preparation of roadbed for the project section of the road, arrangement of pavement, road signs and fencing, waste management, etc.

Temporary infrastructure existing in Adjaristskali River valley (for the construction of HPPs cascade) will be used during the construction works, namely, construction camp, which is located near Didadjara village, concrete plant and warehouses. It should be noted that the capacity of current infrastructure will ensure the construction of the proposed road and bridge.

Maximum duration of the construction of road and bridge is 1 year. The same staff employed for the construction of HPPs cascade will be employed for the construction of the road and bridge and therefore, employment of additional workers are not considered.

Road construction works shall be performed in conformity with active standards, norms, recommendations and instructions.

Works shall be performed in accordance with typical technological diagrams as well as design specifications BCH 24-88 "Technical rules for highway repair and maintenance" SNiP 3.06.04-91 "Bridges and pipes".

Works shall be carried out using overall mechanization and applying advanced methods of works organization performed by specialized teams, in order to reduce the period of performance and increase labour efficiency.

During the road works traffic should be provided on the road, for this reason the existing road should be used before exploitation of the new one.

Traffic control procedures and fencing of the site shall be done in accordance with BCH 37-84, throughout the whole performance period. Layouts of corresponding works shall be agreed with the local representative of the Police. In addition, owners of communications within the road construction site should be preliminary warned.

All materials, semi products and prefabricated structures required should correspond to the design requirements and to the requirements of corresponding standards and have corresponding certificates.

Main construction materials required for the implementation of overall volume of works as well as machines and transport facilities are determined based on active regulations.

4.10.2 Types of Construction Works

According to the elaborated project, following works will be performed within the project section:

1. Preparatory works:
   - Route recovery and strengthening;
   - Punching-out of existing bushes;
   - Punching-out of existing trees.

2. Roadbed:
   - Earthworks in cut off with excavator and with jack hummers;
   - Earthworks in embankment;
   - Cutting ditches in rocky soils;
   - Slope strengthening with anti-stone fall grid;
   - Providing of slope stability by hydro seeding (grass);
   - Roadbed mechanical levelling.

3. Road structures:
   - Construction of reinforced-concrete pipes d-1.5 m;
   - Construction of reinforced-concrete lower retaining wall;
   - Construction of gabion reference walls.

4. Road pavement:
   - Construction of levelling layer sand-gravel mix h-25 cm;

- Construction of base course fractional macadam (0-40 mm) h-20 cm;
- Pavements Lower Layer of porous Asphalt Concrete 7cm;
- Pavements Top Layer Dense Asphalt Concrete 5 cm;
- Construction of bulk shoulder with sand-gravel mix.

5. Road accessory and arrangement:
- Construction of junctions;
- Installation of road signs;
- Marking of carriageway;
- Installation of curved metal boundaries;
- Installation of plastic guiding pile;
- Compensation of punched-out trees with planting of new ones.

6. Bridge:
- Bridge piers are already arranged. Therefore, remained works include: construction of bridge spans, pavement of the surface, arrangement of shoulders (including walking carriageway), arrangement of road signs, roadway markings, installation of railings.

Volume of earth works to be implemented during the construction of the road is given in Table 4.9.2.1. Detail information on types and volumes of works to be implemented are given in Annex 2.

Table 4.9.2.1.

pk +	Fill, m^3	Cut, m^3	Ditch, m^3
pk1	139	648	34
pk 2	965	740	34
pk 3	3379	3548	34
pk 4	87	5851	34
pk 5	13	4917	34
pk 6	1958	4097	25
pk 7	0	0	0
pk 8	558	1206	8
pk 9	248	5914	34
pk 10	902	12582	34
pk 11	1091	3969	34
pk 12	1651	3643	34
Sum	10992	47515	338

4.10.3 Dismantling the Old Infrastructure

After the completion of construction of the proposed road and bridge, existing road will be dismantled before the Didadjara reservoir is filled. It is a one-span bridge without piers. Its length is 30 m.

Railings and other metal removal will occur in the first place, then joinings will be removed and bridge concrete structure will be dismantled by crane. Due to its simple structure, volume of demolition works will not be significant.

4.10.4 List of Required Main Construction Equipment-Machinery

List of required main construction equipment-machinery and transportation facilities is given in Table 4.10.4.1.

Table 4.10.4.1.

№	Name	Quantity (unit)
1	Motor-grader (180 hp)	1
2	Excavator	2
3	Jack-hammer installed on the basis of excavator	2
4	Bulldozer (310 hp)	1
5	Tractor	1
6	Machinery for bush cutting	1
7	Machinery for uprooting	1
8	Machinery for trees cutting	2
9	Automobile crane (with lifting capacity up to 7 t)	1
10	Smooth-wheel roller (16-20 t)	2
11	Pneumatic tamping (10-12 t)	1
12	Vibrating tamper (6 t)	1
13	Asphalt-spreader	1
14	Binder distributor	1
15	Auto concrete-mixer	7
16	Trembler	7
17	Hand-held drill	1
18	Mobile compressor (with pneumatic hammers)	1
19	Flusher	1
20	Road marking car	1
21	Auto-dumper	10
22	Vehicle with ramp	2

4.10.5 Labour Protection and Safety

Road workers should be provided with personal protective equipment (spec. clothing, footwear, etc.), and also the general collective protection measures must be carried out. Healthy and safe conditions should be ensured for workers. Shelters from the rain and sun radiation should be provided.

It is required to observe safety measures, industrial sanitation and fire precaution measures and instructions whilst performing the works, as well as to train the staff. The Contractor is required to instruct the staff on safety measures prior to the commencement of works. Road vehicles shall have small turning radius, equipped with sound signals and light signals which should be in good operating conditions. Parking place shall be fenced with barriers and equipped with red signals of emergency stop during the day and with red signal floodlight at night.

The Contractor is responsible to perform the works in accordance with labour protection and safety requirements as well as industrial sanitation requirements.

4.11 Recultivation Works

According to the requirements of environmental legislation of Georgia, recultivation works should be implemented after the completion of construction works.

Recultivation works include demobilization of temporary structures and equipment – machinery used during the construction, restoration of areas damaged during the construction, removal of contaminated soil for further remediation, removal of construction waste, etc. Recultivation of areas of power houses also includes planting of local plant species around the area.

After completion of the construction works, recultivation works will be implemented in accordance with the requirements of technical regulation on "Topsoil removal, storage, use and reclamation" approved by the decree N424 of the Government of Georgia on December 31, 2013. In particular:

All categories of damaged and degraded soils are subject to reclamation. So are the surrounding land plots, which have partially or completely lost productivity due to the negative impact of damaged or disturbed soils.

Reclamation of degraded soil is carried out in order to recover its use for agricultural, forestry, construction, recreational, environmental, sanitary and other purposes.

The Contractor should ensure integrity of soil cover and its fertility nearly to its original condition for which it is necessary to::

- Remove topsoil, dispose on a separately allocated area and protect the soil quality (from mixing with other layers of soil, from contamination, wash out, scattering, etc.) for further use;
- In case of contaminating area, source of pollution should be eliminated and contaminated area should be recultivated as soon as possible in order to recover integrity of soil cover;
- Protect surrounding area from damage and degradation.

Under this technical regulation, reclamation works should be conducted according to the reclamation project, which should be prepared by the construction contractor prior to the completion of the construction works.

5 Environmental Baseline Description

Administratively, project area is situated within the highest mountainous zone of Autonomous Republic of Adjara – in Khulo Municipality. From the physical-geographic point of view, Khulo Municipality mainly covers Adjara syncline between high ridges of Meskheti, Shavsheti and Arsiani.

The information about natural and social-economic baseline of the study area is presented in the following chapters. The given information is based on the literary sources and fund materials, the material provided by the client and the results of the field work carried out exactly within the highway area.

5.1 Physical-geographic Environment

5.1.1 Climate and Meteorological Conditions

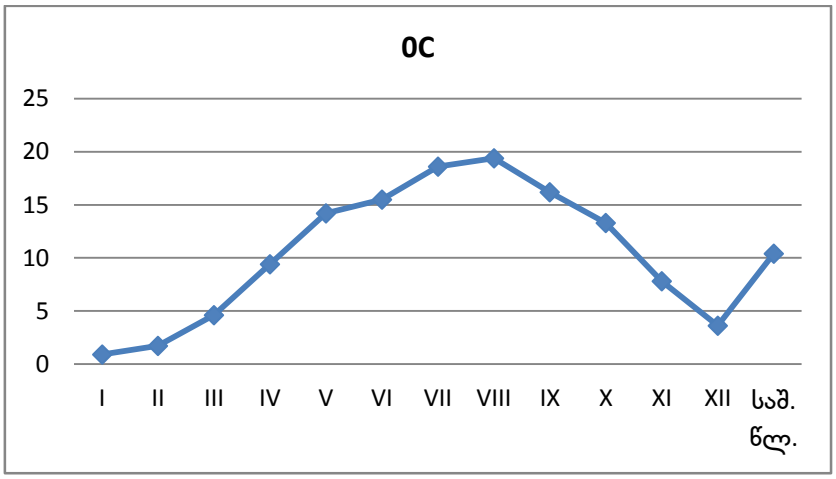
The climate specifications of Autonomous Republic of Adjara are defined with range of factors, including subtropical location and direct influence of the Black Sea. The region belongs to subtropical climate zone with warm winters and hot summers. As for mountainous Adjara, it has relatively less humid mountain climate. High mountainous zone is characterized by humid climate with cold and long winters and short and cool summers.

The Black Sea represents the heat source and thermo regulator for the region, which raises the temperature of adjacent areas in winter and lowers –in summer. Such climate specification is the main pre-condition for rich and diverse nature of Adjara.

Climate conditions of the study area are presented in the following diagrams and tables. During characterization of climate conditions, weather station data of Khulo town are used (source: "Construction Climatology").

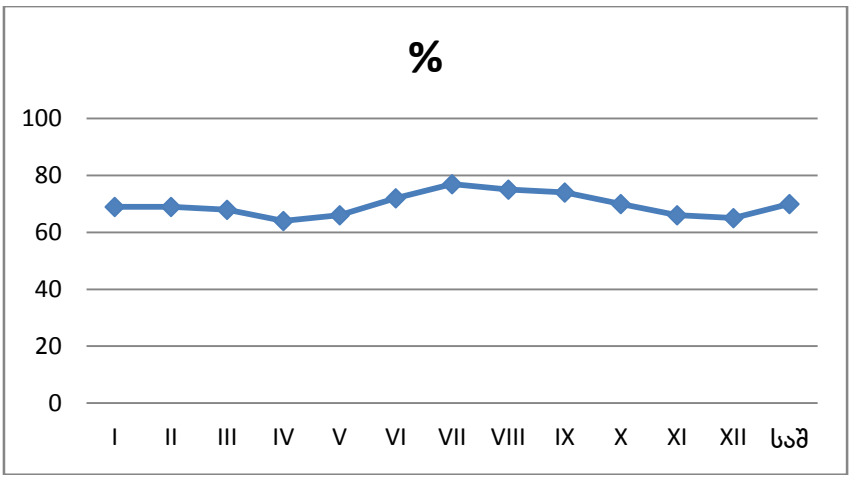
Ambient Air Temperature

Month Ave.	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Ave. Annual	Abs. max. annual	Abs. min. annual
^{0}C	0.9	1.7	4.6	9.4	14.2	15.5	18.6	19.4	16.2	13.3	7.8	3.6	10.4	39	-18



Relative Humidity

Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Average
%	69	69	68	64	66	72	77	75	74	70	66	65	70



Average relative humidity At 13.00 (%)		Average diurnal amplitude of relative humidity (%)	
For the coldest month	For the hottest month	For the coldest month	For the hottest month
64	60	7	30

Precipitation

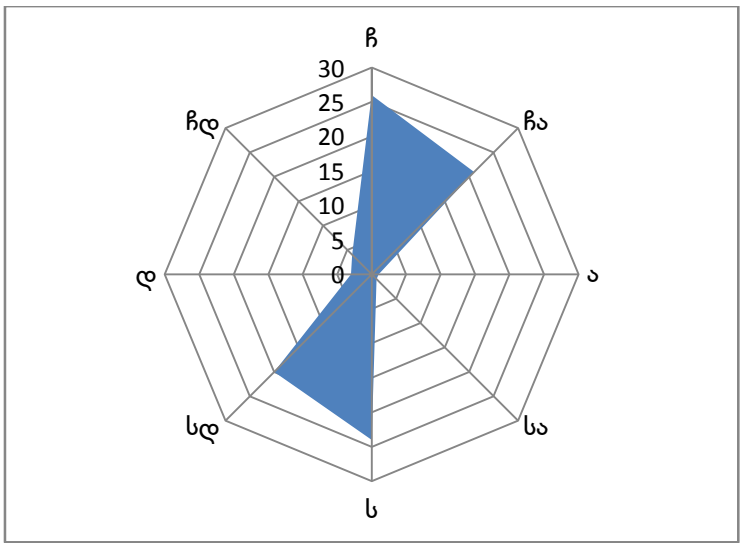
Annual Precipitation, mm	Max. Precipitation Per Diem, mm
1228	133

Wind Characteristics

Max. wind velocity occurred in 1,5,10,15,20. once a year. m/s				
1	5	10	15	20
14	18	19	20	21

Ave. max/ min wind velocity. m/s	
January	July
3,8/2,1	2,6/1,6

Reiteration of wind Directions and calm days (%) a year								
N	NE	E	SE	S	SW	W	NW	Calm
26	21	1	1	24	20	3	4	14



5.1.2 Geological Environment

5.1.2.1 Tectonics

Adjara region is a small part of a deep syncline, formed in the result of the fracture during broadly converging tectonic regime. Formed rift basin is known as the Adjara-Trialeti basin. From Palaeocene (65.5 - 56 mln. years) up to the end of the Eocene (33 mln. years), thick layers of volcanic basalt, terrigenous and tuff genic turbidity is settled in this basin. Exactly these formations form the bedrock, which is currently found in Adjara (Adamia et al 2011).

Significant structural geological variety is shown in Adjara, as the region is within transitive zone. Accordingly, there are some structures, such as wrecked syncline formed in the result of moving tectonic masses along extension and fault formation regimes.

In the west of the region, due to orocline nature of the compression, the folds are directed from north-east to the south-west. As for the east of the region, the axes of the folds run across the south-west. However, according to Bazhenov and Burtman (Bazhenov & Burtman, 2002), the north and south parts of the region are connected by the east-western extension, accordingly, open thrusts directed to the north and south.

Major structures, depicted on the map compiled from published materials of the region, coincide with the geological model, proving the existence of the following structures in Adjara:

- Anticline and syncline with curved axis considers the South-west-north-east orientation in the west, and the north-east-south-west orientation in the south.
- South-west trending thrust faulting in the northern part of Adjara.
- Thrust faulting stretched according to the north-west-south-east extension in the eastern part of Adjara.
- Thrust faulting stretched according to the extension from the north-east to the south-west in the west of the region.

The most part of Adjaristskali valley nearly runs along the axis of the region's syncline. The existed geological maps show that the southern slope of the syncline is inclined with about 15-35°– at 340° in

the west and with 0-10° in the east. The northern edge of the syncline (and the southern edge of the anticline) is inclined with 10-30° mainly in the south-west, besides, the axis of the anticline is not as curved as the syncline axis. However, it should be mentioned that the folds in the region have depending and overlying anticlines and synclines.

5.1.2.2 Relief and General Geological Conditions

The major part of Khulo Municipality is characterized by the high mountainous relief. It is situated on the slopes of Arsiani and Meskheti ridges. As it was mentioned before, the municipality covers the major part of Adjara syncline, located between given ridges.

The physical-geographic features of Adjara syncline lies primarily in its orographic closed nature – in its synclinal shape, in the relatively low humidity of its inner parts.

Adjara syncline is mainly formed by Paleogene suites. Its major part, covering Adjaristskali valley above the village Dandalo, is formed from Middle Eocene volcanic flysch. The later is mainly represented by pyroclastic material- tuff-breccias with alternation of porphyritic overlying rocks of inner formation. The north and south edges of the syncline are totally formed from lower Eocene volcanogenic flysch, where tuffs and tuff genic rocks are dominated.

Region is characterized by typical middle mountainous erosive relief. Absolute elevation ranges between 100-1000 m (the bottom of the valleys) and up to 2000-2700 m (ridges of the framing ranges). Transversal Shavsheti and Meskheti ridges and their interconnecting, mostly meridian Arsiani ridge are the main orographic units. Arsiani ridge is situated between Georgia and Turkey, on the crest of which the project area is represented. Its length is 150 km, average height - 2000-2500 m. The highest point is mountain Arsiani (3165 მ). Arsiani ridge is dividing waters of river Chorokhi and river Mtkvari. The slopes of the ridge are deeply cut by Chorokhi, Adjaristskali, Kvabuliani, Potskhovi and other rivers. Signs of old glaciation could be found on mountain top. Important passes are: Goderdzi (2025 m), Abanoskeli (2315 m); Mountains - Tlili (2541 m), Chanchakhi (2506 m), Tsivtskaro (2189 m).

Goderdzi pass saddle point, (2025 m.), where Batumi highway passes, divides Arsiani ridge in two parts. Southern part is higher and formed mainly by upper tertiary Goderdzi layers (Oligocene-miocene volcanogenic suite). Only in one place middle Eocene flysch is brushed away and denuded in the result of erosive washing out. Northern part is lower and formed by volcanogenic Eocene. Neogene tropical vegetation fossils and prints are observed mostly on the western (entering into Adjara syncline) slopes of Goderdzi pass, than on the eastern (entering into Meskheti syncline) slopes; these prints and fossils are represented within Goderdzi suite volcanic tuffs.

The project area is located at Achara-Trialeti folded zone and represents clearly formed structural-morphological unit, which is located between two massifs (Georgian massif and Artvin- Bolnisi massif) of Transcaucasia middle solid mass and mainly is composed of volcanic stone – elder sedimentary rocks aren't exposed. Post paleogenic rocks (pliocen-pleistocenic, continental-volcanic rocks- "Goderdzi Suite") are developed in far south- east part of the region.
The depth of paleogenic rock is 5-7 km, among this 2.7-4.2 km accounts for lower and middle Eocene and 2.3-2.8 km for upper eocene-oligocene.
Lithologicaly the project area is represented with bulky breccias, which are filled or cemented with pelitic tuffs on our territory with weathered basalt breccias.
As for hydro-geological conditions, fractured aquifer of underground water is spread in the bedrocks of the region.

5.1.2.3 Engineering-geological Conditions of Project Route

Project Route Corridor:

The project area is formed by Paleogenic-volcanic rocks: andesits, basalts, tuff-breccias, which are covered with coluviar, deluviar, proluviar quaternary sediments (with inserts of clay, cobbles, gravel and stones). Their depth varies from 0.5 to 12 meters and is determined by identification of slopes and mining (drilling and exploring shafts).

Distance between mining was selected according to SNiP 1.02.07-87 p.47, table 35, p. 51, table 37, remark 2 and p.373; terrain features and construction category.

Three engineer-geological elements (EGE) are separated on the project area:

- **I EGE** ground layer, ranges between 10-50 cm;
- **II EGE** quaternary sediments, clay with fine particles of small and big-sized cobbles, up to 0.5-1.0 m;
- **III EGE** bedrock - andesites with weathered basalt breccias and cemented pelitic tuffs, below 0,5-1,0 m.

On the project area ground is represented by weathered middle split basalt breccias, which specific weight is 2.6 t/m^3, resistance on pressure -134, according to mining difficulty belongs to VII category.

Following conclusions could be made on the basis of engineering-geological research:

- The engineering-geological conditions on project area are of middle difficulty;
- The location of road that should be replaced on the left bank of river Gorjomi and river Acharitskhali is optimal. It will be necessary to take into account the angle of slope and during the construction period activation of old (relict) creep;
- Beside the relict creeps, the following processes can be developed on the project area: physical weathering, sliding, erosion, creeps;
- There is no ground water in conducted holes, the non-aggressive underground waters were determined in shafts on the low hypsometric depth;
- In order to protect road from developed geodynamic processes, it is necessary to arrange supporting walls and drainage systems.

Project Bridge Site:

As it was mentioned the major part of the project bridge construction works are implemented. The supports of the bridge are already arranged. There are not any engineering-geological difficulties revealed during construction works.

Particularly, engineering-geological conditions of the project bridge location area can be discussed according the borehole №140 drilled within Didadjara HPP location area.

The borehole is drilled on the right slope of the river Gorjomi with coordinates: X – 279298; Y – 4615243. The depth is 25 m.

Quaternary sediments are revealed at 4,85 m depth from the surface: brown and grey, coarsely processed, large fraction gravel, with small consistence of cobbles. Fine-grained andesite cobbles, with silt-sandy filling.

At 1,65-1,95 m depth solid, brown, sandy and salty clay/salty loam is observed. In general, sediments are of grainy structure. Brown and grey, coarsely processed, with average gravel, fine-grained andesite with average consistence of pebbles and boulders are also observed. 600 mm and 700 mm basalt cobbles and boulders are represented.

Basalt boulder is observed between 2.20 - 3.00 m.

Between 4,85 m and 7,45 m, from very weak to weak, from light brown to dark brown amorphic, fine-grained tuff is presented. Sub-horizontal cleavage is revealed with approximately 30^0 slope. Cleavage surface at about 0.5 mm is filled with iron oxides. Strong weathering is observed between 4.85 - 5.30 m rates.

Below 7,45 m, up to the observed 25 m, bedrocks are revealed- from strong to very strong, massive, grey, microcrystal, small-fraction andesite.

Up to 14,30 m depth sub-horizontal cleavage is revealed with nearly 30^0-65^0 slope. Cleavage surface at about 1 mm is filled with iron oxides. Calcite with 2 mm x 7 mm layer is revealed in situ. Forming minerals are fine-grained, though average sized pyroxene and plagioclase is also represented. Between 7.65 - 7.69 m vertical cleavage with 65^0 slope is observed, and between 8.45 - 8.60 m -vertical cleavage with 40^0 slope.

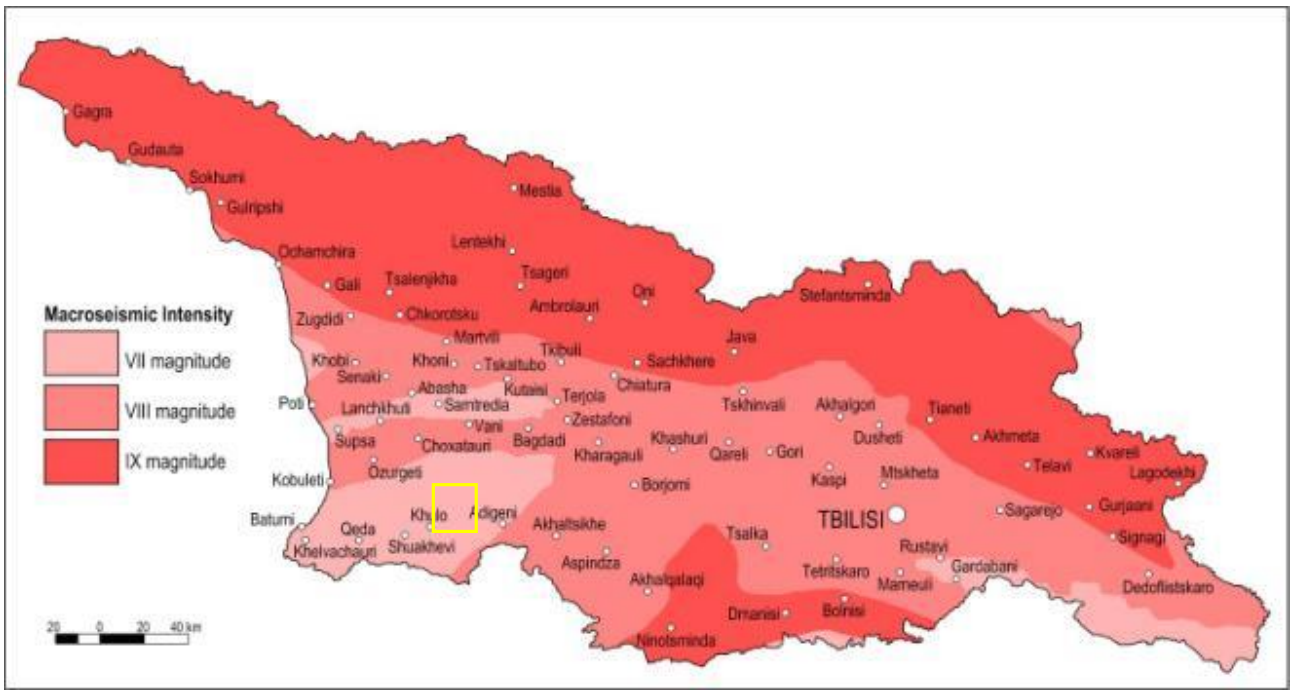
Below 14,30 m depth from sub-horizontal to sub-vertical cleavage with nearly 70^0 slope is observed. Cleavage surface at 0.5 – 2.0 mm is filled with iron oxides, in some places with clay and calcite. In situ calcite with 2 mm x 6 mm layer is revealed. Forming minerals are fine-grained, however, large sized pyroxene, plagioclase and hornblende are also observed.

Bridge supports are fastened to bedrocks.

5.1.2.4 Seismic Conditions

According to the annex №1 on construction regulations and standards “Anti-seismic construction” (pk 01. 01-09), the project area belongs to 7 point seismic zone (MSK 64 scale) (see the figure 5.1.2.4.1.).

Figure 5.1.2.4.1. Seismic Map of Georgia



The maximum horizontal acceleration characteristics of seismic waves within nearest settlement to the study corridor - village Didadjara, are 0.09 m/s^2.

5.1.3 Hydrography

Adjaristskali River originates in 1 km to the east from the mountain Chanchakhi, at 2435 m height and inflows with the river Chorokhi from the right, from 1 km below the village Khertvisi. The length of the river is 90 km, the total drop 2397 m, the average inclination - 26.6 ‰, the catchment area is 1540 km ^{2}, and the average height is 1400 meters. The total number of rivers in the basin 988, the total length - 2165 km, the network frequency is 1.41 km / km^2.

The main tributaries of the river Adjaristskali are Satsikhuri (length 14 km), the river Skhalta (29 km), the river Chirukhistskali (32 km), the river Chvanistsqali (21 km), and the river Akavreta (19 km).

The catchment with asymmetrical shape is stretched along the western part of the Lesser Caucasus, within Adjara area. It is bordered by watersheds of Chakvi, Adjara-Imereti, Arsiani and Shavsheti ranges (1500-2200 m). Upstream of the catchment, up to the estuary of the river Akavreta, the area is highly fragmented with deeply cut steep valleys of tributaries. Fragmentation is weakly revealed in the middle and lower reaches of the terrain.

River mainly flows in narrow and deep, V-shaped valley. Bottom width increases from 15-20 m upstream to 200-500 m in the direction of the confluence.

The mode of water levels is characterized by floods in spring, autumn freshets, low waters in winter and summer. Flood begins in mid-March and lasts until the end of June. Runoff is formed from snowmelt, rain and ground water. In spring 50% of annual runoff flows, 17% -in summer, 19%- in autumn and in winter -14%.

Soils

The variety of Adjara relief, climate and vegetation caused great complexity and diversity of the local soil. As the other components of nature, soils of some districts are also very different and characterized with zonality.

On coastal plains mainly swampy lowlands and alluvial soils are observed. Non-calcareous types of these soils are represented on floodplains, which are swampy in lower areas. Hilly area is mainly covered with red soils. They are typical products of the humid subtropical landscape. Further, in the next zone according to the height, mountain forest soils, in particular, forest soils occupy the area, which are developed under beech forests in the low and medium height mountain zone of the inner mountain area of Adjara. Mountain-meadow soils prevail in the highlands and at the top the soil cover is discontinuous and large area is occupied by landslide and rocky cliffs, poor with soil-vegetation cover.

Main Landscape

Following natural-anthropogenic landscapes are distinguished in mountainous Adjara;

1. The bottom of Adjara depression and the landscape of surrounding foothill is characterized with erosive relief, wet climate, grey soils, moderately mezophilic vegetation, anthropogenic modification, agricultural lands - arable lands (corn, tea, fruits and vegetables, etc.) up to 200-400-500 m above sea level;

2. Low mountain-gorge landscape, with fragmented terraced relief, landslide processes, a Mediterranean type subtropical climate, grey soils, deciduous forests, cultivated areas, arable lands- tea, corn, grapes, fruits, etc. at the height up to 600-700 m asl;

3. The medium mountain-gorge landscape, with strongly fragmented relief, with a moderately warm marine climate, forest grey soils, beech and chestnut forests, modified sections, cultivated vegetation - potatoes, grapes, fruits, etc. at the height from 700 m to 1200-1500 m asl;

4. The medium and high-mountain landscape, with strongly fragmented mountain-gorge relief, landslides and avalanches, moderately cool marine climate, podzolic light brown soils, dominating coniferous forests, with signs of anthropogenic impact; Favourable conditions for the development of animal husbandry. In some places, with the resort and the tourist and recreation areas;

5. The high-mountain terrain, very fragmented, watersheds with steep slopes and flat crest, erosive-denudative relief, with transient climate from moderately cold to cold, mountain-meadow soils, subalpine and alpine vegetation, hayfields and pastures at the height from 2200-2400 m to 3000 m asl.

5.1.4 Biodiversity

5.1.4.1 Flora

One of the main and widely spread formations of Adjara vegetation cover is forest plants. Beech forest mainly creates the middle mountainous zone (from 500-600m to 1200-1500m). Sometimes there are also mixed Hornbeam, Chestnut, Oak, Ash, etc. Underbrush here includes Pontic rhododendron, common laurel, and yellow azalea. Unlike the seacoast, forests of mountainous Adjara are characterized by droughty lands and species, like Oak, Hornbeam, and Pine are typical for such lands.

In high mountain of Adjara, there are coniferous forests from 900-1000m to 2000m a.s.l, but there are also pine forests on the lower mountains, on the southern slopes of lower part of Adjaristskali River.

Pine forests are fragmentary distributed in Adjara and it is created by domination of *Pinus kochiana*. Side-hill of pine forest is not closed and accordingly, synopsize of bushes and grasses are developed. Caucasian Spruce (*Picea orientalis*) and Caucasian fir (*Abies nordmanniana*) creates the closed forest. Due to the fact, understory of bushes and grasses are rarely presented. Such forests are typically connected to beech trees. Together with the Beech, fir also creates co-dominant coenosis. Such phytocoenosis are widely spread in mountainous area of Adjara region. From coniferous forests, there are also just spruce, spruce-firs and just firs on the large area. In Adjara such coenosis are mostly distributed in the upper borders of the forests

In the high mountainous zone (up to 2100m), from the grasses, alpine and subalpine meadows are widely spread. This type of grasses and high mountainous meadows are typically diverse and it is rich with amount of species. Due to the fact that these meadows are used for summer grazing for a long time, natural vegetation cover is changed and it is represented with species types formed as a result of pastoral digression. On Arsiani range, there are mat-grass (*Nardus stricta*) and brown bent (*Agrostis planifolia*), as well as poly-dominant diverse grass meadows, including Yarrow (*Achillea*), etc. The mentioned species are developed on the solid ground of mountain-meadow area. The humid slopes of Shavsheti range and Adjara - Guria range includes meadows of multi herbaceous and grasses. Similar meadows are also presented on the smaller area, mostly within the forests, on the upper border of the forest, on Arsiani range.

5.1.4.1.1 Detail Description of Flora and Vegetation Cover of Project Corridor

In June, 2015 botanic surveys were carried out in the project impact area. Specialist of "Gamma Consulting" LTD, biologist – Nino Tskvitishvili participated in the study.

The study area locates in Khulo Municipality, Adjaristskali gorge, on the area of confluences of two rivers Ghorjomula and Adjaristskali, at the design reservoir of Didadjara.

1,2 km section (length of road corridor 10 m) of project-construction road is situated on the right bank of Adjaristskali River.

The key goal of the botanic research in the project impact area was to identify existing species of plants on the 1,2 km road section and 10m width road corridor; identification of plants included in Georgian and international Res Lists and the issue of their presumable damage was especially essential during the researches.

In the construction corridor, along the whole road section, there is a sparse forest of clusters consisted of different plants, including: black locust (*Robinia fseudoacacia*), goat willow (*Salix caprea*), willow (*Salix sp*). In the clusters, there are also Oriental Spruce (*Picea orientalis*), oak (*Quercus dschorochensis*). Except trees, the area also includes: hawthorn (*Crataegus microphylla*), Philadelphus (*Philadelphus caucasicus*), tree of heaven (*Ailanthus altissima*). In some areas, especially in sparse forest, there are blackberry *(Rubus sp*), dog-rose (*Rosa canina*), red raspberry (*Rubus idaeus*)and Lianas: Green brier (*Smilax excelsa*), ivy (*Hedera sp.*).

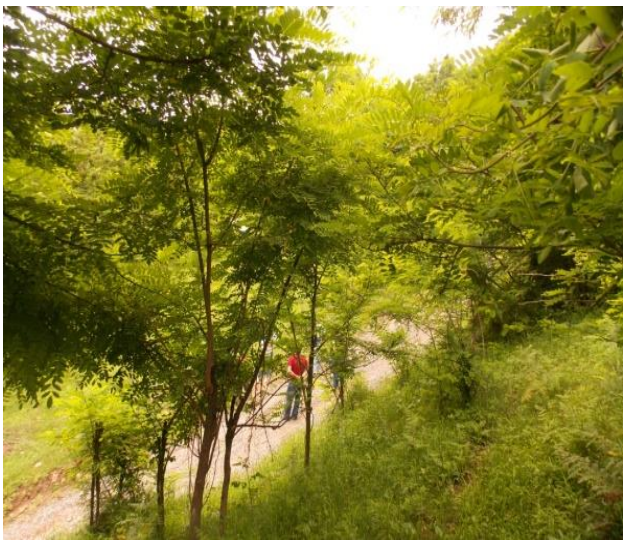
Within the forest cover, there are grazing fields, where grassland covers amounts to 70% and grassland inclination is 40-15^0. Among grasses we fixed: Festuca (*Festuca varia*), lady's mantle (*Alchemilla tephrosericae*), Caucasian clover (*Trifolium ambiguum*), Buttercup (*Ranunculus caucasicus*), common wormwood (*Artemisia absinthium*), lady's smock (*Alopekurus pratensis*), caraway (*Carum meifolium*), common yarrow (*Achillea millefolium*), Creeping Thistle (*Cirsium caucasicum*), hawkbits (*Leontodon hispidus*), bear's foot (*Helleborus caucasicus*), annual nettle (*Urbica urens*), Ferns (*Pteridium tauricum*).

In the study area, during the surveying of pants, it turned out that during the construction works, possible impact on the vegetation cover won't be important, as this hilly relief meadow doesn't have valuable significance in floristic viewpoint.

In the construction corridor there are no protected species of vegetation. The study area is utilized as pastures, so it is the value of average conservation botanic object.

According to the age of the forest cover in the construction corridor belongs to the young forest (secondary origin), according to the density – low cluster trees, mean density of the forest cover is 20-40%, slope inclination – 15-3045^0, forest cluster is formed by trees of same height that belongs to „C' category (fuel wood).

Photo materials about the vegetation cover in the construction area are shown below.



As a result of botanic researches in the possible impact area, protected species of plants (included in red List of Georgia) have not been recorded. Species in the Red List of Georgia may be revealed as a result of pre-construction detailed surveys. In such cases, removal of protected species from the environment should be carried out in accordance with the requirements of the Law of Georgia on "Red List and Red

Book of Georgia" (subparagraph "f" , paragraph 1, Article 24) in agreement with the Ministry of Environment Protection and Natural Resources of Georgia.

5.1.4.2 Fauna

Fauna is diverse in Khulo municipality. There are deer, wolf, fox, bear, Common Marten, Badger, hare, squirrel, wood mouse, hedgehog, mole,. In the high mountainous area Chamois (*Rupicapra*) also inhabits.

Among birds there are: Eurasian woodcock, black kite, hawk, eagle, common raven, raven, blackbird, etc. their presence in the region is not connected to spring and summer seasons. Caspian Snowcock inhabits in sup-alpine and alpine zone. Small amount of Golden Eagle and Great or Spotted Great Rose finch may inhabit on the area. Among birds of prey Black kite and Eurasian sparrow hawk are noteworthy.

As for reptiles, Adjarian Lizard (endemic), slow worm, Caucasus viper, inhabit on the area. From amphibians there are marsh frog, Caucasian toad, tree frogs, and marbled newts.

It is noteworthy that the construction corridor is situated in the high techno genic area and the possibility of presence of big mammals protected by the law is very low.

5.2 Socio-Economic Conditions

5.2.1 General Overview

Area of Khulo municipality amounts to 710km^2. It combines 1 small town, 12 communities and 78 villages. Administrative center of the municipality is small town Khulo (status of small town – from 1964). Distance from Khulo to Tbilisi is 463km, to Batumi – 87km and to the nearest railway station (Makhinjauri) the distance amounts to 91km.

Khulo municipality neighbors to Turkey (length of border line – 20km), Shuakhevi municipality (length of border – 60,5km), Chokhatauri municipality (length of border – 19,5km), Ozurgeti municipality (length of border – 1km), Adigeni municipality (length of border – 28,8km).

5.2.2 Population and Demographic Situation

In Khulo municipality number of population amounts to 23,5 000 (in 2015) that is 15,2% of the whole population of Adjara Autonomous Republic and 0,63% of total amount of Georgia's population. According to the number of population, Khulo Municipality exceeds Kedi and Shuakhevi municipalities and falls behind Batumi, Kobuleti and Khelvachauri municipalities. Degree of population density is 52 persons on 1 km^2. Number of population (2006-2015) in Adjara Autonomous Republic, including Khulo municipality is given in Table 5.2.2.1.

Table 5.2.2.1. Amount of population in Georgia, study region and municipality (thousands)

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Georgia	4,401.3	4,394.7	4,382.1	4,385.4	4,436.4	4,469.2	4,497.6	4483,8	4490,5	3729,5

Autonomous Republic of Adjara	377,2	378,8	380,2	382,4	386,9	390,6	393,7	160.0	161,2	154,1
Khulo Municipality.	33,6	34,0	34,5	35,0	35,5	35,8	35,9	35,9	36,1	23,5

According to the population accounting of 2002, the following amount of population was recorded in the surrounding settlements of the project area:

- Didadjara Community -2344persons
  - Village Didadjara - 1438;
- Dioknisi community - 4120persons
  - Village Geladzeebi - 396.

5.2.3 Economy

Key feature of Adjara economics is agricultural activity, such as growing of citruses and crops, cattle-breeding, meat processing, tea production, tobacco production and processing, food production (fish and fruit canneries, etc.). Except this, touristic infrastructure is well developed in Batumi, the capital of Adjara.

There are no large enterprises in Khulo municipality. Most part of population is self-employed (during the last period, amount of employees increased, they are employed on construction works and on-going projects in the municipality) and the main income resource is agriculture.

5.2.4 Agriculture

There are about 70,000 small farms in Adjara. Soil is mostly usable for tea growing, citruses and tobacco, as well as for the development of cattle-breeding.

Due to the severe weather conditions in Khulo municipality, main activity for the locals is cattle-breeding, growing of potato and tobacco. Main agricultural activity is potato growing that as to the data of 2004 amounts to 1,167 ha area. From other agricultural activities, fruit-growing, market gardening and bee-keeping are noteworthy. 49,000 livestock and 6,000 sheep and goats are registered in the municipality.

Small amount of lands in the project area, erosion processes, as well as complex relief are important interrupting factors for development of agriculture. Landslide and erosion processes are directly connected to loose of agricultural lands and pastures. At the same time, the small amount of agricultural lands, out-dated technologies, lack of support to the agricultural field and unorganized market relations also create additional obstacles for the development of agriculture. In mountainous Adjara, an ordinary family has 4-5 units of cows and presumably, several units of sheep or goat. And the land belonged to one family is not sufficient for feeding the cattle. Due to the fact that land-tenure is the main income source for the locals, serious economic poverty threatens to Adjara population, this pushes them to move in other regions or in neighbour country – Turkey for improving the economic condition.

In mountainous Khulo, about 16,000ha alpine area is used for summer grazing and mowing. The adjacent areas for arrangement of station are mainly used for such purposes.

5.2.5 Road Infrastructure

The length of state importance roads is 52km and the length of local importance – 211km in Khulo municipality. Khulo-Adigeni state importance motor road is situated on Goderdzi pass.

5.2.6 Healthcare

All municipalities of Adjara Autonomous Republic have their own hospital, special reconstruction program is implementing in the region. Within the framework of the program construction of 8 hospitals is already completed.

In the near past, 40-bed hospital, as well as, dispensary was opened in Khulo municipality. In 77 villages of Khulo, 41 medical points are available for the population. 27 doctors and 24 assistants provide medical service in Khulo municipality.

After the flooding in 2006, rehabilitation program of water supply and sewage system was implemented in Khulo. As a result of the program, 7,500 locals were supplied with potable water. Within the project twice more amount of families are provided with water supply than before the launching of the program. Reconstruction works of sewage system of Khulo municipality was also carried out, which determined the decrease of infectious disease caused by the insufficient quality of water (in 2005, from 156 cases of infectious diseases, emergency service was used in 150 cases, and in 6 cases symptoms of disease revealed later).

5.2.7 Historical-Cultural Monuments

Khulo municipality is the highest mountainous area of Adjara Autonomous Republic. Historical Adjara and especially its mountainous regions were the main area with cultural and civilization viewpoint, which is confirmed by existence of arched bridges, fortresses of XI-XII centuries and other monuments.

In Khulo municipality the following historical-cultural monuments are recorded:

- Skhalta Monastery – XII-XIII centuries, vil. Kinchauri;
- Khikhani fortress – XIII century, vil Tkhilvana;
- Uchkho stone arched bridge – XII century, vil. Uchkho;
- Vardtsikhe – XI-XII centuries, vil. Khikhadziri;
- Ruins of Tkhilvani Church – XIII century,vil. Tkhilvana;
- Vernebi Church ruins– IX-X century, vil. Vernebi;
- Ruins of Kaloti church – XI-XIII centuries, vil. Kalota;
- Ruins of Tikinauri Church – XIII century, vil. Khikhadziri;
- Ruins of Sitsikhuri Church – XI century, vil. Satsikhuri;
- Ruins of Vanadzeebi Church – X–XIII centuries, vil. Vanadzeebi.

No historical-cultural monuments are recorded in the surroundings of the project area.

6 Environmental Impact Assessment and Analysis

6.1 General Principles of EIA Methodology

This chapter includes expected environmental and social impact assessment during implementation of works. In order to assess expected changes in natural and social environment, it is necessary to collect and analyse the information about the current situation in the project impact area. The volume of the expected changes is determined on the basis of obtained information, impact recipient objects – receptors would be identified and their sensitivity will be assessed, which is necessary for determining the importance of the impact. After determining the significance of the impact its acceptability is determined, alternative options with less negative impact, necessity of mitigation measures and mitigation measures itself.

The following scheme has been used during the assessment of the environmental and social impact caused by the planned activities:

Stage I: Determination of the major types of the impact and analysis format

Determination of those impacts that may be significant for these types of projects based on the general analysis of the activities.

Stage II: Baseline study

Identification of the receptors, which are expected to be impacted by the planned activities; determination of sensitivity of the receptors.

Stage III: Characterization and assessment of the impact

Determination of the nature, probability, significance and other characteristics of the impact, taking into account the sensitivity of the receptor; Description of the expected changes in the environment and evaluation of their significance.

Stage IV: Identification of mitigation measures

Determination of mitigation, prevention or compensating measures for significant impact.

Stage V: Assessment of the rest impact

Identification of the magnitude of the expected changes in the environment after the implementation of mitigation measures.

Stage VI: Processing of monitoring and management strategies

Monitoring of the effectiveness of mitigation measures is needed to ensure that the impact does not exceed predetermined values, to verify the effectiveness of mitigation measures, or to identify the necessity of corrective measures.

6.1.1 Impact Receptors and their Sensitivity

Following types of impacts are expected during the implementation of planned activities:

- Air quality deterioration;

- Noise propagation;
- Hazardous geological processes development risks;
- Impact on topsoil quality and stability;
- Impact on aquatic environment;
- Impact on biological environment;
- Impact expected during waste management process;
- Visual-landscape changes;
- Impact on land ownership and use;
- Impact on local infrastructure. Limited resources;
- Impact on tourism and economic environment;
- Impact on human health and safety risks.

Sensitivity of a receptor is related to the magnitude of the impact and to the ability of a receptor to resist change or recover after changes, as well as to its relative ecological, social or economic value.

6.1.2 Impact Assessment

The major influence factors have been identified for the environmental impact assessment during the construction and operation phases. Assessment of the expected impact has been implemented in accordance with the following classification:

- Nature - positive or negative, direct or indirect;
- Magnitude - very low, low, medium, high or very high;
- Probability of influence - low, medium or high risk;
- Impact area - district, area or region of activities;
- Duration - Short and long term;
- Reversibility - reversible or irreversible.

Expected changes in the environment and their nature, area of the influence and duration, reversibility and probability of risk realization have been determined for both phases of the project, based on which the significance of the impact has been assessed.

It should be noted that the major part of the works has been already implemented and accordingly, impact on separate receptors of the environment has been already realized. In addition, negative impact on environment is mainly expected during construction phase (relocation of the road). However, this stage of the project is short-term and major part of the impacts will be reversible, it will not last for a long time. During the operation phase, significant positive impact is expected on major receptors of the environment. One of the positive impacts will be reduced risk of noise and dust emissions from traffic, as well as reduced traffic jams, limited movement of vehicles and traffic accidents.

Below are the criteria established for the assessment of the impact on environmental and social receptors; Characterization of the impact; List of relevant mitigation measures; Using established criteria for determining significance and scope of the impact before and after the implementation of mitigation measures.

6.2 Impact on Ambient Air Quality

6.2.1 Impact Assessment Methodology

For the assessment of impact on ambient air quality normative documents of Georgia have been used, which determine the air quality standards. Standards are defined for the protection of health. As the

impact on health depends on the concentration of harmful substances, as well as on the duration of the impact, evaluation criteria considers these two parameters.

Table 6.2.1.1. Assessment criteria for the impact on ambient air quality

Ranking	Category	Short-term concentration (< 24 h)	Unpleasant odour distribution (long-term, or frequent)	Dust distribution (long-term, or frequent)
1	**Very low**	C <0.5 MPC	10% of < OU_E/m^3	Unnoticeable increase
2	**Low**	0.5 MPC < C < 0.75 MPC	10-20% of OUE/m3 standard	Noticeable increase
3	**Medium**	0.75 MPC < C <1 MPC	20-50% of OUE/m3 standard	Slightly disturbs the population, though has no negative impact on health
4	**High**	1 MPC < C <1.5 MPC	50-100% of OUE/m3 standard	Quite disturbs the population, especially the sensitive individuals
5	**Very high**	C > 1.5 MPC	> 100% of OUE/m3 standard	Population is very disturbed, has negative impact on health

Note: C - Estimated concentrations in the environment, considering the baseline

6.2.2 Characterization of the Impact

6.2.2.1 Construction Phase

The approach, where the typical construction equipment operation is considered, has been used for the assessment of ambient air contamination.

Impact of emissions on ambient air quality expected from such technological processes, such as earth works have been estimated and calculated. Implementation of these operations requires the exploitation of a number of mechanisms and use of other necessary material resources.

Given that, the following sources of pollution have been identified: Crane, dump truck and welding works.

Impact is assessed for the section of the road, which passes near the major sensitive receptors (nearest settlement – Didadjara village). This section is the junction of the initial section of the road and the proposed bridge (approximately ვ36+00). The distance from this area to the nearest settlement is 230 m (see Figure 4.2.1.). Impact assessment on the border of 500 m zone was not considered mandatory, as according to calculations concentrations of pollutants will be within normal limits on the border of 230 m zone.

6.2.2.1.1 Emissions During the Operation of Road Construction Vehicle (Crane) (ვ-1)

Source of emission of the pollutant substances is road-construction vehicle engines, loading during the work and during idle mode.

The calculation is performed according to the following methodological guidelines [3,4].

Quantitative and qualitative characteristics of emission of the pollutant substances from the road-construction vehicles are given in Table 6.2.2.1.1.1.

Table 6.2.2.1.1.1. Quantitative and qualitative characteristics of emission of the pollutant substances from the road-construction vehicles

Pollutants		Maximum emission, g/s	Annual emission, t/a
Code	Name		
301	Nitrogen dioxide (nitrogen (IV) oxide)	0,033	0,237
304	Nitrogen (II) oxide	0,0053	0,038
328	Particulate	0,0045	0,032
330	Sulphur dioxide	0,0033	0,023
337	Carbone oxide	0,027	0,194
2732	Fraction of hydrocarbons kerosene	0,008	0,057

Calculation is made in conditions of external temperature of construction sites of the road-construction vehicles (RCV). Number of work days – 150.

Initial data for calculation of emission of the pollutant substances is given in Table 6.2.2.1.1.2.

Table 6.2.2.1.1.2. Initial data of calculations

Name of the road-construction vehicles (RCV)	Idle mode, in minute	Number	One vehicle working time							Number of working days
			Per day, h				In 30 min, min			
			Total	Without load	With load	Idle mode	Without load	With load	Idle mode	
	Caterpillar, capacity of 61-100 kW (83-136 hp)	1 (1)	8	3,5	3,2	1,3	13	12	5	250

Provisional marking, calculation formulas, calculating parameters and their explanation are given below:

The maximum of ***i***-type substance – one-time emission is performed by the following formula:

$$G_i = \sum_{k=1}^{k} (m_{ДВ\,ik} \cdot t_{ДВ} + 1{,}3 \cdot m_{ДВ\,ik} \cdot t_{НАГР.} + m_{XX\,ik} \cdot t_{XX}) \cdot N_k / 1800, \text{ g/s};$$

Where,

$m_{ДВ\,ik}$ – for ***k***-type group, ***i***- type substance specific emission during vehicle drive without loading, g/min;

$1{,}3 \cdot m_{ДВ\,ik}$ – for ***k***-type group, ***i***-type substance specific emission during vehicle drive with load, g/min;
$m_{ДВ\,ik}$ – for ***k***-type group, ***i***-type substance specific emission during vehicle idle mode, g/min;
$t_{ДВ}$ - vehicle working time with 30 minutes interval, without load, min;
$t_{НАГР.}$ - vehicle working time with 30 minutes interval, with load, min;
t_{XX} - vehicle working time with 30 minutes interval with idle mode, min;
N_k – ***k***-type group vehicle amount working simultaneously with 30 minutes interval.

i - type substance total emission from road-vehicles is calculated with the following formula:

$$M_i = \sum_{k=1}^{k} (m_{ДВ\,ik} \cdot t'_{ДВ} + 1{,}3 \cdot m_{ДВ\,ik} \cdot t'_{НАГР.} + m_{XX\,ik} \cdot t'_{XX}) \cdot 10^{-6}, \text{ t/a};$$

Where

$t'_{ДВ}$ – ***k***- type group vehicle total working time without load, min;

$t'_{НАГР.}$ – ***k***- type group vehicle total working time with load, min;

t'_{XX} – ***k***- type group total working time with idling drive mode, min.

Specific emissions of pollutants during the operation of road-construction vehicles are given in Table 6.2.2.1.1.3.

Table 6.2.2.1.1.3. Specific emissions of pollutants during the operation of road-construction vehicles, g/min

Type of road-construction vehicles (RCV)	Pollutants	Driving mode	Idle mode
Caterpillar, capacity of 61-100 kW (83-136 hp)	Nitrogen dioxide (nitrogen (IV) oxide)	1,976	0,384
	Nitrogen (II) oxide	0,321	0,0624
	Particulate	0,27	0,06
	Sulphur dioxide	0,19	0,097
	Carbone oxide	1,29	2,4
	Fraction of hydrocarbons kerosene	,43	0,3

Calculation of annual and maximum single emission of pollutants is given below:

G_{301} = (1,976·12+1,3·1,976·13+0,384·5)·1/1800 = 0,033 g/s;
M_{301} = (1,976·1·250·3,5·60+1,3·1,976·1·250·3,2·60+0,384·1·250·1,3·60)·10^{-6} = 0,237 t/s;
G_{304} = (0,321·12+1,3·0,321·13+0,0624·5)·1/1800 = 0,0053 g/s;
M_{304} = (0,321·1·250·3,5·60+1,3·0,321·1·250·3,2·60+0,0624·1·250·1,3·60)·10^{-6} = 0,038 t/s;
G_{328} = (0,27·12+1,3·0,27·13+0,06·5)·1/1800 = 0,0045 g/s;
M_{328} = (0,27·1·250·3,5·60+1,3·0,27·1·250·3,2·60+0,06·1·250·1,3·60)·10^{-6} = 0,032 t/s;
G_{330} = (0,19·12+1,3·0,19·13+0,097·5)·1/1800 = 0,0033 g/s;
M_{330} = (0,19·1·250·3,5·60+1,3·0,19·1·250 ·3,2·60+0,097·1·250·1,3·60)·10^{-6} = 0,023 t/s;
G_{337} = (1,29·12+1,3·1,29·13+2,4·5)·1/1800 = 0,027 g/s;
M_{337} = (1,29·1·250·3,5·60+1,3·1,29·1·250·3,2·60+2,4·1·250·1,3·60)·10^{-6} = 0,194 t/s;;
G_{2732} = (0,43·12+1,3·0,43·13+0,3·5)·1/1800 = 0,008 g/s;
M_{2732} = (0,43·1·250·3,5·60+1,3·0,43·1·250·3,2·60+0,3·1·250·1,3·60)·10^{-6} = 0,057 t/s;

6.2.2.1.2 Emissions During the Operation of Road Construction Vehicle (Dump Truck) (ვ-2)

Gaseous emission of dump truck is identical to the crane.

6.2.2.1.3 Emission Calculation

Emission calculation is performed according to the following methodological guideline [1].

Control sites

№	Type	Full description of the site		Width (m)	Space (m)	Height (m)	Comment
		Mid-point	Mid-point coordinates,				

		coordinates, I side (m)		II side (m)						
		X	Y	X	Y		X	Y		
1	Given	-400	0	500	0	700	100	100	2	

Control points

№	Point coordinates (m)		Height (m)	Type	Comment
	X	Y			
1	-125,00	200,00	2	Point on the border of the settlement	Nearest settlement

Substances, calculation of which is unreasonable
Criteria for calculation reasonableness E3=0,01

Code	Name	Sum, Cm/MPC
0344	Slightly soluble fluorides	0,0063159
2908	Inorganic dust: 70-20% SiO2	0,0018246

Conclusion:

Based on the calculation results, ambient air quality will not exceed the established norms within control points. standards set by the not exceed the control point, namely, maximum concentrations to the nearest settlement may be generated: For nitrogen dioxide - 0,13 MPC, Nitric oxide - 0,01 MPC, Soot - 0,02 MPC, 6009 group - 0,09 MPC. Maximum concentrations of other substances are practically zero.

Therefore, construction works will not cause air quality deterioration near the settlement.

6.2.2.2 Operation Phase

According to the project, proposed road will be far away from residential houses. Roadbed will be widened and it will have asphalt-concrete pavement. Therefore, operation phase will have significant positive impact on local population, as the scale of the impact will be significantly reduced due to simplified transportation.

6.2.3 Mitigation Measures

Following mitigation measures should be taken during construction phase in order to reduce exhaust and dust emissions:

- Ensuring the technical functionality of construction equipment and vehicles;
- Extinguishing engines or working with a minimum rotation when they are not used;
- Machinery and equipment should be arranged away from sensitive receptors;
- Protecting the optimal speed of the traffic (especially on earth roads);
- Maximum limited use of roads in populated areas. Population should be notified in advance about intensive movement of vehicles;

- Systematic implementation of dust reduction measures in dry weather (e.g. construction sites and roads watering, protection of rules of bulk construction material storage and others);
- In the storage areas for such materials from which dust is expected to be easily spread, a special pavement or watering is required in order to prevent windblown dust from spreading;
- Implementation of precautionary measures in order to avoid excessive dust emission during land works and materials loading-unloading (e.g. restriction loading-unloading material dropping from a big height);
- Instruction of the personnel prior to the works;
- Recording of complaints and ensuring relevant response.

6.2.4 Impact Assessment

Table 6.2.4.1. Summary of the impacts on ambient air quality

Description of impacts and impact sources	Impact receptors	Residual Impact Assessment					
		Nature	**Probability of influence**	**Influence area**	**Duration**	**Reversibility**	**Residual impact**
Construction phase:							
Combustion products, welding aerosols and other harmful substances emitted into ambient air – Combustion products sources - activities requiring construction and special machinery, transportation, etc.	Mainly population of Didadjara village, tourists, workers, biological environment	Direct Negative	Low risk	Areas adjacent to construction sites and residential zone	During construction phase	Reversible	**Low**
Dust emissions – *Source – earth works, transportation, storage and usage of bulk construction materials, movement of equipment and vehicles, and others.*		Direct Negative	Medium risk	Areas adjacent to construction sites and residential zone	During construction, periodically	Reversible	**Medium,** in case of mitigation measures **– Low**
Operation phase:							
Combustion products, welding aerosols and other harmful substances emitted into ambient air	Population of nearby settlements, tourists, biological environment	Indirect Positive	Medium risk	Road corridor	Long term	-	-

6.3 Noise Propagation

6.3.1 Impact Assessment Methodology

Noise levels in Georgia are regulated by normative document – sanitary norms 2.2.4/2.1.8 003/004-01 "noise in workplace, in housing, public buildings and residential areas". The noise level should not exceed the values set by these standards.

Table 6.3.1.1. Evaluation criteria of the impacts related to noise

Ranking	Category	Residential zone	Working, industrial or commercial zone
1	Very low	Acoustic background will increase by less than 3 dBA, at residential zone, during the daytime up to <50 dBA, while during night hours up to <45 dBA	Acoustic background will increase by less than 3 dBA and up to <70 dBA
2	Low	Acoustic background will increase by 3 – 5 dBA, at residential zone, during the daytime up to <55 dBA, while during night hours up to <45 dBA	Acoustic background will increase by 3 – 5 dBA and up to <70 dBA
3	Medium	Acoustic background with sensitive receptors will increase by 6-10 dBA, at residential zone, during the daytime up to <55 dBA, while during night hours up to <45 dBA	up to <70 dBA, Acoustic background with sensitive receptors will increase by 6-10 dBA
4	High	Acoustic background with sensitive receptors will increase by more than 10 dBA, at residential zone, during the daytime up to >70 dBA, while during night hours up to <45 dBA	up to >70 dBA, Acoustic background with sensitive receptors will increase by more than 10 dBA
5	Very high	Acoustic background with sensitive receptors will increase by more than 10 dBA, at residential zone, during the daytime up to <70 dBA and accompanied by a tonal or impulsive noise, while during night hours up to <45 dBA	up to >70 dBA, accompanied by a tonal or impulsive noise

6.3.2 Characterization of the Impact

6.3.2.1 Construction Phase

Construction works will have some negative impact on background noise. Calculation of noise emissions is implemented in the following sequence:

- Determination of noise sources and their characteristics;
- Selection of reference points on the border of protected areas;
- Determination of noise direction from noise source to the reference point and calculation of acoustic of the environmental elements, affecting the distribution of noise (natural screens, green plantation, etc.);
- Determination of noise levels at reference points and its comparison to allowable levels of noise;
- Determination of noise level reduction measures, if necessary.

Impact of the noise propagation is assessed within the section of the project road corridor with passes near the most sensitive receptor – Didadjara village. This section is near the pk6+00. Distance to the residential house is 230m.

The main sources of noise are assumed to be the machinery and vehicles working simultaneously: crane (noise level - 92 dBA) and dump truck (noise level - 85 dBA).

Octave sound pressure levels in the reference point are calculated according to the following formula:

$$L = L_p - 15\lg r + 10\lg \Phi - \frac{\beta_a r}{1000} - 10\lg \Omega, \quad (1)$$

Where,

L_p – Octave level of the noise source capacity;

Φ – noise source direction factor, non-dimensional, is determined through trial and changes from 1 to 8 (depends on spatial angle of sound radiation);

r – Distance from the source of the noise to the reference point;

Ω – Spatial angle of sound radiation, which will be: Ω = 4π- when located in the space; Ω = 2π- when located on the surface of the area; Ω = π - double ribbed angle; Ω = π/2 – triple ribbed angle;

β_a – Sound damping in the air (dBA/km) tabular description.

Average geometric frequencies of the octave lines, H Hz.	63	125	250	500	1000	2000	4000	8000
β_a dBA/km	0	0.3	1.1	2.8	5.2	9.6	25	83

Noise source levels on the noise-generating section are summarized according to the formula:

$$10\lg \sum_{i=1}^{n} 10^{0,1Lpi} \quad (2)$$

Where:

L_{pi} – is i-type noise source capacity.

Following assumptions are made to perform the calculation:

1) If distance between several noise sources, located on the same site is less than distance to the reference point, sources are combined into one group. The total noise level is calculated by the following formula: $10\lg \sum_{i=1}^{n} 10^{0,1Lpi}$;
2) To assess the total level of noise sources combined into one group, as a distance to accounting point was used their distance from geometric center. (as it was mentioned, the distance from noise source center is 180 m);
3) For simplicity, the calculations are performed for the sound equivalent levels (dBA) and average value of its octave indicator is taken as sound damping coefficient in the air βave=10.5 dBA/km;

By putting the data in the second formula, we will obtain the total noise level from the generation point:

$$10\lg \sum_{i=1}^{n} 10^{0,1Lpi} = 10\lg (10^{0,1x92} + 10^{0,1x85}) = 92{,}8 \text{ dBA}.$$

By putting the data in the first formula, we will obtain noise level from reference point, the nearest receptor:

$$L_{damia} = L_p - 15\lg r + 10\lg \Phi - \frac{\beta_a r}{1000} - 10\lg \Omega, = 92{,}8 - 15*\lg 230 + 10*\lg 2 - 10.5*230/1000 - 10x\lg 2\ \pi = 50 \text{dBA}$$

The calculation results are given in Table 6.3.2.1.1.

Table 6.3.2.1.1. Noise propagation calculation results

Main Machinery	Equivalent Noise Level at Generation Point [dBA]	Distance to the Nearest Receptor [m]	Equivalent Noise Level at Nearest Receptors [dBA]	Norm[1]
Main camp: • Excavator; • Bulldozer.	230 m	92,8	50	During daytime – 55dBA. During night-time - 45dBA

Based on the results of calculation, noise levels on the border of settlement will not exceed the norms established for the daytime.

There are a number of circumstances that should be considered and which make it possible to conclude that the construction activities will not cause a significant negative impact on the nearest population. These circumstances are:

- Construction works (especially those generating intensive noise) will be implemented only during daytime;
- The main sources of noise are less likely to work simultaneously;
- It is a linear structure and thus, intensive construction works will continue for a certain period of time on one specific section and the impact will be short-term;
- Natural screens existing between noise sources and control points have not been considered during calculation, which will further reduce the impact. Local relief and vegetation cover should be also considered as the most important factors in reducing the noise;

However, mitigation measures are still required to be considered.

6.3.2.2 Operation Phase

The main sources of noise propagation during the operation phase are:

- Vehicle engines;
- Friction between the tire and the road surface;
- Beeps.

These three sources will be reduced after the modernization of the road. Operation of the proposed road will have positive impact in terms of noise and vibration background.

6.3.3 Mitigation Measures

It is recommended to implement the following mitigation measures in order to minimize noise levels during the construction phase:

- To ensure the technical functionality of construction equipment and vehicles;
- To implement works that cause noise during the daytime only;

[1] Sanitary norm for "noise in workplaces, residential and public buildings, residential development areas, and construction sites".

- Prior to implementing noisy works, warning and the corresponding explanations (if necessary) should to be done with the population;
- Period of implementing noisy works should be determined with consideration of social (holidays);
- Noisy equipment should to be allocated away from sensitive receptors (forest zone, residential houses) as much as possible;
- Temporary barriers (screens) should to be arranged between a significant noise source and the houses, if necessary. The screens can be arranged by using a variety of structures (e.g. shields made from wood materials). The quality of noise protection depends on the material type and thickness of the boards. For instance:
  - Fencing by pine boards (with thickness of 30mm – 12 dBA);
  - Fencing by oak boards (with thickness of 45mm - 27 dBA);
- If necessary, equip personnel with proper protective equipment;
- Instruction of the personnel prior to the beginning of construction Works; \
- In case of complaints, they should be recorded and appropriate action should be taken.

6.3.4 Impact Assessment

Table 6.3.4.1. Summary of the noise impact

Description of impacts and impact sources	Impact receptors	Residual Impact Assessment					
		Nature	**Probability of influence**	**Influence area**	**Duration**	**Reversibility**	**Residual impact**
Construction phase:							
Noise Propagation in Air – Noise propagation from construction equipment and construction operations; – Noise caused by transportation activities.	Population, tourists, animals inhabiting in adjacent areas, workers	Direct Negative	Medium risk	In 0,2-0,5 km radius from construction sites	During construction	Reversible	**Medium.** Taking into account the mitigation measures - **low, or very low**
Operation phase:							
Traffic, vehicle engines and beeps	Population, tourists, animals inhabiting in adjacent areas	Direct and indirect Negative	Medium possibility	Didadjara village and forest zone	Long term	-	-

6.4 Impact on Geological Environment and Soils

6.4.1 Impact Assessment Methodology

Impact on soil and geological environment is assessed with following parameters:

- Intensity, area and duration of the impact;
- Sensitivity towards the changes;
- Ability to recover.

Table 6.4.1.1. Impact assessment criteria on soil

Ranging	Category	Destruction of the fertile soil layer	Soil/Ground Pollution
1	Very Low	Less than 3% of the project area has been destroyed for ever	Soil/ground background conditions have changed unnoticeably
2	Low	3%-10% of the project area has been destroyed for ever	The concentration of pollutants have increased by less than 25%, but less than the permitted value, 6 months will be needed for the soil/ground quality restoration
3	Medium	10%-30% of the project area has been destroyed for ever	The concentration of pollutants have increased by 25-100%, but less than the permitted value, 6-12 months will be needed for the soil/ground quality restoration
4	High	30-50% of the project area has been destroyed forever; small areas are damaged outside of the project area, recultivation of which is possible after completion of the construction works	The concentration of pollutants have increased by more than 100%, or exceeds the permitted value, 1-2 years will be needed for the soil/ground quality restoration
5	Very High	More than 50% of the project area has been destroyed forever; small areas are damaged outside of the project area, recultivation of which is possible after completion of the construction works	The concentration of pollutants have increased by more than 100%, or exceeds the permitted value, more than 2 years will be needed for the soil/ground quality restoration

6.4.2 Characterization of the Impact

6.4.2.1 Construction Phase

Dangerous geological processes have not been observed within the project road corridor. Damages caused by gravity, erosion and other processes have been observed on several sections of the road, activation of which is expected during the construction works.

Project includes some relevant mitigation measures, namely: slopes will be cut with maximum caution and terraced. Soils in active dynamic will be removed. Retaining walls will be arranged in certain sections of the road, rock fall protective grids will be arranged in some areas as well and grass will be planted (see Paragraph 4.7 and 4.9).

Major construction works of the proposed bridge are already implemented and any serious risks have not been yet identified.

Overall, the risk of development of dangerous geological processes during the construction phase can be described as a moderate risk. Considering the appropriate mitigation measures, impact will be reduced.

Topsoil damage and reduction in soil stability is mainly expected during preparatory and construction works, which will be related to vehicle movement within the project area and earth works.

As it was mentioned, roadbed of the initial section of the project road (pk0+00-pk6+00) has been already arranged. Only small part of the left slope should be cut within this section. Topsoil is quite poor throughout the whole length of the left slope and removal and disposal of topsoil is not considered within this section. With this regard, attention should be paid to the second section of the road – from pk7+44 to pk12+00. The section runs through undeveloped areas where average capacity of topsoil is 10 cm. the volume of removed topsoil will be about 450 m^3.

Topsoil removal-disposal works will be carried out during preparatory phase. Soil will be disposed on preliminary selected areas and after completion of construction works it will be used for recultivation purposes. Removal-disposal of soil will increase the risk of erosion. The risk of the impact will be relatively high during the rains.

Soil quality may be affected by improper management of waste (both solid and liquid), violation of rules for fuel and lubricants and construction materials storage, accidental spill of fuel / lubricants from construction machinery and vehicles. Relatively high risks of soil contamination are expected in the vicinity of areas where the parking lot and other potential sources of soil contamination will be arranged.

6.4.2.2 Operation Phase

Considering the design solutions (protective structures), the risk of development of dangerous geological processes during the operation phase will not be high.

The risk of development of dangerous geological processes within the project bridge area is low. It should be noted that bridge piers are arranged at main rock-depth. After Didadjara dam is arranged and the reservoir is filled, the confluence of Ghorjomi River will shift its direction upstream and the reservoir of Shuakhevi HPP will be under the bridge. The risk of bridge piers damage is very low.

Periodic change of Didadjara reservoir water level (difference between the minimum and maximum flood levels id 10 m) may lead to elution and erosion of main rocks of bank slopes. Periodic supervision of such processes will be required during the operation phase. If necessary, additional protective works should be carried out.

Topsoil destruction and violation of stability is not expected during the operation phase. Road operation is usually related to soil contamination by heavy metals on shoulders. The second reason of contamination may be roadside litter.

6.4.3 Mitigation Measures

Construction works will be implemented with maximum protection of precautionary measures:

- Active landslide formations will be removed from the upper slopes and slopes will be given appropriate deviation angle in order to keep them stable;

- Organizational withdrawal of the surface and ground water, provided that it does not lead to additional watering of slopes.

During the operation phase of the road, the major preventive measures for dangerous geological processes are proper operation of protective structures and draining systems, monitoring of landslide and gravitational processes and based on monitoring results, if necessary, implementation of proper corrective measures.

In order to prevent the damage and contamination of soil, it will be required to take into account the following environmental requirements:

Following mitigation measures should be taken in order to prevent destruction of topsoil:

- Prior to the construction works, topsoil will be removed and temporarily disposed on a preliminary selected area. Earth works will be implemented in accordance with the requirements of technical regulation on "Topsoil removal, storage, use and reclamation" approved by the decree N424 of the Government of Georgia on December 31, 2013;
- Preliminary removed topsoil and excavated soil during the earth works will be stored separately. Soil stockpiles will be protected from wind and precipitation;
- Height of the dumps should not exceed 2 m. Slopes of the dump area should be given an appropriate tilt angle (450); Water discharge canals should be arranged throughout the perimeter;
- After completion of construction works, stockpiled soil should be used for recultivation works;
- Strict protection of the working site borders to avoid possible damage of topsoil and soil compaction of the “neighbouring” areas;
- Protection of the roads intended for the vehicle movement (prohibition of passing off the road) in order to prevent possible soil compaction;
- Materials and waste should be stored so that to avoid erosion;
- Area should be cleaned and recultivated after the completion of works.

Following measures should be implemented during the construction phase in order to reduce risks of soil contamination:

- Machinery and equipment should be checked regularly. In case of damage or fuel / oil spill, the damage should be promptly eliminated. Damaged vehicles should not be allowed on the construction site;
- Generated waste will be collected and disposed on a specially allocated area;
- Potentially polluting areas of storm water should be protected from precipitation;
- Restriction of refuelling/maintenance of the machinery/equipment on the construction sites;
- In case of fuel/oil spill, localization of the spilled material and immediate cleaning of the contaminated area. Personnel should be provided with appropriate means (adsorbents, shovels, etc.) and personal security equipment;
- Contaminated soil and ground for further remediation should be taken out from the territory by the contractor equipped with an appropriate permit on these activities;
- Instruction of personnel prior to the works;
- Territory cleaning and recultivation works after completion of the construction works.

6.4.4 Impact Assessment

Table 6.4.4.1. Summary of the impact

Description of impact and its sources	Impact receptors	Residual Impact Assessment					
		Nature	Probability of influence	Influence area	Duration	Reversibility	Residual impact
Construction phase:							
Erosion and other geohazards activation / development and so forth. – Earth works; – Construction works; – Transport operations, using of heavy machinery.	Population, biological environment, soil and other resources	Direct negative	Medium risk	Construction sites and road corridors	Short term	Mainly reversible	**Medium -** taking into account mitigation measures –**low, or very low**
Loss of topsoil – Earth works; – Movement of vehicles and construction equipment, etc.	Population, vegetation cover, animals, surface and groundwater	Direct Negative	Medium risk	Construction sites and road corridors	Short term	Reversible. In exceptional cases - irreversible	**Medium,** considering mitigation measures – **low**
Soil contamination – Spillage of oil or other chemical substances, pollution by waste.	Vegetation cover, surface and ground waters, population	Direct, Negative	Medium risk	Mainly local spills are expected	Short term	Reversible	**Medium,** considering mitigation measures – **very low**
Operation phase							
Erosion and other geohazards activation / development and so forth.	Population, , soil and other resources	Direct Negative	Medium risk	Road corridor	Long term	Reversible	**Low**

6.5 Impact on Aquatic Environment

6.5.1 Impact Assessment Methodology

Considering the planned activities, only water quality deterioration is expected. Change of ground water level and quality deterioration may be also considered.

Table 6.5.1.1. Assessment criteria for the impact on surface water and ground waters

Range	Category	Deterioration of water quality	Change of ground water level	Deterioration of Groundwater[2] Quality
1	Very Low	Background concentration of the substances and water turbidity has invisibly changed	Capacity invisibly changed	Background concentration of the substances has changed invisibly
2	Low	Concentration or turbidity of the water has changed by less than 50%, but does not exceed maximum permissible concentration	Groundwater level has significantly decreased, but has not influenced on the bore-hole water level or on spring water flow	II group[3] substances concentration is less than the permissible for the drinking water
3	Medium	Concentration or turbidity of the water has changed by 50-100%, but does not exceed maximum permissible concentration	Groundwater level has significantly decreased, at the same time obtaining of water from the bore-holes has reduced, impacts on the springs flow	II group substances concentration is exceeding the permissible for the drinking water
4	High	Concentration or turbidity of the water has changed by more than 100%, or exceeded maximum permissible concentration	Bore-holes are temporarily not working, uncharged has reduced in the surface water facilities, which leads to the seasonal drought and environmental impact	Concentration of harmful substances of I group are being identified
5	Very High	Concentration or turbidity of the water has changed by more than 200% and exceeded maximum permissible concentration	Bore-holes are dehumidified, there are no uncharged in the surface water facilities, there are major risks of drought and environmental impact	Concentration of harmful substances of I group exceed the permissible in the drinking water

[2] Georgian law does not regulate underground water quality, that is why standard for drinking water was used
[3] EU directive 80/68/EEC, 1979, December 17, on „protection of groundwater from different hazardous substances“

6.5.2 Characterization of the Impact

Impact on surface water quality is expected due to following cases:

- Pollution from vehicles/equipment as a result of fuel/oil spill;
- Pollution with construction and other wastes, including liquid waste.

Construction works near the active riverbed (arrangement of bridge piers), which is considered to be the major risk of contamination of surface waters is already implemented. During the environmental audit, water sample has been taken near the construction site (before the confluence of Ghorjomi and Adjaristskali Rivers). Following characteristics have been determined in river water samples: PH, suspended particles, BOD, COD, petroleum hydrocarbons and other components.

Laboratory test of water sample has been conducted in the laboratory of scientific firm Gamma, which has the appropriate accreditation to conduct research on water. It is a ISO-17025-accredited laboratory.

Results of water sample analysis are given in Table 6.5.2.1. (See Annex 5 as well).

Table 6.5.2.1. Laboratory test results

№	Component	Dimension	Results	Characteristics
1.	pH	-	7,95	6,5-8,5
2.	BOD	mg/l O_2	3,4	6,0 mg/0_2dm^3
3.	COD	mg/l	<15	30
4.	Turbidity	FTU	255	-
5.	TPH	mg/l	<0.04	0,3
6.	Dry residue	mg/l	131.909	-
7.	Conductivity	mg/l	0.02509	-
8.	Hardness	mg/l	1.794	-
9.	SO_4	mg/l	30.4	500
10.	NO_3	mg/l	Not identified	
11.	Mineralization	mg/l	181,109	1000
12.	Arsenic	mg/l	Not identified	
13.	Cadmium	mg/l	Not identified	
14.	Lead	mg/l	Not identified	

Based on the results, concentrations of pollutants in river water near the project bridge do not exceed the established norms. Works planned for the future will be implemented far away from the riverbed and pollution risk will be further reduced. Based on this, impact on surface water during construction phase may be assessed as low.

During the operation phase, contamination of surface water may be expected only during repair/maintenance works. In order to reduce the impact, mitigation measures determined for the construction phase should be implemented.

The risk of groundwater contamination at the construction phase is expected during the arrangement of profiles. Storm waters may transfer pollutants into deep layers from highly contaminated soil.

6.5.3 Mitigation Measures

Following mitigation measures should be implemented in order to reduce negative impact on surface and ground waters:

- Vehicles / equipment and potentially polluting materials should be located less than 50 meters away from surface waters (where it is possible). If this is not possible, the permanent control and safety measures should be implemented in order to prevent water pollution;
- Prohibition of washing vehicles in river-beds;
- Restriction of refuelling/maintenance of the machinery/equipment on the construction sites;
- Ensure the maintenance of the machinery/equipment, in order to reduce the risk of fuel/oil spill to the minimum;
- Proper management of materials and waste;
- In case of fuel/oil spill on the soil, localization of the spilled material and immediate cleaning of the contaminated area in order to prevent the getting of pollutant in the water;
- Training of the personnel on environmental and safety issues.

In order to reduce the probability of groundwater pollution it is necessary to implement the measures related to the protection of surface and groundwater quality. In addition, duration of earth works should be limited as much as possible (filling of pits and tranches as soon as possible) in order to reduce the risk of contamination of deep layers.

6.5.4 Impact Assessment

Table 6.5.4.1. Summary of impact on surface and ground waters

Description of impact and impact sources	Impact receptors	Residual Impact Assessment					
		Significance	Probability	Impact area	Duration	Reversibility	Residual impact
Construction phase:							
Pollution of surface water with suspended particles, hydrocarbon and other substances – Sources of pollution with suspended particles - contaminated surface runoff, construction works near or in the riverbed; – Sources of pollution with hydrocarbon / chemical substances – discharge of surface runoff contaminated due to spills, or their direct discharge into water body; – Other sources of pollution - industrial or household solid / liquid waste generated within the construction camps.	Animals, groundwater	Mainly indirect, Negative	Medium risk, considering mitigation measures, low risk	Sections of Ghorjomi and Adjaristskali Rivers near construction corridor	During construction phase	Reversible	**Low.** Considering the mitigation measures – **very low**
Deterioration of groundwater quality – Earth works; – Due to movement of pollutants into deep layers of soil	Animals, surface waters with a hydraulic connection	Indirect or direct	Medium risk	Project road corridor	Short term	Reversible	**Low.** Considering the mitigation measures – **very low**
Operation phase							
Change in groundwater level – Arrangement of a waterproof layer within project corridor.	Animals, surface waters with a hydraulic connection	Indirect	Low risk	Project road corridor	Short term	Reversible	**Very low,** or impact is not expected

6.6 Impact on Biological Environment

6.6.1 Impact Assessment Methodology

For the assessment of the impact on biological environment qualitative criteria are introduced for the following categories:

- Integrity of the habitat, where the possible loss or fragmentation of habitats, reduction of the potential capacity of ecosystem and the impact on natural corridors are estimated;
- The loss of species. Impact on species behaviour, where the assessment is implemented about changes in their behaviour that are caused due to the physical changes, including visual impact, noise and atmospheric emissions, as well as about the impact on breeding, nesting, spawning, daily and seasonal migration, activity, and mortality;
- Impact on protected areas.

Criteria established for estimating impact on ecological systems are given in Table 6.6.1.1.

Table 6.5.1.1. Assessment criteria of the impact on biological environment

Category	Impact on habitat integrity	Loss of species. Impact on species behaviour	Impact on protected habitats
Very low	Negligible impact on the integrity of the habitat. After the completion of recultivation works, recovery of the habitat in a short period of time (<1 year)	Changes in behaviour are invisible; death of not valuable species of small mammals / fish is expected; there is no risk of spreading invasive species.	No impact is observed throughout the areas protected by country's legislation or international conventions
Low	Noticeable impact on the integrity of low-value habitat, including the loss of less valuable habitat of 10-20 acres of land. After the completion of recultivation works, recovery of the habitat in two years.	Changes in behaviour may be revealed by standard methods; death of not valuable species of small mammals / fish is expected; there is no risk of spreading invasive species.	A temporary, short-term, minor impact is expected throughout the areas protected by country's legislation or international conventions, which will not cause a long-term violation of ecological integrity
Medium	Significant impact on the integrity of locally valuable habitat, its reduction, reduction of valuable habitats, or less valuable 20 - 50 ha of terrestrial habitat loss. After the completion of recultivation works, recovery of the habitat in 2-5 years	Changes in behaviour of endemic and other valuable species may be revealed by standard methods; death of less valuable animal species is to be expected; appearance of invasive species is expected.	A minor impact is expected throughout the areas protected by country's legislation or international conventions, though ecosystem will be restored within 3 years.
High	Reduction of locally valuable habitats, or less valuable 50-100 ha of terrestrial habitat loss. After the completion of recultivation works, recovery of the habitat in 5-10 years.	Changes in behaviour of protected species may be revealed by standard methods. The death and reduction of protected and valuable animal species is expected; Spread of invasive species	Impact is expected throughout the areas protected by country's legislation or international conventions. Mitigation measures are to be implemented in order to restore the ecosystem. It will need 5 years to be restored.
Very high	Reduction of locally valuable habitats, or less valuable more than 100 ha of habitats loss. After the completion of recultivation works, recovery of the habitat in more than 10 years.	Changes in behaviour of an internationally protected species may be revealed by standard methods. Protected or valuable species of animals die and there is a probability of disappearing these species. Spread of invasive species	There is an impact on the areas protected by country's legislation or international conventions.

6.6.2 Impact on the Integrity of the Habitat and the Destruction of Vegetation

6.6.2.1 Construction Phase

Vegetation cover within the project road corridor is not distinguished with high conservation value. It should be noted that initial impact already occurred. Vegetation cover will be removed in the second section of the road (after bridge, on the left bank of Ghorjomi village). Description of vegetation cover within the project area is given above, in the relevant Paragraph.

Based on botanical survey, there are no protected species of plant (Led List Species) within the project area. Plant species included in the Red List of Georgia may occur as a result of taxation.

Borders of construction sites will be strictly protected in order to avoid damage of additional vegetation cover. After completion of the construction works, the area will be cleaned and removed topsoil will be recovered.

Indirect impact (dust and exhaust impact) will be local, short-term and insignificant.

Impact on flora may be further reduced by proper organization/management of the works and appropriate mitigation measures.

6.6.2.2 Operation Phase

The risk of damage-destruction of vegetation cover during the operation of the road is minimal.

6.6.2.3 Mitigation Measures

Mitigation measures for the impact on vegetation and the integrity of habitat during the construction phase are:

- In order to protect vegetation from too much damage, the boundaries of construction sites and traffic routes should be strictly defined;
- Prior to the construction works the staff should be instructed about the issues related to the protection of vegetation;
- Development of code of conduct of illegal cutting for the staff;
- In case of revealing protected species of plants as a result of taxation, they should be removed from the environment in accordance with the requirements of the Article 24, clause 1, sub clause “f” of the Law of Georgia on the “Red List” and “Red Book” of Georgia and should be agreed with the Ministry of Environment and Natural Resources Protection of Georgia;
- Implementation of compensation measures in case of damaged forest during the reconstruction/construction of the road. Compensation measures include: In agreement with the Ministry of Environment and Natural Resources Protection of Georgia, the territory with relevant area will be selected in order to recover and conserve the damaged vegetation cover. Damaged species of plants will be planted on this territory. In return for each damaged (removed from the environment) tree, 3 similar species will be planted. In case of damage of protected species (Red List species), 10 similar species will be planted. Locations and areas, species and their quantities used for compensation measures will be specified on the basis of the results of taxation. In addition, relevant organization will be responsible for looking after the planted species;
- Implementation of all measures for prevention of air and soil quality deterioration.

During the maintenance works at operation phase, all mitigation measures against the impact on vegetation cover elaborated for the construction phase should be implemented.

6.6.3 Impact on Wildlife, Destruction or Change of behaviour of Species

6.6.3.1 Construction Phase

Road construction will cause temporary disturbance of fauna and migration may occur. Construction works may cause following impacts:

- Concern factors will increase animal species inhabiting in the vicinity of the road and construction sites. If we take into account a high anthropogenic load of the project corridor, such kind of impact is mainly expected on small birds inhabiting in the forest. Scale of the impact for large birds will not be significant. Out of mammals: Various species of forest mice and vole; Out of reptiles: lizard, while working in the vicinity of the river - amphibians;
- Arranged trenches pose a risk to small animals (e.g. mice and different species of voles). They might fall into the trench and get injured;
- Illegal hunting can occur by construction personnel;
- There is a risk of spreading of invasive species;

Also, following indirect impacts are expected, which is discussed in the relevant Paragraph:

- Vibration and noise levels will increase during construction works, as well as emission of dust and other harmful substances in the air. Migration of certain species of animals is expected;
- The destruction of vegetation will have a negative impact on food base and reproduction of vertebrate and invertebrate animal species;
- Contamination of the environment with waste and visual-landscape change may lead to animal deaths or migration;
- In case of water and soil pollution with harmful substances, negative impact is expected on fish, amphibians, birds inhabiting near water and water-related animal species;
- Limited movement during the construction of the penstock, temporary fragmentation of habitats;

Based on the above mentioned, direct (collision/injury) and indirect (migration due to noise, vibration, impact of emission, etc.) impacts on fauna are expected during the construction phase. The main sources of the impacts are:

- Traffic;
- Machinery and people working in the area;
- Earth works and existence of temporary structures.

It should be noted that construction phase is not long-term. Animals/birds will not migrate in a long distances and after completion of works, they will return to their habitats.

Based on the above mentioned, impact on wildlife during the construction phase may be assessed as medium. In case of appropriate mitigation measures and constant monitoring, impact on fauna may be reduced to low level.

6.6.3.2 Operation Phase

Some sources of direct and indirect impact (e.g. earth works, construction works, etc.) on fauna will not exist during the operation of the road. Scale of the impact on fauna will not be significant and considering the planned mitigation measures, impact will be reduced to minimum.

6.6.3.3 Mitigation Measures

Mitigation measures against impact on fauna are:

- Strict protection of traffic routes and boundaries of construction sites;
- Limited speed of traffic in order to reduce direct impact on animal species (collision);
- Record of birds' nests, and prohibit the approach during the breeding season;
- Pits, trenches and other must be protected to prevent fall of animals. For large species – sharp-collared ribbon, for small animals – any flat material – tin, polyethylene and etc. Long boards or logs must be launched into trenches and pits, so that small animals could get out. Trenches must be inspected before filling them with soil.
- To use the minimum amount of light in order to reduce the spread of light;
- Activities causing too much disturbance of animals should be implemented in a short period of time, in no breeding period of time;
- Development of code of conduct prohibiting illegal hunting and personnel instruction;
- Proper management of waste;
- Mitigation measures against water, soil and air contamination, noise propagation, impact on vegetation cover, etc. should be effectively implemented (see relevant Paragraph).

6.6.4 Impact on Protected Areas

Due to the fact that there are no protected areas in the vicinity of the project area, direct impact on them is not expected.

6.6.5 Impact Assessment

Table 6.6.5.1. Summary of the Impact on Biological Environment

Description of impact and impact sources	Impact receptors	Assessment of residual impact					
		Significance	Probability	Impact area	Duration	Reversibility	Residual impact
Construction phase:							
Damage/Destruction of the Vegetation; Habitat loss/fragmentation: – Direct impact: o Cutting of plants; o Rehabilitation of infrastructure. – Indirect impact: o Water pollution; o Soil pollution and erosion	Plant species within the project road corridor, fauna	Direct and indirect, Negative	High risk	– Direct impact area – road corridor; – Indirect impact area – areas adjacent to project road	Medium term	Mainly reversible	**Medium,** Considering the mitigation measures –**low**
Impact on fauna: – Direct Impact: o Vehicle collision, falling into trenches; o Illegal hunting. – Indirect impact: o Cutting down the vegetation in order to arrange infrastructure; o Pollution of air; o Acoustic background Change; o Possible pollution of surface and ground waters; o Soil pollution and erosion; o Visual Impact.	Animal species inhabiting within the project area	Direct and indirect, Negative	High risk	0,5-1,0 km radius from areas adjacent to project road corridor	Construction phase	Mainly reversible	**Medium,** Considering the mitigation measures –**low**
Operation phase:							
Damage/Destruction of the Vegetation; Habitat loss/fragmentation.	Areas adjacent to project road corridor, vegetation cover, fauna	Direct negative	Low risk	Areas adjacent to the project road	Long term	Reversible	**Very low**

– <u>Direct Impact:</u> o Vehicle collision, falling into trenches; o Illegal hunting. – <u>Indirect impact:</u> o Cutting down the vegetation in order to arrange infrastructure; o Pollution of air; o Acoustic background Change; o Soil pollution and erosion; o Visual Impact.	Animal species inhabiting within the project area	Direct and indirect, Negative	Medium risk	0,5-1,0 km radius from areas adjacent to project road corridor	Long term	Mainly reversible	**Low**

6.7 Impacts Caused by Waste Generation and Propagation

6.7.1 Construction Phase

During the construction of the road, soil and inert waste generated in the process of cutting off the slopes is the most notable in terms of quantity. Major part of waste rock will be used for project purposes. The rest part of waste rock and inert material will be disposed on a preliminary selected area in accordance with relevant rules.

Household waste will be collected in appropriate containers and will be transported to the nearest landfill.

Appropriate storage facility will be arranged for temporary disposal of hazardous waste. Hazardous waste for further management will be transferred to licensed contractor. Metal waste will be delivered scrap metal collecting points.

Violation of rules of waste management may cause a number of negative impacts on different receptors of the environment, for example:

- Incorrect management of waste (dumping into water, scattering) may lead to water and soil pollution, as well as to deteriorated sanitary conditions and adverse visual changes;
- Improper disposal of construction waste and waste rock (generated during the excavation works) may cause damming of the roads and may lead to erosion processes, etc.

Therefore it is necessary to protect waste management conditions. Detail descript of waste management is given in Annex 4.

6.7.2 Operation Phase

After completion of the construction works, existing bridge should be dismantled before the Didadjara reservoir is filled. Due to demolition works about 300 m^3 reinforced concrete waste will be generated, which will be removed to the landfill for construction waste.

Waste generated during the operation of the project road and bridge will consist of roadside litter, including food waste, plastic bottles and paper thrown out by passengers. The trash may occur in the river, which is noteworthy; Roadside waste (glass containers, etc.) pose a threat to traffic safety, which may contribute to accidents, there is also a small risk of injury to animals.

6.7.3 Mitigation Measures

Measures considered in the waste management plant will be implemented during the construction and operation phases:

- After the disposal of waste rock, the surface of the disposal area should be recultivated;
- Scrap should be delivered to the relevant service;
- Appropriate areas will be allocated for the disposal of wood waste;
- Labelled hermetic containers should be arranged in construction sites for a temporary storage of hazardous waste.
- Special storage facility should be arranged for temporary disposal of hazardous waste during the operational phase, which should be in compliance with environmental requirements, namely:
    - Storage facility will be marked and will be protected from the impact of atmospheric precipitation and unauthorized encroachments;
    - The floor and walls of the storage facility should be finished with ceramic tiles;

  - Storage should be equipped with wash stand and tap, trap for intake;
  - Shelves and racks for waste disposal;
- Hazardous waste disposal for further management to be done only by adequately licensed contractor;
- Appropriate trained personnel should be hired for waste management; they should receive periodic training and testing. Recording of quantities and types of such waste is required.

During operation of the roadside waste reduction is possible through raising awareness of population, for which following measures are required to be implemented:

- Raise awareness of population and passengers on proper management of waste;
- Population and passengers should be informed about fines in case of littering.

6.8 Landscape and Visual Impact

6.8.1 Impact Assessment Methodology

Visual-landscape impact assessment is more or less subjective. Impact area and duration, as well as the relative ecological value of the landscape are taken as an evaluation criteria.

Table 6.8.1.1. Assessment criteria of the impact on landscape and visual

Ranking	Category	Impact on visual receptors	Duration of landscape changes and spatial boundaries / landscape quality and value
1	Very low	Invisible change in the view	Invisible change in the landscape, or landscape is not valuable
2	Low	Some slight change of view is observed from certain points, which is easily adaptable	Insignificant change in the landscape, or landscape restoration takes 1-2 years
3	Medium	The view has changed noticeably from many points of view, though it is easily adaptable	Some sites of the natural landscape have changed, or landscape restoration takes 2-5 years
4	High	The view has changed noticeably from most of the points, though it is easily adaptable	A large area of natural or high-value landscape has changed, or landscape restoration takes 5-10 years
5	Very high	The view has completely changed from every place, hardly adaptable impact on receptors is expected.	A large area of natural or high-value landscape has changed, or landscape restoration is not possible

6.8.2 Characterization of the Impact

6.8.2.1 Construction Phase

Negative visual impact will be related to increased traffic, vegetation cover removal, construction material disposal and temporary structures arrangement.

Overall it can be said that the construction works will cause partial alteration of usual views and landscape. However, impact will be short-term and medium scale.

After completion of the construction works, vehicles and equipment, materials and waste will be removed from the construction sites, temporary structures will be dismantled and removed, workers will be withdrawn, the area will be recultivated.

6.8.2.2 Operation Phase

The major source of visual impact during the operation will be the traffic. Considering the current baseline condition, operation of the road will cause certain positive impact.

6.8.3 Mitigation Measures

Impact on visual landscape will be mitigated through following measures:

- Reasonable selection of colour and design for permanent structures;
- Temporary structures, materials, and waste should be disposed so that to be less noticeable for visual receptors;
- Protection of sanitary and environmental conditions;
- Recultivation works should be implemented after the completion of construction works;
- Decorative trees and plants should be planted adjacent to the project road.

6.8.4 Impact Assessment

Table 6.8.4.1. Summary of the visual and landscape impact

Description of impact and its sources	Impact receptors	Residual Impact Assessment					
		Nature	Probability of influence	Influence area	Duration	Reversibility	Residual impact
Reconstruction-construction phase:							
Visual landscape impact: – Cutting of trees in working areas and corridors of access roads; – Construction camp and temporary structures; – Waste disposal; – Works related to construction and transportation	Passengers, population, tourists, animal species inhabiting in the vicinity	Direct Negative	Medium risk	Areas adjacent to construction site	During construction phase	Reversible	**Medium,** Considering the mitigation measures – **low**

6.9 Impact on Cultural Heritage

Historical and cultural monuments are not recorded within the project influence zone. However, during the implementation of excavation works some archaeological sites can be discovered. In this case a building contractor is obliged to invite specialists from organs authorized for the expertise by Georgian legislation in order to assess site importance and make decision about continuation of works.

6.10 Impact on Socio - Economic Environment

6.10.1 Impact Assessment Methodology

Following factors should be considered while discussing the impact on socio-economic environment during the construction and operation of the road:

1. Impact on land ownership and use; limited resources;
2. Impact on local infrastructure, limited resources;
3. Impact on employment and economic environment;
4. Health and safety risks.

Impact is assessed according to three categories - **low impact, medium impact and high impact** (see Table 6.10.1.1.

Table 6.10.1.1. Assessment criteria of the impact on socio-economic environment

Ranking	Category	Impact on socio - economic
Positive		
1	**Low**	– Employment rate in region has increased by less than 0.1%. – Average income of the local population has increased by 10%. – Budget revenues of the region have increased by 1%. – Local infrastructure / power supply has been slightly improved, resulting in improved local population living / subsistence and economic environment.
2	**Medium**	– Employment rate in region has increased by 0.1%-1%. – Average income of the local population has increased by 10-50%. – Budget revenues of the region have increased by 1-5%. – Local infrastructure / power supply has been significantly improved, resulting in significantly improved local population living / subsistence and economic environment, which contributes to the economic development of the region.
3	**High**	– Employment rate in region has increased by 1%. – Average income of the local population has increased by more than 50%. – Budget revenues of the region have increased by more than 5%. – Local infrastructure / power supply has been significantly improved, resulting in significantly improved local population living / subsistence and economic environment, which contributes to the economic development of the region.
Negative		
1	**Low**	– A short time delay in the availability of resources or infrastructure is expected, though it will not affect the income of the local population. In addition, it will not be followed by long-term negative impacts on the economic activity of the local population. – Quality of life of the local population will be lowered for a short period of time, though it will not be followed by a long-term negative results. – Health will not be affected. – Impact on safety is negligible. – A long-term, but easily adaptable impact on environment is expected. – Local population will increase by 10% due to migration.
2	**Medium**	– A short time delay in the availability of resources or infrastructure is expected, due to which the local population will have to change their lifestyle for a short period of time. However, it will not have any long-term negative impact on the economic activities of the local population. – Quality of life of the local population will be lowered for a short period of time, though it will not be followed by a long-term negative results. – A certain impact on health is expected, but there is no increased mortality risk. – There are some risks related to safety. – Complaints from citizens are expected about some of the impacts. – Local population will increase by 10-30% due to migration.

3	High	– A short time delay in the availability of resources or infrastructure is expected, due to which the local population will have to change their lifestyle for a short period of time, which will have a long-term negative impact on their economic activities. – Quality of life of the local population will be significantly lowered. – There is a significant impact on health. There is a high risk of increasing mortality rate. – There are some risks related to safety. – Corrupt deals related to employment or nepotism. – People are constantly complaining about the influence of certain factors. In this regard, conflicts arise between residents and staff. – Local population will increase by 30% due to migration. Cultural environment for the local population is significantly changed. Creation of new settlements is expected.

6.10.2 Characterization of the Impact

6.10.2.1 Impact on Land Ownership and Use

The project road partially will pass through privately owned land plots. Information on these land plots will be specified prior to the construction works.

Above mentioned land plots will be purchased. The road corridor will be owned by the state and appropriate compensation will be provided to the current owners. Physical resettlement is not expected.

6.10.2.2 Impact on Local Infrastructure and Limited Resources

Following mitigation measures should be implemented in order to reduce impact during the construction of the project road and bridge:

- Restrict the movement of the caterpillar technique on public roads as far as possible;
- Specially designated personnel (standard bearer) should control the movement of vehicles, if necessary;
- Selection of an optimal bypass route to the construction site, if necessary;
- Relevant banners will be arranged along the road, through which passengers will be informed about the on-going works within the project area;
- Population should be provided with the information about the time and duration of works, if necessary;
- Complaints should be recorded and an appropriate action should be taken.

6.10.2.3 Health and Safety Risks

Except the indirect impact (deterioration of air quality, spread of noise and electric fields, etc., which are described in the relevant subsections) there is a direct risks of impact on health and safety (residents and staff working within the project) during the construction phase.

Direct impact may be: Vehicle collision, power hit, falling from height, injuries while working with construction techniques and others. Strict security measures and a permanent supervision should to be protected in order to prevent direct impacts. Security measures include:

- Personnel should to be trained on safety and labour protection issues;
- Insurance of staff working on heights ropes and special mountings;
- Arrangement of restricting, warning and indicative signs for safety of population and personnel;
- Arrangement of standard medical boxes;
- Control and prohibition of unauthorized and unprotected access to the construction site;

- Maximum protection of safety rules during the transportation;
- Regular assessment of risks to determine specific risk factors for population and for management of such risks;
- Population should be informed about increased traffic;
- Construction personnel shall be provided with personal protective equipment (special - clothing, helmets, etc..).

During the operation of the road, special attention should be paid to traffic accidents.

7 Environmental Impact Mitigation Measures and Monitoring

7.1 General Overview

Hierarchy of environmental measures is following:

- Impact prevention;
- Impact reduction;
- Impact mitigation;
- Compensation.

Impact can be avoided and risks can be reduced by using best construction and operation practices. Designed project considers some measures of mitigation. However, as not every impact can be avoided, a plan of mitigation measures for every phase is worked out to ensure maximum environmental safety of the project.

The plan is "live" document and is to be amended and corrected on the basis of monitoring/observation. In case of any changes in working procedures corresponding amendments are to be made in the mitigation measures plan.

7.2 Mitigation Measures for the Expected Impacts

Tables below give information concerning mitigation measures developed for construction and operation phases and necessary monitoring work, namely:

I. Column presents: description of expected impact according to specific receptor, due to which works may this impact occur and expected scale;
II. Column - Description of mitigation measures' main goals and objectives;
III. Column - List of mitigation measures, which will prevent or mitigate expected impact;
IV. Column - Responsible organization, monitoring and approximate expenses.

7.2.1 Mitigation Measures – Construction Phase

Receptor/impact	Description of Impact	Mitigation Measures	Specification
Emission of inorganic dust in ambient air	• Dust caused by earth works; • Dust caused by traffic movement; • Dust caused by loading and unloading of inert materials, construction materials (including, during the arrangement of road surface).	• Providing the maintenance of construction vehicles and transport means; • Following the rules for storage of construction wastes, in order to avoid raising dust in windy weathers; • In case of possibility of raising dust, covering with tarpaulin of trucks full of friable material must be carried out; • Taking safety measures to avoid dust surplus emission during earth works and loading or unloading of construction materials (e.g.; prohibition of throwing of materials from height during loading and unloading activities); • Following the rules of optimal speed of traffic movement; • Washing of transport wheels (using of "car wash" service is more appropriate); • Providing special instructions for staff (especially, for drivers of transport and technical vehicles) before launching the construction works; • Recording any kind of complains and conducting proper measures.	**Responsible part of mitigation measures:** executor organization **Monitoring:** control of technical maintenance; inspection of drivers and staff members working of the vehicles, inspections in sunny weather **Responsible for monitoring:** Manager of Environmental Protection and Security **Costs of monitoring**: additional costs are not required. **Costs for mitigation measures :** additional costs are not required
Emission of combustion materials in ambient air.	• Emissions from cars and construction engines.	• Providing technical maintenance of installations; • Selection of optimal routs and speed for engine movement; • When machines are not used, their engines must be turned off or they may work with minimal spin speed. • Providing staff members with instructions before starting works.	**Responsible part of mitigation measures:** executor organization. **Monitoring:** control of technical maintenance; inspection of drivers and staff members working of the vehicles. **Responsible for monitoring:** Manager of Environmental Protection and Security. **Costs of monitoring:** additional costs are not required. **Costs for mitigation measures:** additional costs are not required.

Noise emission in working zone	• Noise emission caused by transport; • Noise emission caused by construction vehicles.	• Providing technical maintenance of installations; • To equip staff members with special protection means (earmuffs) – operators of the vehicles must be equipped with hearing protectors. Using of hearing protectors is required on those construction sites, where noise level exceeds 85 dBA. Alternatives of hearing protectors may be restriction of time for workers to stay in high noise area. According to the recommendations of the WB, "working period in sites with 85dB must be half diminished after exceeding each 3db"; • Providing staff members with instructions before starting works.	**Responsible part of mitigation measures:** executor organization **Monitoring:** control of technical maintenance of machines/installations. **Responsible for monitoring:** Manager of Environmental Protection and Security **Costs of monitoring:** additional costs are not required **Costs for mitigation measures:** costs of individual protection means for staff members – "Low costs".
Noise emission on the border of settlement and in forest zone	• Noise and vibration caused by transport; • Noise and vibration caused by construction vehicles.	• Providing technical maintenance of installations; • "Noisy" works must be carried out only daytime; • Providing staff members with instructions before starting works; • Recording any kind of complains and conducting proper measures; • To inform the roadside resident population in advance about the especially noisy works.	**Responsible part of mitigation measures:** executor organization. **Monitoring:** control of technical maintenance of machines/installations. **Responsible for monitoring**: Manager of Environmental Protection and Security. **Costs of monitoring:** additional costs are not required. **Costs for mitigation measures**: additional costs are not required.
Stability of soil and destruction of fertile soil layer	• Change of soil stability during earth works; • Vehicle movement on fertile soil layer.	• To follow fixed safety measures during planned works; • To avoid crossing borders of roads and construction sites in order to prevent soil damage; • Removal of fertile soil layer (in case of necessity) and temporary storage before recultivation; • Disposals of fertile soil layer must be arranged in accordance with the special rules: height of the disposals mustn't be exceeded 2m; inclination of disposal slopes must be 45^0, derivation canals must be arranged on the perimeter; • Providing staff members with instructions before starting works; • Record any possible risks and implementation immediate measures	**Responsible part of mitigation measures:** executor organization **Monitoring:** on-going monitoring **Responsible for monitoring**: Manager of Environmental Protection and Security. **Costs of monitoring**: additional costs are not required. **Costs for mitigation measures:** Costs of storage of removed soil layer with proper rules – "Low costs"
Soil pollution	• Soil pollution with	• Ensuring technical maintenance of installations, well organized	**Responsible part of mitigation measures:**

	wastes; • Pollution by spilling of fuel, oil or other liquids	management of materials to avoid spilling of lubricants; • Proper management of wastes; • Localization and clearance of spilled lubricants; • Providing staff members with instructions before starting works; • To equip with proper technical means and inventory (containers, special collectors for spilled liquids, etc.); • Removal all potential residuals after completion of rehabilitation works; • In case of necessity, laboratory examination of soil quality.	executor organization **Monitoring:** inspection of technical maintenance; control of waste management plan; visual control and in case of necessity, laboratory control of the condition of soil **Responsible for monitoring**: Manager of Environmental Protection and Security. **Costs of monitoring;** in case of necessity costs of laboratory control – "low costs" **Costs of mitigation measures:** costs for special collectors for spilled liquids and costs for soil clearing – "Low costs'.
Surface water pollution	• Pollution caused by improper waste management. • Pollution caused by oil leakage from transport and vehicles.	• Road surface must be laid down just in sunny weather, in order to avoid pollution of stream flow; • Road surface must be laid down with proper safety measures – material and residuals shouldn't be distributed, etc.; • Distance from location of vehicles to surface body of water should be at least 50m (where it is possible, but if it is impossible, permanent control and implementation of safety measures are necessary to prevent water pollution); • To prevent of blocking of riverbed in case of works in the river or its surroundings; • Prohibition of car washing near riverbeds, for washing of transport and vehicles is recommended to use car washing service; • Prohibition of fuel filling for transport or maintenance on the construction sites; • Ensuring technical maintenance of vehicles and installations, to avoid risk of pouring of fuel/oil into the water body; • Proper management of materials and residuals; • Collecting of remaining wastes during the work process and their temporary storage on a special site far from the body of water; • In case of spilling fuel/oil, localization of spilled materials and immediate clearing of polluted area must be carried out, in order to	**Responsible part of mitigation measures:** executor organization **Monitoring: inspection of technical maintenance;** control of waste management plan; visual control of the soil quality. **Responsible for monitoring:** Manager of Environmental Protection and Security. **Costs of monitoring:** additional costs are not required; **Costs for mitigation measures:** additional costs are not required.

		avoid water pollution; • Installation of drainage systems around the potential pollutant sites of run-off the rivers (e.g.: on the perimeter of soil or storage areas of wastes); • Providing staff members with training about environmental protection and security issues.	
Pollution of groundwater	• Deterioration of quality by polluted soil; • Deterioration of quality by spilling of lubricants during construction (earth works) works.	• Implementation all possible measures for preventing deterioration of surface water quality (see corresponding paragraph); • Implementation all possible measures for preventing deterioration of soil quality (see corresponding paragraph).	**Responsible part for mitigation measures:** executor organization **Monitoring:** no monitoring is needed **Responsible for monitoring:** Manager of Environmental Protection and Security. **Costs of monitoring:** **Costs for mitigation measures:** costs of mitigation measures for soil quality protection
Landscape-visual change	• Landscape-visual changes caused by increased transport movement, operation of construction vehicles, storage of building materials and wastes, etc.	• Reasonable selection of colour and design of temporary and permanent installations; • Arrangement of temporary constructions, disposal of materials and residuals so that they should be invisible for visual receptors (for population resident on road sides and passengers); • After completion of rehabilitation works, planting of greenery and restoration works of landscape must be implemented.	**Responsible part for mitigation measures:** Executor organization. **Monitoring:** visual monitoring, in purpose of control ecological and sanitation situation **Responsible for monitoring:** Manager of Environmental Protection and Security. **Costs for monitoring:** additional costs are not required. **Costs for mitigation measures**: no important costs are required
Impact on flora	Destruction of vegetation covers in roadside line.	• Borders of construction sites and transport movement routs must be strictly protected, which excludes extra damage of vegetation cover. After completion of construction works, clearing of the area must be carried out and removed soil layer must be returned on the site; • Cutting trees must be implemented under supervision of specialists of authorized service; • removal of protected species (in case of discovering such species after valuation) from the environment should be carried out in accordance	**Responsible part for mitigation measures:** Executor organization **Monitoring:** visual, periodical inspection **Responsible for monitoring:** Manager of Environmental Protection and Security. **Costs for monitoring:** additional costs are not required. **Costs for mitigation measures:** significant costs

		with the requirements of the Law of Georgia on "Red List and Red Book of Georgia" (subparagraph "f" , paragraph 1, Article 24) in agreement with the Ministry of Environment Protection and Natural Resources of Georgia • In accordance with the principles mentioned in paragraph 6.6.2.3., implementation of appropriate compensation measures for the damaged forest cover during the road construction and rehabilitation works must be carried out; • Implementation of all necessary measures to avoid deterioration of quality of ambient air and soil; • Providing staff members with instructions about the issues of vegetation cover protection before launching the works; • After completion of works, planting of greenery and ornamental plants must be carried out.	will be required for compensation measures of damage of vegetation cover.
Impact on fauna	• Temporary disturbance of local fauna during the movement of transport, construction vehicles and people (direct impact – clash, indirect impact – noise, dust, emissions etc.).	• Borders of construction sites and transport movement routs must be strictly protected; • Selection of optimal speed of movement to reduce direct impact (clash); • Special measures must be worked out for reduction of dust, noise and vibration; • Spilling of oils and other pollutants in the water and soil must be prohibited; • Holes, trenches etc., must be reinforced in order to avoid falling of animals; • Providing staff members with instructions before starting works.	**Responsible part for mitigation measures:** Executor organization **Monitoring:** control of waste management, control of maintenance of installations; **Responsible for monitoring:** Manager of Environmental Protection and Security. **Costs for monitoring:** additional costs are not required. **Costs for mitigation measures**: additional costs are required
Wastes	• Construction wastes (including, harmful wastes) • Household wastes.	• Wastes (especially inert construction wastes) must be reused (e.g. for arrangement of road layer; • To find special areas protected for outside impacts for temporary disposal of wastes; • Strict control of waste management process; to create a special book of record to account amount of wastes, type of wastes and following steps for their management;	**Responsible part for mitigation measures:** Executor organization **Monitoring:** control of waste management. **Responsible for monitoring:** Manager of Environmental Protection and Security. **Costs for monitoring:** additional costs are not required.

		• Harmful wastes must be properly packed and marked; • Management of harmful wastes must be carried out by authorized contractor.	**Costs for mitigation measures:** • Costs of hired contractor for removal of harmful wastes; • Costs of packing of wastes in accordance with existing rules and their transportation; total costs – "average".
Ensuring security and health of population and staff members	• Direct impact (accidents related to transport, etc.); • Indirect impact (emissions, acoustic baseline, water and soil pollution).	• Before hiring and after that, staff members must be provided with trainings about security and labour protection issues for several times in a year; • During working at a height, staff members must be provided with ropes and special straps; • Signs of warning, prohibition and pointing must be arranged near construction sites with the purpose of security of staff members and local population; • There must be special medical boxes in the construction area and dangerous sites;; • Foreigners mustn't be allowed to enter the construction sites without permission or without special safety accessories; • Following safety measures during transport operations is obligatory; • Assessment of risk factors for the population and proper management of such risks must be permanently implemented on sites; • Staff members must be provided with special safety accessories (coveralls, helmets, etc.); • Implementation of special measures to prevent deterioration of ambient air quality, as well as, water and soil quality (see corresponding paragraphs).	**Responsible part for mitigation measures:** Executor organization **Monitoring:** recurrent control/inspection. **Responsible for the monitoring:** special staff. **Costs for monitoring:** in case of necessity, costs for hiring additional staff will be required – "High costs". Monitoring works don't require any additional costs. **Costs for mitigation measures:** "Average costs"
Impact on traffic flows	• Traffic congestion; • Limited traffic movement; • Risks of accidents	• Maximal restriction of movement of caterpillar vehicles • In case of necessity, standard-bearer must control the movement of vehicles, as well as traffic flow on the main road; • Near the construction sites there must be special warning signs (for drivers of motor cars); • Population and passengers must be informed about the time and period	**Responsible part for mitigation measures:** Executor organization **Monitoring:** recurrent control. **Responsible for monitoring:** Manager of Environmental Protection and Security. **Costs for monitoring:** additional costs are not

		of construction works; • In case of any complains, they must be recorded and conducted proper measures.	required. **Costs for mitigation measures:** costs of arrangement of warning signs – "low costs'

7.2.2 Mitigation Measures – Operation Phase

Receptor/impact	Impact Description	Mitigation Measures	Specification
Emission of combustion materials and dust in ambient air.	• Emissions and dust caused by traffic	• Planting and growing of ornamental plants; • In case of complains, measuring of air quality must be carried out in main construction points;	**Responsible part for mitigation measures:** competent state service **Monitoring:** visual inspection of artificial vegetation cover. **Responsible part for the monitoring:** competent state service.
Noise emission	• Noise caused by vehicle engines; • Wheels – noise caused by friction on the road surface; • Voice signal emission	• Preservation of vegetation cover at roadside houses, planting and growing of ornamental plants; • In case of complains, measuring of noise degree and corresponding activities must be carried out in main construction points;	**Responsible part for mitigation measures:** competent state service **Monitoring:** control of technical maintenance of vehicles and installations. **Responsible part for the monitoring:** competent state service.
Wastes	• Scattered wastes by passengers of cars moving on the main road and	• Providing service points with garbage bins; • Rising of self-consciousness of population and passengers and transferring information about waste management; • Providing public awareness about fines for littering the environment;	**Responsible part for mitigation measures:** competent state service **Monitoring:** monitoring of throwing rubbish from cars.

	accumulated wastes in service points.	• Installation of special banners containing information about the illegality of littering and fines must be carried out on the roads.	**Responsible part for the monitoring:** competent state service.
Health and security of passengers and pedestrians.	• Risk of accidents	• Installation of corresponding signs within the motor roads; • Permanent control of technical condition of the motor road surface and other road components (signs, zebra crossings, etc.) and implementation proper rehabilitation works in case of damage.	**Responsible part for mitigation measures:** competent state service **Monitoring:** control of speed and traffic rules. **Responsible part for the monitoring:** competent state service.

8 Environmental Monitoring Plan

In the framework of the planned construction works, the process of ecological monitoring aims at solving of the following objectives:

- Confirming that the construction and exploitation procedures are carried out in compliance with environmental legislation;
- Ensuring the control of the risks and ecological impact;
- Providing stakeholders with relevant environmental information;
- Confirming the process of minimizing/mitigating the negative impacts, measuring the effectiveness and making necessary adjustments when needed;
- The permanent environmental control during the project implementation (construction and exploitation).

Environmental monitoring plan for reconstruction-construction and operation of the project road is given in paragraphs 8.1. and 8.2. It is noteworthy that this is a general plan and it may be detailed and adjusted during the working process.

8.1 Monitoring Plan for the Construction Phase

Object of control	Point of control/testing	Method	Frequency/time	Purpose	Responsible Part
1	2	3	4	5	6
Ambient air	Construction base, Construction sites.	• Visual; • Control of technical maintenance of installations	• Within the process of earth works; • During intensive transport operations; • Recurrent control in sunny weathers; • During construction works; • Checking maintenance of vehicles before starting works.	• Quality of ambient air should correspond to the normative degree; • Reduction of impact on health of population • Providing the security of workers	Executor organization
Noise	Construction sites; Nearest receptor	• Control; • Measuring; • Control of technical maintenance of installations.	• Recurrent control (especially, during noisy operations); • Measuring – in case of complains; • Checking maintenance of vehicles before starting works.	• Providing correspondence with health care and security standards; • Minimal disturbance of population; • Providing comfort working conditions for workers.	Executor organization
Soil	Construction base – disposal area of building materials and wastes; Construction sites.	• Visual control; • Supervision of waste management; • Laboratory control; • Control of technical maintenance of installations	• Recurrent control; • Inspection after completion of works; • Laboratory control – in case of necessity (spilling of oils).	• Preservation of soil stability and quality; • Reduction of impacts on receptors (vegetation cover, population, etc.) depending on soil quality.	Executor organization
Surface water	Construction base near surface waters	• Visual control; • Supervision of waste management and sanitary conditions.	• Recurrent control and inspection.	• Protection of river water; • Reduction of impact on receptors (aquatic biodiversity, etc.,) depending on river water quality.	Executor organization
Negative visual changes	Construction base - disposal area of building	• Visual control; • Supervision of waste	• Recurrent control and inspection; • Control after completion of	• Prevention of dissatisfaction of population;	Executor organization

	materials and wastes; Construction sites.	management and sanitary conditions.	works	• Prevention of dissatisfaction of passengers.	
Condition of biological environment.	Line of project road (especially, proximity of forest zone)	• Visual control;	• Control within working hours; • Unplanned control. • After completion works, inspection of vegetation cover and its restoration, if it is possible.	• Preservation of vegetation cover; • Reduction of negative impact on animals.	Executor organization
wastes	Construction site and/or adjoining area; Area for waste disposal.	• Visual inspection of the area; • Control of waste management.	• Recurrent control and inspection; • After completion of works	• Protection of soil and water quality; • Reduction risks of negative visual effect; • Prevention of dissatisfaction of population.	Executor organization
Security of labour	Territory of implementation of works.	• Inspection; • Providing safety accessories and recurrent control of their maintenance. • Control of fulfilment labour security requirements.	• Before launching works; • Recurrent control during works.	Providing conditions in accordance with health care and security standards, prevention/minimization of traumatism.	Executor organization

8.2 Monitoring Plan for the Operation Phase

Object of control	Point of control/testing	Method	Frequency/time	Purpose	Responsible part
Ambient air	Nearest receptors (houses)	• Instrumental measurement.	Control after getting complains.	Minimal disturbance of population.	Technical supervision and monitoring service of roads department of Georgia.
noise	Nearest receptors (houses)	• Instrumental measurement.	Once in a year or after getting complains.	Minimal disturbance of population.	Technical supervision and monitoring service of roads department of Georgia.
Wastes	Roadside line	• Visual inspection of the territory.	Daily	Prevention of pollution of environment by wastes.	Local cleaning municipal department or contractor
Security of passengers	Along the whole road	• Visual inspection; • Control of traffic signs and their maintenance in the roadside line; • Control of technical condition of road surface	Several times in a year.	Providing security for passengers and pedestrians.	Technical supervision and monitoring service of roads department of Georgia.

9 Emergency Response Plan

9.1 Goals and Objectives of the Plan

Goal of the emergency response plan is to determine and establish guidelines for workers employed for the road construction works in order to ensure rational and coordinated actions of personal during techno genic accidents or incidents, as well as protection of personnel, population and environment.

Objectives of this plan are:

- Determination of possible emergency situations during the road construction;
- Determination of groups responsible for response to each type of emergency situation, their equipment, emergency action plans and responsibilities;
- Determination of internal and external alarm systems;
- Immediate activation of internal resources and, if necessary, mobilization of additional resources and relevant procedures;
- Provision of emergency management system;
- Ensure compliance with legislative, regulatory and safety requirements during emergency situations.

Expected emergency response plan envisages the requirements of Georgian laws and legislative acts.

9.2 Types of Emergency Situations

Considering specificities of planned activities, following types of emergency situations are expected:

- Traffic accidents;
- Accidental spills of pollutants;
- Fire;
- Personnel traumatism and incidents related to their health safety.

It is noteworthy, that emergency situations, listed above, may be subsequent and development of one emergency situation may initialize another one.

9.2.1 Traffic Accidents

Trucks and heavy machinery will be used during construction works. During their movement on public and access roads, following are expected:

- Collision with transport means, real estate or livestock of local population;
- Collision with local population;
- Collision with project personnel;
- Collision with other project machinery;
- Collision with local infrastructure facilities;

High risk of traffic accidents will be related to relatively intensified traffic. A number of preventive measures should be taken in order to minimize the risks of traffic accidents, including: limitation of traffic speed, arrangement of warning signs, selection of optimal routes for vehicles, regulation of traffic by standard-bearer, etc.

9.2.2 Accidental Spills of Pollutants

Oil spill risk may be related to a violation of the conditions of their storage, fuel or oil leakage from vehicles and equipment and so forth.

9.2.3 Fire

The main factor of accident may be anthropogenic, namely: indifference of personnel and violation of safety norms, violation of storage rules for fuels, oils and other explosive substances and etc. in order to prevent fire eruption, strict supervision over fuel and lubricants storage rules, provision of fire fighting means on the construction site, periodic training of personnel on fire prevention and elimination of its consequences will be required.

9.2.4 Personnel Traumatism and Incidents Related to their Health Safety

Except incidents related to other emergency situations, personnel traumatism may also be related to:

- Incidents related to heavy machinery/equipment used for project implementation;
- Fall from large heights;
- Poisoning with used chemical substances;
- Electric shock, during working near aggregates under high voltage.

9.3 General Preventive Measures

Preventive measures for traffic accidents:

- Selection of optimal transport movement routes and speed restrictions;
- Installation of warning, prohibiting and pointing road signs at access roads and construction camps;
- During movement of special and oversized machinery they should be escorted by specially equipped machinery and trained experienced personnel.

Preventive measures for hazardous substance spill:

- Strict supervision over implementation of fuel and chemicals' storage and use terms. Fitness of storage vessel must be checked before storing;
- The technical functionality of oil containing equipment should be periodically monitored;
- Termination of works / suspension of equipment and machinery operation and implementation of maintenance work after detection of minor spill, so that incident would not become large-scale.

Preventive measures for fire/explosion:

- Periodical training and testing of personnel on fire prevention issues;
- Storage of easily flammable and explosive substances at safe places. Installation of corresponding warning signs at their warehouses;

- Implementation of fire safety rules and arrangement of functional fire fighting equipment at the territory;

Preventive measures for personnel traumatism/injury:

- Periodical training and testing of personnel on labour safety issues;
- Provision of personnel with individual protection means;
- Warning signs should be arranged within the dangerous zones;
- Preparation of special staff, which will control implementation of safety norms at construction sites and will register facts of violation

9.4 Approximate Scale of Accidents

According to expected emergencies, liquidation resources and legislative requirements, accidents and emergency situations are sorted in 3 groups. Table 9.4.1 gives description of emergency situations according to their level, indicating corresponding reaction.

Table 9.4.1. Description of Emergencies according to their levels

Accidents	Level		
	I level	II level	III level
General	The internal resources are sufficient for emergency liquidation	External resources and workforce are needed for emergency liquidation	Involvement of regional and country resources for emergency liquidation
Damage of other hydraulic structures	Minor damage of hydraulic structures that is temporary, but will not interrupt significantly HPP operation. The provocation of other emergencies is less expected. HPP personnel will manage to liquidate emergency.	Hydraulic structures damage, which significantly impede the functioning of the power plant and the other risks provoking an emergency situation.	Significant damage to hydraulic structures (bank protection structures injury, significant damage to the pipeline, etc.). There is a high risk of flooding and damage to infrastructure facilities. It is needed to mobilize external resources for rapid elimination of the accident.
Hazardous substance spillage	Local spillage, which does not need external interference and can be eliminated with internal resources. The risks of spreading of the substance on large areas and river contamination do not exist.	Large spills (spills of hazardous substances 0.3 tons to 200 tons). There are risk of substance spreading in the area and the risk of the river pollution.	Large spills (more than 200 tons)
Fire /Explosion	Local fire, which does not need any external interference and is easily controlled. The meteorological conditions are not conductive to the rapid spread of the fire. There are no inflammable and explosive sections/ warehouses and materials.	Large fires, which spread quickly due to the weather conditions. There are inflammable/explosive areas/ warehouses and materials. It is necessary to call the local fire squad.	A large fire, which spread rapidly. The ignition risk of surrounding neighbourhoods and provocation of other emergencies is high. The approach to the territory is complicated. The inclusion of the regional fire service for the liquidation of the incident is necessary.
Road accidents	The damage of equipment, vehicles, infrastructure and non-valuable items takes place. Human health is not in danger.	The damage of the equipment, vehicles, infrastructure and valuable objects takes place. There is the threat to human health or II level traumatism is registered.	The damage of the equipment, vehicles, infrastructure and valuable objects takes place. There is the high risk of development of other emergencies. There is the threat to human health or III level traumatism is registered.
Personnel injury / Traumatism	• One incident of traumatism; • Light fracture, bruises; • I degree burns (skin surface layer damage); • Assistance to injured personnel and the liquidation of the incident is possible by local medical service.	• Individual cases of accidents; • Severe fracture - a fracture of the joints of the middle; • II degree burns (deep layer of the skin lesions); • There is the need to move injured personnel to the local medical facility.	• Several traumatic accidents; • Severe fracture - Articular fracture etc.; • III and IV degree burns (skin, hypodermic tissues and muscle lesions); • There is the need to move injured personnel to the regional or Tbilisi medical service centres with relevant profile.

Note: Considering the scale of the project, its duration and specificity of location, the anticipated emergency situations will be mainly of I levels and less likely of II level, except hydraulic structures damage.

9.5 Emergency Response

9.5.1 Response During Traffic Accidents

During the accident of road transport, it is necessary to implement the following strategic actions:

- To stop vehicles/equipment;
- Transmission of information in accordance with the emergency report scheme;
- In case if there is no danger for human health and there are no risks of provoking other emergency situations (for example: collision of other vehicles, explosion, fire, oil spill, hydrodynamic accident or others), then:
    - Get out of the vehicle/equipment or get away from the accident place and stand on a safe distance;
    - Wait for the police/rescue team to come.
- In case of further threats, act as follows:
    - Get out of the vehicle/equipment or get away from the accident place and stand on a safe distance;
    - If the vehicle accident has occurred on the dangerous section of the road of public use (for example: in the turning, there visual field on the road is limited), then ask to the accident witness to stop the cars moving in direction of an accident location;
    - If you are alone on the accident place, place the warning signs or sharp colour safe signs on the road away from the place of an accident, so that those signs will be visible for the drivers moving in direction of an accident place and will ensure the car stop;
    - In case of explosion, fire, oil spill, hydraulic accident and others, ac in accordance with the strategy given in the relevant paragraphs;
    - In case if there is a threat on the health of a person, do not try to move the body;
    - If the injured person is lying in the middle of the street, cover him with something and confine the accident location, so that it will be seen from a distance;
    - Remove everything from him, which might be making asphyxia (belt, scarf);
    - First aid to the injured in accordance with the first aid strategy given in the relevant paragraphs (but remember, by extra movement of the injured person, you might create additional risks to his health).

9.5.2 Response to Hazardous Material Spill

This section discusses only I scale emergency response strategy. The types of hazardous substances spill response are significantly determined by ground surface, also, the initial condition.

In case of hazardous substances spill on the pervious surface, it is necessary to implement the following strategic actions:

- Information transfer according to the other personnel and emergency service;
- Stopping every device-equipment working on the site;
- Ask personnel to mobilize equipment and personal protection means for emergency response;

- Block the entrances of household-fecal sewage systems (lids of wells);
- Absorbents should be placed together in such way to create continuous barrier (fence) in front of the edge of moving oil products. Ends of the barrier must be folded in front, so that it will have a shape of a horseshoe;
- Spilled oil products containment place must be covered with polyethylene membrane sheets, in order to prevent the oil occurrence in the lower layers of soil;
- It should be noted, that if it is not available to lay down the polyethylene sheets, then the barrier arrangement will cause the oil accumulation on one place, which in turn will cause soil saturation with oil and oil products occurrence in the lower layers;
- For drying in the spilled substances, absorbent pads usage is necessary;
- Gather the oil products in such way, that it will be possible to collect them in container and then remove;
- After absorption of the oil, these pads should be placed in polyethylene bags (if needed, these pads might be reused);
- The site should be completely cleaned from residual oil products, in order to exclude the wash-off of the pollutants by the rain water;
- After completion of cleaning operations, every cleaning material must be collected, wrapped and warehoused in relevantly safe areas.
- Processing of vegetation and upper layer of the soil on existing on the ground surface must begin right after removal of the pollution source or after stopping the leakage;
- When the whole spilled oil products will be cleaned, removal and remediation works implementation must start under supervision of construction works manager/head of the facility and invited specialists with a relevant competence.

9.5.3 Response During Fire

The strategic actions of the person and the personnel working in the vicinity, who detected fire or smoke, are as follows:

- Termination of works on every site, except for safety measures;
- Assessment of the situation, reconnaissance of fire hearth and adjacent territories;
- Withdrawal of the equipment-devices from the areas, where the fire spreading is possible;
- Electrical equipment should be turned out from the circuit;
- In case if fire is strong and it is hard to approach the fire hearth, some kind of fire or explosive hazardous sites/substances are located adjacently, then:
    - Get away from the danger zone:
    - Inform senior manager/operator about the accident;
    - Wait for rescue team and when they appear, inform them about the fire reasons and the situation in the vicinity of fire hearth;
- In case if the fire is not strong, the fire hearth is easily approachable and getting near to it is not dangerous for your health. At the same time, there are certain risks of fire distribution on adjacent territories, then, act as follows:
    - Inform senior manager/operator about the accident;

- Search for the nearest fire stand and supply yourself with necessary fire inventory (fire extinguisher, axe, crowbar, bucket and etc.);
- Try to liquidate fire hearth with fire extinguisher, in accordance with the instruction shown on the fire extinguisher;
- In case if there is no fire stand on the site, use sand or water for fire hearth liquidation or cover it with less flammable thick cloth;
- In case if the electrical equipment turned into the circuit are near the fire hearth, it is prohibited to use water;
- In case of fire in the closed space, do not window the room (except for special needs), because the fresh air supports fire and fire scale growth.

Strategic actions of site manager/chief operator in case of fire:

- Gathering detailed information on fire hearth location, existing/stored devices-equipment in the vicinity and substances;
- Information transfer in accordance with the notification scheme;
- Visiting the accident place and reconnaissance of the situation, risks analysis and assessment of expected fire scales (I, II or III scale);
- Ask whole personnel to use vehicles and fire extinguishing equipment;
- Controlling and managing the personnel actions.

9.5.4 Response during Accidents Related to Human Injuries and Incidents Related to Their Health and Safety

The person, who is taking care of injured person, must notify ambulance about an accident as a first action. Before the rescue will appear, injured person must receive first aid service in accordance with the tactics given below in following chapters. Before carrying out medical service, it is necessary to assess the situation and determine if approaching and helping an injured person might create some threat.

9.5.4.1 First Aid during the bone fracture

Open and closed bone fractures are being distinguished:

- For the open fracture is characterized the violence of skin cover integrity. In this case, there is wound and bleeding in the damaged area. There is a high risk of infection in case of open fracture. In case of open fracture:
  - Promptly call helper, so that helper will immobilize the damaged area of the injured person, while you will process the wound;
  - Cover the wound with clean cloth and directly press on it to stop the bleeding. Do not press directly on broken bone fragments;
  - Without touching the wound with fingers, surround the damaged area with a clean cloth and fit ix;

- If the broken bone fragment is seen in the wound, place the soft cloth around the bone fragment in such way, that the cloth will not be removed and the bandage would not impact on bone fragments. Fix the bandage I such way, that it will not disrupt the blood circulation below the wrapped place;
- Carry out a broken bone immobilization, in the same way as during covered fracture;
- Check pulse, capillary filling and sensitivity below the wrapped place once in every 10 minutes.

- We are dealing with a closed fracture, if the ski integrity is not damaged in the injured area. In this case, haemorrhage and edema are observed in the injured area. In case of closed fracture:
  - Ask injured person to stay still and fix the damaged part of the fracture above and below it by hand, before it will be immobilized (fixed);
  - For a good fixation, fix the injured part of the body on uninjured part. If the fracture is on the hand, fix it on the body with triangle bandage. If the fracture is on the leg, fix the damaged leg on another leg;

Check pulse, sensitivity and capillary filling below the wrapped place once in every 10 minutes. If the blood circulation or sensitivity is reduced, make a less tight bandage.

9.5.4.2 First Aid During Wounds and Bleeding

There are three types of bleeding:

- There is a little blood. In this case is risk of infection:
  - Clean the wound of injured person with any colourless liquid suitable for drinking;
  - Wrap the wound with clean cloth.
- There is a lot of blood. In this case there is a risk of blood loss:
  - Cover the wound with several layers of cloth and make press bandage;
  - If the blood is still leaking, tight the cloth to the wound again (do not take of the blood-drenched cloth) and strongly press on blood source area.
- The blood is pouring like a fountain from the wound. In this case the blood loss is very fast. In this case you must push finger (or fingers) on the artery projection area to avoid this and then put a bandage.

The areas of load on the artery are: the lower third of an arm and upper third of the thigh. The bandage should be fixed like this:

- The bandage is fixed only in extreme case, because often it leads to irreversible damage;
- The bandage is fixed above wound;
- The location where the bandage will be fixed must be covered with cloths. If the wound area is bare, we should place clean cloth under the bandage;
- First bandage must be tight (fixed as possible), then the bandage is getting tight and in addition placed 3-4 times (rope, belt and etc. can be used instead of bandage);
- The bandage should be fixed for 1 hour in the winter and for 2 hours in summer. Then we should release and after 5-10 minutes fix it slightly above from the original location;

- Check if the bandage is properly fixed – if it is properly fixed, there should be no pulse on limb;
- What we should not do;
- Do not put a hand in the wound;
- Do not take anything from the wound. If some foreign body is seen in the wound, we should try to maximally fix it (put a bandage around this body).

- Internal bleeding is hardly determinable damage. Suspect internal bleeding, when the shock signs are observed after getting injured, but there is no significant blood loss. In case of internal bleeding:
  - Lay injured person on his back and rise his legs up;
  - Remind tight clothes on neck, chest, waist;
  - Do not give food, medicine or drinks to injured person. If injured person is conscious and is very thirsty, just wet his lips;
  - Warm injured person – cover with blanket or cloth;
  - Check the pulse in every 10 minutes, as well as breathing and consciousness. If the person is losing mind, place him in safe location.

9.5.4.3 First Aid in Case of Burn

The burn might be developed by hot objects and steam impact (thermal burn), by chemical substances impact on the skin (chemical burn), electricity impact (electrical burn). In order to properly carry out first aid, you must determine the degree of burn, which depends on damage depth and damage area (on what part is the burn distributed).

- The first aid measures during the burn are:
  - It is dangerous to breath in the smoke, so if there is a smoke in the room and it is not available to window fast, remove the injured person on a safe place, on a fresh air;
  - If the clothes are burning on the person, do not start to roll his body, pour the water on the body (in case of electrical burning, usage of water next to the equipment in the circuit, is prohibited);
  - If there is no possibility to use water, cover the body with non-synthetic cloth;
  - It is necessary to start cooling the burnt area in time with cold water (in case of I and II scale burn, water it for 10-15 minutes, in case of III and IV scale burn wrap it with clean wet cloth and then cool it in the water in such wrapped conditions);
  - Remove the cloth and other objects, from the damaged area, which may interrupt blood flow. Do not remove cloth pieces, which are stick to the damaged area;
  - Cover the damaged area with sterile wrapping. This would reduce the likelihood of infection;
  - Breathing in a hot air is possible when burnt, which leads to the burning of respiratory tracts. If the victim has hard noisy breathing, facial or neck burn, singed hair cover of face and nose, swelled mouth and lips, swallowing difficulty, cough, hoarseness voice – suspect the respiratory tracts burn and wait for the medical service;
  - Constantly check breathing and pulse before the medical service will come, be ready to carry out reanimation measures;

- It is not allowed to take off the clothes particles from the burnt skin, cause this may lead to the deepening of the damage;
- It is not allowed to destroy the integrity of blebs, because the skin cover is damaged and it makes a favourable conditions for the invasion of infection in the body;
- Do not use ointments, lotions or oils for processing the damaged parts;
- It is prohibited to process the chemical burn areas with neutralizing solutions/ For example, alkaline caused burn treatment with acid.

9.5.4.4 First Aid in Case of Electrical Trauma

There are three types of electrical trauma:

- The trauma caused by high-voltage electricity. The damage developed as a result of high voltage traumas, are fatal in most cases. Severe burns are being developed at this time. Due to the strong muscle compression the injured person is often threw away on a significant distance, which leads to serious injuries. In case of high-voltage power trauma:
  - It is prohibited to get close to the injured person, before the electricity will be turned off and if necessary, the isolation will be made. Remain 18 m radius safe distance. Do not let other witnesses to approach the injured person;
  - After receiving electric trauma, as soon as approaching the injured person, open the breathing ways without moving head back, by moving the lower jaw in front;
  - Check breathing and circulation signs. Be prepared to make reanimation measures;
  - If the injured person is unconscious but is breathing, place him in a safe location;
  - Carry out first aid in case of burns and other injuries.
- The electrical trauma caused by low-voltage electricity. Low-voltage electricity trauma may turn into serious damages and even death reason. Often, this kind of electrical trauma is caused by damaged plugs, wiring and equipment. When standing on a wet floor or touching undamaged electrical wiring with wet hands, the risks of getting the electrical trauma are sharply increasing. In case of low-voltage power caused trauma:
  - Do not touch the injured person, if he is touching the power source;
  - Do not use metal object for removing the power source;
  - If you are able, stop power supply (turn off the power switch). If it is not available, turn off the electrical equipment from the power source;
  - If you are not able to switch off the electricity, then stand on dry insulation thing (for example: a plank of wood, on rubber or plastic pad, on book or pile of newspapers);
  - Remove the victim's body from the power source by broom, stick, and chair. You can move the victim's body away from the power source, or vice versa, the power source away from the body, if it is more convenient;
  - Without touching the body of injured person, tie a rope around his foot and shoulders and move away from the power source;

- At least, grab the injured person in dry not-tight cloth and move him away from the power source;
- If the victim is unconscious, open the airways, check the breathing and pulse;
- If the victim is unconscious, is breathing and has a pulse, place in a safe location. Cool the burned areas and wrap it;
- If the visible injuries are not seen on the victim and feels good, advice to take a rest.

- The electrical trauma caused by lightning/thunder:
  - Various traumas, burns, face and eyes damage is often by the electrical trauma. Sometimes the lightning may cause a sudden death.

Quickly move damaged person form the place of the accident and serve with first aid as in case of different type of the electrical trauma.

9.6 Equipment Necessary for Emergency Response

Personal protection means are:

- Helmets;
- Safety glasses;
- Uniforms with reflective stripes;
- Waterproof boots;
- Gloves.

Fire extinguishing equipment:

- Standard fire extinguisher: on every site, as well as on every special machines and equipment;
- Buckets, sand, shovels and etc.;
- Properly equipped fire stands;
- Fire truck – the nearest fire fighters team truck will be used.

Emergency medical service equipment:

- Standard medical boxes: Standard medical boxes for vehicles: on every project vehicle and equipment;
- Ambulance car

Spill response equipment:

- Heavy duty plastic bags;
- Absorbent pads;
- Gloves;
- Drip trays;
- Buckets;
- Polyethylene film.

9.7 Necessary Qualification and Personnel Training

Testing of each system of emergency response must be periodically implemented, obtained experience must be documented and weak spots should be improved (the same should take place in case of accident realization).

The whole staff, employed on treatment facility construction and operation, must undergo introductory training, which includes emergency response course. Personnel additional training registration system should exist and be kept at offices of customer or contractors.

10 Public Awareness and Public Opinion Research

Under the Article 37 of the Constitution of Georgia, every citizen has the following rights:

- "Everyone shall have the right to live in healthy environment and enjoy natural and cultural surroundings. Everyone shall be obliged to care for natural and cultural environment";
- "Everyone shall have the right to receive a complete, objective and timely information as to a state of his/her working and living environment."

Based on the above mentioned, the contractor is obliged to conduct public hearing of the project prior to submission of documents for ecological examination.

The information about appointment of public hearing was published in the issue of August 7, 2015 of the newspaper "Sakartvelos Respublika"(The Republic of Georgia) and in the issue of August 8, 2015 of local newspaper "Adjara". Information on date/time of public hearing (September 29, 2015, 12:00), location (administrative building of Khulo Municipality. Address: Khulo, Tbel Abuseridze street №1) and purposes of public hearing was also published in this statement. Public hearing may be attended by any representative of the public.

Project documentations are available at following addresses:

- Administrative building of Khulo Municipality – Tbel Abuseidze street №1;
- Office of Adjaristskali Georgia LLC – Irakli Abashidze street N6, Batumi;
- Office of Gamma Consulting Ltd – Guramishvili avenue №17a. Tel: 2 60 15 27.

11 Conclusions and Recommendations

Following conclusions and recommendations were worked out within the Environment Impact Assessment (IEA) of construction and operation of road.

Main Conclusions:

1. Project implementation will importantly improve traffic movement and support the improvement of social-economic situation and tourism development in the region.;
2. Significant part of construction works is already implemented, accordingly, presumable negative impacts during the construction is partly resolved;
3. Impact caused by noise and dust, on animals inhabiting in the forest zone, will be reduced as a result of road operation;
4. Negative impact on the environment is mostly presumable on the construction phase, at the same time, impacts will be short-term due to the duration of the construction. It is noteworthy that main part of negative impacts is already resolved;
5. Risks of emissions of harmful substances in ambient air and disturbance of population by noise emission are not high. Impact will be more tangible on the wildlife;

6. Certain sections of project road are situated in average complicated relief conditions. Accordingly, erosive and other geological processes will be activated. But the project considers corresponding preventive measures (on some certain sections construction of reinforced installations will be carried out);
7. Removal and storage works of soil may be carried out on some certain sections. Impact risks on soil are not high;
8. Road is situated in the construction corridor, which is not too sensitive with biodiversity standpoint. Despite the fact, possible risks on biodiversity must be considered and corresponding mitigation and compensation measures should be carried out;
9. As a result of construction, certain amount of waste rocks will be produced. Most of them will be used for arrangement of roadbed. And part of waste rocks will be stored in certain selected areas. Implementation of re-cultivation works for waste rock disposal areas is necessary;
10. Project implementation will change the current visual-landscape situation. Main receptors of impact are wildlife, local population and tourists;
11. Impact on historical-cultural monuments is not presumable as a result of project implementation;
12. Project is connected to economic resettlement and corresponding compensative measures;
13. Project implementation will cause significant positive social-economic benefit.

Recommendations:

1. Contractor is responsible to establish strict monitoring on mitigation measures presented in the Environment Impact Assessment and considered by ecological examination;
2. Disposal areas for soils must be arranged in accordance with appropriate rules, height of waste rocks mustn't exceed 2m, lateral sides of waste rocks must have corresponding inclination, diversion canal must be arranged on the perimeter;
3. For temporary disposal of harmful wastes, arrangement of proper storage facilities must be considered. Removal of harmful wastes and waste management must be carried out by contractor, who has the corresponding permit;
4. Planting of greenery on the road corridor should be considered in the project documentation; for the greenery works using local species is recommended;
5. Within the process of road construction special staff (Health and security officer - H&SE) should be selected, who will control the safety standards;
6. Staff members must be equipped with special protective means during the construction works.

12 References

1. УПРЗА ЭКОЛОГ, версия 3.00 ФИРМА "ИНТЕГРАЛ" Санкт-Петербург 2001-2005г.
2. «Методическим пособием по расчету, нормированию и контролю выбросов загрязняющих веществ в атмосферный воздух», СПб., 2005.
3. МЕТОДИКА проведения инвентаризации выбросов загрязняющих веществ в атмосферу для баз дорожной техники (расчетным методом) Москва 1998.
4. Расчет выбросов загрязняющих веществ при проведении горных работ в соответствии с «Методикой расчета вредных выбросов (сбросов) для комплекса оборудования открытых горных работ (на основе удельных показателей)»: Люберцы, 1999.
5. სნწ II-7-81*. მშენებლობა სეისმურ რაიონებში.
6. სანიტარიული წესები და ნორმები _ «ზედაპირული წყლების გაბინძურებისაგან დაცვის შესახებ» (სანწდან 2.1.5. 000 _ 00).
7. ხმაური სამუშაო ადგილებზე, საცხოვრებელი, საზოგადოებრივი შენობების სათავსოებში და საცხოვრებელი განაშენიანების ტერიტორიაზე, 2001 წ.
8. საქართველოს გეოლოგია, ნინო მრევლიშვილი, თბილისი 1997;
9. საქართველოს ფიზიკური გეოგრაფია, ლ. ი. მარუაშვილი, თბილისი 1964;
10. საქართველოს გეოლოგიური რუკა, გ. გუჯაბიძე თბილისი 2003.
11. www.geostat.ge.

13 Annexes

13.1 Annex 1.

საქართველოს რეგიონული განვითარებისა და ინფრასტრუქტურის სამინისტრო

საქართველოს საავტომობილო გზების დეპარტამენტი

N 2–03/4767
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შ.პ.ს „გროს ენერჯი ჯგუფის“ -ის გენერალურ დირექტორს

ბატონ **ანგული ტყებუჩავას**

ბატონო **ანგული,**

თქვენი 18.06.2014 წლის N195 წერილის პასუხად, რომელიც შეეხება აჭარის რეგიონში ხულოს რაიონის ტერიტორიაზე მდინარე აჭარისწყალზე ჰიდროელექტრო სადგურის შემოსავლელი, შიდასახელმწიფოებრივი მნიშვნელობის ბათუმი(ანგისა)-ახალციხის საავტომობილო გზის კმ 82 - კმ 84-ზე წარმოდგენილი საპროექტო დოკუმენტაციის (სახიდე გადასასვლელის გარეშე) შეთანხმების საკითხს, გაცნობებთ, რომ საავტომობილო გზის რეკონსტრუქციის წარმოდგენილი საპროექტო დოკუმენტაციის შესაბამისად საქართველოს საავტომობილო გზების დეპარტამენტი არ არის წინააღმდეგი აღნიშნული სამუშაოების განხორციელებაზე. ამასთანავე გთხოვთ, დამატებით წარმოდგენილი იქნას სახიდე გადასასვლელის საპროექტო დოკუმენტაცია.

ნუგზარ გასვიანი

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13.2 Annex 2. Consolidated Sheet of Construction Works Scale

№	სამუშაოს დასახელება Decoription	განზ-ბა Unit	რაოდ-ბა Quantity	შენიშვნა Remark
1	2	3	4	5
I	მოსამზადებელი სამუშაოები			
	Preparatory Works			
1	ტრასის აღდგენა დამაგრება	კმ	1,2	
	Basic Survey and detailed setting out	km		
2	გზის განთავისების ზოლის ფარგლებში არსებული ბუჩქნარების გაკაფვა და ამოძირკვა	ჰა	0,225	
	Cutting and uprooting of existing shrubs	ha		
3	გზის განთავისების ზოლის ფარგლებში არსებული ტყის მასივის გაკაფვა და ამოძირკვა	ჰა	0,556	
	Felling and uprooting of existing forest	ha		
4	მოსაკრებლის ოდენობა ბუნებრივი რესურსებით სარგებლობისათვის	ლარი	15000	
	Levy for the use of natural resources	georgian lari		
5	არსებული ბეტონის კედლის დაშლა პნ. ჩაქუჩებით დატვირთვა ა/თვითმცლელებზე და გატანა ნაგავში	მ³	180	
	Demolition of existing concrete wall with pneumatic hammers, loading and transportation to dump site	m³		
6	არსებული ბეტონის პარაპეტების მოხსნა და გატანა	ც	6	
	Removal of existing concrete parapets	pc		
7	არსებული ღობის დემონტაჟი	გ.მ	350,00	
	Removal of existing fences	m		
II	მიწის ვაკისის მოწყობა			
	Road Bed			
II-1	ჭრილი / Cut			
1	IV. კატ. გრუნტის დამუშავება ექსკავატორით ჭრილში და დატვირთვა ა/თვითმცლელებზე	მ³	12892	
	Excavation of IV category soil in cut with excavator, loading on dump trucks	m³		
2	VIII. კატ. გრუნტის დამუშავება ჭრილში ექსკავატორის ბაზაზე დამონტაჟებული კოდალით დატვირთვა ა/თვითმცლელებზე	მ³	30081	
	Excavation of VIII category soil in cut with excavator mounted hammer, loading on dump trucks	m³		
3	ყრილის მოწყობა ჭრილიდან მოხიდული გრუნტით	მ³	19351	
	Provide, place and compact fill with material from cut	m³		
4	VIII. კატ. გრუნტის დამუშავება ექსკავატორის ბაზაზე დამონტაჟებული კოდალით კუვეტების მოსაწყობად და დატვირთვა ა/თვითმცლელებზე	მ³	350	
	Excavation of VIII category soil for road side ditches with excavator mounted hammer, loading on dump trucks	m³		
5	ზედმეტი გრუნტის გატანა	მ³	23972	
	Transporation of surplus soil to dumpvsite	m³		
III	ხელოვნური ნაგებობების მოწყობა			
	Construction of Artificial Structures			
III-1	რკან-ბეტონის დ-1,5 მ მილები / Reinforced concrete pipe culverts, d=1,5m	მ/ს	2	იხ. ცალკე separate sheet
III-2	რკან-ბეტონის ქვედა ბარჯვნი კედელი / Reinforced-concrete lower retaining wall	გრძ.მ/Lm	90	იხ. ცალკე separate sheet
III-3	გაბიონების მოწყობა / Gabion Walls	გრძ.მ/Lm	312	იხ. ცალკე separate sheet
III-4	ქვაცვენის საწინააღმდეგო ბადის მოწყობა Installation of rockfall protective grid	მ²/m²	4185	
1	VIII. კატ. გრუნტის დამუშავება პნ. ჩაქუჩებით დატვირთვა ა/თვითმცლელებზე და გატანა	მ³	74	
	Excavation of VIII category soil in cut with Hand , loading on dump trucks	m³		
2	ანკერი III22მმ, L=1000მმ	ცალი	223	
	Ancor III22mm. L1000mm	unit		
3	ქვიშა-ცემენტის ხსნარი	მ³	20	
	Sand Concrete	m³		
4	ფერდის გაბურღვა ანკერებისათვის ხელით 60სმ-ზე	ცალი	340	
	Drilling Slope vor Ancor width Hand 60sm	unit		
5	ანკერი III18მმ, L=700მმ	ცალი	340	
	Ancor III18mm. L700mm	unit		
6	ბადე 15X15X0.3სმ	მ²	2820	
	Grid 15X15X0.3sm	m²		
7	ბაგირი 8.2მმ	გ.მ	2010	
	Rope 8.2mm	L.M		
8	ჰიდროთესვა და გამაგრება MacMat MR1080	მ²	6470	
	Hydro-seeding end harden MacMat MR1080	m²		

1	2	3	4	5
IV	საგზაო საფარის მოწყობა			
	Road Pavement			
1	ქვესაგები ფენა ქვიშა-ხრეშოვანი ნარევით, სისქით 25სმ	მ³	2858	
	Construction of sub-base with sand-gravel mix, thickness 25 cm	m³		
2	საფუძვლის ფენა ფრ. ღორღი (0-40) სისქით 20სმ	მ³	1782	
	Construction of base course with fractional gravel, thickness 20 cm	m³		
3	თხევადი ბიტუმის მოსხმა	ტ	4,97	
	Apply cutback bitumen	t		
4	მსხვილმარცვლოვანი ა/ბეტონი სისქით 7სმ	მ²	8277	
	Asphalt Concrete 7sm	m²		
5	თხევადი ბიტუმის მოსხმა	ტ	2,47	
	Apply cutback bitumen	t		
6	წვრილმარცვლოვანი ა/ბეტონი სისქით 5სმ	მ²	8277	
	Asphalt Concrete 5sm	m²		
7	მისაერთი გვერდულების მოწყობა ქვიშა-ხრეშოვანი ნარევით	მ³	642	
	Construction of shoulders with sand-gravel mix	m³		
V	არსებულ გზასთან მიერთებებზე გარდამავალი საფარის მოწყობა			
	leveling Road bed on existing road junctions			
1	თხევადი ბიტუმის მოსხმა	კგ	42	
	Apply cutback bitumen	kg		
2	შემასწორებელი ფენა წვრილმარცვლოვანი ა/ბეტონი	ტ	3,4	
	Leveling layer Asphalt Concrete 5sm	t		
3	საფარი წვრილმარცვლოვანი ა/ბეტონი სისქით 4სმ	მ²	140	
	Pavement Asphalt Concrete 4sm	m²		
4	მისაერთი გვერდულების მოწყობა ქვიშა-ხრეშოვანი ნარევი	მ³	2,4	
	Construction of shoulders with sand-gravel mix	m³		
VI	მიერთებების მოწყობა			
	Junctions			
1	მიერთებების მოწყობა	ც	3	იხ. ცალკე
	Construction of junctions	pc		separate sheet
VII	გზის კეთილმოწყობა			
	Road Furniture			
1	ინდივიდუალური საგზაო ნიშნების მოწყობა	ც	4	
	Individual road signs	pc		
2	სტანდარტული საგზაო ნიშნების მოწყობა	ც	39	
	Road signs	pc		
3	კილომეტრული ნიშნების მოწყობა	ც	2	
	km posts	pc		
4	ლითონის ფოსტა L=2.75მ	ც	34	
	Metal Post L=2.75m	pc		
5	ლითონის ფოსტა L=3.5მ	ც	13	
	Metal Post L=3.5m	pc		
6	ლითონის ფოსტა L=4.5მ	ც	6	
	Metal Post L=4.5m	pc		
7	ბეტონი B20	მ³	15	
	Concrete B20	m³		
8	საორიენტაციო ბოძკინტების მოწყობა	ც	54	
	Road side marker posts	pc		
9	ლითონის ზღუდარების მოწყობა	ც	793	
	Steel safety guardrails	pc		
10	გზის ჰორიზონტალური მონიშვნა	მ²	347	
	Horizontal road marking	m²		
11	გზის მარჯვენა მხარეს წიწვოვანი ხეების დარგვა	ც	50	
	Coniferous tree planting	pc		

13.3 Annex 3. Printout Version of Air Pollutant Emission Report-Construction Stage

УПРЗА ЭКОЛОГ, версия 3.1
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სერიული ნომერი 01-01-2568, სამეცნიერო-კვლევითი ფირმა «გამა»

საწარმოს ნომერი 503; ხიდი ხულო
ქალაქი ხელვაჩაური

საწყისი მონაცემების ვარიანტი: 1, საწყისი მონაცემების ახალი ვარიანტი
გაანგარიშების ვარიანტი: გაანგარიშების ახალი ვარიანტი
გაანგარიშება შესრულებულია: ზაფხულისთვის
გაანგარიშების მოდული: "ОНД-86"
საანგარიშო მუდმივები: E1= 0,01, E2=0,01, E3=0,01, S=999999,99 კვ.კმ.

მეტეოროლოგიური პარამეტრები

ყველაზე ცხელი თვის ჰაერის საშუალო ტემპერატურა	26,9° C
ყველაზე ცივი თვის ჰაერის საშუალო ტემპერატურა	6° C
ატმოსფეროს სტრატიფიკაციის ტემპერატურაზე დამოკიდებული კოეფიციენტი, A	200
ქარის მაქსიმალური სიჩქარე მოცემული ტერიტორიისთვის (გადამეტების განმეორებადობა 5%-ის ფარგლებში)	21 მ/წმ

საწარმოს სტრუქტურა (მოედნები, საამქრო)

ნომერი	მოედნის (საამქროს) დასახელება

გაფრქვევის წყაროთა პარამეტრები

აღრიცხვა:
"%" - წყარო გათვალისწინებულია ფონის გამორიცხვით;
"+" - წყარო გათვალისწინებულია ფონის გამორიცხვის გარეშე;
"-" - წყარო არ არის გათვალისწინებული და მისი წვლილი არაა შეტანილი ფონში.
ნიშნულების არარსებობის შემთხვევაში წყარო არ ითვლება.

წყაროთა ტიპები:
1 - წერტილოვანი;
2 - წრფივი;
3 - არაორგანიზებული;
4 - წერტილოვანი წყაროების ერთობლიობა, გაერთიანებული ერთ სიბრტყულად გათვლისთვის;
5 - არაორგანიზებული, დროში ცვლადი გაფრქვევის სიმძლავრით;
6 - წერტილოვანი, ქოლგისებური ან ჰორიზონტალური გაფრქვევით;
7 - ქოლგისებური ან ჰორიზონტალური გაფრქვევის წერტილოვანი წყაროების ერთობლიობა;
8 - ავტომაგისტრალი.

აღრიცხვა ანგარიშისას	მოედ. №	საამქ. №	წყაროს №	წყაროს დასახელება	ვარიანტი	ტიპი	წყაროს სიმაღლე (მ)	დიამეტრი (მ)	აირ-ჰაეროვანი ნარევის მოცულ. (მ3/წმ)	აირ-ჰაეროვანი ნარევის წიჩქარე (მ/წმ)	აირ-ჰაეროვანი ნარევის ტემპერატ. (°C)	რელიეფის კოეფ.	კოორდ. X1 ღერძი (მ)	კოორდ. Y1 ღერძი (მ)	კოორდ. X2 ღერძი (მ)	კოორდ. Y2 ღერძი (მ)	წყაროს სიგანე (მ)
+	0	0	1	ამწე	1	3	5,0	0,00	0	0,00000	0	1,0	0,0	0,0	3,0	-2,0	5,00

ნივთ. კოდი	ნივთიერება	გაფრქვევა (გ/წმ)	გაფრქვევა (ტ/წლ)	F	ზაფხ.: Cm/ზდკ	Xm	Um	ზამთ.: Cm/ზდკ	Xm	Um
0301	აზოტის (IV) ოქსიდი (აზოტის დიოქსიდი)	0,0330000	0,2370000	1	0,695	28,5	0,5	0,695	28,5	0,5
0304	აზოტის (II) ოქსიდი (აზოტის ოქსიდი)	0,0053000	0,0380000	1	0,056	28,5	0,5	0,056	28,5	0,5
0328	შავი ნახშირბადი (ჭვარტლი)	0,0045000	0,0320000	1	0,126	28,5	0,5	0,126	28,5	0,5
0330	გოგირდის დიოქსიდი	0,0033000	0,0230000	1	0,028	28,5	0,5	0,028	28,5	0,5
0337	ნახშირბადის ოქსიდი	0,0270000	0,1940000	1	0,023	28,5	0,5	0,023	28,5	0,5
2732	ნავთის ფრაქცია	0,0080000	0,0570000	1	0,028	28,5	0,5	0,028	28,5	0,5

+	0	0	2	თვითმცლელი	1	3	5,0	0,00	0	0,00000	0	1,0	41,0	-6,0	199,0	-54,0	10,00

ნივთ. კოდი	ნივთიერება	გაფრქვევა (გ/წმ)	გაფრქვევა (ტ/წლ)	F	ზაფხ.: Cm/ზდკ	Xm	Um	ზამთ.: Cm/ზდკ	Xm	Um
0301	აზოტის (IV) ოქსიდი (აზოტის დიოქსიდი)	0,0330000	0,2370000	1	0,695	28,5	0,5	0,695	28,5	0,5
0304	აზოტის (II) ოქსიდი (აზოტის ოქსიდი)	0,0053000	0,0380000	1	0,056	28,5	0,5	0,056	28,5	0,5
0328	შავი ნახშირბადი (ჭვარტლი)	0,0045000	0,0320000	1	0,126	28,5	0,5	0,126	28,5	0,5
0330	გოგირდის დიოქსიდი	0,0033000	0,0230000	1	0,028	28,5	0,5	0,028	28,5	0,5
0337	ნახშირბადის ოქსიდი	0,0270000	0,1940000	1	0,023	28,5	0,5	0,023	28,5	0,5

აღრიცხვა ანგარიშისას	მოედ. №	საამქ. №	წყაროს №	წყაროს დასახელება	ვარიანტი	ტიპი	წყაროს სიმაღლე (მ)	დიამეტრი (მ)	აირ-ჰაეროვანი ნარევის მოცულ. (მ3/წმ)	აირ-ჰაეროვანი ნარევის წიჩქარე (მ/წმ)	აირ-ჰაეროვანი ნარევის ტემპერატ. (°C)	რელიეფის კოეფ.	კოორდ. X1 ღერძი (მ)	კოორდ. Y1 ღერძი (მ)	კოორდ. X2 ღერძი (მ)	კოორდ. Y2 ღერძი (მ)	წყაროს სიგანე (მ)
2732				ნავთის ფრაქცია	0,0080000			0,0570000	1		0,028	28,5	0,5		0,028	28,5	0,5		
+	0	0	3	შედუღების პოსტი	1	3	5,0	0,00	0		0,00000	0	1,0	42,0	-7,0	55,0	-9,0	5,00	

ნივთ. კოდი	ნივთიერება	გაფრქვევა (გ/წმ)	გაფრქვევა (ტ/წლ)	F	ზაფხ.: Cm/ზდკ	Xm	Um	ზამთ.: Cm/ზდკ	Xm	Um
0123	რკინის ოქსიდი	0,0010000	0,0018000	1	0,011	28,5	0,5	0,011	28,5	0,5
0143	მანგანუმი და მისი ნაერთები	0,0000870	0,0001500	1	0,037	28,5	0,5	0,037	28,5	0,5
0301	აზოტის (IV) ოქსიდი (აზოტის დიოქსიდი)	0,0003000	0,0005000	1	0,006	28,5	0,5	0,006	28,5	0,5
0304	აზოტის (II) ოქსიდი (აზოტის ოქსიდი)	0,0000500	0,0000800	1	0,001	28,5	0,5	0,001	28,5	0,5
0337	ნახშირბადის ოქსიდი	0,0030000	0,0060000	1	0,003	28,5	0,5	0,003	28,5	0,5
0342	აირადი ფტორიდები	0,0001800	0,0003200	1	0,038	28,5	0,5	0,038	28,5	0,5
0344	სუსტად ხსნადი ფტორიდები	0,0003000	0,0006000	1	0,006	28,5	0,5	0,006	28,5	0,5
2908	არაორგანული მტვერი: 70-20% SiO2	0,0001300	0,0002000	1	0,002	28,5	0,5	0,002	28,5	0,5

ემისიები წყაროებიდან ნივთიერებების მიხედვით

აღრიცხვა:
"%" - წყარო გათვალისწინებულია ფონის გამორიცხვით;
"+" - წყარო გათვალისწინებულია ფონის გამორიცხვის გარეშე;
"-" - წყარო არ არის გათვალისწინებული და მისი წვლილი არაა შეტანილი ფონში.
ნიშნულების არარსებობის შემთხვევაში წყარო არ ითვლება.

(-) ნიშნით აღნიშნული ან აღუნიშნავი () წყაროები საერთო ჯამში გათვალისწინებული არ არის

წყაროთა ტიპები:
1 - წერტილოვანი;
2 - წრფივი;
3 - არაორგანიზებული;

4 - წერტილოვანი წყაროების ერთობლიობა, გაერთიანებული ერთ სიბრტყულად გათვლისთვის;
5 - არაორგანიზებული, დროში ცვლადი გაფრქვევის სიმძლავრით;

6 - წერტილოვანი, ქოლგისებური ან ჰორიზონტალური გაფრქვევით;
7 - ქოლგისებური ან ჰორიზონტალური გაფრქვევის წერტილოვანი წყაროების ერთობლიობა;
8 - ავტომაგისტრალი.

ნივთიერება: 0123 რკინის ოქსიდი

№ მოედ.	№ საამქ.	№ წყაროს	ტიპი	აღრიცხვა	გაფრქვევა (გ/წმ)	F	ზაფხ.			ზამთ.		
							Cm/ზღკ	Xm	Um (მ/წმ)	Cm/ზღკ	Xm	Um (მ/წმ)
0	0	3	3	+	0,0010000	1	0,0105	28,50	0,5000	0,0105	28,50	0,5000
სულ:					0,0010000		0,0105			0,0105		

ნივთიერება: 0143 მანგანუმი და მისი ნაერთები

№ მოედ.	№ საამქ.	№ წყაროს	ტიპი	აღრიცხვა	გაფრქვევა (გ/წმ)	F	ზაფხ.			ზამთ.		
							Cm/ზღკ	Xm	Um (მ/წმ)	Cm/ზღკ	Xm	Um (მ/წმ)
0	0	3	3	+	0,0000870	1	0,0366	28,50	0,5000	0,0366	28,50	0,5000
სულ:					0,0000870		0,0366			0,0366		

ნივთიერება: 0301 აზოტის (IV) ოქსიდი (აზოტის დიოქსიდი)

№ მოედ.	№ საამქ.	№ წყაროს	ტიპი	აღრიცხვა	გაფრქვევა (გ/წმ)	F	ზაფხ.			ზამთ.		
							Cm/ზღკ	Xm	Um (მ/წმ)	Cm/ზღკ	Xm	Um (მ/წმ)
0	0	1	3	+	0,0330000	1	0,6947	28,50	0,5000	0,6947	28,50	0,5000
0	0	2	3	+	0,0330000	1	0,6947	28,50	0,5000	0,6947	28,50	0,5000
0	0	3	3	+	0,0003000	1	0,0063	28,50	0,5000	0,0063	28,50	0,5000
სულ:					0,0663000		1,3958			1,3958		

ნივთიერება: 0304 აზოტის (II) ოქსიდი (აზოტის ოქსიდი)

№ მოედ.	№ საამქ.	№ წყაროს	ტიპი	აღრიცხვა	გაფრქვევა (გ/წმ)	F	ზაფხ.			ზამთ.		
							Cm/ზღკ	Xm	Um (მ/წმ)	Cm/ზღკ	Xm	Um (მ/წმ)
0	0	1	3	+	0,0053000	1	0,0558	28,50	0,5000	0,0558	28,50	0,5000
0	0	2	3	+	0,0053000	1	0,0558	28,50	0,5000	0,0558	28,50	0,5000
0	0	3	3	+	0,0000500	1	0,0005	28,50	0,5000	0,0005	28,50	0,5000
სულ:					0,0106500		0,1121			0,1121		

ნივთიერება: 0328 შავი ნახშირბადი (ჭვარტლი)

№ მოედ.	№ საამქ.	№ წყაროს	ტიპი	აღრიცხვა	გაფრქვევა (გ/წმ)	F	ზაფხ.			ზამთ.		
							Cm/ზღკ	Xm	Um (მ/წმ)	Cm/ზღკ	Xm	Um (მ/წმ)
0	0	1	3	+	0,0045000	1	0,1263	28,50	0,5000	0,1263	28,50	0,5000
0	0	2	3	+	0,0045000	1	0,1263	28,50	0,5000	0,1263	28,50	0,5000
სულ:					**0,0090000**		**0,2526**			**0,2526**		

ნივთიერება: 0330 გოგირდის დიოქსიდი

№ მოედ.	№ საამქ.	№ წყაროს	ტიპი	აღრიცხვა	გაფრქვევა (გ/წმ)	F	ზაფხ.			ზამთ.		
							Cm/ზღკ	Xm	Um (მ/წმ)	Cm/ზღკ	Xm	Um (მ/წმ)
0	0	1	3	+	0,0033000	1	0,0278	28,50	0,5000	0,0278	28,50	0,5000
0	0	2	3	+	0,0033000	1	0,0278	28,50	0,5000	0,0278	28,50	0,5000
სულ:					**0,0066000**		**0,0556**			**0,0556**		

ნივთიერება: 0337 ნახშირბადის ოქსიდი

№ მოედ.	№ საამქ.	№ წყაროს	ტიპი	აღრიცხვა	გაფრქვევა (გ/წმ)	F	ზაფხ.			ზამთ.		
							Cm/ზღკ	Xm	Um (მ/წმ)	Cm/ზღკ	Xm	Um (მ/წმ)
0	0	1	3	+	0,0270000	1	0,0227	28,50	0,5000	0,0227	28,50	0,5000
0	0	2	3	+	0,0270000	1	0,0227	28,50	0,5000	0,0227	28,50	0,5000
0	0	3	3	+	0,0030000	1	0,0025	28,50	0,5000	0,0025	28,50	0,5000
სულ:					**0,0570000**		**0,0480**			**0,0480**		

ნივთიერება: 0342 აირადი ფტორიდები

№ მოედ.	№ საამქ.	№ წყაროს	ტიპი	აღრიცხვა	გაფრქვევა (გ/წმ)	F	ზაფხ.			ზამთ.		
							Cm/ზღკ	Xm	Um (მ/წმ)	Cm/ზღკ	Xm	Um (მ/წმ)
0	0	3	3	+	0,0001800	1	0,0379	28,50	0,5000	0,0379	28,50	0,5000
სულ:					**0,0001800**		**0,0379**			**0,0379**		

ნივთიერება: 0344 სუსტად ხსნადი ფტორიდები

№ მოედ.	№ საამქ.	№ წყაროს	ტიპი	აღრიცხვა	გაფრქვევა (გ/წმ)	F	ზაფხ.			ზამთ.		
							Cm/ზღკ	Xm	Um (მ/წმ)	Cm/ზღკ	Xm	Um (მ/წმ)
0	0	3	3	+	0,0003000	1	0,0063	28,50	0,5000	0,0063	28,50	0,5000
სულ:					**0,0003000**		**0,0063**			**0,0063**		

ნივთიერება: 2732 ნავთის ფრაქცია

№ მოედ.	№ საამქ.	№ წყაროს	ტიპი	აღრიცხვა	გაფრქვევა (გ/წმ)	F	ზაფხ.			ზამთ.		
							Cm/ზღკ	Xm	Um (მ/წმ)	Cm/ზღკ	Xm	Um (მ/წმ)

0	0	1	3	+	0,0080000	1	0,0281	28,50	0,5000	0,0281	28,50	0,5000
0	0	2	3	+	0,0080000	1	0,0281	28,50	0,5000	0,0281	28,50	0,5000
სულ:					**0,0160000**		**0,0561**			**0,0561**		

ნივთიერება: 2908 არაორგანული მტვერი: 70-20% SiO2

№ მოედ.	№ საამქ.	№ წყაროს	ტიპი	აღრიცხვა	გაფრქვევა (გ/წმ)	F	ზაფხ.			ზამთ.		
							Cm/ზღკ	Xm	Um (მ/წმ)	Cm/ზღკ	Xm	Um (მ/წმ)
0	0	3	3	+	0,0001300	1	0,0018	28,50	0,5000	0,0018	28,50	0,5000
სულ:					**0,0001300**		**0,0018**			**0,0018**		

წყაროების გაფრქვევა ჯამური ზემოქმედების ჯგუფების მიხედვით

აღრიცხვა:
"%" - წყარო გათვალისწინებულია ფონის გამორიცხვით;
"+" - წყარო გათვალისწინებულია ფონის გამორიცხვის გარეშე;
"-" - წყარო არ არის გათვალისწინებული და მისი წვლილი არაა შეტანილი ფონში.
ნიშნულების არარსებობის შემტხვევაში წყარო არ ითვლება.

(-) ნიშნით აღნიშნული ან აღუნიშნავი () წყაროები საერთო ჯამში გათვალისწინებული არ არის

წყაროთა ტიპები:
1 - წერტილოვანი;
2 - წრფივი;
3 - არაორგანიზებული;

4 - წერტილოვანი წყაროების ერთობლიობა, გაერთიანებული ერთ სიბრტყულად გათვლისთვის;
5 - არაორგანიზებული, დროში ცვლადი გაფრქვევის სიმძლავრით;

6 - წერტილოვანი, ქოლგისებური ან ჰორიზონტალური გაფრქვევით;
7 - ქოლგისებური ან ჰორიზონტალური გაფრქვევის წერტილოვანი წყაროების ერთობლიობა;
8 - ავტომაგისტრალი.

ჯამური ზემოქმედების ჯგუფი: 6009

№ მოედ.	№ საამქ.	№ წყაროს	ტიპი	აღრიცხვა	კოდი ნ-ვა	გაფრქვევა (გ/წმ)	F	ზაფხ.			ზამთ.		
								Cm/ზღკ	Xm	Um (მ/წმ)	Cm/ზღკ	Xm	Um (მ/წმ)
0	0	1	3	+	0301	0,0330000	1	0,6947	28,50	0,5000	0,6947	28,50	0,5000
0	0	1	3	+	0330	0,0033000	1	0,0278	28,50	0,5000	0,0278	28,50	0,5000
0	0	2	3	+	0301	0,0330000	1	0,6947	28,50	0,5000	0,6947	28,50	0,5000
0	0	2	3	+	0330	0,0033000	1	0,0278	28,50	0,5000	0,0278	28,50	0,5000
0	0	3	3	+	0301	0,0003000	1	0,0063	28,50	0,5000	0,0063	28,50	0,5000
სულ:						**0,0729000**		**1,4514**			**1,4514**		

ჯამური ზემოქმედების ჯგუფი: 6039

№ მოედ.	№ საამქ.	№ წყაროს	ტიპი	აღრიცხვა	კოდი ნ-ვა	გაფრქვევა (გ/წმ)	F	ზაფხ.			ზამთ.		
								Cm/ზღკ	Xm	Um (მ/წმ)	Cm/ზღკ	Xm	Um (მ/წმ)
0	0	1	3	+	0330	0,0033000	1	0,0278	28,50	0,5000	0,0278	28,50	0,5000
0	0	2	3	+	0330	0,0033000	1	0,0278	28,50	0,5000	0,0278	28,50	0,5000
0	0	3	3	+	0342	0,0001800	1	0,0379	28,50	0,5000	0,0379	28,50	0,5000
სულ:						**0,0067800**		**0,0935**			**0,0935**		

ჯამური ზემოქმედების ჯგუფი: 6046

№ მოედ.	№ საამქ.	№ წყაროს	ტიპი	აღრიცხვა	კოდი ნ-ვა	გაფრქვევა (გ/წმ)	F	ზაფხ.			ზამთ.		
								Cm/ზღკ	Xm	Um (მ/წმ)	Cm/ზღკ	Xm	Um (მ/წმ)
0	0	1	3	+	0337	0,0270000	1	0,0227	28,50	0,5000	0,0227	28,50	0,5000
0	0	2	3	+	0337	0,0270000	1	0,0227	28,50	0,5000	0,0227	28,50	0,5000

0	0	3	3	+	0337	0,0030000	1	0,0025	28,50	0,5000	0,0025	28,50	0,5000
0	0	3	3	+	2908	0,0001300	1	0,0018	28,50	0,5000	0,0018	28,50	0,5000
სულ:						**0,0571300**		**0,0498**			**0,0498**		

გაანგარიშება შესრულდა ნივთიერებათა მიხედვით (ჯამური ზემოქმედების ჯგუფების მიხედვით)

კოდი	ნივთიერება	ზღვრულად დასაშვები კონცენტრაცია			*ზდკ-ს შესწორების კოეფიციენტი /საორ. უსაფრ. ზემოქ. დონე	ფონური კონცენტრ.	
		ტიპი	საცნობარო მნიშვნელობა	ანგარიშში გამოყენებ.		აღრიცხვა	ინტერპ.
0123	რკინის ოქსიდი	ზდკ საშ. დ/ღ	0,0400000	0,4000000	1	არა	არა
0143	მანგანუმი და მისი ნაერთები	მაქს. ერთ.	0,0100000	0,0100000	1	არა	არა
0301	აზოტის (IV) ოქსიდი (აზოტის დიოქსიდი)	მაქს. ერთ.	0,2000000	0,2000000	1	არა	არა
0304	აზოტის (II) ოქსიდი (აზოტის ოქსიდი)	მაქს. ერთ.	0,4000000	0,4000000	1	არა	არა
0328	შავი ნახშირბადი (ჭვარტლი)	მაქს. ერთ.	0,1500000	0,1500000	1	არა	არა
0330	გოგირდის დიოქსიდი	მაქს. ერთ.	0,5000000	0,5000000	1	არა	არა
0337	ნახშირბადის ოქსიდი	მაქს. ერთ.	5,0000000	5,0000000	1	არა	არა
0342	აირადი ფტორიდები	მაქს. ერთ.	0,0200000	0,0200000	1	არა	არა
0344	სუსტად ხსნადი ფტორიდები	მაქს. ერთ.	0,2000000	0,2000000	1	არა	არა
2732	ნავთის ფრაქცია	საორ. უსაფრ. ზემოქ. დონე	1,2000000	1,2000000	1	არა	არა
2908	არაორგანული მტვერი: 70-20% SiO2	მაქს. ერთ.	0,3000000	0,3000000	1	არა	არა
6009	არასრული ჯამური ზემოქმედების ჯგუფი, კოეფიციენტი "1,6": ჯამური ზემოქმედების ჯგუფი (2) 301 330	ჯგუფი	-	-	1	არა	არა
6039	ჯამური ზემოქმედების ჯგუფი: ჯამური ზემოქმედების ჯგუფი (2) 330 342	ჯგუფი	-	-	1	არა	არა
6046	ჯამური ზემოქმედების ჯგუფი: ჯამური ზემოქმედების ჯგუფი (2) 337 2908	ჯგუფი	-	-	1	არა	არა

*გამოიყენება განსაკუთრებული ნორმატიული მოთხოვნების გამოყენების საჭიროების შემთხვევაში. პარამეტრის "შესწორების კოეფიციენტი/საორ. უსაფრ. ზემოქ. დონე", მნიშვნელობის ცვლილების შემთხვევაში, რომელის სტანდარტული მნიშვნელობა 1-ია, მაქსიმალური კონცენტრაციის გაანგარიშებული სიდიდეები შედარებული უნდა იქნას არა კოეფიციენტის მნიშვნელობას, არამედ 1-ს.

საანგარიშო მეტეოპარამეტრების გადარჩევა
ავტომატური გადარჩევა

ქარის სიჩქარეთა გადარჩევა სრულდება ავტომატურად
ქარის მიმართულება

სექტორის დასაწისი	სექტორის დასასრული	ქარის გადარჩევის ბიჯი
0	360	1

საანგარიშო არეალი
საანგარიშო მოედნები

№	ტიპი	მოედნის სრული აღწერა				სიგანე (მ)	ბიჯი (მ)		სიმაღლ. (მ)	კომენტარი
		შუა წერტილის კოორდინატები, I მხარე (მ)		შუა წერტილის კოორდინატები, II მხარე (მ)						
		X	Y	X	Y		X	Y		
1	მოცემული	-400	0	500	0	700	100	100	2	

საანგარიშო წერტილები

№	წერტილის კოორდინატები (მ)		სიმაღლ. (მ)	წერტილ. ტიპი	კომენტარი
	X	Y			
1	-125,00	200,00	2	წერტილი დასახლებული ზონის საზღვარზე	უახლოესი დასახლება

ნივთიერებები, რომელთა ანგარიშც არამიზანშეწონილია
ანგარიშის მიზანშეწონილობის კრიტერიუმები E3=0,01

კოდი	დასახელება	ჯამი Cm/ზდკ
0344	სუსტად ხსნადი ფტორიდები	0,0063159
2908	არაორგანული მტვერი: 70-20% SiO2	0,0018246

გაანგარიშების შედეგები ნივთიერებების მიხედვით (საანგარიშო წერტილები)

წერტილთა ტიპები:
0 - მომხმარებლის საანგარიშო წერტილი
1 - წერტილი დაცვის ზონის საზღვარზე
2 - წერტილი საწარმო ზონის საზღვარზე
3 - წერტილი სანიტარულ-დაცვითი ზონის საზღვარზე
4 - წერტილი დასახლებული ზონის საზღვარზე
5 - განაშენიანების საზღვარზე

№	კოორდ X(მ)	კოორდ Y(მ)	სიმაღლ. (მ)	კონცენტრ. (ზდკ-ს წილი)	ქარის მიმართ.	ქარის სიჩქ.	ფონი (ზდკ-ს წილი)	ფონი გამორი-ცხვამდე	წერტილ. ტიპი

ნივთიერება: 0123 რკინის ოქსიდი

1	-125	200	2	1,2e-3	140	2,03	0,000	0,000	4

ნივთიერება: 0143 მანგანუმი და მისი ნაერთები

1	-125	200	2	4,1e-3	140	2,03	0,000	0,000	4

ნივთიერება: 0301 აზოტის (IV) ოქსიდი (აზოტის დიოქსიდი)

1	-125	200	2	0,13	144	0,80	0,000	0,000	4

ნივთიერება: 0304 აზოტის (II) ოქსიდი (აზოტის ოქსიდი)

1	-125	200	2	0,01	144	0,80	0,000	0,000	4

ნივთიერება: 0328 შავი ნახშირბადი (ჭვარტლი)

1	-125	200	2	0,02	144	0,80	0,000	0,000	4

ნივთიერება: 0330 გოგირდის დიოქსიდი

1	-125	200	2	5,2e-3	144	0,80	0,000	0,000	4

ნივთიერება: 0337 ნახშირბადის ოქსიდი

1	-125	200	2	4,5e-3	143	0,80	0,000	0,000	4

ნივთიერება: 0342 აირადი ფტორიდები

1	-125	200	2	4,2e-3	140	2,03	0,000	0,000	4

ნივთიერება: 2732 ნავთის ფრაქცია

1	-125	200	2	5,3e-3	144	0,80	0,000	0,000	4

ნივთიერება: 6009 ჯამური ზემოქმედების ჯგუფი (2) 301 330

1	-125	200	2	0,09	144	0,80	0,000	0,000	4

ნივთიერება: 6039 ჯამური ზემოქმედების ჯგუფი (2) 330 342

1	-125	200	2	9,2e-3	142	1,27	0,000	0,000	4

ნივთიერება: 6046 ჯამური ზემოქმედების ჯგუფი (2) 337 2908

1	-125	200	2	4,7e-3	143	0,80	0,000	0,000	4

13.4 Annex 4. Waste Storage, Transportation and Disposal Conditions, Generated during Construction Phase

№	Waste	Waste Management	Safety conditions during storage and transportation	Waste processing, burial or utilization conditions
1	2	3	4	5
1. Domestic Waste				
1.1.	Domestic and food waste	**Waste collection and delivery to DSWL [8]** • Collection and disposition of waste – in special containers placed in construction sites. • Removal from operation grounds by municipal trucks under agreement. * DSWL - Domestic Solid Waste Landfill	• It is prohibited to put 1, 2 and 3 hazard class waste in solid domestic waste containers, including luminescent bulbs, oily waste and others, those are not allowed for disposal to domestic solid waste landfill. • Solid domestic waste shall be transported to final disposal site by special vehicles to avoid pollution of environment.	Burial: According to sanitary and landfill operation rules. Responsibly: contractor organization
1.2.	Paper and cardboard pieces, plastic bags			
1.3.	Crushed glass, rubber and plastic waste, used and defective incandescent bulbs			
1.4.	Swept waste, fallen leaves			
2. Hazardous class 3 and 4 waste allowed for disposal to domestic waste landfill				
2.1.	Broken roofing slates, asbestos-cement waste	**Waste collection and delivery to DSWL** • collection in the area of the production unit and disposal • broken roofing tiles, asbestos waste – to be packed in plastic bags and kept in enclosed open-air sites. • paronite, plastic and rubber pipes, glass fibre, foam plastic waste – within bounded open ground. • wood waste, chips – under shed or open areas covered with plastic. Delivery to domestic solid waste landfill using private transport.	It is prohibited: · Placement of industrial waste in containers allocated for domestic solid waste. · Removal of 3 and 4 hazard class is done only following consent from the landfill management and availability of relevant 'control slip' · During transportation safety measures required to avoid pollution of environment must be put in place.	Burial: According to sanitary and landfill operation rules. Responsibility: contractor organization
2.2.	Paronite, plastic and rubber waste			
2.3.	Paper and wooden packaging waste			
2.4.	Wood waste, chips			
2.5.	Plastic pipes, glass fibre, sandpaper, abrasive dust waste			
3. Industrial waste prohibited for disposal to domestic waste landfill				
3.1. Mercury containing and material waste:				
3.1.1.	Luminescent tube waste	**Collection - accumulation – removal to storage** • Collection on operation grounds: • Placement of used luminescent tubes in dry, integer packaging, which exclude the risk of any damage during transportation; • Damaged or broken lamps must be placed in	• Burned out luminescent tubes, used or broken tubes containing mercury are replaced and collected by adequately trained staff. It is prohibited: • Storage in the open air; • Storage in open premises;	Shall be delivered to temporary storage facility. Handed over to authorized contractor for subsequent utilization.

		plastic bags, tied up and placed in cardboard boxes. Premises – ventilated. • Accumulation of this type of waste on operation ground is prohibited. • Delivery to the temporary storage facility is done on private vehicles in compliance with the completed document.	• Storage unpacked; • Piling; • Placement on the ground; • Handing over to organization not authorized for processing of this type of waste. • During transportation of mercury containing lamps safety measures required to avoid pollution of environment must be put in place.	
3.1.2.	Mercury thermometer waste	**Collection - accumulation – removal to storage** • Accumulation on production sites in tight plastic bags and then in integer cardboard boxes; • Accumulation of this type of waste on operation ground is prohibited; • Removal – to temporary storage on the basis of necessary formal documents.	It is prohibited: • Placement of mercury thermometers in containers allocated for domestic solid waste disposal. • Storage in the open air and without packaging. • Litter around. • In case of damage and spillage of mercury treatment/neutralisation of premises must be carried put.	Shall be delivered to temporary storage facility. Handed over to authorized contractor for subsequent utilization.
3.2. Waste Chemicals				
3.2.1	Chemical salts and substances, medicine with passed expiry date	**Collection - accumulation – removal to storage** • Collection – in tight plastic bags and then into undamaged boxes correspondingly labelled with weight and date indicated. • Storage – in premises with adequate ventilation. Relevant record made in register. • Removal to storage with appropriate documentation.	It is prohibited: • Disposal of chemicals in containers allocated for domestic solid waste disposal. • Storage in the open air and without packaging. • Litter around. • During transportation of waste chemicals safety measures required to avoid pollution of environment must be put in place.	Shall be delivered to temporary storage facility. Handed over to authorize contractor for subsequent utilization.
1.3. Lead Containing Waste				
3.3.1	Waste lead accumulators (not drained of accumulator acid)	**Collection - accumulation – removal to storage** • Accumulation – on maintenance site, in premises to be ventilated. • Collection – in premises to be ventilated, in wooden boxes placed on metal support. • Removal to waste storage based on relevant documents	It is prohibited: • Placement of accumulator waste in containers allocated for domestic waste disposal; • Disposal of accumulator acid into sewer. • Mechanical processing of accumulators. • Long-term storage on the spot of generation (>1 week).	Shall be delivered to temporary storage facility. Handed over to authorize contractor for subsequent utilization.

3.4. **Waste slightly contaminated with oil (oil content <15%)**				
3.4.1	Oily rags	**Collection - accumulation – removal for utilization** • Accumulation – in special labelled container, on the spot of generation. • Removal for utilization (incineration) under agreement with contractor	It is prohibited: • placement of oily waste in containers allocated for domestic waste disposal • Scattering around • During transportation safety measures required to avoid pollution of environment must be put in place.	Handed over to authorized contractor for subsequent utilization.
3.4.2	Used oil filters	**Collection - accumulation – removal to storage** • Accumulation – on the spot of generation, in plastic bags placed in cardboard boxes • Removal to waste storage based on relevant documents.	It is prohibited: • Placement of oily waste in containers allocated for domestic waste disposal • Scattering around • During transportation safety measures required to avoid pollution of environment must be put in place.	Shall be removed to temporary storage. Handed over to authorized contractor for subsequent utilization.
3.5. **Waste Oil and Petroleum Products**				
3.5.1	Used industrial oils and lubricants	**Collection - accumulation – removal to storage** • Accumulation - on the spot of generation, in closed plastic or metal containers. • Removal to waste storage based on relevant documents.	It is prohibited: • Spillage of oil. • Disposal of waste oil into industrial-storm water drainage system, pouring on soil or disposal into water body.	Shall be removed to temporary storage. Handed over to authorize contractor for subsequent utilization.
3.5.2	Used transformer oils, which do not contain stable organic pollutant, in particular PCB	**Collection - accumulation – removal to storage** • Accumulation - on the spot of generation, in closed plastic or metal containers. • Removal to waste storage based on relevant documents.	It is prohibited: • Spillage of oil. • Disposal of waste oil into industrial-storm water drainage system, pouring on soil or disposal into water body. • Waste oil transportation with other materials or substances.	Shall be removed to temporary storage. Handed over to authorized contractor for subsequent utilization.
3.6. Plastic and rubber waste				
3.6.1	Waste tyres	**Collection - accumulation – removal to storage** • Collection – on the spot of generation in premises under solid cover.	Burning of rubber articles is strictly prohibited.	

		• Accumulation on site- not recommended. • Removal to waste storage based on relevant documents.		
3.6.2	Waste laser printer cartridges	**Collection-disposal to SDWL*** • Accumulation - on the spot of generation, in plastic bags. • Accumulation – in long-term storage. • Removal – by their own vehicle * **SDWL** – Solid Domestic Waste Landfill	• Placement of used cartridges in containers allocated for domestic solid waste. • Removal of waste is done only following consent from the landfill management and availability of relevant 'control slip' During transportation safety measures required to avoid pollution of environment must be put in place.	• Burial: According to sanitary and landfill operation rules. Responsibility: contractor organization
3.7. **Medical Waste**				
3.7.1 3.7.2	Used cotton wool and syringes. Expired medical supplies	**Collection - accumulation – removal for utilization** • I plastic bags, on the site of generation. • Removal for utilisation (incineration) under agreement with contractor.	It is prohibited to dispose medical waste in containers allocated for domestic waste or scattering around.	Utilization is carried out by contractor organization
3.8. Waste paint and paint cans		**Collection - accumulation – removal to storage** • Collection – in wooden boxes, on the spot of generation. • Accumulation – on the spot of generation, in closed premise or under a shed on solid base, until completion of works. • Removal - to long-term waste storage facility based on relevant documents.	It is prohibited: • Placement of paint and metal drums in containers allocated for domestic waste disposal. • Scattering/spilling around.	Shall be removed to temporary storage. Handed over to authorized contractor for subsequent utilization.
3.9. Waste metal				
3.9.1	Scrap metal	**Collection - accumulation – removal to storage** • Collection – within specially allocated area on the spot of generation. • Accumulation - within specially allocated area on the spot of generation until completion of maintenance works. The area must be sloped towards industrial-storm water collector well. • Removal – to long-term waste storage based on relevant documents	It is prohibited: • Placement of metal waste in containers allocated for domestic waste.	Shall be removed to temporary storage. Handed over to authorized contractor for subsequent utilization.
3.9.2	Waste welding electrodes	**Collection - accumulation – removal to storage** • Collection – on the spot of generation.	It is prohibited: Placement of metal waste in containers allocated	Shall be removed to temporary storage. Handed over to

		• Accumulation – in metal drums or wooden boxes, on the spot of generation up to completion of maintenance works. • Removal – to waste storage based on relevant documents.	for domestic waste.	authorized contractor for subsequent utilization.
3.10. Wood Waste				
3.10.1	Wooden pieces	**Accumulation – removal by private persons** · Collection – in situ, at certain places · Removal – delivery to pre-agreed place using the company's or rented vehicles	It is prohibited: • Placement of wood waste in domestic waste containers	Handed over private persons on contractual basis or terms established by the company
3.11. **Waste heavily contaminated with oil**				
3.11.1	Contaminated soil and sand	**Collection – accumulation – removal of petroleum-contaminated soil to temporary storage** · Collection – in metal tanks (on the spot of generation). · Accumulation - on the site of generation is not recommended. · Placement – in temporary storage of petroleum-contaminated soil, based on relevant documents	It is prohibited: • Placement on soil or open ground. • Discharge into collecting system. • Pouring on the ground or discharge into the water body. • During transportation –spill prevention measures put in place.	• Is subject to removal to temporary storage of contaminated soil. • Is subject to remediation
3.12.	**Solid Waste Generated on the WWTP Shield System Screens and Extracted Activated Sludge**			
1.12.1.	Solid Waste Generated on the Screens	**Collection – accumulation – removal by authorized contractor** • Collection on plant site in special containers; • Accumulation in situ is not recommended; • Disposal on domestic waste landfill possessing environmental permit.	It is prohibited: • Placement on soil or open ground. • Discharge into collecting system. • Pouring on the ground or discharge into the water body. • During transportation –spill prevention measures put in place.	• To be handed for further utilization to authorized organization having appropriate permit; • Disposal on domestic waste landfill possessing environmental permit.
1.12.2.	Extracted Activated Sludge	**Extraction – dewatering – removal by authorized contractor** • After dewatering, placement in special closed containers; • Accumulation on WWTP site is not recommended; • Composting and re-using in agriculture as the fertilizer is possible.	It is prohibited: • Placement on soil or open ground. • Discharge into collecting system. • Pouring on the ground or discharge into the water body. • During transportation –spill prevention measures put in place.	• To be handed for further utilization to authorized organization having appropriate permit; • Subsequent management – composting or disposal on the landfill possessing special permit.

13.5 Annex 5. Ghorjomi River Water sample analysis results

სამეცნიერო–კვლევითი ფირმა "გამა"
საქართველო, თბილისი 0124, გურამიშვილის 17ა
ტელ: (99532) 260-10-24, 260-10-22

წყლის ქიმიური ანალიზი # 2306 ლაბ.№655w

დამკვეთი: გამა

			მგ/ლ	მგ-ექვ
წყლის სახეობა	ზედაპირული	სიხისტე		1.794
წყლის დასახელება	მდ. ღორჯომი	თავ. ტუტიანობა		N.D.
წყალპუნქტი		გახსნ. O_2	-	
რეგიონი		თავ. CO_2	-	
დებიტი(მ³/დღე)	-	ჟ.ქ.მ.(მგ/ლ O)	<15	
პასპორტი		ჟ.ბ.მ.(მგ/ლ O)	3,4	
ფერი	-	ორგ. C	-	
სუნი		ჯამური SiO_2	-	
გემო		H_3PO_4	-	
სიმღვრივე (FTU)	255.00	H_3BO_3	-	
pH	7.95	H_2S	-	
ტემპერატურა	-	TPH	<0.04	
მშრ.ნაშთი(მგ/ლ)	131.909			
ელგამტარობა(სიმ/მ)	0.02509			

კათიონები

იონი	მგ/ლ	მგ-ექვ	მგ-ექვ%
NH_4	N.D.	N.D.	N.D.
*Ca	26.000	1.3000	58.94
*Mg	6.000	0.4938	22.39
Na	8.800	0.3843	17.42
K	1.050	0.0269	1.22
Ni	N.D.	N.D.	N.D.
Cu	N.D.	N.D.	N.D.
Mn	0.020	0.0007	0.03
Zn	N.D.	N.D.	N.D.
ჯამი	41.870	2.2058	100%

ანიონები

იონი	მგ/ლ	მგ-ექვ	მგ-ექვ%
Cl	7.799	0.2200	8.77
*HCO_3	100.040	1.6400	65.35
CO_3	N.D.	N.D.	N.D.
*SO_4	30.400	0.6333	25.24
NO_2	N.D.	N.D.	N.D.
NO_3	1.000	0.0161	0.64
ჯამი	139.239	2.5095	100%

ტოქსიკომპ.	მგ/ლ	მგ-ექვ
დარიშხანი	N.D.	N.D.
კადმიუმი	N.D.	N.D.
ტყვია	N.D.	N.D.
სულ	0.000	0.000

<*> - 20%-ზე–მეტი; <N.D.> - მგრძნობიარობაზე დაბლა; <-> - არ გაზომილა < - ფონური მნიშვნელობა

მინერალიზაცია (მგ/ლ): 181.109

სამუშაოთა ხელმძღვანელი

ვ.გვახარია
03.07.2015