Dariali Hydropower Plant Project

Expert Advice on Terrestrial Biodiversity Conservation, Land Take and Compensation Report

Tbilisi 2013

INTRODUCTION

Botanical and Zoological surveys have been carried in order to address the key data gap existing in ESIA of Dariali HPP Project from the Biodiversity standpoint that is provided in the "Expert Advice on Terrestrial Biodiversity Conservation, Land Take and Compensation Report" that includes two Annexes: I. Survey and comparative analysis of flora and vegetation of Dariali Hydropower Plant Project Corridor and compensation sites (carried out by Botanists: Dr Mariam Kimeridze and Mr David Chelidze) and II. Survey and comparative analysis of fauna of Dariali Hydropower Plant Project Corridor and compensation sites (carried out by Zoologists: Dr Alexander Bukhnikashvili, Dr Teimuraz Kokosadze and Mrs Marine Gioshvili).

Three small areas of land were removed from the Kazbegi National Park for the Dariali HPP construction totaling 8,737 ha that belonged to the area within the Boundaries of Traditional Use Zone of the KNP. Three territories have been added to the Protected Areas as compensation areas for the land lost at Dariali due to HPP: Nature Monument of Sakhiznari Cliff Columns-335,7ha, Nature Monument of the Abano Mineral Lake-0,04 ha and Nature Monument of the Truso Travertines-4,2 ha. For additional information with regard to impact of Dariali HPP construction on KNP please see the report prepared by Dr Mariam Kimeridze "Impact of Dariali HPP on Kazbegi National Oark Traditional USE Zone" dated 31.05.2013).

The detailed botanical and zoological studies were carried out in the river Tergi gorge within the borders of the Project Corridor and Compensation Sites. The expected negative impact on the botanical and zoological receptors caused by construction and operation of the Dariali HPP in the Project Corridor and adjacent areas has been revealed. The plant communities and floral and faunal species of various conservation value spread in the project impacted area and compensation sites have been identified. Comparative analysis has been carried out for Dariali HPP Project Corridor that includes three small areas of land which were removed from the Kazbegi National Park and compensation areas from the Biodiversity standpoint.

Based on the detailed botanical and zoological studies of the compensation sites (Natural monument of Abano Mineral Lake, Natural Monument of Trusso Travertines, Natural Monument of Sakhiznari Cliffs) the identification and detailed description of sensitive areas has become possible. As a result of extensive Biodiversity surveys we can conclude, that those sites of Dariali Hydropower Plant which were located in the Traditional Use Zone of Kazbegi National Park and excluded from Kazbegi Protected Area before the beginning of construction of Dariali Hydropower Plant, represent the sites of much lower conservation value as compared with the Compensation Sites, in the context of sensitive habitats and communities and populations of rare and endangered species. Granting the status of Natural Monuments to the Abano Mineral Lake, Trusso Travertines and Sakhiznari Cliffs to balance exclusion of the sites which were located in the Traditional Use Zone of Kazbegi National Park, is more than a sufficient compensation from the qualitative and quantitative context.

Dariali Hydropower Plant Project

Dariali HPP Project Area and Compensation Sites Comparative Analysis Botanical Component

Annex I

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TABLE OF CONTENTS

SURVEY AND COMPARATIVE ANALYSIS OF FLORA AND VEGETATION OF DARIALI HYDROPOWER PLANT PROJECT CORRIDOR AND COMPENSATION SITES

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1. OVERVIEW OF FLORA AND VEGETATION OF PROJECT CORRIDOR AND COMPENSATION SITES

Dariali Hydropower Plant territory and Compensation Sites are located in Kazbegi District, which is situated in the central part of the Greater Caucasus and represents the high-mountain territory rather cut with deep ravines. The geology of Kazbegi District mainly contains the Palaeozoic shale of sediment rocks and Jurassic limestone and marl rocks. A great role in its geology is also played by igneous rocks.

The main river of the district is Tergi with its right tributaries Snotskali (Gudushauris Aragvi) and Brolistskali (Khdistskali) and left tributaries Chkheri and Devdoraki, which originate from glaciers. The climate of the region is conditioned by the rugged topography, vicinity of glaciers and high altitude. Along with the vertical zonality the air temperature and precipitation vary. The region is located in the moderately humid climate zone with the relatively dry, cold winter and long summer at the altitude up to 1999 meters. The minimum temperature in this zone is up to -25-28ºC, absolute maximum - +28-31 ºC, precipitation – 600-900 mm. During a year one maximum of precipitation is in May – 100-200 mm, and one minimum – in January, 15-25 mm. The seasonal snow cover lasts for 3-5 months.

At the altitudes 1900-2500-2600 meters the climate is moderately humid with relatively dry, cold winter and short summer. The absolute temperature minimum is -25-30 ºC, absolute maximum - +25-30 ºC. The annual precipitation is 1000-1200 mm. During a year one maximum is in May-June and one minimum – in January – 50-60 mm. The seasonal snow cover lasts for 5-7 months. At higher altitudes there are mountain peaks covered with snow and glaciers, i.e. the climate is highland.

The main soils in the region are mountain-meadow. Vegetation is mainly represented by habitats of subalpine birch forest and alpine meadows. In the Dariali Gorge at the altitude up to 1200-1700 meters the southern slopes of the rocky ridges are held by pine (*Pinus kochiana)* forest habitat. The rocky scrubs are mainly represented by juniper (*Juniper depressa, J. Sabina*).

The vegetation in Kazbegi District is represented by the following habitats (sensitive habitats are marked with asterisk [*]):

1. 3220 Alpine rivers and the herbaceous vegetation along their banks
2. 4060 Alpine and boreal heaths
3. 50GE1 mountain xerophytic scrubs
4. 50GE3 Tragacanthic scrub
5. 61GE01 Sub-alpine high herbaceous vegetation
6. 61GE02 Sub-alpine meadows
7. 6150 Siliceous alpine and boreal grasslands
8. 62GE04 Vegetation of urban and rural areas
9. 62GE05 Vegetation of pastures
10. 70GE02* Low grass marshes
11. 8110 Siliceous scree of the montane to snow levels
12. 8220 Siliceous rocky slopes with chasmophytic vegetation
13. 8310* Caves
14. 8340* Rock and true glaciers
15. 91PK-GE Caucasian Pine forest (*Pinus kochiana*)
16. 9BF-GE* Subalpine birch krummholz (*Betula litwinowii*)

The Project Corridor and Compensation Sites are covered with subalpine and alpine meadows.

The subalpine meadows are represented by the following sub-types of habitat (Code 61GE02-01):

1. Grass meadows (Bromopsieto) with the dominant species: *Bromopsis variegata, Agrostis tenuis, A. planifolia.* This community holds both dry and moist habitats. Appropriate species of the community are *Trifolium ambiguum, Lotus caucasicus, Alchemilla sericata,* etc. It is distributed up to the altitude of 2700 meters a.s.l. It is used for mowing.
2. *Agrostieta* meadows with the dominant species – *Agrostis tenuis, A.planifolia.* This community holds moist river banks.
3. *Festuca ovina* meadows which hold the southern slope. Characteristic species are: *Koeleria albovii, Bromopsis riparia, Agrostis tenuis, Carex buschiorum, Pulsatilla violacea, Thymus collinus*.
4. Fescue-grass *(Festuca varia)* contains many grass and herbaceous species and represents the grass forbs community.

The sub-types of alpine meadow habitats (Code 6150-01):

1. *Festuceta ovinae*
2. *Festuceta supinae*
3. *Nardeta strictae*
4. *Festuceta supinae + Carex meinshauseniana*
5. *Kobresieta humilis*

6150-02. Alpine snowbed (Code 6150-02)

Alpine snowbeds can be found in plain places between large stone sand moraines at the upper border of the alpine zone, where snow melt is late and vegetation is late. It consists of the following grasses: *Poa alpina, Phleum alpinum, Festuca supina,* etc. and herbaceous species: *Campanula biebersteiniana, Carum caucasicum, Veronica gentianoides, Gnaphalium*

supinum, Pedicularis crassirostris, P.armena, Poa alpina, Taraxacum stevenii, Sibbaldi asemiglabra, etc.

2. DETAILED BOTANICAL DESCRIPTION OF PROJECT CORRIDOR AND COMPENSATION SITES

The detailed botanical studies were carried out in the river Tergi canyon within the borders of the Project Corridor and Compensation Sites. The expected negative impact on the botanical receptors caused by construction and operation of the Dariali HPP in the Project Corridor and adjacent areas has been revealed. The plant communities and species of various conservation value spread in the project impacted area and compensation sites have been identified (attributed to the Red List, endemic, rare). The detailed descriptions of phytocenoses developed in the Project Corridor and Compensation Sites are given below.

During the Botanical Survey vegetation occurrence/coverage was assessed according to Drude's scale. Symbols of Drude's scale indicate frequency of occurrence/coverage of a species. The symbols are as follows: Soc (socialis) – the dominant species, frequency of occurrence/coverage exceeds 90%; Cop^3 (coptosal) – an abundant species, frequency of occurrence/coverage 70-90%; Cop^2 – a species is represented by numerous individuals, frequency of occurrence/coverage 50-70%; Cop^1 – frequency of occurrence/coverage 50-70%; Sp^3 (sporsal) – frequency of occurrence/coverage about 30%; Sp^2 (sporsal) – frequency of occurrence/coverage about 20%; Sp^1 (sporsal) – frequency of occurrence/coverage about 10%; Sol (solitarie) – scanty individuals, frequency of occurrence/coverage about to 10%; Un (unicum) – a single individual.

2.1. DARIALI HPP PROJECT TERRITORY

The right bank of the river Kurostskali at its inflow into the river Tergi. The designed place for construction of watershed facilities.

Site N1. GPS coordinates N42^{0}66'72.3''/E 44^{0}64'54.7'', 1725 m a.s.l. Exposition northwest, slope inclination 5-35^0. Weathered detritus, erosive relief. The following species of plants are growing sparsely: *Oxytropis cyanea,* Cerastium sp., *Fesstuca varia, Moehringia trinervia,* Pyrethrum sp., *Tussilago farfara, Taraxacum officinale, Trifolium spadiceum, Artemisia absinthium, Senecio sosnovskyi*. Sparse are sea-buckthorn (*Hippopaë rhamnoides*) species. The habitat of low conservation value. (This site was located in the zone of traditional use of Kazbegi National Park, which was excluded from the Kazbegi Protected Territory before the beginning of construction of Dariali Hydropower Plant, Fig. N 1 on the map).

Site 1. Erosive relief

Site 1. *Oxytropis cyanea*

Site 1. *Taraxacum officinale*

Site N2. **GPS coordinates N42^{0}66'88.0''/E 44^{0}64'57.8''**, 1572 m a.s.l. Exposition northwest, slope -5-10^0. Grass forbs meadow-pasture (degraded). The habitat is of low conservation value. (This site located in the zone of traditional use of Kazbegi National Park which was excluded from the Kazbegi Protected Territory before the beginning of construction of Dariali Hydropower Plant, Fig. N 1 on the map).

Alchemilla sp.-Cop^3
Carum carvi- Cop^2
Trifolium ambiguum- Cop^1
Taraxacum officinale-Sp^3
Plantago lanceolata- Sp^2
Agrostis planifolia- Sp^2
Minuartia sp.- Sp^1
Cirsium caucasicum-Sol
Juniperus depressa-Unic

Site 2. *Taraxacum officinale*

Site 2. *Cirsium caucasicum*

Site 2. Grass forbs meadow-pasture (degraded)

Site N3. GPS coordinates N42^{0}67’04.2’’/E 44^{0}64’76.5’’, 1702 m a.s.l. Represented with the same type of vegetation – the degraded pasture with stripes of sea-buckthorn (*Hippopaë rhamnoides*), barberry (Berberis sp.), sweet briar (*Rosa canina*) scrub, goat willow, (*Salix caprea*) in ravines. The height of sea-buckhorn attains to 2.5 m, of barberry – 1,5 m, briar – 2 m, goat willow – 4-6 m. This is the habitat of low conservation value. (This site located in the zone of traditional use of Kazbegi National Park which was excluded from the Kazbegi Protected Territory before the beginning of construction of Dariali Hydropower Plant, Fig. N 1 on the map).

Site 3. Degraded pasture with scrubs

Site 3. *Rosa canina*

Site 3. *Berberis vulgaris*

Site 3. Sea-buckthorn (*Hippopaë rhamnoides*)

Site 3. Goat willow (*Salix caprea*)

Site 3. Pasture

Site N4. **GPS coordinates N42^{0}40’29.9’’/E 44^{0}38’55.1’’**, 1725 m a.s.l. southwest exposition. Slope inclination- 20-25^0. This territory is occupied with sea-buckthorn (*Hippophaë rhamnoides*) shrubbery. Thecoverage of vegetation is 60%. The sea-buckthorn height attains to 2 m., the herbaceous vegetation is represented by the following species: *Galium album, Artemisia absinthium, Cirsium caucasicum, Urtica dioica.* The habitat is of low conservation value. (This site located in the zone of traditional use of Kazbegi National Park which was

excluded from the Kazbegi Protected Territory before the beginning of construction of Dariali Hydropower Plant, Fig. N 1 on the map).

Site 4. Sea-buckthorn shrubbery (*Hippophaë rhamnoides*)

Site 4. Sea-buckthorn shrubbery (*Hippophaë rhamnoides*)

Site 4. Sea-buckthorn shrubbery (*Hippophaë rhamnoides*)

Site N5. GPS coordinates N42^{0}40'21.6''/E 44^{0}39'00.0'', 1740 m a.s.l., southwest exposition. Slope inclination - 5º. This site represents the grass forbs meadow degraded from grazing. The habitat is of low conservation value. (This site located in the zone of traditional use of Kazbegi National Park, which was excluded from the Kazbegi Protected Territory before the beginning of construction of Dariali Hydropower Plant, Fig. N 1 on the map). The vegetation coverage is 80%, phytocenosis height – 5 cm. Below is provided species cover-abundance by Drude scale:

Festuca varia-Cop^3
Plantago lanceolata- Cop^3
Cirsium caucasicum-Cop^2
Cerastium arvense-Cop^1
Oxytropis cyanea-Cop^2
Euphorbia iberica-Sparsus
Taraxacum officinale-Cop^1
Potentilla sp.-Sparsus

Macrotomia echioides-Sol

Around the described plot is developed shrubbery of sea-buckthorn, barberry, juniper (*Hippophaë rhamnoides, Berberis vulgaris, Juniperus depressa*).

Site 5. Overgrazed grass forbs degraded meadow with the sea-buckthorn shrubbery in the background

Site 5. Overgrazed grass forbs degraded meadow with shrubbery of the sea-buckthorn, barberry and juniper in the foreground

Site 5. Overgrazed grass forbs degraded meadow with the shrubbery of sea-buckthorn, barberry and juniper in the foreground

Site 5. Juniper *Juniperus depressa*

Site 5. Penstock site

Site N6. GPS coordinates N42^{0}67’18.3’’/E 44^{0}64’80.3’’, 1705 m a.s.l. Exposition – west, slope inclination -10-15^0. Sea-buckthorn (*Hippophaë rhamnoides*) shrubbery with admixed barberry (*Berberis vulgaris*), sweet briar (*Rosa canina*), blackberry and juniper (*Juniperus depressa*). The juniper height is 0.5 m. The habitat is of medium conservation value.

Site 6. Juniper (*Juniperus depressa*)

Site 6. Sea-buckthorn shrubbery (*Hippophaë rhamnoides*)

Site N7. GPS coordinates N42^{0}67’78.9’’/E 44^{0}64’75.0’’, 1674 m a.s.l. Exposition – west. Slope inclination - 20-25^0. In the degraded grass forbs meadow the sea-buckthorn scrub is growing in kind of islets (like the previous site). The habitat is of medium conservation value.

Site 7. Sea-buckthorn scrubbery in degraded grass forb meadow

Site 7. Sea-buckthorn shrubbery (*Hippophaë rhamnoides*)

Site N8. GPS coordinates N42^{0}68'04.7''/E 44^{0}64'69.5'', 1663 m a.s.l. Sparse juniper shrubbery (*Juniperus depressa*). Slope inclination - 0^0. Juniper height attains to – 0.5 m. With admixed young sea-buckthorn (*Hippophaë rhamnoides*) growth. The habitat is of medium conservation value. (This site is located in the zone of traditional use of Kazbegi National Park which was excluded from the Kazbegi Protected Territory before the beginning of construction of Dariali Hydropower Plant, Fig. N 2 on the map).

Site 8. Juniper shrubbery (*Juniperus depressa*)

Site 8. Juniper shrubbery (*Juniperus depressa*)

Site N9. GPS coordinates N42^{0}68'16.6''/E 44^{0}64'68.4'', 1662 m a.s.l. Sea-buckthorn shrubbery with admixed goat willow. Exposition – northwest. Slope inclination -5^0. Sea-buckthorn height – 2.5m, goat willow height -4-5m. Isolated species of birch (*Betula litwinowii*) with the height 5m. On the adjacent bank Cirsium sp., *Artemisia absinthium, Echinops sphaerocephalus* are growing. The habitat is of medium conservation value. (This site located in the zone of traditional use of Kazbegi National Park which was excluded from the Kazbegi Protected Territory before the beginning of construction of Dariali Hydropower Plant, Fig. N 2 on the map).

Site 9. Sea-buckthorn shrubbery with admixed goat willow and birch

Site 9. Sea-buckthorn shrubbery with admixed goat willow and birch

Site 9. *Echinops sphaerocephalus*

Site N10. GPS coordinates N42^{0}68’42.4’’/E 44^{0}64’46.7’’, 1621m a.s.l. Juniper shrubbery (*Juniperus sabina*). Exposition - southwest, slope 10-15^0. Juniper height from 40-50 cm to -1 meter. With admix sweet briar (*Rosa canina*), sea-buckthorn (*Hippophaë rhamnoides*), rock-red currant (*Ribes biebersteinii*). The habitat is of medium conservation value. (This site located in the zoneof traditional use of Kazbegi National Park which was excluded from the Kazbegi Protected Territory before the beginning of construction of Dariali Hydropower Plant, Fig. N 2 on the map).

Site 10. Juniper (*Juniperus sabina*) **Site 10.** Juniper (*Juniperus sabina*)

Site N11. GPS coordinates N42^{0}40’15.5’’/E 44^{0}39’03.7’’, 1757 m a.s.l. Northwest exposition. Slope inclination-5-15^0. The habitat is of medium conservation value. This site is represented with overgrazed grass forbs meadow. Coverage of vegetation–90%. Phytocenosis height – 40 cm. Below is provided species cover-abundance by Drude scale. Symbols of Drude’s scale indicate frequency of occurrence/coverage of a species. (This site located in the zoneof traditional use of Kazbegi National Park which was excluded from the Kazbegi Protected Territory before the beginning of construction of Dariali Hydropower Plant, Fig. N 2 on the map).

Festuca varia-Cop^3
Alchemilla caucasica-Cop^3
Carum meifolium-Cop^3
Taraxacum officinale-Cop^1
Plantago saxatilis- Cop^1
Potentilla crantzii-Cop^2
Gentiana nivalis-Sparsus
Polygala alpicola-Sparsus
Pulsatilla violacea-Sparsus
Thymus sp.-Sparsus
Trifolium ambiguum-Cop^2
Oxytropis cyanea-Sparsus
Coronilla balansae-Cop^2
Euphorbia iberica -Sparsus
Ranunculus oreophyllus-Cop^1
Festuca ovina-Sparsus
Cerastium arvense-Sparsus
Androsace barbata-Sol
Galium album-Sol
Primula algida-Sol
Veronica gentianoides-Sol
Mosslayer is developed.

The site is represented by the sparse shrubbery among the stones with the following spacies: barberry (*Berberis vulgaris*), juniper (*Juniperus depressa*), *Asplenium trichomanes, Thalictrum buschianum*.

Site 11. Grass forbs meadow

Site 11. Grass forbs meadow

Site 11. *Pulsatilla violacea*

Site 11. *Primula algida*

Site 11. *Pulsatilla violacea*

Site 11. *Pulsatilla violacea*

Site N12. **GPS coordinates N42^{0}40’32.4’’/E 44^{0}38’55.7’’**, 1724 m a.s.l. Southwest exposition. Slope inclination-5-20^0.The habitat of medium conservation value. On this site is developed overgrazed grass forbs degraded meadow. Coverage of vegetation is 90%. Phytocenosis height – 5 cm. Below is provided species cover-abundance by Drude scale. (This site located in the zoneof traditional use of Kazbegi National Park which was excluded

from the Kazbegi protected territory before the beginning of construction of Dariali hydropower plant, Fig. N 2 on the map).

Festuca ovina-Cop^{3}
Plantago saxatilis- Cop^{2}
Potentilla crantzii-Sparsus
Pulsatilla violacea-Sparsus
Cerastium arvense-Sparsus
Androsace barbata-Sol
Linaria meyeri-Sol

The site is represented by the sparse shrubbery with the following species: barberry (*Berberis vulgaris*), juniper (*Juniperus depressa*).

Site 12. *Juniperus depressa*

Site 12. *Androsace barbulata*

Site 12. *Berberis vulgaris*

Site 12. *Linaria meyeri*

Site 12. *Berberis vulgaris*

Site 12. *Androsace barbulata*

Site 12. *Pulsatilla violacea* aspect

Site 12. *Pulsatilla violacea* aspect

Site N13.GPS coordinates N42^{0}40’25.0’’/E 44^{0}38’53.8’’, 1719 m a.s.l. The northwest exposition, Slope inclination -10-15^0. The habitat of low conservation value. The territory is represented by sea-buckthorn shrubbery with admixed goat willow (*Salix caprea*), juniper (*Juniperus depressa*) and barberry (*Berberis vulgaris*). The sea-buckthorn height is 2.5 m, the goat willow height is 3 m, barberry height – 1.5 m, juniper – 1 m. Coverage of vegetation is 50%. (This site located in the zone of traditional use of Kazbegi National Park which was excluded from the Kazbegi Protected Territory before the beginning of construction of Dariali Hydropower Plant, Fig. N 2 on the map).

Site 13. Sea-buckthorn shrubbery with admixed goat willow, juniper and barberry

Site 13. Sea-buckthorn shrubbery with admixed goat willow, juniper and barberry

Site 13. Sea-buckthorn shrubbery with admixed goat willow, juniper and barberry

Site N14. Kazbegi District. Slope inclination-30º. Southern exposition, foliated detritus.

Festuca varia+Thymus nummalarius

Total coverage 90%. 3 layers: I – 40 cm, 20%. II – 25 cm, 45%. III – 10 cm, 60%. Aspect – pink *Thymus nummalarius*, yellow *Leontodon hispidus* and blue *Campanula collina* flowers in the greyish-green background. Topologically associated with Festuca varia+Alopecurus glacialis. The habitat is of medium conservation value. (This site located in the zone of traditional use of Kazbegi National Park which was excluded from the Kazbegi Protected Territory before the beginning of construction of Dariali Hydropower Plant, Fig. N 2 on the map).

Festuca varia- Cop^2
Thymus nummalarius- Cop^2
Agrostis planifolia- Sp^3
Zerna variegata- Sp^2
Festuca rubra- Sp^2

Helictotrichon asiaticus- Sp^1
Anthoxanthum odoratum- Sp^1
Campanula collina- Sp^2
Vicia purpurea- Sp^1
Poa caucasica- Sp^1
Leontodon hispidus- Sp^1
Ranunculus oreophilus- Sp^1
Euphrasia ambliodonta- Sp^1
Centaurea fischeri- Sol
Polygonum carneum- Sol
Alopecurus glacialis- Sol
Silene ruprechtii- Sol
Trifolium ambiguum- Sol
Carex meinshauseniana- Sol
Luzula spicata- Sol
Alchemilla pycnotricha-Sol
Gentiana caucasica- Sol
Poa alpina - Sol
Alectorolophus minor- Sol
Sedum involucratum- Sol
Campanula aucheri- Sol
Sparsely moss.

Site N15. GPS coordinates N42^{0}68'45.9''/E 44^{0}64'47.2'', 1612 m a.s.l. Exposition – southwest. Slope inclination - 70-80^0. Rock complex. *Juniperus sabina, Juniperus depressa,*with admixed *Spiraea hypericifolia*. Herbaceous plants are represented by: *Minuartia brotheriana, Saxifraga cartiloginea, Sedum caucasicum, Sempervivum caucasicum, Asplenium septentionale, Saxifraga juniperifolia*. The habitat is of high conservation value.

Site 15. Rock complex with *Juniperus sabina*

Site 15. Rock complex with *Juniperus depressa*

Site 15. *Minuartia brotheriana*

Site 15. *Sempervivum caucasicum*

Site 15. Limewort

Site 15. *Saxifraga cartilaginea*

Site 15. *Saxifraga juniperifolia*

Site N16. **GPS coordinates N42^{0}68’45.9’’/E 44^{0}64’47.2’’**, 1612 m a.s.l. Meadowsweet (*Spiraea hypericifolia*) on the rock. Slope inclination -70-80-90^0, exposition – southwest. With admixed *Ephedra procera*. Herbaceous vegetation is represented by chasmophytes: *Minuartia brotheriana, Saxifraga juniperifolia, Draba brioides.* The habitat is of high conservation value.

Site 16. Meadowsweet (*Spiraea hypericifolia*)

Site 16. *Ephedra procera*

Site N17. GPS coordinates N42^{0}68'57.4''/E 44^{0}64'34.1'', 1585m a.s.l. On the rock (slope inclination - 80-90^0) are developed juniper shrubbery with admixed meadowsweet - *Spiraea hypericifolia, Ephedra procera*. Below, on the right bank terrace of the river are developed sea-buckthorn shrubbery. Iberian Aster (*Aster ibericus)* flowers in autumn. The habitat is of medium conservation value.

Site 17. "Rock legs"

Site 17. Sea-buckthorn shrubbery

Site 17. *Aster ibericus*

Site 17. *Ephedra procera*

Site 17. *Saxifraga juniperifolia*

Site N18. GPS coordinates N42^{0}72’88.0’’/E 44^{0}62’93.1’’, 1400 m a.s.l. Exposition – west, slope inclination -30-35^0. The height of herblayer is -40 cm. The grass forbs meadow Festucetum-mixtoherbosa. The habitat is of low conservation value. (This site located in the zone of traditional use of Kazbegi National Park, which was excluded from the Kazbegi Protected Territory before the beginning of construction of Dariali Hydropower Plant, Fig. N 2 on the map).

Festuca varia-Cop^2
Phleum alpinum- Cop^2
Agrostis planifolia- Cop^1
Potentilla cranzii- Sp^3
Galium verum- Sp^3
Thymus sp.- Sp^2
Coronilla varia- Sp^2
Achillea millefolium- Sp^2
Artemisia absinthium-Sp^1
Salvia verticillata- Sp^1
Hypericum perforatum- Sp^2
Thalictrum alpinum-Sol
Plantago lanceolata-Sol
Echium vulgare-Sol

Site 18. Grass forbs meadow Festucetum-mixtoherbosa

Site 18. Grass forbs meadow Festucetum-mixtoherbosa

Site 18. Grass forbs meadow Festucetum-mixtoherbosa

Site 18. Dariali. Tunnel portal vicinity

Site N19. Dariali. Rock complex. The same place. Rock inclination – 70-90ºC. Exposition – west. Pine (*Pinus kochiana*), juniper (*Juniperus depressa)* sparsely grow on the rock. From herbaceous plants are represented the following species: *Parietaria judaica, Anthemis marschalliana* subsp. *marschalliana, Saxifraga cartilaginea, Saxifraga juniperifolia, Asplenium septentrionale*. The habitat is of medium conservation value. (This site located in the zone of traditional use of Kazbegi National Park which was excluded from the Kazbegi Protected Territory before the beginning of construction of Dariali Hydropower Plant, Fig. N 3 on the map).

Site 19. Rock complex

Site 19. *Parietaria judaica*

Site 19. *Parietaria judaica*

Site 19. *Juniperus depressa*

Site 19. *Juniperus depressa*

Site 19. *Saxifraga juniperifolia*

Site 19. *Saxifraga juniperifolia*

Site N20. Such rock-forest complexes are represented in Dariali Gorge, along the right bank of the river Tergi to Gveleti Bridge. **GPS coordinates from Gveleti bridge: N42^{0}70’99.8’’/E 44^{0}62’76.2’’**, 1421 m a.s.l. The habitat is of medium conservation value.

Site 20. *Saxifraga cartilaginea*

Site 20. *Anthemis marschalliana* subsp. *marschalliana*

Site 20. *Asplenium septentrionale*

Site 21. Kazbegi District, southeast exposition. Slope inclination - 15º, inclined relief, undulating subrelief.

Festuca varia+Agrostis planifolia

Total coverage 98%. 2 layers: I-45 cm, 25%, II-30 cm, 85%. The aspect – pink *Polygonum carneum* flowers in the greyish-green background. Topologically associated with bentgrass community developed on the prominent forms of the relief. The habitat is of low conservation value. (This site located in the zone of traditional use of Kazbegi National Park which was excluded from the Kazbegi Protected Territory before the beginning of construction of Dariali Hydropower Plant, Fig. N 3 on the map).

Festuca varia-Cop^2
Agrostis planifolia- Cop^2
Zerna variegata-Sp^3
Festuca rubra- Sp^3
Helictotrichon asiaticus- Sp^1
Polygonum carneum- Sp^3
Campanula collina- Sp^1
Anthoxanthum odoratum- Sp^1
Potentilla crantzii- Sp^2
Myosotis alpestris- Sp^1
Poa alpina- Sp^1
Trifolium ambiguum- Sp^1
Euphrasia ambliodonta- Sp^1
Deschampsia flexuosa- Sp^1
Centaurea fischeri-Sol
Betonica grandiflora- Sol
Cerastium purpurascens- Sol
Silene ruprechtii- Sol
Leontodon hispidus- Sol
Carex meinshauseniana- Sol
Carex huetiana- Sol
Luzula multiflora- Sol

Pimpinella rhodanta- Sol
Veronica gentianoides- Sol
Luzula spicata- Sol
Campanula aucheri- Sol
Tragopogon reticulates- Sol
Knautia involucrata- Sol
Carum caucasicum- Sol
Alectorolophus minor- Sol
Bryum pallescens- Sp^1 (by small groups)

Most widely from the meadows in this ravine is represented the bentgrass community, among them the leading role has Festuca varia+Carex meinshauseniana.

2.2. COMPENSATION SITES
2.2.1 NATURE MONUMENT OF ABANO MINERAL LAKE

Site N1. Trusso Canyon. Abano Lake. **GPS coordinates N42^{0}58'81.4''/E 44^{0}42'20.7''**, 2144 m a.s.l. Exposition – south. Slope inclination-0-3^0, height of herblayer -70-80 cm, coverage-90%. Variegated fescue grass forbs meadow (Festucetum variae mixtoherbosa). The habitat is of low conservation value.

Festuca varia-Cop^3
Agrostis planifolia- Cop^2
Alchemilla sp.-Sp^3
Ranunculus sp.- Sp^3
Potentilla sp.- Sp^3
Hieracium sp.- Sp^1
Taraxacum officinale- Sp^1
Trifolium ambiguum- Sp^1
Carum meifolium- Sp^1

Site N 2. Trusso Canyon. Fragment of grass forbs meadow at the northern bank of the Abano Lake. Exposition – south. Slope inclination-70-80, height of herblayer – 1.5 m, coverage – 50-60%. The habitat is of low conservation value.

Anthriscus sylvestris- Cop^3
Festuca ovina- Sp^2
Festuca varia- Sp^1
Phleum pratense- Sp^1
Cirsium sp.-Sol
Betonica grandiflora- Sp^1
Artemisia vulgaris-Sol
Urtica dioica- Sp^2
Sisymbrium irio- Sol
Achillea millefolium- Sol

Site 2. Abano Lake

Site N3. Trusso Canyon. On the rocks adjacent to the Abano Lake are growing the following species: Alchemilla sp., *Androsace villosa, Saxifraga exarata, Artemisia splendens, Veronica gentianoides, Thalictrum alpinum, Polygala alpicola, Potentilla crantzii, Minuartia oreina, Sempervivum caucasicum*, Allium sp. In caves is growing *Cystopteris fragilis*. The habitat is of the high conservation value.

Site 3. Rocks adjacent to the Abano Lake

Site 3. Variegated fescue community

Site 3. Variegated fescue community

Site 3. *Potentilla crantzii*

Site 3. View to the village Abano

Site 3. *Artemisia splendens*

Site 3. Abano Lake

Site 3. Rocks adjacent to Abano Lake

Site 3. Grass forbs meadow, cow parsley growth (*Anthriscus sylvestris*)

Site 3. *Cystopteris fragilis* in caves

Site 3. *Saxifraga exarata*

Site N4. Trusso Canyon. The village Abano vicinity, southwest exposition, ~2500 m a.s.l., undulating relief, stepwise subrelief. Dry, stone soil. Slope inclination 35º.

Festuca varia+Carex meinshauseniana

The greyish-green aspect. 2 layers: I – 60 cm, 45%, II-20 cm, 90%. Total coverage – 100%. The layers are not clearly expressed. Topologically is associated with Carex meinshauseniana+Thymus-+Festuca, Carex meinshauseniana+Festuca varia. The habitat is of medium conservation value.

Festuca varia- Cop[1]
Carex meinshauseniana- Cop[1]
Festuca rubra- Sp[2]
Bromus variegatus- Sp[1]
Alopecurus glacialis- Sp[1]
Avenastrum asiaticum- Sp[1]
Betonica grandiflora- Sp[1]
Chaerophyllum roseum- Sp[1]
Thymus grossheimii- Sp[1]
Sedum involucratum- Sp[1]
Phleum montanum- Sol
Koeleria caucasica- Sol
Poa caucasica- Sol
Trisetum pretense- Sol
Campanula collina- Sol
Cerastium purpurescens- Sol
Orobus cyaneus- Sol
Vicia grossheimii- Sol
Veronica gentianoides- Sol
Myosotis alpestris- Sol

Alchemilla grossheimii- Sol
Macrotomia echioides- Sol
Polygonum carneum- Sol
Draba incana- Sol
Hypericum polygalifolium- Sol
Potentilla crantzii- Sol
Arenastrum pubescens-Sol
Centaurea fischeri var. *ochroleuca*-Un
Moss *Rhytidium rugosum, Webers polymorpha,* in a small quantity.

Site N5. Trusso Canyon, Zekagori vicinity. Southwest exposition. Slope inclination 30º. ~2400 m a.s.l., Microrelief is slightly stepwise, undulating, sometimes with schists with the diameter 5-25 cm.

Festuca varia+Carex bushiorum

The aspect – Cephalaria and Scabiosa flowers in the greyish-green background. 3 layers: I- 70 cm, 15%, II – 32 cm, 50%, III – 13 cm, 60%. Borders with Caricetum (Carex bushiorum), Carex bushiorum+grasses, grass forbs and forbs grass meadows. The habitat is of the medium conservation value.

Festuca varia-Cop^1
Carex bushiorum- Cop^1
Cephalaria gigantea- Sp^3
Festuca sulcata- Sp^2
Bromus vaiegatus- Sp^1
Poa alpina- Sp^1
Anthyllis caucasica- Sp^3
Alchemilla sericata- Sp^3
Pastinaca armena- Sp^2
Lotus caucasicus- Sp^2
Vicia purpurea- Sp^3
Alectorolophus minor- Sp^2
Veronica gentianoides- Sp^1
Campanula collina- Sp^1
Erigeron orientalis- Sp^1
Thalictrum simplex- Sp^1
Ranunculus oreophilus- Sp^1
Betonica grandiflora- Sp^1
Salvia verticillata- Sp^1
Galium verum- Sp^1
Scabiosa bipinnata- Sp^1
Psephellus dealbatus-Sp^1
Euphrasia tatarica-Sp^1
Phleum phleoides-Sol
Gentiana cruciata- Sol
Gentiana caucasica- Sol
Aconitum anthora- Sol

Pulsatilla album- Sol
Pedicularis comosa- Sol
Leontodon hispidus- Sol
Rumex acetosa- Sol
Myosotis alpestris- Sol
Plantago lanceolata- Sol
Allium szovitsii- Sol
Trifolium ambiguum- Sol
Macrotomia echioides- Sol
Euphorbia buschiana- Sol
Polygonum carneum- Sol
Minuartia bieberstainii- Sol
Campanula sarmatica- Un
Primula macrocalyx- Un
Orchis caucasica-Un
Jurinea sp.-Sol
No mosses.

Site N5[a]. Trusso, Suatisistskali Canyon. West exposition, slope inclination 30º. ~2600 m a.s.l., Microrelief is stepwise.

Festuca varia+Festuca ovina

Aspect – greyish-green. 2 layers: I-60 cm, 40%, II-32 cm, 50%, III – 15 cm, 7-%. Total coverage is 98%. Borders with rhododendron+variegated fescue, matgrass+alpine snowbed elements, alpine snowbed, sedge-variegated fescue (*Carex buschiorum*), Caricetum (*Carex tristis*). The habitat of high conservation value.

Festuca varia-Cop^2
Festuca ovina- Cop^1
Festuca supina- Sp^2
Bromus variegatus- Sp^2
Avenastrum asiaticum- Sp^2
Poa iberica- Sp^1
Agrostis planifolia- Sp^1
Trifolium ambiguum- Sp^2
Vicia grossheimii- Sp^2
Alchemilla glabricaulis- Sp^1
Silene ruprechtii- Sp^2
Cerastium purpurescens- Sp^1
Minuartia biebersteinii- Sp^1
Chaerophyllum roseum- Sp^1
Betonica grandiflora- Sol
Poa alpina-Sp^2
Carex meinshauseniana- Sp^1
Draba siliquosa- Sp^1
Campanula collina- Sp^1
Euphrasia tatarica- Sp^1

Galium cruciatum- Sp^1
Sedum involucratum- Sp^1
Galium verum-Sol
Centaurea fischeri- Sol
Veronica gentianoides- Sol
Gentiana septemfida- Sol
Myosotis alpestris- Sol
Koeleria caucasica- Sol
Leontodon hispidus- Sol
Luzula spicata- Sol
Avenastrum pubescens- Sol
Primula algida- Sol
Trisetum pretense- Sol

Mosses-*Weisia crispate, Webera polymorpha*, also lichens in small quantity - *Peltigera canina, Cladonia fimbricata* var. *simplex* f. *minor*.

2.2.2 NATURE MONUMENT OF TRUSSO TRAVERTINES

Site N6. Trusso travertineS. **GPS coordinates N42^{0}58'35.1''/E 44^{0}42'57.1''**, 2134 m a.s.l., exposition – north, northwest, slope inclination-5-10^0, height – 60-70 cm. On travertine sometimes we can see *Betula litwinowii, Salix kazbekensis* grown up by islets. All around travertine are developed Festucetum variae, where sparsely willows (*Salix kazbekensis*) and birches (*Betula litwinowii)* grow up. The habitat is of high conservation value. Festucetum variae. Exposition – north, northeast, slope – 0-35º.

Festuca varia- Cop^3
Agrostis planifolia- Sp^3
Alchemilla sp.- Sp^3
Carum carvi- Sp^2
Potentilla sp.- Sp^1
Festuca ovina- Cop^1
Mosses.

Here and there *Agrostis planifolia* is growing (height – 40 cm) in kind of islets.

Site 6. *Agrostis planifolia* islets

Site 6. Trusso Travertines

Sometimes, on dried up travertines the fragments of grass forbs meadow - *Festuca varia, Agrostis planifolia* and mosses (in particular, at northern parts of small turfs) reveal themselves – the initial stages of turfing manifest.

Site 6. Agrostis planifolia

Site 6. Festucetum variae border

Site 6. Trusso Travertines

Site 6. "Salt Desert"

Site 6. *Taraxacum stevenii*

Site 6. Birch and willow specimens

Site 6. *Gentiana angulosa*

Site 6. Festucetum variae

Site 6. Initial stage of turfing

Site 6. Initial stage of turfing

Site 6. Trusso Travertines

Site N7. Kazbegi District. Right terrace of Trusso Canyon, village Ketrisa vicinity (between Ketrisa and Kasara jaws). ~2100 m a.s.l., plaining, alluvial-proluvial blanket.

Caricetum inflatae purum

Coverage 75%. 1 layer – 45 cm. Topologically associated with Carex inflata+Carex panacea, Carex inflate+Heleocharis pauciflorum meadowed marsh. Association substrate is silted due to seasonal floods. The habitat is of high conservation value.

Carex inflata-Soc
Juncus lampocarpus-Sp^1
Deschampsia caespitosa- Sp^1 groups
Equisetum palustre-Sol
Heleocharis pauciflora- Sol
Agrostis alba- Sol
Phragmites communis- Sol
Triglochin palustris- Sol
Blysmus compressus- Sol
Carex panacea- Sol
Cratoneuron commutatum var. *falcatum*- Sp^2 groups
Campylium protensum f. *calcarea*- Sp^2 groups

Mosses are developed on slightly elevated hillocks.

Site N8. Kazbegi District. Right terrace of Trusso Canyon, village Ketrisa vicinity (between Ketrisa and Kasara jaws). ~2100 m a.s.l., plaining (with slight sloping), alluvial-proluvial blanket. Compared with the previous site this site has the elevated relief, near the outlet of groundwater spring. The habitat is of high conservation value.

Carex inflata+Carex panacea

Coverage 85%, Layer 1 – 45 cm. Topologically associated with Caricetum inflatae purum, the meadowed marsh. It seems that running water conditions are necessary for Carex panacea.

Carex inflata-Cop^2
Carex panacea- Cop^2
Heleocharis pauciflora- Sp^2
Blysmus compressus- Sp^3
Equisetum palustre- Sp^2
Triglochin palustris-Sol
Carex kotschyana-Sol
Juncus lampocarpus-Sol
Cratoneuron commutatum var. *falcatum*- Sp^1 groups

Site N9. Kazbegi District. Right terrace of Trusso Canyon, village Ketrisa vicinity (between Ketrisa and Kasara jaws). ~2100 m a.s.l. Elevated relief at the marsh surface. Coverage 85%. 2 layers: I-35 cm, 95%, II-15 cm, 60%. Topologically is associated with Caricetum inflatae purum, meadowed marsh, Carex inflate+Blysmus compresus – this association floristically and structurally is similar to that. The habitat is of medium conservation value.

Carex inflata+ Heleocharis pauciflora

Carex inflata-Cop^3
Heleocharis pauciflora- Cop^3
Blysmus compressus-Sp^3
Equisetum palustre-Sp^3
Deschampsia caespitosa-Sp^1
Juncus lampocarpus-Sp^1
Carex dacica-Sol
Carex panacea- Sol
Agrostis alba- Sol
Cratoneuron commutatum var. *falcatum*- Sp^2 groups
Campylium protensum f. *calcarea*- Sp^2 groups

Site N9^a. Kazbegi District. Right terrace of Trusso Canyon, village Ketrisa vicinity (between Ketrisa and Kasara jaws). ~2100 m a.s.l. Elevated relief at the marsh bank strip. Coverage 95%. 2 layers: I-15 cm, 40%, II-5 cm. Mosslayer coverage - 65%. The association involves nonlayered plant spesies as well. Carex inflata+ Heleocharis pauciflora, Caricetum inflatae purum. The habitat is of medium conservation value.

Blysmus compressus+ Cratoneuron commutatum var. falcatum

Blysmus compressus- Cop^3
Cratoneuron commutatum var. *falcatum*- Cop^3
Heleocharis pauciflora- Sp^3
Deschampsia caespitosa- Sp^2
Equisetum palustre- Sp^1

Agrostis alba- Sp[1]
Carex dacica- Sp[2]
Carex inflata- Sp[2]
Parnassia palustris-Sol
Gentiana blepharophora- Sol
Ranunculus oreophilus- Sol
Campylium polygamum var. *stagnatum*- Sp[1]groups

In the described marsh the major place is held by Caricetum inflatae purum, then in the periphery of the marsh - Blysmus compressus+Cratoneuron commutatum var. falcatum, also Blysmetum compressae purum, then - Carex inflata+ Heleocharis pauciflora and on the smallest spots - Carex inflata+Carex panacea.

Site N10. Kazbegi District. Right terrace of Trusso Canyon, village Ketrisa vicinity (between Ketrisa and Kasara jaws). ~2100 m a.s.l., The young alluvial substratum – silty, with seasonal floods. The habitat is of medium conservation value.

Equisetetum palustrae purum

Coverage 80%. Layer 1-30 cm. Topologically associated with Blysmetum compressae purum and Potamogetonetum (formed by Potamogeton pectinatus) where this species of horsetail gradually penetrates along with sedimentation.

Equisetum palustre-Soc
Blysmus compressus- Sp[1]
Deschampsia caespitosa-Sol
Triglochin palustris- Sp[1]
Agrostis alba- Sp[1]
Juncus lampocarpus-Sol

Site N11. Kazbegi District. Left terrace of the Trusso Canyon, village Ketrisa vicinity (between Ketrisa and Kasara jaws). The young alluvial substratum. ~2100 m a.s.l.. The bottom is covered with salts from the springs of narzan type. The habitat is of high conservation value.

Triglochinetum palustrae purum

Coverage 80%. 2 layers: I-40 cm, 25%; II-10 cm (mainly formed by the *Triglochin palustris* leaf mass), 70%.

Triglochin palustris-Soc
Agrostis alba- Sp[3]
Deschampsia caespitosa- Sol
Blysmus compressus- Sp[1]

The described association is also observed in the complex of associations described at the right side of the canyon.

Site N12. Kazbegi District. Left terrace of Trusso Canyon, village Ketrisa vicinity (between Ketrisa and Kasara). ~2100 m a.s.l. With feeding of narzan type spring water. The substrate is very mobile. The water attains the moss cover.

Blysmus compressus+Drapanocladus aduncus

Total coverage 100%. 2 layers: I-20 cm, 50%; II- moss cover 70%. Topologically associated with Triglochinetum palustrae purum, Blysmetum compressae purum, Triglochin palustris+Juncus bufonius. The latter association is represented on small sections in Triglochineta complex. As it seems Blysmus compressus+Drapanocladus aduncus will substitute Triglochinetum palustrae purum. Blysmetums on this Trusso terrace are represented rather broadly. The habitat is of high medium conservation value.

Blysmus compressus- Cop^3
Drapanocladus aduncus var. *pseudosendtneri*- Cop^3
Agrostis alba-Sp^1Gr
Triglochin palustris- Sp^1
Heleocharis pauciflora- Sp^1
Deschampsia caespitosa- Sol

Site N13. Kazbegi District. Left terrace of Trusso Canyon. ~2100 m a.s.l.. plaining. Between Ketrisa and Kasara jaws.

Triglochin palustris+Juncus bufonius

Total coverage 85%. 2 layers: I-45 cm, 35%, II – 8 cm, 60%. Topologically associated with Triglochinetum purum, Blysmus compressus+Drapanocladus aduncus, Blysmetum compressae purum. This association ecologically and structurally is similar to Triglochinetum purum, but here the surface water thickness is small and salts are more accumulated. The habitat is of high conservation value.

Triglochin palustris- Cop^3
Juncus bufonius- Cop^3
Agrostis alba- Sp^1
Juncus lampocarpus- Sp^2
Heleocharis pauciflora- Sp^1
Blysmus compressus- Sol
Catabrosa aquatica-Sol

Among Triglochinetum-s the most widespread is Triglochinetum palustrae purum.

Site N14. Kazbegi District. Left terrace of Trusso Canyon. ~2100 m a.s.l. plaining. Between village Ketrisa and Kasara jaws. The habitat is of high conservation value.

Triglochin palustris+ Drapanocladus aduncus

Total coverage 98%. 3 layers: I – 40 cm, 10%; II- 10 cm, 45%, III – mosslayer coverage 65%. Topologically associated with Triglochinetum purum, Triglochin palustris+Juncus bufonius, Blysmus compressus+Drapanocladus aduncus.

Triglochin palustris- Cop^3
Drapanocladus aduncus var. *kneiffii*- Cop^3
Juncus lampocarpus- Sp^1
Agrostis alba- Sp^1
Heleocharis pauciflora-Sol
Juncus bufonius-Sol

Throughout the area of associations described on the left terrace of Trusso are observed the outlets of mineral springs which feed those associations.

Site N14^a. In the vicinity of the village Ketrisa (Trusso Canyon) in addition to the above described marshes there is also one wetland – near Kasara jaws (in the bottom side of the Canyon, towards the village Ketrisa). In this wetland are spread 1. Heleocharidetum pauciflorae purum. Total coverage 75%. Floristically poor. There are also Blysmus compressus, Triglochin palustris and etc. 2. Blysmus compressus+Cratoneuron commutatum, 3. Blysmetum compressae purum, 4. Carex dacica+Cratoneuron commutatum, 5. Caricetum dacicae purum. The latter associations are floristically very poor. Among them on a larger area are spread: Heleocharidetum pauciflorae purum, Blysmetum compressae purum, Blysmetum cratoneurosum commutatum; other associations are less spread. The habitat is of medium conservation value.

Site N15. Kazbegi District, Trusso Canyon. East exposition, slope inclination 30º. Mezorelief is slightly concave-straight, microrelief is slightly undulating. ~2200 m a.s.l.

Festuca varia+herbal-grass meadow domination

Aspect – greenish-greyish. 3 layers are not clearly expressed. I – 45-60 cm, 30%, II-30 cm, 55%, III – 20 cm, 65%. Coverage 98%. It borders the rocky outcrops and forbs-grass meadow. The habitat is of high conservation value.

Festuca varia- Cop^3
Vicia purpurea- Sp^3
Trifolium trichocephalum- Sp^2
Carex buschiorum- Sp^2
Ranunculus oreophilus- Sp^2
Alectorolophus minor- Sp^2
Bromus vaiegatus-Sp^1
Koeleria caucasica- Sp^1
Avenastrum asiaticum- Sp^1
Agrostis planifolia- Sp^1
Orobus cyaneus- Sp^1
Anthyllis caucasica- Sp^1
Bupleurum polyphyllum- Sp^1
Linum hipericifolium- Sp^1
Hypericum polygonifolium- Sp^1
Lotus caucasicus- Sp^1
Anthoxanthum odoratum- Sol

Luzzula multiflora- Sol
Astrantia biebersteinii- Sol
Polygonum carneum- Sol
Gentiana septemfida- Sol
Alchemilla sericata- Sol
Trifolium ambiguum- Sol
Campanula collina- Sol
Peucedonum pschavicum- Sol
Luzula spicata- Sol
Primula sp.- Sol
Veronica gentianoides- Sol
Dianthus discolor- Sol
Fritillaria lutea- Sol
Geranium ruprechtii- Sol
Centaurea fischeri- Sol
Rubus saxatilis- Sol
Leontodon hispidus- Sol
Asyneuma campanuloides- Sol
Pedicularis condensata- Sol
Vicia grossheimii- Sol
Erigeron caucasicus- Sol
Juniperus depressa- Sol
Cotoneaster integerrima- Sol
Minuartia ruprechtii-Sol
Rumex acetosa-Un
Scabiosa caucasica-Un
No mossesare observed.

2.2.3 NATURE MONUMENT OF SAKHIZNARI CLIFFS

Site N16. Sakhiznari. The northern slope of the mountain peak Kabarjina. The place Sakhiznari is near the river Sioni. **GPS coordinates N42^{0}57’58.9’’/E 44^{0}56’40.5’’**, 2379 m a.s.l. At the rock bottom is developed the herbal-grass meadow - Festucetum variae with admixed rhododendron (*Rhododendron caucasicum*) and birch (*Betula litwinowii*) sparse growth and with admixed *Daphne glomerata*. Slope inclination – 10-25º. Here and there are observed the fragments of plants of alpine snowbed. The habitat is of high conservation value.

Gnaphalium supinum-Cop^2
Vaccinium myrtillus- Cop^1
Hieracium pilosella- Cop^1
Daphne glomerata-Sp^2
Campanula sp.- Sp^1
Cerastium sp.- Sp^1
Alchemilla sp.- Sp^1
Rhododendron caucasicum-Sol
Salix caprea-Sol
Mosses- Cop^3

Lichens - Sp[1]

Site 16. Rhododendron (*Rhododendron caucasicum*)

Site 16. *Gentiana angulosa*

Site 16. Sakhiznari

Site 16. Variegated fescue community

Site 16. Litvinov's birch

Site 16. Garland flower (*Daphne glomerata*)

Site 16. *Gnaphalium supinum*

Site 16. Alpine snowbed

Site 16. *Hieracium pilosella*

Site 16. Rhododendron

Site 16. Moss and lichen

Site N17. Located on detritus. Slope 30-35ºC. Exposition – north. Sparsely are growing *Senecio sosnowskyi, Oxyria elatior*, Scrophularia sp., Pyrethrum sp., *Minuartia brotheriana, Astragalus kazbekii*. The habitat is of high conservation value.

Site 17. *Senecio sosnowskyi*

Site N18. The grass forbs meadow is developed on detritus and partially on turf with spots of rhododendron and juniper. Slope inclination– 35-40º, exposition – north, coverage – 20-30%. The habitat of medium conservation value.

Deschampsia flexuosa-Sp[3]
Festuca varia- Sp[2]
Geranium gymnocaulon- Sp[2]
Leontodon hispidus- Sp[1]
Epilobium sp.- Sp[1]
Cirsium sp.- Sol
Pedicularis sp.-Sol
Rhododendron caucasicum-Sol
Juniperus depressa-Unic

Site 18. Mountain crowberry (*Empetrum hermaphroditum*)

Site 18. Wavy hair-grass (*Deschampsia flexuosa)*

Site 18. Juniper (*Juniperus depressa*)

Site 18. Wavy hair-grass *Deschampsia flexuosa*

Site 18. Sakhiznari

Site 18. Juniper and goat willow (*Salix caprea*)

Site N19. Sparse rhododendron growth below the caves. Slope inclination– 35-40º, exposition – north, coverage – 30-40%. The habitat of medium conservation value.

Rhododendron caucasicum-Sp[1]
Juniperus depressa -Unic
Betula litwinowii -Sol
Daphne glomerata-Sol

Out of herbaceous plants the following species are growing:
Festuca varia-Cop[1] (height-60-70 cm)
Centaurea cheinanthifolia subsp. *cheinanthifolia*-Sol
Rhynanthus sp.-Sol
Taraxacum officinale-Sol
Moss-Cop[2]

Site 19. Rhododendron (*Rhododendron caucasicum*)

Site N20. Sakhiznari Cliffs. 2450-2500 m a.s.l. slope inclination– 70-90º. Exposition – north, northwest, northeast. Sparsely are growing the joint plants (chasmophytes). The habitat is of high conservation value.

Saxifraga exarata- Sol
Minuartia sp.- Sol
Alchemilla sericea- Sol
Saxifraga cartiloginea- Sol
Minuartia brotheriana- Sol
Draba bryoides- Sol
Festuca ovina- Sol

Here and there are observed single rhododendrons (*Rhododendron caucasicum).*

Site 20. Rhododendron (*Rhododendron caucasicum*)

Site 20. *Draba bryoides*

Site 20. *Minuartia brotheriana*

Site 20. *Saxifraga cartilaginea*

Site N21. Sakhiznari. South and southeast exposition. ~2200 m a.s.l. Microrelief is undulating stepwise. Here and there are small stones.

Festuca varia+Alchemilla sericata

Aspect – greyish-greenish. 3 layers: I-60 cm, 35%; II – 25 cm, 55%; III – 10 cm, 65%. Coverage – 98%. Borders with Carex buschiorum+Festuca varia, Festucetum vaiae, canyon, rocky outcrops. The habitat is of high conservation value.

Festuca varia-Cop^2
Alchemilla sericata- Cop^1
Carex buschiorum- Sp^2
Koeleria caucasica- Sp^2
Festuca sulcata- Sp^2
Bromus variegatus- Sp^1
Anthoxanthum odoratum- Sp^1
Medicago glutinosa- Sp^2
Psephellus dealbatus- Sp^2
Thymus grossheimii- Sp^2
Plantago caucasica- Sp^2
Potentilla crantzii-Sp^1
Trifolium alpestre- Sp^1
Bupleurum polyphyllum- Sp^1
Gentiana septemfida- Sp^1
Salvia verticillata- Sp^1
Hypericum polygonifolium- Sp^1
Draba incana- Sp^1
Galium cruciatum- Sp^1
Ranunculus caucasicus- Sp^1
Euphrasia tatarica- Sp^1
Minuartia caucasica- Sp^1
Galium verum- Sp^1
Avenastrum asiaticum-Sol

Campanula trautvetteri- Sol
Veronica gentianoides- Sol
Myosotis alpestris- Sol
Leontodon hispidus- Sol
Campanula collina- Sol
Aconitum anthora- Sol
Peucedanum pschavicum- Sol
Trifolium ambiguum- Sol
Anthyllis caucasica- Sol
Allium kunthianum- Sol
Centaurea fischeri- Sol
Phleum montanum- Sol

Mosses are represented in small amount: *Thuidium philibertii, Entodon orthocarpus, Homalothecium philippeanum*.

Site N22. Sakhiznari. West and southwest exposition, slope inclination 35º. ~2400 a.s.l. Microrelief slightly stepwise.

Festuca varia+Alchemilla sericata

Aspect – greyish-green, 3 layers: I – 55 cm, 35%; II – 30 cm, 50%; III – 10 cm, 55%. Coverage 98%. Topologically associated with Festuca varia+Carex buschiorum. The habitat is of high conservation value.

Festuca varia-Cop^2
Alchemilla sericata- Cop^2
Festuca sulcata- Sp^2
Bromus variegatus- Sp^2
Anthoxanthum odoratum- Sp^2
Avenastrum asiaticum-Sp^1
Festuca ovina- Sp^1
Agrostis planifolia- Sp^1
Carex buschiorum- Sp^1
Trifolium ambiguum- Sp^1
Anthyllis caucasica- Sp^1
*Potentilla craantzi*i- Sp^1
Publeurum polyphyllum- Sp^1
Myosotis alpestris- Sp^1
Ranunculus oreophilus- Sp^1
Primula luteola- Sp^1
Silene ruprechtii- Sp^1
Draba siliquosa- Sp^1
Sedum involucratum- Sp^1
Minuartia oreina- Sp^1
Phleum montanum-Sol
Koeleria caucasica- Sol
Trifolium canescens- Sol

Vicia grossheimii- Sol
Luzula multiflora- Sol
Gentiana septemfida- Sol
Leontodon hispidus- Sol
Cerastium arvense- Sol
Campanula collina- Sol
Alchemilla picnotricha-Un

Rather big variety of mosses: *Bryum pallescens, Rhitidium rugosum, Campylium chrysophyllum*. There are also a lot (comparatively lesser) lichens - *Peltigera canina*, Cladonia sp.

Site N23. Sakhiznari. West exposition, slope inclination 38º, ~2300 m a.s.l. Microrelief stepwise, here and there are observed stones (in a very small amount).

Grass- variegated fescues

Aspect – greenish-greyish, 3 layers: I -65 cm, 45%, II-35 cm, 85%; III-16 cm, 35%. Coverage 97%. from one side it borders with rocks, topologically associated with the following groups: Carex meinshauseniana+Festuca varia, Festuca varia+Carex meinshauseniana, Festuca varia+Carex meinshauseniana+Alchemilla sericata. The habitat is of high conservation value.

Festuca varia-Cop^2
Festuca sulcata- Sp^3
Bromus variegatus- Sp^3
Deschampsia flexuosa- Sp^2
Calamagrostis arundinacea- Sp^2
Poa iberica- Sp^2
Koeleria caucasica- Sp^2
Avenastrum asiaticum- Sp^2
Anthoxanthum odoratum- Sp^2
Avenastrum pubescens- Sp^1
Agrostis planifolia- Sp^1
Carex meinshauseniana- Sp^1
Carex buschiorum- Sp^1
Luzula multiflora- Sp^1
Bupleurum polyphyllum- Sp^1
Vicia purpurea- Sp^1
Thymus grossheimii- Sp^1
Alchemilla sericata- Sp^1
Potentilla crantzii- Sp^1
Rosa boissieri-Sp^1
Silene ruprechtii- Sol
Scabiosa caucasica- Sol
Polygala alpicola- Sol
Betonica grandiflora- Sol
Geranium renardii- Sol
Trifolium ambiguum- Sol

Trifolium canescens- Sol
Myosotis alpestris- Sol
Cephalaria gigantea- Sol
Gentiana angulosa- Sol
Veronica gentianoides- Sol
Gentiana septemfida- Sol
Galium cruciatum- Sol
Centaurea fischeri- Sol
Cerastium arvense- Sol
Rumex acetosa- Sol
Polygonum alpinum- Sol
Phleum montanum- Sol
Trifolium alpestre-Un
Fritillaria lutea- Un
Primula ruprechtii- Un
Selaginella helvetica-Sol

Out of mosses only *Bryum pendulum* is present, out of lichens - *Cladonia sp.*

Site N24. Sakhiznari. West exposition, slope 40º, ~2300 m a.s.l. Microrelief stepwise.

Festuca varia+Calamagrostis arundinacea

Aspect – greyish-green, 3 layers: I-70 cm, 40%; II-35 cm, 70%; III- 15 cm, 35%. Coverage 100%. Topologically is associated with Carex meinshauseniana+Festuca varia, Festuca varia+Carex meinshauseniana, Festuca varia+Carex meinshauseniana+Alchemilla sericata. Grass-variegated fescues. The habitat is of high conservation value.

Festuca varia-Cop^2
Calamagrostis arundinacea- Cop^1
Poa iberica- Sp^2
Poa nemoralis- Sp^1
Bromus variegatus- Sp^1
Agrostis planifolia- Sp^1
Deschampsia flexuosa- Sp^1
Festuca sulcata- Sp^1
Carex meinshauseniana- Sp^1
Carex buschiorum- Sp^1
Luzula multiflora- Sp^2
Vicia grossheimii- Sp^2
Lotus caucasicus- Sp^2
Publeurum polyphyllum- Sp^2
Galium cruciatum- Sp^2
Dianthus discolor-Sp^1
Orobus cyaneus- Sp^1
Gentiana septemfida- Sp^1
Chaerophyllum roseum- Sp^1
Veronica gentianoides- Sp^1

Alchemilla sericata- Sp[1]
Pyrethrum roseum- Sp[1]
Leontodon hispidus- Sp[1]
Ranunculus oreophilus- Sp[1]
Campanula collina- Sp[1]
Alectorophus minor- Sp[1]
Cirsium obvalatum- Sp[1]
Potentilla crantzii- Sp[1]
Rubus saxatilis- Sp[1]
Gentiana caucasica- Sp[1]
Avenastrum pubescens-Sol
Avenastrum asiaticum- Sol
Anthoxanthum odoratum- Sol
Betonica grandiflora- Sol
Centaurea fischeri- Sol
Trifolium canescens- Sol
Polygonum carneum- Sol
Cephalaria gigantea- Sol
Polygonum alpinum- Sol
Gentiana angulosa- Sol
Silene ruprechtii- Sol
Linum hypericifolium- Sol
Betula verrucosa- Sol
Daphne glomerata- Sol
Anthyllis caucasica- Sol
Cerastium purpurescens- Sol
Inula grandiflora- Sol
Vaccinium myrtillus- Sol
Koeleria caucasica- Sol
Sedum involucratum- Sol
Orchis triphylla (*=Dactylorhiza urvilleana*)-Un

Mosses are observed in small quantity - *Tortella tortuosa, Webera nutans*. Out of lichens – only *Cetraria islandica* f. *maculata*.

3. SENSITIVE AREAS OF PROJECT DORRIDOR AND COMPENSATION SITES

Based on the detailed botanical studies of the Project Corridor and compensation sites (Natural monument of Abano Mineral Lake, Natural Monument of Trusso Travertines, Natural Monument of Sakhiznari Cliffs) the identification and detailed description of sensitive areas has become possible. Therefore, based on the field studies in the Project Corridor the following medium and high-sensitive areas have been revealed.

3.1 DARIALI HPP PROJECT CORRIDOR

High conservation value habitats:
Site N15. GPS coordinates N42^{0}68’45.9’’/E 44^{0}64’47.2’’, 1612 m a.s.l. Exposition – southwest. Slope inclination - 70-80^0. Rock complex. *Juniperus sabina, Juniperus*

*depressa,*with admixed *Spiraea hypericifolia*. Herbaceous plants are represented by the following species: *Minuartia brotheriana, Saxifraga cartiloginea, Sedum caucasicum, Sempervivum caucasicum, Asplenium septentionale, Saxifraga juniperifolia*.

Site N16. **GPS coordinates N42^{0}68'45.9''/E 44^{0}64'47.2''**, 1612 m a.s.l. Meadowsweet shrubbery (*Spiraea hypericifolia*) on the rock. Slope inclination-70-80-90^0, exposition – southwest. With admixed *Ephedra procera*. Herbaceous plants are represented by chasmophytes: *Minuartia brotheriana, Saxifraga juniperifolia, Draba brioides.*

Medium conservation value habitats:

Site N6. GPS coordinates N42^{0}67'18.3''/E 44^{0}64'80.3'', 1705 m a.s.l. Exposition – west, slope inclination-10-15^0. Sea-buckthorn shrubbery (*Hippophaë rhamnoides*) with admixed barberry (*Berberis vulgaris*), sweet briar (*Rosa canina*), blackberry and juniper (*Juniperus depressa*). The juniper height is 0.5 m.

Site N7. GPS coordinates N42^{0}67'78.9''/E 44^{0}64'75.0'', 1674 m a.s.l. Exposition – west. Slope inclination- 20-25^0. In the degraded grass forbs meadow the sea-buckthorn scrub is growing in kind of islets (like the previous site).

Site N8. GPS coordinates N42^{0}68'04.7''/E 44^{0}64'69.5'', 1663 m a.s.l. Sparse juniper (*Juniperus depressa*). Slope inclination - 0^0. Juniper height attains to – 0.5 m. Some spots of young sea-buckthorn (*Hippophaë rhamnoides*). (This site located in the traditional use zone of Kazbegi National Park which was excluded from the Kazbegi Protected Territory before the beginning of construction of Dariali Hydropower Plant, Fig. N 2 on the map).

Site N9. GPS coordinates N42^{0}68'16.6''/E 44^{0}64'68.4'', 1662 m a.s.l. Sea-buckthorn shrubbery with admixed goat willow. Exposition – northwest. Slope inclination-5^0. Sea-buckthorn height – 2.5 m, goat willow height -4-5 m. Isolated species of birch (*Betula litwinowii*) with the height 5 m. On the adjacent bank Cirsium sp., *Artemisia absinthium, Echinops sphaerocephalus* are growing. (This site located in the traditional use zone of Kazbegi National Park which was excluded from the Kazbegi Protected Territory before the beginning of construction of Dariali Hydropower Plant, Fig. N 2 on the map).

Site N10. GPS coordinates N42^{0}68'42.4''/E 44^{0}64'46.7'', 1621 m a.s.l. Juniper shrubbery (*Juniperus sabina*). Exposition - southwest, slope inclination 10-15^0. Juniper height from 40-50 cm to -1 meter. With admixed sweet briar (*Rosa canina*), sea-buckthorn (*Hippophaë rhamnoides*), rock-red currant (*Ribes biebersteinii*). (This site located in the traditional use zone of Kazbegi National Park, which was excluded from the Kazbegi Protected Territory before the beginning of construction of Dariali Hydropower Plant, Fig. N 2 on the map).

Site N11. GPS coordinates N42^{0}40'15.5''/E 44^{0}39'03.7'', 1757 m a.s.l. Northwest exposition. Slope inclination -5-15^0. This site is represented with the overgrazed grass forbs degraded meadow. Vegetation coverage – 90%. Phytocenosis height – 40 cm. The detailed description of the site provides species cover-abundance by Drude scale in this section. There are sparse shrubbery amongst stones, where we can observe the following species: barberry (*Berberis vulgaris*), juniper(*Juniperus depressa*), *Asplenium trichomanes, Thalictrum buschianum* (Caucasian endemic). (This site located in the traditional use zone of Kazbegi

National Park which was excluded from the Kazbegi Protected Territory before the beginning of construction of Dariali Hydropower Plant, Fig. N 2 on the map).

Site N12. **GPS coordinates N42^{0}40'32.4''/E 44^{0}38'55.7''**, 1724 m a.s.l. Southwest exposition Slope inclination-5-20^0. On this site is developed the overgrazed grass forbs degraded meadow. The coverage is 90%. Phytocenosis height – 5 cm. On this site are sparsely growing scrubs of barberry (*Berberis vulgaris*), juniper(*Juniperus depressa*). (This site located in the Traditional Use Zone of Kazbegi National Park, which was excluded from the Kazbegi Protected Territory before the beginning of construction of Dariali Hydropower Plant, Fig. N 2 on the map).

Site N14. Kazbegi District. Slope inclination 30º. Southern exposition, foliated detritus. Festuca varia+Thymus nummalarius. Total coverage 90%. 3 layers: I – 40 cm, 20%. II – 25 cm, 45%. III – 10 cm, 60%. Aspect –pink *Thymus nummalarius,* yellow *Leontodon hispidus* and blue *Campanula collina* flowers in the greyish-green background. Topologically associated with Festuca varia+Alopecurus glacialis. (This site located in the Traditional Use Zone of Kazbegi National Park which was excluded from the Kazbegi Protected Territory before the beginning of construction of Dariali Hydropower Plant, Fig. N 2 on the map).

Site N17. GPS coordinates N42^{0}68'57.4''/E 44^{0}64'34.1'', 1585 m a.s.l. On the rock (slope - 80-90^0) are developed juniper shrubbery with admixed meadowsweet - *Spiraea hypericifolia, Ephedra procera*. Below, on the right bank terrace of the river are developed sea-buckthorn shrubbery. Iberian Aster (*Aster ibericus)* flowers in autumn.

Site N19. Dariali. Rock complex. The same place. Rock inclination– 70-90ºC. Exposition – west. Pine (*Pinus kochiana*), juniper (*Juniperus depressa)* sparsely grow on the rock. Out of herbaceous plants are represented the following species: *Parietaria judaica, Anthemis marschalliana* subsp. *marschalliana, Saxifraga cartilaginea, Saxifraga juniperifolia, Asplenium septentrionale*. (This site located in the traditional use zone of Kazbegi National Park which was excluded from the Kazbegi Protected Territory before the beginning of construction of Dariali Hydropower Plant, Fig. N 3 on the map).

Site N20. Such rock-forest complexes are represented in Dariali Gorge, along the right bank of the river Tergi to Gveleti Bridge. **GPS coordinates from Gveleti bridge: N42^{0}70'99.8''/E 44^{0}62'76.2''**, 1421 m a.s.l. The habitat is of medium conservation value.

3.2 COMPENSATION SITES

High compensation value habitats:
Natural Monument of Abano Mineral Lake
Site N3. Trusso Canyon. On rocks adjacent to the Abano Lake are growing: Alchemilla sp., *Androsace villosa, Saxifraga exarata, Artemisia splendens, Veronica gentianoides, Thalictrum alpinum, Polygala alpicola, Potentilla crantzii, Minuartia oreina, Sempervivum caucasicum*, Allium sp. In caves is growing *Cystopteris fragilis*.

Site N5^a. Trusso, Suatisistskali Canyon. West exposition, slope inclination 30º. ~2600 m a.s.l., Microrelief is stepwise. Festuca varia+Festuca ovina. Aspect – greyish-green. 2 layers: I-60 cm, 40%, II-32 cm, 50%, III – 15 cm, 7-%. Total coverage 98%. Borders with

rhododendron+variegated fescue, matgrass+alpine snowbed elements, alpine snowbed, sedge-variegated fescue (*Carex buschiorum*), Caricetum (*Carex tristis*).

Natural Monument of Trusso Travertines

Site N6. Trusso Travertines. **GPS coordinates N42^{0}58'35.1''/E 44^{0}42'57.1''**, 2134 m a.s.l., exposition – north, northwest, slope -5-10^0, height – 60-70 cm. On travertine sometimes we can see *Betula litwinowii, Salix kazbekensis* grown up by islets. All around travertines are developed variegated fescue- Festucetum variae, with sparsely admixture willows (*Salix kazbekensis*) and birches (*Betula litwinowii)*.

Site N7. Kazbegi District. Right terrace of Trusso Canyon, village Ketrisa vicinity (between Ketrisa and Kasara jaws). ~2100 m a.s.l., plaining, alluvial-proluvial blanket. Caricetum inflatae purum. Coverage 75%. 1 layer – 45 cm. Topologically associated with Carex inflata+Carex panacea, Carex inflate+Heleocharis pauciflorum meadowed marsh. Association substrate is silted due to seasonal floods.

Site N8. Kazbegi District. Right terrace of Trusso Canyon, village Ketrisa vicinity (between Ketrisa and Kasara jaws). ~2100 m a.s.l., plaining (with slight sloping), alluvial-proluvial blanket. Compared with the previous site this site has the elevated relief, near the outlet of groundwater spring. Carex inflata+Carex panacea. Coverage 85%, Layer 1 – 45 cm. Topologically associated with Caricetum inflatae purum, the meadowed marsh. It seems that running water conditions are necessary for Carex panacea.

Site N11. Kazbegi District. Left terrace of Trusso Canyon, village Ketrisa vicinity (between Ketrisa and Kasara jaws). The young alluvial substratum. ~2100 m a.s.l.. The bottom is covered with salts from the springs of narzan type. Triglochinetum palustrae purum. Coverage 80%. 2 layers: I-40 cm, 25%; II-10 cm (mainly formed by the *Triglochin palustris* leaf mass), 70%.

Site N13. Kazbegi District. Left terrace of Trusso Canyon. ~2100 m a.s.l.. plaining. Between Ketrisa and Kasara jaws. Triglochin palustris+Juncus bufonius. Coverage 85%. 2 layers: I-45 cm, 35%, II – 8 cm, 60%. Topologically associated with Triglochinetum purum, Blysmus compressus+Drapanocladus aduncus, Blysmetum compressae purum. This association ecologically and structurally is similar to Triglochinetum purum, but here the surface water thickness is small and salts are more accumulated. Among Triglochinetum the most widespread is Triglochinetum palustrae purum.

Site N14. Kazbegi District. Left terrace of Trusso Canyon. ~2100 m a.s.l. plaining. Between village Ketrisa and Kasara jaws. Triglochin palustris+Drapanocladus aduncus. Coverage 98%. 3 layers: I – 40 cm, 10%; II- 10 cm, 45%, III – mosslayer 65%. Topologically associated with Triglochinetum purum, Triglochin palustris+Juncus bufonius, Blysmus compressus+Drapanocladus aduncus.Throughout the area of associations described on the left terrace of Trusso are observed the outlets of mineral springs which feed those associations.

Site N15. Kazbegi District, Trusso Canyon. East exposition, slope inclination 30º. Mezorelief is slightly concave-straight, microrelief is slightly undulating. ~2200 m a.s.l. Festuca varia+ grass forbs meadow domination. Aspect – greenish-greyish. 3 layers are not clearly expressed. I – 45-60 cm, 30%, II-30 cm, 55%, III – 20 cm, 65%. Coverage 98%. It borders the rocky outcrops and grass forbs meadow. The habitat is of high conservation value.

Natural Monument of Sakhiznari Cliffs

Site N16. Sakhiznari. The northern slope of the mountain peak Kabarjina. The place Sakhiznari is near the river Sioni. **GPS coordinates N42^{0}57'58.9''/E 44^{0}56'40.5''**, 2379 m a.s.l. At the rock bottom is developed the grass forbs meadow - Festucetum variae with admixed rhododendron (*Rhododendron caucasicum*) and birch (*Betula litwinowii*) and also *Daphne glomerata*. Slope inclination – 10-25º. Here and there are observed the fragments of plants of alpine snowbed.

Site N17. Located on detritus. Slope inclination 30-35º. Exposition – north. Sparsely are growing *Senecio sosnowskyi*, *Oxyria elatior*, Scrophularia sp., Pyrethrum sp., *Minuartia brotheriana, Astragalus kazbekii*.

Site N20. Sakhiznari Cliffs. 2450-2500 m a.s.l. slope inclination – 70-90º. Exposition – north, northwest, northeast. Sparsely are growing the joint plants (chasmophytes). Here and there are observed single rhododendrons ((*Rhododendron caucasicum).*

Site N21. Sakhiznari. South and southeast exposition. ~2200 m a.s.l. Microrelief is undulating stepwise. Here and there are small stones. Festuca varia+Alchemilla sericata. Aspect – greyish-greenish. 3 layers: I-60 cm, 35%; II – 25 cm, 55%; III – 10 cm, 65%. Canopy – 98%. Borders with Carex buschiorum+Festuca varia, Festucetum vaiae, canyon, rocky outcrops.

Site N22. Sakhiznari. West and southwest exposition, slope inclination 35º. ~2400 a.s.l. Microrelief slightly stepwise. Festuca varia+Alchemilla sericata. Aspect – greyish-green, 3 layers: I – 55 cm, 35%; II – 30 cm, 50%; III – 10 cm, 55%. Coverage 98%. Topologically associated with Festuca varia+Carex buschiorum.

Site N23. Sakhiznari. West exposition, slope inclination 38º, ~2300 m a.s.l. Microrelief stepwise, here and there are observed stones (in a very small amount). Grass- variegated fescues. Aspect – greenish-greyish, 3 layers: I -65 cm, 45%, II-35 cm, 85%; III-16 cm, 35%. Canopy 97%. from one side it borders with rocks, topologically associated with the following groups: Carex meinshauseniana+Festuca varia, Festuca varia+Carex meinshauseniana, Festuca varia+Carex meinshauseniana+Alchemilla sericata.

Site N24. Sakhiznari. West exposition, slope inclination 40º, ~2300 m a.s.l. Microrelief stepwise. Festuca varia+Calamagrostis arundinacea. Aspect – greyish-green, 3 layers: I-70 cm, 40%; II-35 cm, 70%; III- 15 cm, 35%. Coverage 100%. Topologically is associated with Carex meinshauseniana+Festuca varia, Festuca varia+Carex meinshauseniana, Festuca varia+Carex meinshauseniana+Alchemilla sericata. Grass-variagated fescues.

Medium conservation value habitats:

Natural Monument of Abano Mineral Lake

Site N4. Trusso Canyon. The village Abano vicinity, southwest exposition, ~2500 m a.s.l., undulating relief, stepwise subrelief. Dry, stone soil. Slope inclination 35º. Festuca varia+Carex meinshauseniana. The greyish-green aspect. 2 layers: I – 60 cm, 45%, II-20 cm, 90%. Total coverage – 100%. The layers are not clearly expressed. Topologically is

associated with Carex meinshauseniana+Thymus-+Festuca, Carex meinshauseniana+Festuca varia.

Site N 5. Trusso Canyon, Zekagori vicinity. Southwest exposition. Slope inclination 30º. ~2400 m a.s.l., Microrelief is slightly stepwise, undulating, sometimes with schist with the diameter 5-25 cm. Festuca varia+Carex bushiorum. The aspect – Cephalaria and Scabiosa flowers in the greyish-green background. 3 layers: I- 70 cm, 15%, II – 32 cm, 50%, III – 13 cm, 60%. Borders with Caricetum (Carex bushiorum), Carex bushiorum+grasses, forbs-grass and grass-forbs meadows.

Natural Monument of Trusso Travertines

Site N9. Kazbegi District. Right terrace of Trusso Canyon, village Ketrisa vicinity (between Ketrisa and Kasara jaws). ~2100 m a.s.l. Elevated relief at the marsh surface. Coverage 85%. 2 layers: I-35 cm, 95%, II-15 cm, 60%. Topologically is associated with Caricetum inflatae purum, meadowed marsh, Carex inflate+Blysmus compresus – this association floristically and structurally is similar to Carex inflata+ Heleocharis pauciflora.

Site N9[a]. Kazbegi District. Right terrace of Trusso Canyon, village Ketrisa vicinity (between Ketrisa and Kasara jaws). ~2100 m a.s.l. Elevated relief at the marsh bank strip. Coverage 95%. 2 layers: I-15 cm, 40%, II-5 cm. Mosslayer - 65%. The association involves nonlayered plants as well. Topologically connected with Carex inflata+ Heleocharis pauciflora, Caricetum inflatae purum. Blysmus compressus+ Cratoneuron commutatum var. falcatum ,in the described marsh the major place is held by Caricetum inflatae purum, then in the periphery of the marsh - Blysmus compressus+Cratoneuron commutatum var. falcatum, also Blysmetum compressae purum, then - Carex inflata+ Heleocharis pauciflora an on the smallest spots - Carex inflata+Carex panacea.

Site N10. Kazbegi District. Right terrace of Trusso Canyon, village Ketrisa vicinity (between Ketrisa and Kasara jaws). ~2100 m a.s.l., The young alluvial substratum – silty, with seasonal floods. The habitat is of medium conservation value. Equisetetum palustrae purum. Coverage 80%. Layer 1-30 cm. Topologically associated with Blysmetum compressae purum and Potamogetonetum (formed by Potamogeton pectinatus) where this species of horsetail gradually penetrates along with sedimentation.

Site N12. Kazbegi District. Left terrace of Trusso Canyon, village Ketrisa vicinity (between Ketrisa and Kasara). ~2100 m a.s.l.. With feeding of narzan type spring water. The substrate is very mobile. The water attains the mosslayer. Blysmus compressus+Drapanocladus aduncus. Canopy 100%. 2 layers: I-20 cm, 50%; II- mosslayer 70%. Topologically associated with Triglochinetum palustrae purum, Blysmetum compressae purum, Triglochin palustris+Juncus bufonius. The latter association is represented on small sections in Triglochineta complex. As it seems Blysmus compressus+Drapanocladus aduncus will substitute Triglochinetum palustrae purum. Blysmetums on this Trusso terrace are represented rather broadly.

Site N14[a]. In the vicinity of the village Ketrisa (Trusso Canyon) in addition to the above described marshes there is also one wetland – near Kasara jaws (in the bottom side of the canyon, towards the village Ketrisa). In this wetland are spread 1. Heleocharidetum pauciflorae purum. Coverage 75%. Floristically poor. There are also Blysmus compressus,

Triglochin palustris and etc., 2. Blysmus compressus+Cratoneuron commutatum, 3. Blysmetum compressae purum, 4. Carex dacica+Cratoneuron commutatum, 5. Caricetum dacicae purum. The latter associations are floristically very poor. Among them on a larger area are spread: Heleocharidetum pauciflorae purum, Blysmetum compressae purum, Blysmetum cratoneurosum commutatum; other associations are less spread.

Natural Monument of Sakhiznari Cliffs

Site N18. The grass forbs meadow is developed on detritus and partially on turf with admixed rhododendron and juniper. Slope inclination– 35-40º, exposition – north,coverage– 20-30%.

Site N19. Sparse rhododendron scrubs below the caves. Slope inclination– 35-40º, exposition – north, coverage – 30-40%.

3.3 CONCLUSIONS

Thus, in Dariali Hydropower Plant Project Corriddor are represented 2 high conservation value (HCV) habitats and 11 medium conservation value (MCV) habitats, where 7 sites of medium conservation value were located in the zone of Traditional Use of the Kazbegi National Park which were excluded from the Kazbegi Protected Area before the beginning of construction of Dariali Hydropower Plant. As it is known, for compensation to it the Abano Mineral Lake, Trusso Travertines and Sakhiznari Cliffs were given the status of Natural Monument. On the above-mentioned compensation sites are represented 16 habitats of high conservation value and 11 habitats of medium conservation value. Hence, as a result of the comparative analysis of the Project Corridor and Compensation Sites we can conclude that in the context of sensitive habitats and communities as well as rare species populations the Compensation Sites represent the habitats of much higher conservation value.

4. RARE AND ENDEMIC SPECIES OF PROJECT CORRIDOR AND COMPENSATION AREAS

Noteworthy is that in the Project Corridor and Compensation Sites there are some rare, endemic, endangered and species as well as the species protected under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES 1975; universal). The species protected under Bern convention are not growing in the Project Corridor and Compensation Sites.

Below is given the list and status of rare, endemic and endangered species protected under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES):

1. *Anthemis marschalliana* subsp. *marschalliana* – a Caucasian endemic. It can be observed on the Project Corridor, site N19 (this site was located in the area of Traditional Use of Kazbegi National Park and excluded from Kazbegi Protected Area before the beginning of construction of Dariali Hydropower Plant, figure N3 on the map) and on Project Corridor, site 20.
2. *Saxifraga juniperifolia* – the plant having the interesting disjunctive area as Caucasus-Bulgaria-Northeast Anatolia. It can be found on the Project Corridor, site N15, site N16, site N19 (this site was located in the area of Traditional Use of Kazbegi National Park and excluded from Kazbegi Protected Area before the beginning of construction of Dariali Hydropower Plant, figure N3 on the map).

3. *Minuartia brotheriana* – the endemic of Central Caucasus. May be found on the Project Corridor, Site 15, Site 16; on the Compensation Area – site 17, site 20.
4. *Sempervivum caucasicum* – the Caucasian endemic. Is found on the Project Corridor, site 15; on the Compensation Area – site 3.
5. *Salix kazbekensis* - the Caucasian endemic. Is found on the Compensation Area , site 6.
6. *Draba bryoides* – the Caucasian endemic. Is found on the Compensation Area , site 20.
7. *Astragalus kazbekii* - the Caucasian endemic. Is found on the Compensation Area , site 17.
8. *Senecio sosnowskyi* - - the Caucasian endemic. Is found on the Compensation area , site 17.
9. *Cirsium caucasicum* – the Caucasus- Asia Minor (Caucasian subendemic). Is found on the Project Corridor, site 2 (this site was located in the area of Traditional Use of Kazbegi National Park and excluded from Kazbegi Protected Area before the beginning of construction of Dariali Hydropower Plant, figure N1 on the map), the on the Project corridor, site 4 (this site was located in the area of traditional use of Kazbegi National Park and excluded from Kazbegi Protected Area before the beginning of construction of Dariali Hydropower Plant, figure N1 on the map); on the Project Corridor, site 5 (this site was located in the area of Traditional Use of Kazbegi National Park and excluded from Kazbegi Protected Area before the beginning of construction of Dariali Hydropower Plant, figure N1 on the map.)
10. *Aster ibericus* – Caucasus-Eastern Anatolia (Caucasian subendemic). Is found on the Project Corridor, site 17.
11. *Ranunculus oreophilus* – the Crimean-Caucasian endemic. Is found on theProject Corridor, site 14 (this site was located in the area of Traditional Use of Kazbegi National Park and excluded from Kazbegi Protected Area before the beginning of construction of Dariali Hydropower Plant, figure N2 on the map); on the Compensation Area, Site 5, Site 9, Site 15, Site 22, Site 24.
12. *Linaria meyeri* – the endemic of the Greater Caucasus (Central and Eastern Caucasus). Is found on the Project Corridor, site 12 (this site was located in the area of traditional use of Kazbegi National Park and excluded from Kazbegi Protected Area before the beginning of construction of Dariali Hydropower Plant, figure N2 on the map);
13. *Vicia grossheimii* – a Caucasian endemic. Is found on the Compensation Area, Site 4, Site 5^{a}, Site 15, Site 22, Site 24.
14. *Lotus caucasicus* - a Caucasian endemic. Is found on the Compensation Area, Site 5, Site 15, Site 24.
15. *Scabiosa bipinnata* – Caucasus-Eastern Anatolia (subendemic). Is found on the Compensation Area , site 5.
16. *Psephellus dealbatus* - Caucasus-Asia Minor (Northeast) (subendemic). Is found on the Compensation Area, Site 5, Site 21.
17. *Campanula sarmatica* – an endemic of Central and Eastern Caucasus. Is found on the Compensation Area, site 5.
18. *Peucedanum pschavicum* – an endemic of the Greater Caucasus. Is found on the Compensation Area, Site 21.
19. *Pulsatilla violacea* - a Caucasian endemic. Is found on the Project Corridor, site 11 (this site was located in the Traditional Use Zone of Kazbegi National Park and excluded from Kazbegi Protected Area before the beginning of construction of Dariali Hydropower Plant, figure N2 on the map); on the Project Corridor, site 12 (this site was located in the Traditional Use Zone of Kazbegi National Park and excluded from Kazbegi Protected

Area before the beginning of construction of Dariali Hydropower Plant, figure N2 on the map);

20. *Fritillaria lutea* – an endemic of Caucasus-Asia Minor (Northeast Anatolia). Is found on the Compensation Area, Site 15, Site 22.
21. *Scabiosa caucasica* – Caucasus – Anatolia (subendemic). Is found on the Compensation Area, Site 15, Site 23.
22. *Medicago glutinosa* – a Greater Caucasus endemic. Is found on the Compensation Area, Site 21.
23. *Primula luteola* – a Greater Caucasus endemic. Is found on the Compensation Area, Site 22.
24. *Sedum involucratum* – a Caucasian endemic. Is found on the Compensation Area, Site N5A, Site 22, Site 24.
25. *Carex buschiorum* – a Crimean-Caucasian endemic. Is found on Compensation Area, Site N5[a], Site 15, Site N22, Site N23, Site N24.
26. *Rosa boissieri* – Caucasus-Northeast Anatolia (subendemic). Is found on the Compensation Area, Site 23.
27. *Thalictrum buschianum* – a Caucasian endemic. Is found on the Project corridor, Site N11 (this site was located in the Traditional Use Zone of Kazbegi National Park and excluded from Kazbegi Protected Area before the beginning of construction of Dariali Hydropower Plant, figure N2 on the map);
28. *Orchis purpurea subsp. caucasica* (=*Orchis caucasica*)- a species protected under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES 1975; universal). Is found on the Compensation Area, Site 5.
29. *Dactylorhiza urvilleana* (=*Orchis triphylla*)- a species protected under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES 1975; universal). Is found on the Compensation Area, Site 24.

4.1 CONCLUSIONS

Thus, on the Project Corridor and Compensation Territories (Natural Monument of Abano Mineral Lake, Natural Monument of Trusso Travertines, Natural Monument of Sakhiznari Cliffs) total 29 rare species are growing. Out of them 10 species are found on the Project Corridor from which 7 species are growing on the sites which were located in the Traditional Use Zone of Kazbegi National Park and excluded from Kazbegi Protected Area before the beginning of construction of Dariali Hydropower Plant. On the Compensation Sites are growing 22 rare and endemic species, and out of the list of above-mentioned rare plants 3 rare species grow both on the Project Corridor and Compensation Sites.

Consequently, we can conclude, that those sites of Dariali Hydropower Plant which were located in the Traditional Use Zone of Kazbegi National Park and excluded from Kazbegi Protected Area before the beginning of construction of Dariali Hydropower Plant, represent the sites of much lower conservation value as compared with the Compensation Sites, in the context of sensitive habitats and communities and populations of rare and endangered species. Granting the status of natural monuments to the Abano Mineral Lake, Trusso Travertines and Sakhiznari Cliffs to balance exclusion of the sites which were located in the Traditional Use Zone of Kazbegi National Park, is more than a sufficient compensation from the qualitative and quantitative context.

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Dariali Hydro Power Plant Project

REPORT
ON SURVEY AND COMPARATIVE ANALYSIS OF FAUNA OF DARIALI HYDROPOWER PLANT PROJECT CORRIDOR AND COMPENSATION SITES

ANNEX II

Tbilisi 2013

CONTENT

Preface

Aim of this review is to describe, from the animal biodiversity conservation standpoint, the potential impact zone of the Dariali Hydro Power Plant Project (further - Project) and sites, which are extracted out of the Kazbegi National park for the construction purposes, as well as sites allocated as Compensation sites to this Protected area.

This report contains general characteristic of the Georgian fauna within area of the project implementation and enumerates the animal species, which are protected by Georgian or international legal acts (e.g. Conventions, Agreements etc), and those of them that could be thought as the species, which are affected by the impact factors of the construction works and/or of operation of the Dariali HPP. In the report are listed major threats to sensitive species, are noted the expected impacts of construction and operation and measure to mitigate them, as well as residual impacts and required offsets measures.

Generally, the report is based on the bibliographic data, known collections, author's experience and results of the surveys, executed by authors on 4-8 October 2013, 14-20 May and 4-8 June of 2013, as well as on 25-30 June and 15-24 July 2010. The scientific zoological issues dedicated to Georgian fauna with detailed information on species distribution within limits of the area under consideration are very scarce. Not numerous published works describing fauna of Kazbegi region are at least about 20 year old. Thus consultations with colleagues-scientists and interview of locals are considered as one of valuable sources of information.

The review is divided into several sections.

Section 1 – The first section describes approaches and a method used in this report, and describes the project and its impact on animals.

Section 2 – includes brief overview of physical-geographical and zoogeographical aspects of study area and ecosystems within the project area.

Section 3 – contains general characteristics of environmental receptors - animal species composition, according to taxonomic groups and species included in Red Data List of Georgia.

Section 4 – contains results of the Field Surveys carried out in 2013

Section 5 – Comparison of Sites Extracted from National Park vs. Compensation Sites

Section 6 – Recommendations.

Section 7 – The last section contains References and Attachments.

Section 1. Introduction

Brief description of the project

The Project carried out by "Darial Energy" JSC is dedicated to construction of a hydropower station of run-of-river type. An installed capacity of the HPP will be 108 MW. The project area is located in the north slope of the Caucasus mountain chain, on the right-hand bank of Tergi River, on the 8 km long section between town Stepantsminda and state border crossing point on the Georgian-Russian border (NTS, 2011).

Reservoir construction is not planned. Low level water discharge dam will be arranged on water intake. The power plant will consist of a low dam at Stepantsminda, settling tank, diversion system (diversion channel and diversion tunnel), underground power plant and substation.

The dam, spillway and intake are located at the north vicinities of town of Stepantsminda. All related infrastructure are situated on the right-hand bank of the Tergi River. Derivation canal extending from the water intake to a sedimentation basin, the sedimentation basin itself, and the diversion pipeline extending from the sedimentation basin to the headrace tunnel entrance are affecting two plots extracted out of the Kazbegi National park (#246 and #015). The end of the tailrace tunnel and the channel are situated on the territory of the third land site extracted out of the National park (#016). A new substation will be located at the confluence of river Khdistskali (Brolistskali or Kistinka) with the river Tergi.

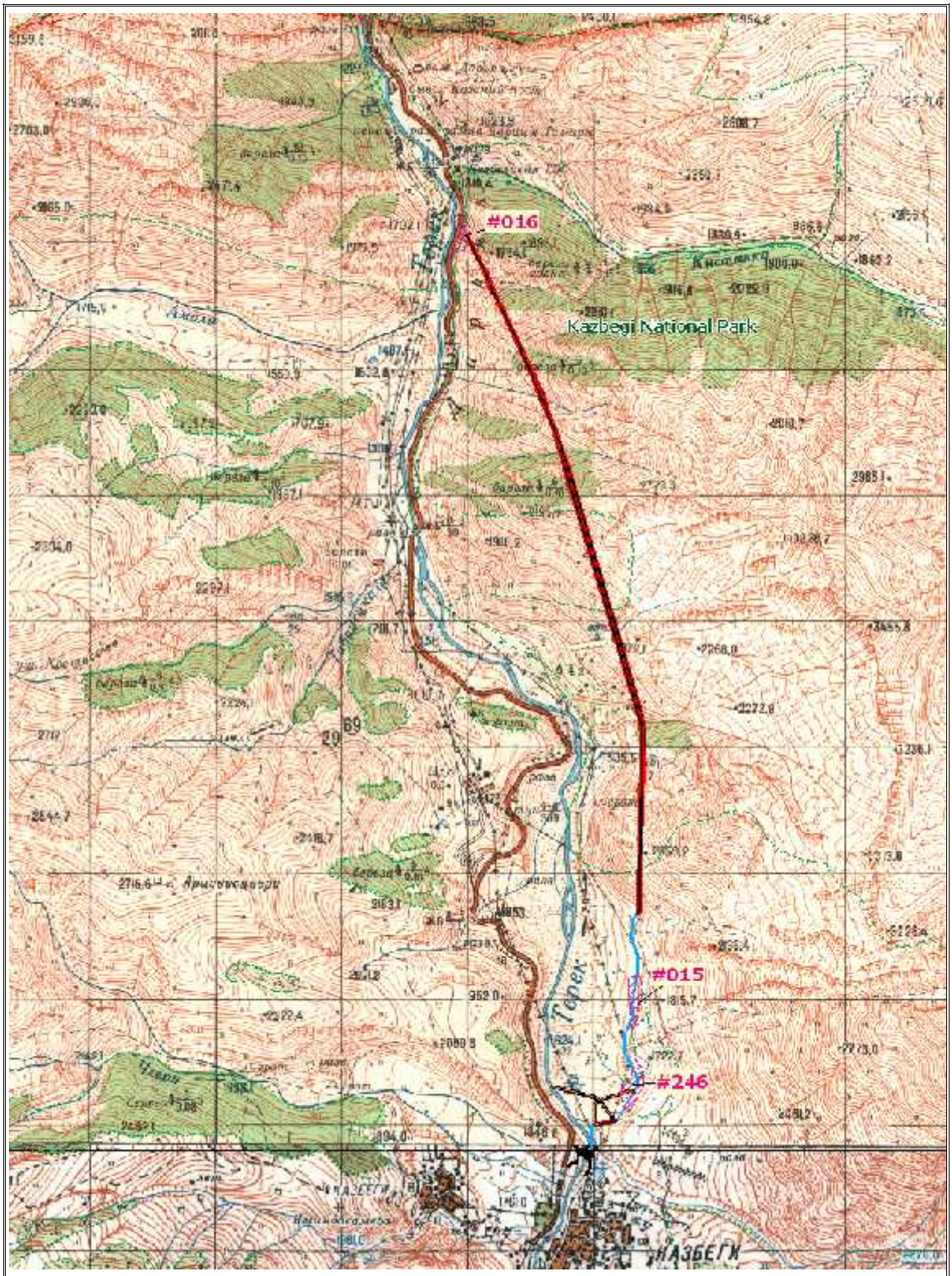
The total distance between the dam with water intake structure and the tailrace is approximately 7 km. The environmental flow has been calculated as 10% of the mean annual flow at the dam location, and is declared as much as 2.54 m^3/s. A few small rivers and ravines are joining the river Tergi downstream of the headworks.

This area is for a long time populated by humans. Lands of following villages are situated within the impact area of the Project: Stepantsminda, Tsdo, and Gveleti. Main car road is situated along the left-hand bank of the river Tergi from Stepantsminda till the bridge at the Gveleti, and farther it runs on the right-hand bank to the state border. There are not developed a network of dirt roads between villages. Natural ecosystems on the banks are quite degraded due to anthropogenic pressure. Land is used for livestock grazing.

At the moment of the zoological field survey 2013 the excavation of the headrace tunnel, underground powerhouse and tailrace tunnel were in progress. Construction of the headworks water diversion canal and sedimentation basin not yet began.

Table #1. Basic parameters of the Dariali HPP, received from Dariali Energy JSC

Main characteristics of the reservoirs	Dariali
Elevation of the head water (masl)	1725
Elevation of the tail-water (masl)	1333
HPP calculating water flow (cub.m/sec)	33.0
Sanitary water flow (cub.m/sec)	2.54
High of the dam (m)	4
Maximal water head (Calculating pressure (net) (m)	370-380



Map 1. The schema of the Dariali HPP Project

Dark red line – diversion tunnels, Light blue line – diversion pipeline, Black polygon – headworks, Brown polygon – sedimentation basin, Orange line-flushing gallery and water spillway channel, Magenta hatched polygon – sites extracted from NP (#015, #016, #246), Green dashed line – border of the Kazbegi National park

The construction of the Dariali Hydro Power Plant will include:

- construction of temporary and constant dams;
- construction within the riverbed, including the water intakes and other facilities;
- temporary diversion of the main channel of the river Tergi;
- construction of the HPP and ancillary infrastructure;
- tunnels and canals construction
- construction of power lines;
- construction of switching stations and of transformation stations;
- setting up of temporary construction camps to house the workers;
- allocation of the areas required for construction material etc.
- construction of temporary access roads to the construction site on of headrace canal on the right-hand bank of the river Tergi;
- preparation of the construction sites - land clearing and disposal of gravel, soil, vegetation and unstable material;
- excavation and operation of different quarries for an extraction of material for dam, embankments, and extraction of sand and gravel for aggregate mixtures, cement works;
- measures against geohazard - landslides, rock-falls, etc.;
- measures to prevent erosion on critical side-slopes;

Influence of these activities will affect terrestrial fauna in different ways and in different extent. From the standpoint of the preservation of the biodiversity of terrestrial animal one can see that: The terrestrial fauna of the river system downstream will be not affected in any significant extent, because immediately downstream of the Dariali HPP is the border between Georgia and Russia, and border guard infrastructure is situated. The main car road is situated along the river banks. Traffic n this road is quite intensive during the warm period of the year. Dam of another one hydropower plant is located in 4 km downstream at the village of Upper Lars. This area is populated by humans and ecosystem is modified a long time ago.

Also, it could be hardly expected that the terrestrial fauna of the whole watershed upstream will be affected. Increasing of the geo-hazardous processes, like are landslides, erosion, habitat change etc., triggered by construction works and water level change, potentially can affect population of some species, but these processes are random and results of those are unpredictable.

As the most affected animals' one can consider those of them dwelling on and using the construction site - the HPP site, water intake area and immediate surroundings, including ancillary infrastructure, workers settlements, access roads, areas required for construction material etc.

The animals that have occupied the banks of the river would be affected in the lesser extent. Soil erosion risk will increase, ecosystems in the close proximity of the river could be changed, but this process will give to the animals' a time to adapt. Moreover, animals from such impacted areas would be able to move to alternative habitats, not far from the initial place, because large areas covered with the same ecosystems are lying on the both sides of the Tergi River. Areas where there is no construction activities, but effects of such activities could be observed are defined as Impact Area.

For the evaluation of the consequences of the realization of the project and estimation of the impacts on all the environmental receptors all the sensitive receptors, which might be affected, are identified. In our case, these are as follows: ecosystems and habitats, populations of animals that could be, directly or indirectly, affected by the construction and operation of the Dariali Hydro Power Plant Project. Therefore, all possible impacts of the project on all the identified populations of the protected species and all key biotopes and ecosystems, which might be affected by the project, are analyzed during the environmental assessment.

Methodological approach

To define the impacts on the animal biodiversity, it is necessary to know, which species and in which numbers are really using the project territory. According to Betty Marriot (1997), it is necessary, using all kinds of the accessible sources of information, find out the following:

1. Whether there are evidences of presence of those or other species within the Impact Area?
2. Whether there are habitats within the Impact Area, which are crucial for the species, considered in the report?
3. Whether did the realization of the project will have a negative impact on these species and their crucial habitats?

It is possible to define the species that could be found within the impact zone of the project via estimating the features of the area (fodder supplies of the habitat, affinity of habitation of the human, presence of water sources and shelters, etc.) that are limiting use of a territory by animals. Knowing the requirement of species to the living space and their need in resources – there is possibility to estimate (presumably) a total number of the affected individuals of this species.

The basic method of the work is the usage of check-lists of species and overlap (superposition) of several respective maps: maps of distribution ranges, map of landscapes, land cover map, land use map, map of land tenure and map of an economic infrastructure, etc. Such method could be named as a «method of simple matrixes» in understanding of L. Canter (1996). The authors expert opinion, based on above mentioned, is presented in the report.

Species selection

The general principle for species selection for the analysis is that each species, considered in the report, have a forcible argument to include it in the list for consideration. Construction, operation and maintenance of the Dariali Hydro Power Plant should not lead to the harm to animals that occur in Georgia, especially, to the endangered species. All species, included in the list for consideration in this report, are presumed as the species impacted by the Project.

Methods of observation and counts of animals

Hydrobionts

Plankton - The standard method of the plankton organisms collecting is a zooplankton net.
Benthos - The benthic organisms should be collected during standard kick-net stream study using the kick-net and landing-nets (Barbour M., *et al*, 1999). Collected invertebrates should be washed in the water and stored in a special container with alcohol. Afterwards the material should be threatened in lab using Bogorov's camera and binoculars.

Fish - The foot-surveys along the banks of the river Tergi and its tributaries within the impact zone with periodical efforts to catch fish using the landing net (hand net) for small fishes, and using the cast net to catch larger specimens. Depth, velocity, substrate and cover measurements

should be taken by hydrologist in advance of the ichthyologist trip and will be transferred to zoological group for sites where fish will be captured.

Terrestrial fauna

Amphibians and Reptiles - Foot-survey along the banks of the river Tergi and its tributaries within the impact zone and on sites of the Kazbegi National Park (extracted and compensation sites); direct visual observations and count of the adult animals.

Birds - Direct visual observations from high located watching points and land-based survey with using binoculars (magnitude up to 12x). All records should be documented with details of observation (dates, time, location of watching site, weather conditions, number of observed individuals and flocks, age, if possible, of observed birds, distance from observers, directions and height of flight, etc.). Especially attention should be paid to find nests of large birds of prey, which are nesting in proximity of the construction sites.

Methods:

a) The methods of "point transects", generally used for counts of all bird species during the breeding seasons on large territories (Svensson, 1974, 1979; International Bird Census Committee, 1969; Holmberg, 1979);

B) The specific survey methods are recommended for local Georgian conditions in order to find the Caucasian Black Grouse and Caucasian Snowcock (Kutubidze, 1974).

Bats - Direct surveying of all places, suitable for the bats roosts – caves, artificial undergrounds, old abandoned buildings, attics, mature trees with hollows etc.; registration by ultrasound bat detectors (Pettersson D-200) on transects – along the linear structures of landscape (roads, banks, forest edges etc.) and at the water bodies. Presence of bats on large numbers can be considered as presence of seasonal bat association, such as maternity, nursery or wintering colony. In such a case, the colony should be investigated and status of colony and number of bats should be recorded.

Small Mammals - Registration of signs of activity within the corridor of the Project area — combination of the various methods: burrow count on transects, registration of footprints and droppings, visual counts during survey on foot etc.

Large mammals - Registration of signs of activity within the Study area (footprints, droppings, direct visual counts from high watching points) should be done in a combination of various methods of census of large mammals – tracking on transects, direct visual counts from high watching points, ground counting by team on foot, as well as indirect methods, e.g. dung counting (Krebs, Ch., 2006; Sutherland, W., 2006; Thompson, W., White, G., Gowan, Ch., 1998). Aim is to find all possible evidences of the large mammals' presence on the study area, to have an idea on the usage of the territory of Project by these species.

The Common otter (*Lutra lutra*) survey methods largely rely on finding evidence in the form of droppings (known as spraints), footprints, holts, tracks and feeding remains. The survey should be done during daylight hours; any evidence observed should be annotated on a plan and recorded by GPS (Chanin P., 2003). Generally, to confirm presence of the otter, it is enough to make survey on the bank of the river on about 1.5-2 km of length, in a habitat suitable for the otter.

Key-site selection

Site selection has two aspects. From one hand, should be selected site important for animals as a key-site. That maybe breeding or nesting place, feeding (foraging) site, stopover site during migration, wintering or hibernation place, etc. From another hand, it should be selected sites

within the area of the Dariali Project area where an impact of the construction, operation, accidents and repair works will result in harm to fauna.

All "sensitive" sites - sites, that are requiring extra cares during constructions and/or operations of the transmission line, and all sites, where can arise problems with preservation the biodiversity – are considered in the report. The sites and species groups or, even, individual species, that are requiring the additional study for evaluating the consequence of the Dariali Hydro Power Plant Project impact on the fauna – are mentioned, also.

Section 2. Zoogeographical Aspects of Study Area, Brief Overview

Physical-geographic region in which will be situated the Dariali Hydro Power Plant

The part of Georgian territory from the Krestovy (Cross) Pass to the Georgia-Russia border is situated on the northern slopes of the Greater Caucasus range in the valley of the river Tergi and in the valley of its right-hand tributary - river Baidara. This area is located between the Great Caucasus Mountain Range and the Khokh Range to the southeast and east from the Mount Kazbek, within the Stepantsminda (Kazbegi) municipality of the Mtskheta-Mtianeti province of Georgia. From the physical-geographic standpoint, the Project area lies on the slope of the Kazbegi Mountain at the conventional border between Central and Eastern Caucasus within the upper reaches of the river Tergi (Terek in English). All rivers and streams here belong to the basin of the river Terek and to the basin of the Caspian Sea. The Tergi River rises near the juncture of the The Greater Caucasus Range and the Khokh Range, to the southwest of Mountain Kazbek. At the village Kobi it turns north to the town of Stepantsminda and further toward the Russian border. The river Tergi ravine downstream from the town of Stepantsminda (former Kazbegi) till the Georgian-Russian border is known as a Darial Pass. Here will be constructed the Dariali HPP. The impact area covers downstream of the Tergi river tributaries - rivers Chkheri, Amali (Devdoraki), Khdistskali (Brolistskali, Kistinka), Kuro and several nameless rivers and streams. Ravine of the Tergi from river head up to confluence with the river Baidara is known as Truso Gorge. The entire ravine of the river Tergi within the Georgian territory is mostly rocky and woodless. The Darial Pass and the Truso Gorge, at the Kassara Jaws are narrow canyons with high rocky walls. River Tergi flow velocity is fast. River has not large flat areas. The relatively slower flow velocity can be observed within the Dariali HPP project area only at the village Tsdo. Other sites with slow flow velocity are situated upstream of the town Stepantsminda: at the confluence with the river Snostskali, at the village Kobi and in a few places in the Truso Gorge near the Compensation Sites (Truso Travertine and Abano Lake), where the river channel is branching. The denudation processes, soil erosion and avalanches are characteristic for the River Tergi basin. Especially, it is known for the left-hand tributaries of the river. In the 19-th century, the Devdoraki glacier ice-slide had filled up the riverbed of Tergi.

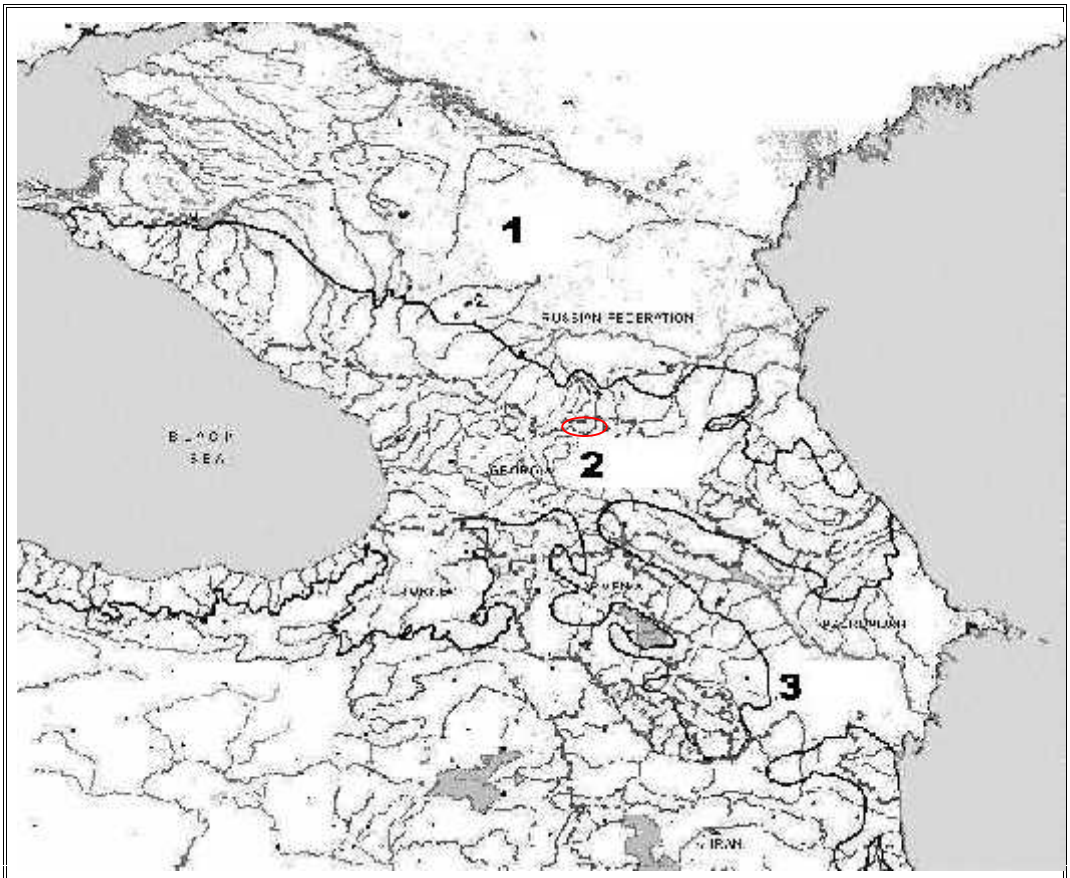
Zoogeographic Characteristics of the Caucasus and Project Area

From the viewpoint of zoogeography, the entire Caucasus is located in the Holarctic or Palaearctic kingdom or zone, depending on the terminology used by experts in zoogeographic zoning. The zoning of the World Geographic Atlas of 1964 published in Moscow1 is used in the report. According to Vereshchagins map (1964), the Caucasus includes several zoogeographic sub-zones. In the north of the region there are two districts of the Kazakhstan-Mongolian province of the Central Asian sub-zone. The low reaches of the Tergi river (named there Terek) lies within this province. The middle of the Caucasus is mountains of the Greater and Lesser Caucasus and Talish that belong to the Caucasus district of the Circumboreal sub-zone isolated from the main part of the sub-zone by steppes. The Circumboreal sub-zone is sometimes referred

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

to as the sub-zone of Western Eurasia, which in principle does not change its characteristics and boundaries in the Caucasus (World of Geography 1984). Southern boundaries of the Caucasus region lie within the Anterior Asia district of the Mediterranean province and Kura district (almost entire Azerbaijan) of the Iran-Turan province. Both these provinces belong to the Mediterranean sub-zone. Thus, three zoogeographic sub-zones and four zoogeographic provinces neighbour in the Caucasus. Map 2 shows that in some locations boundaries of the zoogeographic sub-zones come very close to each other. (Map from Regional Bat Conservation Plan for Caucasus, 2008, prepared by A.Kandaurov).

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



Map 2. Boundaries of Zoogeographic Sub-zones
1. Central-Asian 2. Circumboreal 3. Mediterranean; Solid line is the zoogeographic sub-zone boundary; Dash line is the state border; Red oval – Project area

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

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

The Project Area is situated within the limits of the Caucasus region of the Caucasus district of the Circumboreal sub-zone. The Caucasus zoogeographic region covers mountains, usually at an altitude higher than 2000 m. On the northern slopes of Caucasus Mountain Chain it spreads much on lower elevations. The main landscapes of the Caucasian zone are mountain woods, sub-alpine forest and sub-alpine meadows. Climate in the most part of the zone is mountainous, severe, with high precipitation (≥1,000 mm per year). The lower borders of this zone are well delimited by the edge of temperate forest. This region covers upper parts of the Caucasian mountain ranges and its spurs. The Kazbegi National Park is situated within this zoogeographic region of the Caucasus district.

Terrestrial fauna of the Project area (Darial Pass) is quite degraded because of presence of human habitation and in result of long time usage for agriculture and for livestock breeding.

From the hydrobiological and ichthyological standpoint, presented on the website Freshwater Regions of the World (http://feow.org/) the Project area lies within the ecoregion "411: Western Caspian Drainages" (http://www.feow.org/ecoregions/details/411). This ecoregion is one of four Caucasian ecoregions that is clearly different by its composition of true riverine fish fauna. Geographically it belongs to the northern Caucasian slope and overlaps with drainages of the Caspian Sea basin. The ecoregion includes rivers of the Western Caspian coast from the Kuma to Samur River and small rivers in Azerbaijan to the north of the Greater Caucasus Range. The main rivers in the ecoregion include the Kuma, Terek, Sulak, and Samur rivers. As in the other Caucasian ecoregions, the upper part of the rivers are mountainous in character, the middle reaches are depending on the degree of development of foothills, and the lower reaches, particularly of large rivers, have broad, partly swampy, floodplains. The lower reaches of the Terek River on the plains of the eastern Northern Caucasus are occupied by steppes (feathergrass, sagebrush) and semi-deserts (saltwort, sand). Area of Terek river delta and the present coastline is covered by semi-arid and arid floodplain vegetation, including marshes, meadows, and halophyte meadows in river floodplains. Communities of coastal and lowland forests are represented on the Tersko-Sulak lowland along the main channels of the Terek. These forests typically feed on underflow and subsoil waters. A large area of lowland forests within the Tersko-Sulak lowland has been deforested and converted for agriculture. Humid areas in foothills are covered by lowland forests of Alder-tree (*Alnus barbata)*. The succession of vegetation zones occurs with elevation: from the forest-steppe landscape in the foothills to the zone of large-leaved forests and subalpine meadows and birch and pine krummholz on highest elevations.

Ecosystems (landscapes) of the Project area

Ranges of the animal species and areas of distribution of species complexes often coincide with borders of biotopes or landscapes. Landscapes are mosaic scattered within each of physical-geographic or zoogeographical regions. Best systems of division of landscapes of the Caucasus, and in particular of the Georgia, are given By Ketskhoveli (1957, 1973), Gulisashvili Et Al. (1975), Beruchashvili et al., (1988), Sokolov and Tembotov (1989). System of Prof.

N.Beruchashvili provides more detailed view on types of habitat spread on the territory (See landscape map below – Map 3).

The main types of ecosystems within the Dariali Hydro Power Plant Project area are as follows:

- The glaciers (152 on the landscape map) are covering top of the Kazbegi Mount. No impact on this ecosystem is expected.

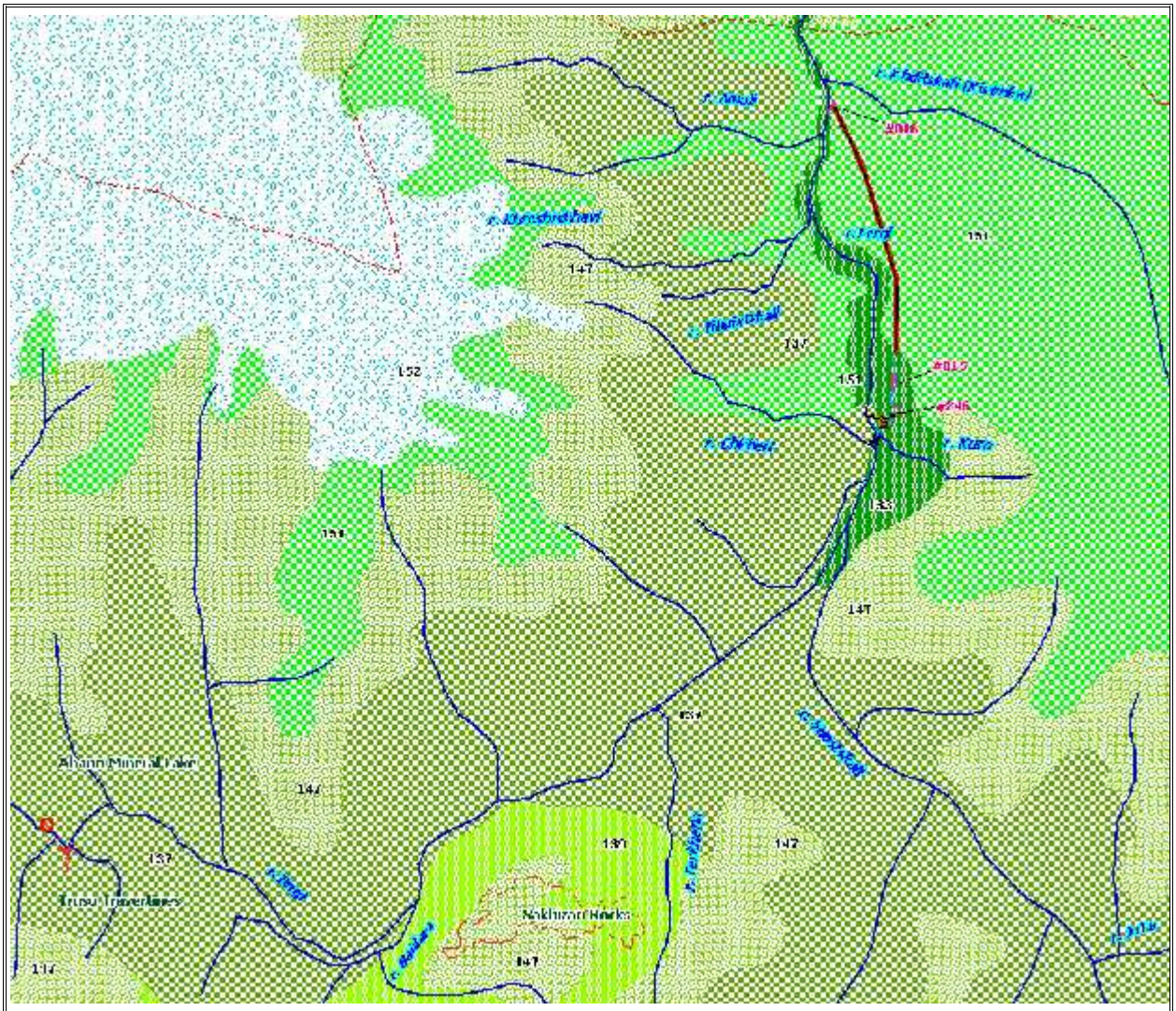
- The high-mountain subnival landscapes with plant micro-communities, mosses and lichens (151) are covering slopes of mountains just below the glaciers and nival habitats and very steep or vertical rocky slopes on lower elevation on both sides of the Dariali pass from Kazbegi to the Georgia-Russia border. The headrace diversion tunnel and underground HPP are situated within this landscape, but no negative impact on the habitat could be expected. All infrastructures are located under ground, on the level of the bottom of the river Tergi valley, and no interventions on the land surface of the upper parts of mountains are planned.

- The Caucasian high-mountain paleo-glacial denudational and volcanic landscapes with alpine meadows and Rhododendron bush thickets (147) are developed on slopes lower than sub-nival landscape, on elevations above 2000 masl. Western part of the Sakhizari Compensation site is covered by this landscape. This landscape will be not affected while no interventions are here planned.

- The Caucasian high-mountain sub-alpine meadows and steppe-meadow (139) occupies sloped of the Mountain Kabarjina from the river Tergi valley till the Rhododendron bushes belt. The eastern part of the Sakhizari compensation site covered by steppe-meadows. This landscape will be not affected while no interventions are here planned.

- The Caucasian high-mountain sub-alpine meadows (137) with combination of bushes and, krummholz (elfin forest or crooked-stem forest) are spread within the wide valleys of rivers Tergi and Snostskali (up to Pansheti village) and their tributaries and on lower parts of mountains slopes. There are inclusions of secondary grasslands and pines forests within the valleys. This area is under human population influence for a long time. Forest, which is not included in the Kazbegi National Park, is used for fuel-wood harvesting and livestock grazing. Open grasslands natural and secondary meadows are pastures. No construction activities are planned on this territory. The compensation sites Abano Mineral Lake and Truso Travertine are situated within this ecosystem in close proximity of village Ketrisi and of the car road to this village.

- The Caucasian upper-mountain erosional-denudational landscape with pine forests and birch groves (133) was covering the bottom of the river Tergi valley within the Dariali pass from the village Pansheti to the Russian border. All construction sites and sites extracted out the Kazbegi National park are situated within this landscape. This area in surroundings of Stepantsminda (extracted sites #246, #015) is treeless, covered with degraded low grasses (secondary meadows) with sparse bushes and small suppressed trees. Small sites of the remnants of the secondary forest and bushes and birch groves located at the bottom of rocks on both side of the river. The third extracted site (#016) is situated within such vegetation.



Map 3 – Landscapes (ecosystems) of the Project area

Dark red line – diversion tunnels, Light blue line – diversion pipeline, Black polygon – headworks, Brown polygon – sedimentation basin, Orange line-flushing gallery and water spillway channel, Magenta hatched polygon – sites extracted from NP (#015, #016, #246), Green dashed line – border of the Kazbegi National park; *Red line – border of Compensation sites.*

133 - Caucasian upper-mountain erosional-denudational, in some places paleo-glacial landscapes with pine forests and birch groves; **137 -** Caucasian high-mountain landscapes with combination of sub-alpine meadows, crooked forest and bushes; **139** - Caucasian high-mountain volcanic landscapes with sub-alpine meadows and steppe-meadows; **147** - Caucasian high-mountain paleo-glacial denudational and volcanic landscapes with alpine meadows and Rhododendron bush thickets; **151 -** High-mountain subnival landscapes with plant micro-communities, mosses and lichens; **152 –** glaciers;

Animal complexes in the ecosystems

From zoogeographic standpoint and for the animal conservation purposes we can aggregate all landscapes into two complexes.

- Upper-mountain pine forests and birch groves, alternated by secondary bushes and meadows within the Darial Pass, and the steep rocks with plant micro-communities on the banks of the river Tergi and self river Tergi in section of depleted flow between headworks and tailrace tunnel outlet.

- High mountain open landscapes (sub-alpine and alpine meadows), krummholz and Rhododendron bush thickets on the rest part of the river Tergi valley and mountains.

Upper-mountain pine forests and birch groves complex

Here are known 11 mammals, about 51 species of birds are nesting and migrating there, four-five reptilian, 3-4 amphibians and up to four 12 fish species in the river. Most of species are common and abundant small mammals and passerine birds. Moreover, some of species inhabiting neighbour areas are often visiting this habitat in different seasons.

Among such species, penetrating in this area, are noted the protected by law species (both seen and known from published issues). There were noted four mammals, included in the Red Data List. One of them is Critically Endangered Eurasian Lynx (*Lynx lynx),* two species are Endangered - Brown Bear (*Ursus arctos)* and Chamois (*Rupicapra rupicapra*), and two are Vulnerable species - East Caucasian Tur (*Capra cylindricornis*) and Otter (*Lutra lutra*). The East Caucasian Tur was seen on rocks during the field visit in May 2013. All others are fixed as occasional visitors by locals. The real presence of the last one – the Otter is doubtful, taking into account conditions of habitat and habitat preferences of this species.

One endangered bird species, the common crane (*Grus grus*) regularly migrates through the Dariali Pass in spring and autumn and one Vulnerable bird species Bearded Vulture (*Gypaetus barbatus*) has nest on the high rocks near the tailrace tunnel. One Vulnerable reptile - Dinnik's Viper (*Vipera dinniki*) was found at the workers camp, and one Vulnerable fish - Brown Trout (*Salmo fario*) in the river. Five Vulnerable insects are found here during site visits in May and June of 2013: Butterflies Apollo (*Parnassius apollo)* Scarlet Tiger (*Callimorpha dominula),* Apollo (*Parnassius apollo),* Meleager's Blue (*Polyommatus daphnis*) Alpine bumble bee (*Bombus alpigenus*), and dragonfly Dark pincertail (*Onychogomphus assimilis*). Totally - 15 species.

Most sensitive to human presence and activity impact are: East Caucasian Tur, Chamois, Bearded Vulture, and, in case of poaching or water pollution - Brook Trout.

High mountain complex

The High mountain complex covers upper part of the Greater Caucasus range from border with the Russian Federation down till the upper edge of forest on the southern slopes. This complex is widespread in upper parts of the Project area. The area contains rocks, screes, and plant micro-communities, Rhododendron bush thickets, subalpine and alpine meadows, elfin woods and birch and pine forests.

Animals that occupy this area belong to Caucasian region of the Caucasian district of Circumboreal sub-zone. This zone is characterized with high level of endemism and with number of fragile ecosystems and sensitive species. The most vulnerable ecosystems are sub-alpine meadows, tall-herb communities, and elfin woods (crooked-stem forest). In the same time, these landscapes are richest and the most important for a wellbeing of mountain fauna.

Here are fixed 18 mammals species; about 30 bird species (both nesting and migrating); five reptilians, two amphibian and one fish. Among protected by law species there are five mammals, two of them species Endangered: Brown Bear (*Ursus arctos)* and Chamois (*Rupicapra rupicapra*), and three species are Vulnerable: East Caucasian Tur (*Capra cylindricornis),* Grey Dwarf Hamster (*Cricetulus migratorius*) and endemic rodent Long-Clawed Mole-Vole (*Prometheomys schaposchnikovi)*; seven Vulnerable birds species: Golden Eagle (*Aquila chrysaetos),* Bearded Vulture (*Gypaetus barbatus),* Eurasian Griffon (*Gyps fulvus),* Caucasian Black Grouse (*Tetrao mlokosiewiczi*), White-winged Redstart (*Phoenicurus erythrogaster)* and Great Rosefinch (*Carpodacus rubicilla*); one Vulnerable reptile Dinnik's Viper (*Vipera dinniki*); one Vulnerable fish - Brook Trout (*Salmo fario*); and five insects

Butterflies Apollo (*Parnassius apollo)* Scarlet Tiger (*Callimorpha dominula)*, Apollo (*Parnassius apollo)*, Meleager's Blue (*Polyommatus daphnis*) Alpine bumble bee (*Bombus alpigenus*), and dragonfly Dark pincertail (*Onychogomphus assimilis*). Totally -19 species.

Most sensitive to human presence and activity impact are: Chamois, Caucasian Tur, Bearded Vulture, Caucasian Black Grouse, Long-Clawed Mole-Vole and, in case of poaching or water pollution - Brook Trout.

Two habitats could be affected during the construction or operation of the Dariali HPP:

River floodplain and banks - differing from surrounding landscapes by the higher soil humidity, less developed soil layer, more developed bush vegetation on edges, and cover of pebble at the water edge. The ecosystem forms narrow belt along the rivers, up to several tens of meters of width. Generally, they are quite diverse in regard of species composition of plants and animals, but the construction area contains poor animal complex due to long time of human pressure. It is of importance for many species as feeding place. Animal community of these ecosystems can be affected if large part of the vegetation will be removed. The ecosystem can be affected in case of fuel leakage during construction work.

Freshwater ecosystems. Attention must be paid to brown trout and invertebrate species dwelling in the river Tergi. The ecosystem is sensitive to the impact of the depleted water flow during operation of the Dariali HPP. The ecosystem can be affected during construction work in case of large fuel leakage.

Section 3. General Characteristics of Animal Species' Composition
(according to Taxonomic Groups)

Mammals

108 species of mammals occur in Georgia. These species are associated in 64 genera of 28 families that belong to 7 orders. From this amount 4 species, probably, do not meet any more in wild nature of Georgia. Seven species were acclimatized in Georgia or have penetrated after acclimatization on adjacent territories (Bukhnikashvili, Kandaurov 1998, 2002; Gurielidze, 1997). Within the study area (including Darial Pass, extracted sites of National park and compensations sites) are known ranges of distribution of 35 terrestrial mammal species. Two more species (common otter (*Lutra lutra*) and lynx (*Lynx lynx*)) are also noted in interview by locals, but occurring of these species within the Construction Area is unlikely. Although, the inhabitation of some individuals of lynx in Sakhizari compensation site can not be excluded. Among these 37 mammalian species 25 are known from published issues (Bukhnikashvili 2004, Shidlovsky 1976, Шидловский М.В., 2013, Janashvili A., 1963). 20 species are recorded in results of authors field surveys in 2001-2013th years, and eight of them (five bats and three musteline) are fixed first time for the administrative district. Totally, seven species are named in locals interview, among them four species (otter, wolf, brown bear and lynx) are not confirmed by scientific publications and our direct observation during last three year. Taken into the consideration the habitat features, the presence of more bat species can be expected.

There are not large areas of the key-habitats of the endangered mammals within the Construction Area itself and within the sites extracted from National park. Parts of populations or some individuals of the protected by law species can be affected during construction and operation of the Dariali HPP, as well as, in results of vehicle accidents within the construction zone (the feeding strategy of some medium-sized carnivore species, picking up dead animals from the road, leads in increased mortality).

All bats that occur in Georgia are included in the Appendix II of Bonn Convention and protected under EUROBATS Agreement. Bats are extremely restricted in finding shelters for breeding colonies. Suitable for the roosting shelters (trees hollows, caves, crevices in rocks and the abandoned buildings) are of great importance for their wellbeing. Wintering and maternity roost can be destroyed if some trees with hollows will be cut (e.g. tree cutting before dam construction) or if bridges and other old buildings along the banks of the river will be destroyed during preparation works in not proper time. In addition, a spill of a fuel in stagnate water on the floodplain can destroy the food resource of the maternity colony, which will substantially reduce number of young.

Within the construction area presence of the 6 bat species is confirmed (See Table 2) by direct observation using Ultrasound bat detectors (Pettersson D 200). The species of bats recorded in the project area are not listed in the National Red Data List and IUCN Red List as threatened (The Red List of Threatened Animals IUCN, 2003; Red Data List of Georgia, 2006). They are not included in the Action Plans of Bat Conservation for Caucasus and Georgia, as well (Kandaurov A. ed. 2008; Bukhnikashvili A., et al., 2008).

Table 2. Bat species occurring within the work area
DO – occurrence of the species confirmed by direct observations and Ultrasound bat detector, C – Museum;
IA – Impact Area Dariali Pass; ES – sites extracted of National park; CS – Compensation sites

№	Species - Latin name	Common English name	Georgian name	Red list	IA	ES	CS
1.	*Myotis nattereri*	Natterer's Bat	ნატერერის მღამიობი	LC			DO
2.	*Myotis mystacinus*	Whiskered Bat	ულვაშა მღამიობი	LC			DO
3.	*Nyctalus leisleri*	Lesser Noctule Bat	მცირე მელამურა	NT			DO
4.	*Pipistrellus pipistrellus*	Common Pipistrelle	ჯუჯა ღამორი	LC	DO		DO
5.	*Pipistrellus pygmaeus*	Soprano Pipistrelle	პაწია ღამორი	LC			DO
6.	*Plecotus auritus*	Brown Big-eared Bat	რუხი ყურა	LC			C

The Brown Big-eared Bat (*Plecotus auritus*) from Kobi village (near the Sakhizari compensation site) is stored in the Zoological collection of the Georgian State Museum and not confirmed by contemporary studies. All other species found by authors in vicinities of the Compensation site Sakhizari, in the river Snostskali valley in 2010-2012^{-th} years. In addition, the Common Pipistrelle (*Pipistrellus pipistrellus*) was fixed within the Project area at the tailrace tunnel (Khdistskali river mouth) during the field survey in the summer 2013.

Most of recorded bat species are preferring shelters in buildings. The destroying of any old buildings during construction is not planned, thus adverse impact on bats is unlikely. Moreover, climate of the study area and bats behaviour during observations forces us to conclusion that only summer associations of males are found within the construction area, and thus adverse impact on maternal colony may be excluded.

Evaluation of impacts related with construction and operation of Dariali HPP require additional surveys in the summer to assess usage of the Dariali Pass as a foraging area.

In additional it should be noted that the Project area lies within the ranges of distribution of some species, which are of community interest. There are game species and species attractive for

tourists. Among them are nine mammals, of middle and large size, which are listed in the Table 3.

Table 3. Some mammal species occurring within the work area
The occurrence of the species confirmed by: DO – direct observations, C – Museum, P – Published issues;, LI – Locals interview; IA – Impact Area Darial Pass; ES – sites extracted of National park; CS – Compensation sites; OA – other areas of Kazbegi municipality

	Latin name	English name	Georgian name	Status of presence	IA	ES	CS	OA
1	*Canis lupus*	Wolf	მგელი	Resident	no	no	LI	**DO**
2	*Vulpes vulpes*	Fox	მელა	Resident	**DO**	**DO**	**DO**	**DO**
3	*Ursus arctos*	Brown Bear	დათვი	visitor	LI	no	LI	no
4	*Meles meles*	Badger	მაჩვი	Resident	no	no	no	**DO**
5	*Martes foina*	Stone Marten	კლდის კვერნა	Resident	**DO**	**DO**	**DO**	**DO**
6	*Capra cylindricornis*	East-Caucasian tur	ჯიხვი	Resident	**DO**	no	no	no
7	*Rupicapra rupicapra*	Chamois	არჩვი	Resident	LI	no	LI	no
8	*Lynx lynx*	Lynx	ფოცხვერი	Resident	no	no	LI	no
		Presumed	**species**					
9	*Lutra lutra*	Common Otter	წავი	Irregular visitor?	LI	no	no	no

Presence of five species is confirmed via direct observations and by tracks. Information on other four species is obtained during interview of locals. Two most common species - fox (*Vulpes vulpes*) and stone marten (*Martes foina*) are dwelling everywhere. Their presence is confirmed by direct observations and footprints within the impact area (at the workers camp), on extracted sites (#246 and #015) and on compensation sites (Abano Lake and Sakhizari). Outside the study area, marten is fixed by authors at the village of Ukhati (1988), Devdoraki glacier (2003, 2010), and in the Truso gorge (2010). Presence of the most attractive mammals: East-Caucasian tur (*Capra cylindricornis*) and chamois (*Rupicapra rupicapra*) are known form published issues and from interview with locals. The East-Caucasian tur was seen by authors on the rocks above the tailrace tunnel outlet (Khdistskali river mouth) during the field survey in the May, 2013. Chamois is reported in scientific publications for the whole Kazbegi municipality (Соколов В.В., Сыроечковский Е.Е. Ред. 1989) and reported by locals for Sakhizari compensation site and as a winter visitor for the rocks above the Tergi river channel on the right side of the river. The wolf (*Canis lupus*) is reported by locals for Sakhizari compensation site, footprints of wolf seen at the village Juta in 2010. Tracks of the badger (*Meles meles*) found at the village Juta in 2010. This species is not reported in scientific publications for the study area. Brown bear (*Ursus arctos*) is also not reported in scientific papers. According to locals, bear occurs in Sakhizari compensation site and rarely is seen passing on mountain slopes above impact area at Khdistskali mouth and Gveleti. Also, the lynx (*Lynx lynx*) is living in Sakhizari compensation site, locals say.

The otter (*Lutra lutra*) is only species, connected in his lifestyle with river, and sensitive to changes of water flow. Occurrence of the otter within the Dariali Pass (i.e. impact area) and in the Kazbegi municipality as a whole is not reflected in the scientific publications or collections (Бухникашвили А. И др., 2007). According to interview with one local man, otter rarely visits area of the Dariali Pass (i.e. impact area). Despite of efforts to find footprints and faeces of otter during visits in the Dariali Pass in May, June and October of 2013 nothing was found.

During field excursions and in result of an analysis of the published issues (literature data), sites, which can be considered as those having an important significance from the mammals' biodiversity preservation standpoint, were not defined within the impact area of the Project (Dariali Pass and extracted sites). The upper parts of the rocks at the confluence of rivers Khdistskali (Kistinka) and Tergi are occupied by East Caucasian tur and chamois, these areas are considerable higher on the slopes than bottom of the Dariali Pass, and thus can not be affected by the construction or operation of the Dariali HPP. The Sakhizari compensation site is only place, which could be considered as having significance for mammals as home-range and feeding area. The wolf, brown bear and lynx (according to locals) occur there.

Birds

There are approximately 400 bird species recorded for Georgian avifauna. (A. Abuladze, personal communication, 2013, Boehme *et al*, 1987; Kutubidze, M., 1985, Zhordania R., 1979). More than 220 of these species breed regularly or incidentally in Georgia, others appear in the country during migrations or in wintertime.

Territory of Georgia is important to Western Palaearctic birds' migration. Diversity of the bird species and numbers of each species greatly increase in spring and in autumn during seasonal transit migrations and on lowlands in winter. The south-eastern coast of the Black Sea is one of the most important sites of Western Palaearctic birds' migration. One of the migration routes is going along the valley of the rivers Aragvi and Tergi. The Project area is used by a various species of birds-of-prey and passerines as a stopover site on passage.

At least of 148 bird species were recorded in the region of the Project area. 24 bird species are classified as year-round residents; 38 are migratory summer breeders. About 108 species are recorded (regularly or irregularly) during seasonal migrations in spring and autumn, from which at least 26 species are also recorded in study area during breeding season as breeders, and at least 82 species were recorded only during passage. Winter avifauna is presented of year-round resident bird species and more than up to ten species winter visitors or occasional visitors. About ten bird species are rare irregular in small numbers visitors to study area or occasional elements (vagrants).

Avifauna of the impact zone of the Project is well studied. The scientific ornithological station of the Institute of Zoology of Georgian Academy of Sciences operated in the town Stepantsminda (Kazbegi) since 1975 till 1990 under leadership of Dr. A. Abuladze. Moreover, expeditions of the Institute of Geography Academy of Sciences USSR investigated bird species composition and ecology every year in 70 – 80^{-th} years under leadership of Dr. T. Zimina and Dr. M. Zhuravlev (Зимина Р., и др., 1988, 1990). Last census of the birds was carried out by Dr. A. Abuladze in May of 2013. Dr. Abuladze kindly consulted authors of this report. According to him not less than 142 species are direct observed within the study area in different years and seasons. Five species are known from travel reports of birders and foreign ornithologists. These species are as follows: Mallard (*Anas platyrhynchos*), Armenian Gull (*Larus armenicus*), Tawny Owl (*Strix aluco caucasica*), Calandra Lark (*Melanocorypha calandra*), and Goldcrest (*Regulus regulus)* only in forest.

For the impact assessment only breeding bird species are of interest. Migrating species and occasional visitors have enough space to avoid negative effect of the construction and operation of the hydropower plant, if any. Number of birds breeding within the study area (impact area, sites extracted from National park and sites devoted to compensation) is quite limited.

The breeding avifauna of Impact area (bottom of the Dariali Pass and close vicinities of the town Stepantsminda) consist of about 16 common and abundant forest passerines and ravine waders:

Little Ringed Plover (*Charadrius dubius*), Common Sandpiper (*Actitis hypoleucos*), Barn Swallow (*Hirundo rustica*), Eurasian Crag Martin (*Ptyonoprogne rupestris*), Water Pipit (*Anthus spinoletta*), White Wagtail (*Motacilla alba*), Grey Wagtail (*Motacilla cinerea*), Common Shrike (*Lanius collurio*), Blackcap (*Sylvia atricapilla*), Whinchat (*Saxicola rubetra*), Northern Wheatear (*Oenanthe oenanthe*), Black Redstart (*Phoenicurus ochruros*), Common Blackbird (*Turdus merula*), Great Tit (*Parus major*), Winter Wren (*Troglodytes troglodytes*), and European Goldfinch (*Carduelis carduelis*). 13 species were observed during field surveys in the summer and autumn of 2013 and in 2010-2012-th years. Three species: Great Tit, Winter Wren, and European Goldfinch were recorded earlier. No one of recorded there bird species is protected by law.

Breeding avifauna of the extracted sites is similar to those of impact area, with excluding of synanthropic and river-related species. About 12 bird species are nesting on secondary meadows and on rocks above its: Eurasian Sparrowhawk (*Accipiter nisus*), Bearded Vulture (*Gypaetus barbatus*), Common Kestrel (*Falco tinnunculus*), Eurasian Crag Martin (*Ptyonoprogne rupestris*), Water Pipit (*Anthus spinoletta*), Caucasian Chiffchaff (*Phylloscopus collybita lorenzii*), Whinchat (*Saxicola rubetra*), Northern Wheatear (*Oenanthe oenanthe*), Black Redstart (*Phoenicurus ochruros*), Winter Wren (*Troglodytes troglodytes*), Rock Bunting (*Emberiza cia*), European Goldfinch (*Carduelis carduelis*).

The Bearded Vulture, which is listed in the National red data list, can be considered as breeder in the extracted sites only conventionally. The nest of this bird is situated on the high rock close to the tailrace tunnel (200-250 m above the road). An adult bird with one younger was observed during the site visits in May of 2013. That is clear evidence that construction works have no adversely impact on this bird. Other bird species are not protected by law.

The compensation sites are different from bird ecology standpoint. Two sites within the Truso gorge (Abano Lake and Truso Travertine) are situated within the open valley of the river Tergi on the relative plane terrain, covered with secondary meadow. These sites are small and easy accessible for humans, feral and shepherds dogs and other raptors. No bird nests were found on both these sites. About 18 species were recorded there during breeding season here. Probably, their nests are situated in surrounding (rocks, river banks, and bushes) and birds use the sites as feeding grounds. These species are as follows: Common Kestrel (*Falco tinnunculus*), Peregrine Falcon (*Falco peregrinus*), Little Ringed Plover (*Charadrius dubius*), Eurasian Crag Martin (*Ptyonoprogne rupestris*), Water Pipit (*Anthus spinoletta*), White Wagtail (*Motacilla alba*), Grey Wagtail (*Motacilla cinerea*), Whinchat (*Saxicola rubetra*), Northern Wheatear (*Oenanthe oenanthe*), Black Redstart (*Phoenicurus ochruros*), Winter Wren (*Troglodytes troglodytes*), Rock Bunting (*Emberiza cia*), European Goldfinch (*Carduelis carduelis*), White-winged Snowfinch (*Montifringilla nivalis*), Red-billed Chough (*Pyrrhocorax pyrrhocorax*), Yellow-billed Chough (*Pyrrhocorax graculus*), Common Raven (*Corvus corax*). Among these 18 species, 12 were recorded during ornithological excursions in last decades, and 6 species are known from published issues and birder reports. No one of recorded there bird species is protected by law.

The Sakhizari compensation site is large, high mountain Kabarjina with top at the 3136 masl, covered with very rough terrain and natural vegetation. Press of livestock grassing is relative low. Thus avifauna of this area is rich in comparison with both other compensation sites. During number of ornithological excursions since 1988 year totally 21 species were recorded during breeding season. Noteworthy species, which are nesting on elevations higher than 2500 masl, - Gueldenstaedt's Redstart (*Phoenicurus erythrogaster*) and Caucasian Great Rosefinch (*Carpodacus rubicilla*). Within the study area, only here are known endemic Galliformes: Caucasian Snow Cock (*Tetraogallus caucasicus*), Caucasian Black Grouse (*Tetrao*

mlokosiewiczi). The nests of the large birds-of-prey: Bearded Vulture (*Gypaetus barbatus*), Griffon Vulture (*Gyps fulvus*) and Peregrine Falcon (*Falco peregrinus*) are known in this area. All of above noted species with exception of Caucasian Snow Cock and Peregrine Falcon are listed in the Georgian National Red Data List (2006) as threatened species. Other species are found on other two compensation sites, too. List of breeding birds of Sakhizari includes, but is not limited by following species: Eurasian Sparrowhawk (*Accipiter nisus*), Bearded Vulture (*Gypaetus barbatus*), Griffon Vulture (*Gyps fulvus*), Peregrine Falcon (*Falco peregrinus*), Caucasian Snow Cock (*Tetraogallus caucasicus*), Caucasian Black Grouse (*Tetrao mlokosiewiczi*), Eurasian Crag Martin (*Ptyonoprogne rupestris*), Water Pipit (*Anthus spinoletta*), Whinchat (*Saxicola rubetra*), Northern Wheatear (*Oenanthe oenanthe*), Black Redstart (*Phoenicurus ochruros*), Gueldenstaedt's Redstart (*Phoenicurus erythrogaster*), Winter Wren (*Troglodytes troglodytes*), Rock Bunting (*Emberiza cia*), European Goldfinch (*Carduelis carduelis*), Caucasian Great Rosefinch (*Carpodacus rubicilla*), White-winged Snowfinch (*Montifringilla nivalis*), Red-billed Chough (*Pyrrhocorax pyrrhocorax*), Yellow-billed Chough (*Pyrrhocorax graculus*), Common Raven (*Corvus corax*). Among these 21 species, 9 were recorded during ornithological excursions in last years, and 12 species are known from published issues and birder reports. Five of them are listed in the Georgian National Red Data list. Totally 24 species are found on the all compensation sites.

Based on all available data and taking into account the viewpoint of bird conservation, it can be concluded that breeding avifauna of the impact zone can be classified as a poor by breeding species and is presented in general by common, widely distributed and numerous bird species. The dominate group of breeding birds are forest and meadow passerine. Noteworthy is a fact that surroundings of this area contains a breeding sites of Bearded Vulture (*Gypaetus barbatus*) exactly above the impact area, feeding area of Griffon Vulture (*Gyps fulvus*) and Common Kestrel (*Falco tinnunculus*). No species can be assumed as being under special impact of the construction the Dariali Hydropower Plant.

In results of field excursions (2010, 2012 and 2013), an analysis of the published issues (literature data) and of interview with locals, only site, which can be considered as those having a significance from the birds' biodiversity preservation standpoint, is the compensation site Sakhizari .

Table 4. Bird species occurring within the work area

The occurrence of the species confirmed by: DO – direct observations, IA – Impact Area Dariali Pass; ES – sites extracted of National park; CS – Compensation sites; OA – other areas of Kazbegi municipality; Status of presence: YR-R – year-round resident, SB – summer breeder, PM – passage migrant

	Latin name	English name	Georgian name	Status of presence	IA	ES	CS	OA
1	*Accipiter nisus*	Eurasian Sparrowhawk	მიმინო	SB		DO	DO	DO
2	*Gypaetus barbatus*	Bearded Vulture	კრავიჭამია	YR-R		DO	DO	DO
3	*Gyps fulvus*	Eurasian Griffon	ორბი	YR-R			DO	DO
4	*Falco peregrinus*	Peregrine Falcon	შევარდენი	SB, PM			DO	DO
5	*Falco tinnunculus*	Common Kestrel	ჩვეულებრივი კირკიტა	SB, PM,		DO	DO	DO
6	*Tetraogallus caucasicus*	Caucasian Snow Cock	შურთხი	YR-R			DO	DO
7	*Tetrao mlokosiewiczi*	Caucasian Black Grouse	როჭო	YR-R			DO	DO
8	*Charadrius dubius*	Little Ringed Plover	მცირე წინტალა	SB, PM	DO		DO	DO
9	*Actitis hypoleucos*	Common Sandpiper	მებორნე	SB, PM	DO			DO
10	*Hirundo rustica*	Barn Swallow	სოფლის მერცხალი	SB, PM	DO			DO
11	*Ptyonoprogne rupestris*	Crag Martin	კლდის მერცხალი	SB, PM	DO	DO	DO	DO
12	*Anthus spinoletta*	Water Pipit	მთის მწყერჩიტა	SB	DO	DO	DO	DO

13	*Motacilla alba*	White Wagtail	თეთრი ბოლოქანქარა	SB, PM	DO		DO	DO
14	*Motacilla cinerea*	Grey Wagtail	მთის ბოლოქანქარა	SB	DO		DO	DO
15	*Lanius collurio*	Red-backed Shrike	ღაჟო	SB, PM	DO			DO
16	*Sylvia atricapilla*	Blackcap	შავთავა ასპუჭაკა	SB, PM	DO			DO
17	*Phylloscopus collybita*	Common Chiffchaff	ჭედია ყარანა	SB		DO		DO
18	*Saxicola rubetra*	Whinchat	მდელოს ოვსადი	SB, PM	DO	DO	DO	DO
19	*Oenanthe oenanthe*	Northern Wheatear	ჩვეულებრივი მეღორღია	SB, PM	DO	DO	DO	DO
20	*Phoenicurus ochruros*	Black Redstart	შავი ბოლოცეცხლა	SB	DO	DO	DO	DO
21	*Phoenicurus erythrogaster*	Gueldenstaedt's Redstart	წითელმუცელა ბოლოცეცხლა	YR-R			DO	DO
22	*Turdus merula*	Eurasian Blackbird	შავი შაშვი	YR-R	DO			DO
23	*Parus major*	Great Tit	დიდი წივწივა	YR-R	DO			DO
24	*Troglodytes troglodytes*	Winter Wren	ჭინჭრაქა	YR-R	DO	DO	DO	DO
25	*Carpodacus rubicilla*	Caucasian Great Rosefinch	დიდი კოჩობა	YR-R			DO	DO
26	*Emberiza cia*	Rock Bunting	მთის გრატა	SB		DO	DO	DO
27	*Carduelis carduelis*	European Goldfinch	ჩიტბატონა	SB, PM	DO	DO	DO	DO
28	*Montifringilla nivalis*	White-winged Snowfinch	ალპური მთიულა	YR-R			DO	DO
29	*Pyrrhocorax pyrrhocorax*	Red-billed Chough	წითელნისკარტა მაღრანი	YR-R			DO	DO
30	*Pyrrhocorax graculus*	Yellow-billed Chough	ალპური მაღრანი	YR-R			DO	DO
31	*Corvus corax*	Common Raven	ყორანი	YR-R			DO	DO
			Total observed species		16	12	24	31

Bird migration routes across project area

Bird migration and nomadic movements take place in Georgia during the whole year. However, there are sharply seen two migratory periods – spring and autumn passage. The important Euro-African and Euro-Asian migratory fly-ways of many bird species cross the territory of Georgia. Not less than 215 species, or more than half of bird species of Georgia, are migratory birds, which are absent in the winter. Not less than 230 species are regularly noted at the period of seasonal migrations in the spring and autumn. Also, about 40 species are irregular migrants. The fly-ways of migratory birds' on the territory of Georgia are linked with natural "guiding" lines – with the outlines of the Black Sea coast line, valleys of the large rivers (Inguri, Khobistskali, Rioni, Mtkvari and with their tributary - Aragvi), mountain ranges, mainly with the Greater Caucasus Chain and its spurs, and less with the Surami ridge and with ranges of the Lesser Caucasus. There are known primary, secondary and additional flyways, as well as concentration places of migratory flocks, so-called "migratory bottle-necks" and stop-over sites (places of their stay for the resting). The "bottle-necks" are situated on the passes in mountains (especially passes of the Great Caucasus including Cross pass) and in valleys of large rivers – Mtkvari, Rioni, Aragvi, Tergi (Terek), Alazani, and in valleys of some tributaries of them. The most important bottle-neck is located in south-western part of Kolkheti Lowland on the coastal lowlands of Kolkheti and Adjara. The general flyway within the Project area lies along the Aragvi and Tergi rivers. Number of the migrants varies noticeably from year to year. Unfortunately, the available data, does not allow defining an exact number of the birds, which are flying during the seasonal migrations through the Project area. The general fly-way within the project area is going through the Dariali Pass, over the Project area. It follows the valleys of the rivers Aragvi, Baidara and Tergi.

Spring (second decade of March – first decade of May). General direction of the migration is from the South to the North. There are using all suitable valleys of the rivers and the coast of the Black Sea. One can see four waves of the birds' migration on the territory of Georgia in the spring - form the beginning of March till the middle of March, in second half of March, from the

first week of April till the third week of April, from the end of April till the second week of May. Arrivals of the migrant birds, which are nesting in Georgia, continue from 5-10 May to 20-25 May, with peak between 10 and 20 May. The most important factors of intensification of spring migration are the meteorological conditions on the plains of the North Caucasus and the existence in Transcaucasia.

Autumn (September – end of October). General direction of the migration is from the North to the South. The birds' flocks cross the Main Caucasus Ridge through the passes in the gorges of the main rivers and go down to the intermountain plains. They do not follow to the bends of these riverbeds. The main part of the birds flies along the coastline of the Black Sea and above the sea. Birds gather in large flocks in the Kolkheti/Colchic Lowlands. Autumn passage is longer and more active than the spring passage. The first autumn migrants appear even at the beginning of August. The autumn passage ends at the turn of November. There are shown three waves of the autumn migration - at the beginning of September, from the second week of September till the first week of October, at the end of October. The most numerous groups are passerines (*Passeriformes*), waders (*Charadriiformes*), birds-o-prey (*Falconiformes*), geese (*Anseriformes*). The cold snaps on Russia territory, as well as also weather conditions (direction and force of winds, intensity and character of precipitation, height and density of the cloudiness) in some regions of Georgia and in adjacent regions of Russia and Turkey influence the intensity of the autumn passage.

Number of the migrants varies noticeably from year to year. Unfortunately, the available data, does not allow defining an exact number of the birds, which are flying during the seasonal migrations through the territory of the Project.

The power lines will affect the migratory birds, especially in the places where the wires are situated across the direction of fly-way (e.g. were the wires are going across the river valleys). One can consider the birds killing on transmission line and poles, because of electrocutions and accidents, as one of the assumed (conjectural) residual impacts of the high-voltage power-line (transmission line) on the animal biodiversity (Katherine H., 2004). Of course, the high-voltage power line is not so much dangerous for birds like e.g. the power lines of medium voltage (1 kV to 60 kV). But, still one can expect that certain number of electrocutions will have place. Group of species most likely to be affected by electrocution includes Ciconiiformes, Falconiformes, Strigiformes and Passeriformes (Bevanger K., 1998). Ciconiiformes – the white stork is listed in the Red Data List of Georgia, as well as a number of raptors (Falconiformes).

Not only do power line poles pose a lethal threat to birds. Birds can be killed by colliding with power lines or severely injured and thus die from the injuries. Birds that migrate at night are especially threatened. Bird species which are characterized by rapid flight and the combination of heavy body and short wings run a high risk of colliding with power lines, because of restricted speed of reaction to unexpected obstacles. Among such birds most likely are Galliformes, Gruiformes and Ciconiiformes (Bevanger K., 1998). Galliformes – quail (*Coturnix coturnix*) an important game species in Georgia. Collisions with wires for this species are well-known. The Dariali Pass is one of important flyway for– two species of *Gruiformes* common crane (*Grus grus*) and demoiselle crane (*Anthropoides virgo*).The common crane migrates through it even in greater numbers than along the Black sea coastline (Dr. A. Abuladze, personal communication, 2013).

Reptiles

54 species of reptiles were ever recorded for Georgia (Bakradze & Chkhikvadze, 1992; Tarkhnishvili et al., 2002). The major part of reptile species is restricted in their distribution in the south-eastern part of Georgia, and can not be affected by the construction. 8 species of reptiles are recorded for the Project area. One species is presumed to occur within the area of the proposed Project: the Derjugin's Lizard (*Darevskia derjugini*) (Tarkhnishvili D., 2012). There are one regional endemic of the Middle East that is found only in the Caucasus and the northern part of the Asia Minor - Georgian or Spiny-Tailed Lizard (*Darevskia rudis*) and two species - found exclusively in the Caucasus: Daghestanian Rock Lizard (*Darevskia daghestanica*) and Caucasian rock lizard (*D. caucasica*). The rock lizards are very much depended on specific places of dwelling - rocks rich with insects. Therefore, they meet in a plenty on a few sites removed from each other.

Five of eight reptiles were catch during last three years by specialists of the Institute of Zoology, of Ilia State University. Two species of rock lizards are found within the study area: Caucasian Rock Lizard everywhere, with exceptions of compensation sites in 2013 and Daghestanian Rock Lizard at the Sakhizari compensation site in 2010 (Bukhnikashvili A., et al., 2013,). The Ring Snake (*Natrix natrix*) was seen on the river Tergi bank (within the impact area) in 2013, also. Noteworthy is a venomous snake – the Dinnik's Viper (*Vipera dinniki*), which was fixed within the impact area, at the workers camp two times: in 2010 and 2013-th years by professional herpetologist David Bekoshvili (personal communication). The Dinnik's Viper is only species of reptilian found in the study area, which is listed in the National Red Data list. Harm to snake population in the Dariali Pass will be insignificant in case of implementation of proper mitigation measures.

Table 5. Reptilian species occurring within the work area

The occurrence of the species confirmed by: DO – direct observations, C – Museum, P – Published issues;, LI – Locals interview; IA – Impact Area Darial Pass; ES – sites extracted of National park; CS – Compensation sites; OA – other areas of Kazbegi municipality

	Latin name	English name	Georgian name	Status of presence	IA	ES	CS	OA
1	*Darevskia caucasica*	Caucasian Rock Lizard	კავკასიური ხვლიკი	resident	**DO**	**DO**		**DO**
2	*Darevskia daghestanica*	Daghestanian Rock Lizard	დაღესტნური ხვლიკი	resident			**DO**	P
3	*Darevskia derjugini*	Artvin Lizard,	ართვინის ხვლიკი	presumed	P	P	P	P
4	*Darevskia rudis*	Spiny-Tailed Lizard	ქართული ხვლიკი	resident	P	P	P	P
5	*Lacerta strigata*	Caspian Green Lizard	ზოლიანი ხვლიკი	resident	P	P	?	P
6	*Coronella austriaca*	Smooth Snake	სპილენძა	resident	P	P	P	**DO**
7	*Natrix natrix*	Ring Snake	ჩვეულიბრივი ანკარა	resident	**DO**			
8	*Vipera dinniki*	Dinnik's Viper	დინიკის გველგესლა	VU	P	**DO**	P	P

Amphibians

There are 12 species of amphibians found in Georgia (Tarkhnishvili, 1995, 1996). Five species of amphibians are noted for the Project area. Long-legged Wood Frog (*Rana macrocnemis*) is found everywhere. Two species, Eurasian Marsh Frog (*Pelophylax ridibundus*) and Green Toad

(*Bufo viridis*) are seen within the impact area in the water pools on the road and in the roadside ditch. Two newt species, Northern Banded Newt (*Ommatotriton ophryticus*) and Southern Crested Newt (*Triturus karelinii*) are noted for Kazbegi State Reserve by R. Zhordania (Жордания Р., 1960) as vouchers in the Zoological Collection of the Georgian State Museum. No other data, which confirms information on presence of these species within the study area, were found by authors of this report.

Among amphibians that are or can be found within the Construction area, two species Long-legged Wood Frog and Northern Banded Newt are regional endemic of the Caucasus and northern part of Anatolia. No one of recorded there amphibian species is protected by law.

All amphibian species are in need of stagnant, or of very slowly current, freshwater bodies for reproduction. Frogs and toads can breed in small pools, ditches on flat slopes, and in oxbows on the floodplain. Only places, suitable for the newts' reproduction, are small lakes located at the confluence of the river Amali (Devdoraki) with river Tergi. This site situated close to impact area, but it is hardly possible that the construction will affect it adversely, while no activities are planned on this area. The operation of the Dariali HPP will not harm amphibian species. So, no negative impacts are expected for amphibians. Change of water flow can provide them new places for reproduction.

Table 6. Amphibian species occurring within the work area
The occurrence of the species confirmed by: DO – direct observations, C – Museum, P – Published issues;, LI – Locals interview; IA – Impact Area Darial Pass; ES – sites extracted of National park; CS – Compensation sites; OA – other areas of Kazbegi municipality

	Latin name	English name	Georgian name	IA	ES	CS	OA
	Ommatotriton ophryticus	Northern Banded Newt	მცირეაზიური ტრიტონი				P ?
	Triturus karelinii	Southern Crested Newt	სავარცხლიანი ტრიტონი				P ?
	Bufo viridis	Green Toad	მწვანე გომბეშო	**DO**			
	Pelophylax ridibundus	Eurasian Marsh Frog	ტბორის ბაყაყი	**DO**			
	Rana macrocnemis	Long-legged Wood Frog	მცირეაზიური ბაყაყი	**DO**	**DO**	**DO**	**DO**

Fish

About 33 species of freshwater and anadromous fish are known in the scientific literature from the whole basin of the Terek River (or Tergi River in Georgian part). Some sea- and brackish water fish species penetrate in the lower reaches of river Terek delta. Range of distribution of these species is far out of the project impact area, thus they are not considered in this report. The dams on the river Terek (Pavlodolskaya, Kargalinskaya and Malokabardinskaya) are serious obstacle for migration of anadromous fish-species. Such species as are: Sterlet (*Acipenser ruthenus*), Russian sturgeon (*Acipenser gueldenstaedtii*), Bulatmai barbel (*Barbus capito*), Caspian kutum (*Rutilus kutum*), Caspian shemaya or Danube bleak (*Chalcalburnus chalcoides*) ceased their seasonal migration above these dams. The Caspian Salmon occurs in small number in the middle reach of the river due to reintroduction programs for this species carried out on fish plants in Russian Federation (Mayskiy, Chegemskiy and Ardonskiy). Larger part of species inhabits the lower parts of the river basin with slow flow velocity, and sand and clay bottom of the river.

Up to ten species are recorded for upper reaches of the Tergi river within the borders of the Russia: Brown trout (*Salmo trutta),* Terek Barbel (*Barbus ciscaucasicus),* North Caucasian longbarbel gudgeon (*Romanogobio ciscaucasicus),* Caucasian Chub (*Leuciscus cephalus*

orientalis), Terek nase (*Chondrostoma oxyrhynchum),* North Caucasian bleak (*Alburnus hohenackeri),* Schneider (*Alburnoides bipunctatus),* Krynicki's loach (*Oxynoemacheilus merga*), Ciscaucasian spined loach (*Sabanejewia caucasica*). Among them only five species known from the Georgian territory: Brown trout, Terek Barbel, Caucasian Chub, Schneider, Krynicki's loach (See Table 7).

Brown trout was seen during the field visits of ichthyologist in 2013th year within the impact area at the bridge of Gveleti. The Terek Barbel and Schneider were caught by the ichthyologist Dr. T. Kokosadze during the field survey in the same area in 2006Th year. The Caucasian Chub noted in the published issues and can be expected due to habitat preferences and presence of the Schneider. The upper edge of the Chub distribution range is some above of the lower edge of the trout distribution edge (Эланидзе Р., 1983). The Krynicki's loach is noted in the work of Ninua N., Japoshvili B., 2008, as Barbatula barbatulus caucasicus Berg, 1899 (in accordance with Integrated Taxonomic Information System (ITIS), [see Encyclopedia of Life http://eol.org/pages/220230/names], and referred, as a species living on the Georgian territory, on the map on the IUCN Red Data List site (http://maps.iucnredlist.org/map.html?id=135495). Though, occurrence of this species in the impact area of the Project (in the river Tergi within the Dariali Pass) is doubtful while in collections are not evidences of it presence here, and because of the velocity of flow on this site of the river, and habitat preferences of the species.

Terek Barbel (*Barbus ciscaucasicus*) - occurs in clear, fast and cold rivers. It feeds on benthos and periphyton (freshwater algae) on stones. This species spawns in May - August.

Schneider (*Alburnoides bipunctatus*) - occurs in the lower sections of the impact area with relative slow flow velocity. It feeds on benthos, plankton and periphyton on stones. This species spawns in May – August. This species is listed in the Appendix III of the Bern Convention.

Caucasian Chub (*Leuciscus cephalus orientalis*) – occurs in the lower sections of the impact area, prefers relative warm water and slow flow velocity. It feeds on with benthos, plankton and partly on periphyton. This species spawns in April – July.

Brown Trout (*Salmo trutta fario)* occurs in mountain rivers in cold and clear water. It feeds on rheophilic forms of benthic organisms. The non-migratory form of the trout spawns since October till March. The migratory form attends spawning grounds in the same time with peak of spawning in October-November.

Table 7. Fish species occurring within the work area

The occurrence of the species confirmed by: DO – direct observations, C – Museum, P – Published issues;, LI – Locals interview; IA – Impact Area Dariali Pass; LR – lower reaches of r. Tergi (Terek), UR – upper reaches of r. Tergi (Terek) within Russian territory, OA – other rivers in Kazbegi municipality

	Latin name	English name	Georgian name	LR	UR	IA	OA
1.	*Acipenser ruthenus*	Sterlet	ტარაღანა	P			
2.	*Acipenser gueldenstaedtii*	Russian sturgeon	რუსული ზუთხი	P			
3.	*Salmo ciscaucasicus*	Caspian Salmon	თერგის ორაგული	P			
4.	*Salmo trutta*	Brown trout	კალმახი	?	P	**DO**	**DO**
5.	*Cyprinus carpio*	Common carp	გოჭა, კობრი	P			
6.	*Carassius carassius*	Crucian carp	მრგვალი კარჩხანა	P			
7.	*Barbus ciscaucasicus*	Terek Barbel	თერგული წვერა	P	p	**DO**	
8.	*Barbus capito*	Bulatmai barbel	ჭანარი	P			

	Latin name	English name	Georgian name	LR	UR	IA	OA
9.	*Barbus brachycephalus*	Caspian barbel	მოკლეთავა წვერა	P			
10.	*Romanogobio ciscaucasicus*	North Caucasian longbarbel gudgeon	თერგული ციმორი	P	p		
11.	*Scardinius erythrophthalmus*	Common rudd	ფარფლწითელა	P			
12.	*Rutilus rutilus*	Common roach	ნაფოტა	P			
13.	*Rutilus kutum*	Caspian kutum	კუტუმი	P			
14.	*Leuciscus cephalus orientalis*	Caucasian Chub	ქაშაპი	P	P	P	
15.	*Chalcalburnus chalcoides*	Caspian shemaya	შემაია	P			
16.	*Chondrostoma oxyrhynchum*	Terek nase	თერგული ტობი	P	P		
17.	*Alburnus alburnus charusini*	Terek bleak	თერგული თაღლითა	P			
18.	*Alburnus hohenackeri*	North Caucasian bleak	ამიერკავკასიური თაღლითა	P	P		
19.	*Alburnoides bipunctatus*	Schneider, Spirlin	ფრიტა	P	p	**DO**	
20.	*Abramis brama*	Common bream	კაპარჭინა	P			
21.	*Ballerus sapa*	White-eye bream	თეთრთვალა	P			
22.	*Blicca bjoerkna*	Silver Bream	ბლიკა	P			
23.	*Oxynoemacheilus merga*	Krynicki's loach	თერგის გოჭალა	P	P	P?	
24.	*Sabanejewia caucasica*	Ciscaucasian spined loach	თერგის გველანა	P	P		
25.	*Sander lucioperca*	Zander, Pikeperch	ფარგა	P			
26.	*Sander volgensis*	Volga pikeperch	ვოლგური ფარგა	P			
27.	*Pelecus cultratus*	Sichel, Ziege	გორდათევზი	P			
28.	*Rhodeus sericeus*	Amur Bitterling	ტაფელა	P			
29.	*Gambusia holbrooki*	Eastern mosquitofish	ჰოლბრუკის გამბუზია	P			
30.	*Silurus glanis*	Wels catfish	ლოქო	P			
31.	*Tinca tinca*	Tench	გუწუ	P			
32.	*Leucaspius delineatus*	Belica	Обыкновенная верховка	P			
33.	*Esox lucius*	Northern pike	ქარიყლაპია	P			

Brown trout is only fish species which forms more or less valuable population upstream of the impact area in the river Snostskali, and has some significance for local population as a subject of poaching. This species is listed in the Red Data list of Georgia as Vulnerable, thus destroying of its habitat and fishing are prohibited by law.

During the field visit this species was fixed by visual observation within the impact area at the Gveleti Bridge and was caught by hired local fisherman at the river Snostskali confluence with river Tergi.

The integrity of the trout's population in the river Tergi is supported by gene flow between sub-populations. This gene flow is possible while individual trout can come in upper reaches of the river through the Dariali Pass during season of favorable water level and flow velocity. That is why construction of the fish-pass on the dam is obligatory and amount of the so called "environmental flow" must be carefully calculated.

Invertebrates

Thousands of invertebrates species occurs in Georgia and most of them are very poorly studied (Foster-Turley P., Gokhelashvili R., 2009). Invertebrates, and in particular insects, a new group, which is included in the EIA process in last decades. Nine invertebrate species, occurring in Georgia, are listed as threatened - Critically Endangered, Endangered or Vulnerable in the 2008 IUCN Red Data Book. 43 species of invertebrates are listed in the Georgian National Red Data list (2006). Conservation status of the most of other species can be characterized as DD (Data deficient), except narrow-ranged forms, which are a priori threatened. There is only fragmentary bibliography on spatial distribution of most of them in the region under consideration. In Georgia, we have not State Register of fauna, as an officially accepted document for the use in the EIA. Such document is prepared only for Adjara - the Register of the Fauna of Adjara (Bukhnikashvili A., ed., 2011). That is obstacle to consider the wholly spectrum of invertebrates in this report.

Valery Petrov, entomologist of Georgian State Museum, carried two field surveys in the lower part of the impact area, river Khdistskali (Kistinka) mouth and tailrace tunnel construction site, in 14-20 May 2013 and in 4-8 June 2013. He had counted about 40 species of Butterflies (Lepidoptera), four bumblebees (Apoidea, Bombini) and one bee species (Apoidea, Halictodae), one species of Neuroptera, four beetles (Coleoptera), one Cicada (Cicadoidea) and two mollusks. About 135 species of bees and bumblebee (Apoidea) and up to 105 species of beetles (Coleoptera) are noted in the scientific publications as found in the Kazbegi municipality. Four species of the insects fixed on the study area are listed in the National Red Data list of Georgia.

It is expected that invertebrate species hardly could be affected by the construction of the Dariali HPP on a population level or on a species level, because of very limited area of habitat destroying in results of construction. There are not large areas of the key-habitats of the endangered invertebrates within the Project area. It seems that the Project can not be considered as one which will have significant adverse impact on these species. That's why we do not describe here invertebrate species occurring within the area of interests. Invertebrate species listed in the Red Data List of Georgia will be noted below in the Table 8.

Endemics to Caucasus within the project area

The Caucasus has high concentration of endemic species, exceeding those in the vast majority of non-tropical regions. The total number of regional endemic species varies between 20-30% for fish, amphibians, reptiles, and mammals (Badridze J. *et al*, 1996) and is possibly even higher for some groups of invertebrates. Largely, this is explained by presence of Pliocene forest refugia in the western Caucasus, where many species currently absent from the rest of the Planet survived both sharp decrease of humidity 5 millions of years before present and the Ice Age (Tarkhnishvili, 1996; Tarkhnishvili et al., 2000, 2001). 21 vertebrate taxa, considered endemic to the Caucasus, are listed in the IUCN Red Data List under categories DD, LR(nt), VU, EN, and CR. Those include eight mammals, one bird, ten reptiles, and two amphibians. There are at least five mammals, one bird, 17 reptiles, 18 fish and hundreds of invertebrates (insects, snails, crustaceans) endemic to the Caucasus but not included in either national or international Red Lists. For instance, some of the sixteen narrow ranged lizards of genus Darevskia, several unisexual taxa among them, have the area of occupancy so little that they obviously fall under the IUCN Red List criteria but little attention is paid to the conservation of these species.

Within the territory of Georgia the region of the Western Lesser Caucasus, with its extremely high humidity level and landscapes, has the highest diversity of forest plants and animals throughout the South Caucasus and harbors a high proportion of the regional endemics,

including Pliocene relict species (nearly 50% of the vertebrate species endemic to the Caucasus). Another area which is reach with endemic to Caucasus species is sub-alpine and alpine belts of the Greater Caucasus.

The Dariali HPP construction area is situated outside of the Western Lesser Caucasus, but lies in the sub-alpine and alpine belts of the Greater Caucasus. Within the Impact Area of the project, one can find among mammals – endemic to Caucasus species: Caucasian Mole (*Talpa caucasica*), Robert's Snow Vole (*Chionomys roberti*), Caucasian Snow Vole (*Chionomys gud*), East Caucasian Tur (*Capra cylindricornis*) and two endemic bird species Caucasian Grouse (*Tetrao mlokosiewiczi*), Caucasian Snow Cock (*Tetraogallus caucasicus*) and one endemic subspecies Caucasian Chiffchaff (*Phylloscopus collybita lorenzii*). Among reptiles there are one regional endemic of the Middle East that is found only in the Caucasus and the northern part of the Asia Minor - Georgian or Spiny-Tailed Lizard (*Darevskia rudis*). Three species are regional endemic found exclusively in the Caucasus – the Caucasian Rock Lizard (*Darevskia caucasica*), Daghestanian Rock Lizard (*Darevskia daghestanica),* and Derjugin's Lizard *(Darevskia derjugini*). One reptilian species the Dinnik's Viper (*Vipera dinniki*) is strictly endemic to the Great Caucasus mountain chain. Among the amphibian species one can see two regional endemic species of the Middle East are found only in the Caucasus and the northern part of the Asia Minor: Northern Banded Newt (*Ommatotriton ophryticus)* and Caucasian Wood Frog (*Rana macrocnemis*). Certainly, such species desire an especial attention from the conservation point of view. As it is shown above no one of the endemic species will be negatively affected during construction and operation of the Dariali HPP.

Red Data List of Georgia

32 terrestrial species, listed in the National Red Data list, are recorded within the Project Area. According to Criteria of Georgian Red List out of six mammals - five species are Vulnerable (VU), two Endangered (EN) and one Critical Endangered (CR); among 17 bird species two are Critical Endangered, three species - Endangered and 12 are Vulnerable; one reptile is Vulnerable; one fish species - Vulnerable; all five invertebrate species are Vulnerable. Presence on the territory under consideration of the 20 species is confirmed by direct observation done by authors and their colleagues during 2010-2013^{-th} years or in a few cases earlier, occurrence of eight species can be supported by published scientific papers and books, presence of more four species declared in the interview of locals. Among these species occurrence of three species can be presumed according to known habitats and species peculiarities, but presence of one specie Otter (*Lutra lutra*) is doubtful because of conditions of the river channel, banks vegetation and fish resources in this place. Among all the NRDL species, 18 have their home-ranges within the territory under consideration, nine species are regular migrants through the area and five species are rare to occasional visitors. For details see Table 8**.** Among the eight mammal species, only one can be suffered. Some individuals of the small rodent - Grey Hamster (*Cricetulus migratorius*), which use the part of the work area as their home ranges, will be killed during construction. This will not result in large changes in population numbers.

As it is stated above, the impact area is not occupied by population of the otter (Бухникашвили А., и др., 2007). Otter can appear there as a vagrant in latter autumn and in winter during low water period in the Tergi river. It is very unlikely that otter can pass to upper reaches of the river, while town of Stepantsminda is situated immediate above the headworks of the Dariali HPP on the river Tergi. Swimming upstream in this mountain river is impossible. One can suggest that dogs (not only feral), as well as people, will pose a hard obstacle to animals that are running along the river banks. As well, Otter is not recorded on sites extracted out of National park and on sites included into the National park as compensation. There are not water bodies on the Sakhizari natural monument. The area of Truso Travertine and of Abano Mineral lake is too small, too open and without shelters (bushes of forest on banks) to support otter occurrence.

Presumably, lynx and bear are rare visitors in the Project area and it is unlikely that they will be suffering due to construction or operation of the Dariali HPP. Bats protected under Bonn Convention, can be suffered if some roosts will be destroyed during renovation of the bridges and other old buildings. Operation of the Dariali HPP will not have any impact on bats populations.

Among listed in the NRDL 17 bird species, recorded within the borders of the Kazbegi municipality, ten species are passage migrants, one species is year-round visitor, one species is occasional visitor and only five species are year-round residents, which are breeding there.

The Project area (Dariali Pass and extracted sites) is of importance for one bird species local breeder the Bearded Vulture. One can consider this bird as affected of the construction only conventionally, while the nest is on 200-250 m above the road, and adult bird with one younger was observed during the site visits. The operation of the the Dariali HPP will not be a threat for this bird.

The Compensation site Sakhizari is of importance for five bird species included in the National Red Data list, which have nests on this site. These species are as follows: Bearded Vulture, Griffon vulture, Caucasian black grouse, Gueldenstaedt's redstart, Caucasian Great Rosefinch. Ten other protected by law species use the mountain Kabarjina and Sakhizari as a stop-over site during migration. Surroundings of this area contain a foraging area of year-round visitor species - Golden Eagle.

Only reptile, included in the NRDL, the venomous snake – the Dinnik's Viper (*Vipera dinniki*) is found within the impact area at the workers camp. Personal of working crew should be instructed to how they must deal with the snakes. Harm to snake population in the Dariali Pass will be insignificant in case of implementation of proper mitigation measures. It could be not excluded that this species occurs else on other sites. Distribution of this species on the lands of the Kazbegi National park is in need of investigation. No amphibian species listed in the National Red Data list occur within area under consideration.

One protected by law fish species, the Brown trout (*Salmo fario)* listed in the National Red Data list, was found during the field survey by ichthyologist. The unsuccessful attempts to catch the trout have demonstrated that river Tergi channel within the Dariali Pass is used by trout as way to upper reaches of the river, to spawning grounds. There are not large areas of feeding grounds or suitable to spawning places within the impact area of the Project.

Five species of the insects fixed on the study area are listed in the National Red Data list of Georgia (Didmanidze E., 2005, Skhirtladze I., 2008). It is expected that invertebrate species hardly could be affected by the construction of the Dariali HPP on a population level or on a species level, because of very limited area of habitat destroying in results of construction. There are not large areas of the key-habitats of the endangered invertebrates within the Project area. It seems that the Project can not be considered as one which will have significant adverse impact on these species.

Table 8. Animal species, included in the Red Data List of Georgia (2006), which are occurring within the impact area of the Project.

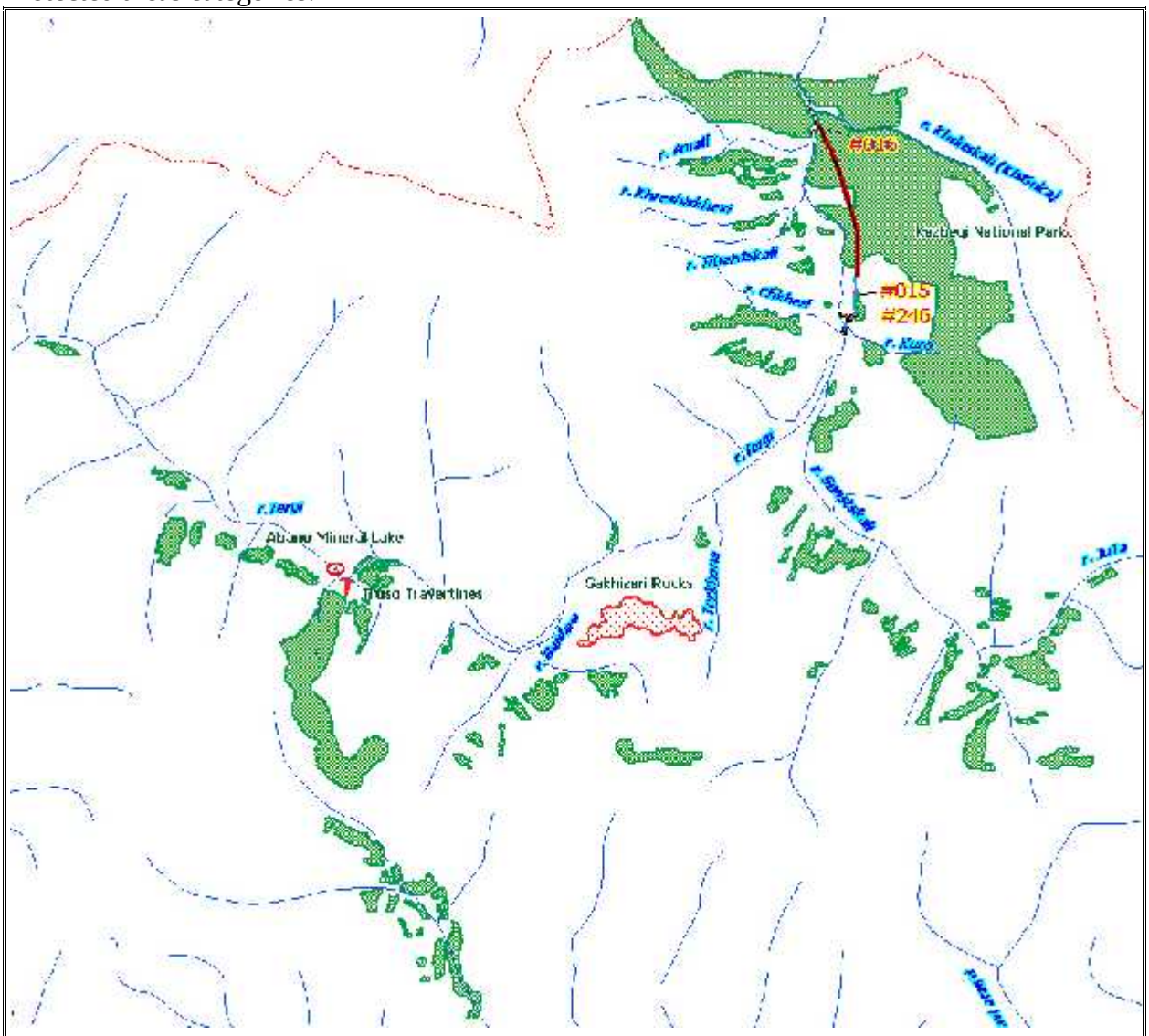
NRDL categories: VU – Vulnerable, EN – Endangered; CR – Critical Endangered; Type of occurrence: H – home range of the species lies within the area; YR-R – year-round resident (for birds); V – the species is a visitor within the area, M – species migrating across the area, ? - occurrence of the species is doubtful. The occurrence of the species is confirmed by: DO – the direct observations or tracks, C – Museum, P – Published issues;, LI – Locals interview; Areas: IA – Impact Area Dariali Pass; ES – sites extracted of National park; CS – Compensation sites; OA – other areas of Kazbegi municipality

#	*Latin name*	English name	Georgian name	National status	IA	ES	CS	OA	Type of occurrence	Comments
		Mammals	**ძუძუმწოვრები**							
1	*Lynx lynx*	Lynx	ფოცხვერი	CR			LI		H	
2	*Lutra lutra*	Otter	წავი	VU	LI?				V?	Not confirmed
3	*Ursus arctos*	Brown Bear	მურა დათვი	EN	LI		LI		V	Visitor
4	*Sicista kazbegica*	Kazbeg Birch Mouse	ყაზბეგური თაგვანა	VU				P	H	
5	*Prometheomys schaposchnikovi*	Long-Clawed Mole-Vole	პრომეთეს მემინდვრია	VU				P	H	
6	*Cricetulus migratorius*	Grey Hamster	ნაცრისფერი ზაზუნელა	VU				P	H	
7	*Capra cylindricornis*	East Caucasian Tur	დაღესტმური ჯიხვი	VU	DO				H	
8	*Rupicapra rupicapra*	Chamois	არჩვი	EN	LI		LI		H	
		Birds	**ფრინველები**							
1	*Buteo rufinus*	Long-legged Buzzard	ველის კაკაჩა	VU				DO	M	Regular migrant
2	*Buteo lagopus*	Rough-legged Buzzard	ფეხებანჯგვლიანი კაკაჩა	VU				DO	M	Regular migrant
3	*Aquila heliaca*	Imperial Eagle	ბეგობის არწივი	VU				DO	M	Regular migrant
4	*Aquila clanga*	Greater Spotted Eagle	მყივანი არწივი	VU				DO	M	Rare migrant
5	*Aquila chrysaetos*	Golden Eagle	მთის არწივი	VU			DO	DO	V	seasonal vertical movements
6	*Neophron percnopterus*	Egyptian Vulture	ფასკუნჯი	VU				DO	V	Rare visitor
7	*Gypaetus barbatus*	Bearded Vulture	კრავიჭამია	VU	DO			DO	YR-R	Nest observed
8	*Aegypius monachus*	Cinereous Vulture	სვავი	EN				DO	V	Rare visitor
9	*Gyps fulvus*	Eurasian Griffon	ორბი	VU			DO	DO	YR-R	

#	*Latin name*	English name	Georgian name	National status	IA	ES	CS	OA	Type of occurrence	Comments
10	*Falco cherrug*	Sacker	გავაზი	CR				DO	M	Regular migrant
11	*Falco vespertinus*	Red-footed Falcon	თვალშავი	EN				DO	M	Regular migrant
12	*Falco naumanni*	Lesser Kestrel	ველის კირკიტა	CR				P	M	Regular migrant
13	*Accipiter brevipes*	Levant Sparrow hawk	ქორცქვიტა	VU				P	M	Regular migrant
14	*Carpodacus rubicilla*	Great Rosefinch	დიდი კოჭობა	VU			DO	P	YR-R	Above 2500 masl
15	*Phoenicurus erythrogastrus*	Güldenstädt's Redstart	წითელმუცელა ბოლოცეცხლა	VU			DO	P	YR-R	Above 2500 masl
16	*Tetrao mlokosiewiczi*	Caucasian Black Grouse	კავკასიური როჭო	VU			LI	P	YR-R	
17	*Grus grus*	Common Crane	რუხი წერო	EN	DO			DO	M	Regular migrant
		Reptiles	ქვეწარმავლები							
1	*Vipera dinniki*	Dinnik's viper Caucasus subalpine viper	დინიკის გველგესლა	VU	DO			P	H	
		Fish	თევზები							
1	*Salmo fario*	Brown Trout	მდინარის კალმახი	VU	DO			P	H	
		Invertebrates	უხერხემლოები							
		Insects	მწერები							
1	*Callimorpha dominula*	Tiger Moth	დათუნელა ჰერა	VU	DO			P	H	
2	*Parnassius apollo*	Apollo	აპოლონი	VU	P			P	H	
3	*Polyommatus daphnis*	Meleager's Blue	ცისფერა მელიაგრი	VU	DO			P	H	
4	*Bombus alpigenus (= B. wurflenii)*	Alpine bumble bee	ალპური ბაზი	VU	DO			P	H	
5	*Onychogomphus assimilis*	Dark Pincertail	მსგავსი ნემსიყლაპია	VU	P			P	H	
	TOTAL =36 species		ძუძუმწოვრები	**24VU+5 EN+3CR**	**13**	**0**	**8**	**27**	**18H; 9M; 5V;**	

Protected Areas

The Georgian Law "On the Protected Areas System" (7 March 1996), determines following categories for protected areas: State Nature Reserve, National Park, Natural Monument, Managed Nature Reserve, Protected Landscape, Multiply Use Protected Area, and protected areas included in international network - Biosphere Reserve, World Heritage Unit, Wetland of International Importance. The project area is situated in close proximity of the Kazbegi National park, status of which is equal to status of the protected area of II category according to IUCN Protected areas categories.



Map 4. Kazbegi National park – green polygons, compensation sites – red polygons

Kazbegi National Park is located on the northern slopes of the Caucasus Mountain Chain. The territory of Kazbegi Protected Areas is fragmented. More than 105 plots of different size and shapes, with a total area of 8707 hectares, are situated on elevations above1400 masl. The main aim of the protected area is to protect biodiversity and landscapes of high mountains in Central Caucasus. Administration of Kazbegi National Park manages the following territories: Kazbegi National Park - 8686.6 ha, with former Kazbegi Strict State Reserve as a core, Nature Monument of Sakhizari Cliffs - 335,7 ha, Nature Monument of the Abano Mineral Lake - 0,04 ha and Nature Monument of the Truso Travertine - 4,2 ha (http://www.apa.gov.ge/index.php?site-id=39&page=4&id=1). The Kazbegi National park was established according to the “Law about the status of protected area (საქართველოს კანონი "დაცული ტერიტორიების სტატუსის შესახებ)” #5486-I, issued by Parliament of Georgia 22 November 2007. Changes in size and

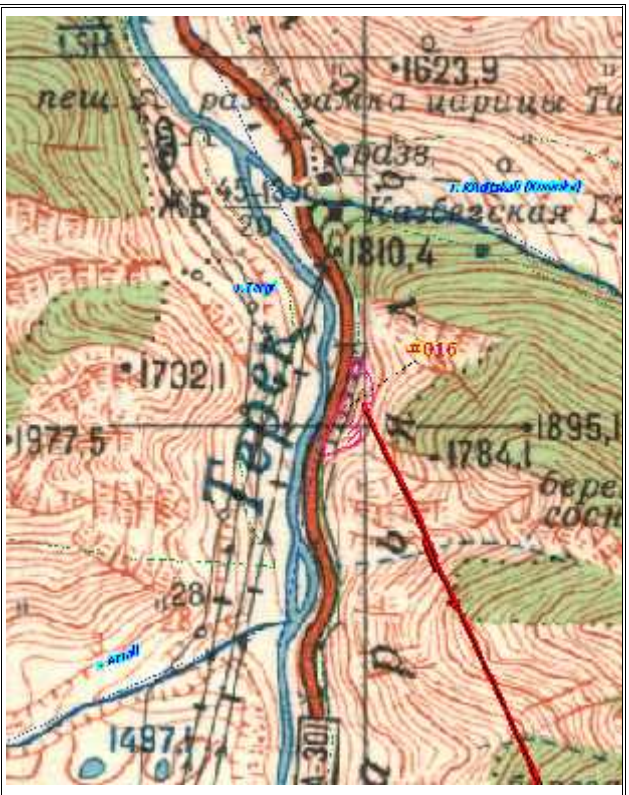
boundaries wee approved by the in law of Parliament of Georgia #5853, of 28 March 2012. In this Law it was amendment about the increasing area and establishment of above noted Natural Monuments.

A total of 8.77 ha land was allocated to "Dariali Energy" JSC for the construction of Dariali HPP on the basis of resolution #2247 of the government of Georgia of 18 November, 2011 "on allocation of 87,737m^2 of land of special designation under the State Forest Fund for the construction of "Dariali Hydro power plant on the territory on Kazbegi National Park". This land (three sites of total area of 8.77 hectares) is required for construction of headrace pipeline to headrace tunnel and tailrace tunnel outlet. The headrace tunnel itself will be constructed below ground and will not have any impact on surface land of National park.
These land plots areas follows:

1. Plot #246 (code 740113246) with an area of 3.76 ha at the beginning of the pipeline route immediately below the weir/dam;
2. Plot #015 (code 740115015) with an area of 3.28 ha which is one km away from the weir/dam site;
3. Plot No 16 (code 740115016) with an area of 1.73 ha is at the downstream end of the project.

Plots #246 and #015 are on the right bank of the Tergi River downstream of Stepantsminda town. The land along with some private land is required to build the first section of the water delivery system (a buried pipeline) for the Dariali HPP. The two pieces of National Park land are taken from a small fragment area of the park which is itself surrounded by private land. The two areas situated on elevation around of 1700 masl, are covered by secondary meadow and Sea-buckthorn groves. Plot #016 is at the downstream area on the elevation about of 1500 masl is covered by bushes. It will be used in operations for the switchyard and transformers. The land is immediately alongside the main road to the border and is between the road and step rock.

Map 5. Extracted sites #015 and #246



Map 6. Extracted sites #016

As compensation for the loss of these three small sites from the National Park three additional areas have been assigned Natural Monument status and included them in the protected area.

These are the Abano Mineral Lake, Truso Travertine and the Sakhizari Cliffs. Both together, Abano Mineral Lake and Truso Travertine, are two times smaller than extracted sites, but Sakhizari Cliffs (335.7 ha) is larger than extracted sites in more than 40 times, and are more better protected by the high elevations (2500-3100 masl) and by rough terrain.

Map 7. Sakhizari Compensation site

Map 8. Abano Lake and Truso Travertine

Section 4. Results of the Field Surveys

The main aims of the field study were identification of the animals' presence within the impact area of the Dariali HPP and determination of the zoological importance of the area affected by Dariali of HPP, of site extracted from the Kazbegi National Park and sites allocated for the park as compensation for extracted land. The field survey (4-8 October 2013) was done on the places of the above ground facilities (such as headworks, buried pipeline and sedimentation basin), within the floodplain of the river Tergi in section of the depleted flow and on sites #015, #016 and #246 extracted from Kazbegi National park as well as, on the Compensation sites Abano Mineral Lake, Truso Travertine and Sakhizari Cliffs. All these areas are farther referred to as a Study Area.

The survey was conducted along the river Tergi and lower reaches of its tributaries via trails and road. The habitat investigations were taking place by visual reconnaissance, as well by observing opposite slopes through binoculars. Important habitats and locations were marked with handheld GPS. Characteristic and important locations were photographed. Observation from points and during surveys-on-foot along the conventional transects were the main methods of field works. All found evidences of presence of any animal were fixed with photograph and GPS.

Besides, the Study area was investigated several times before the last field survey.

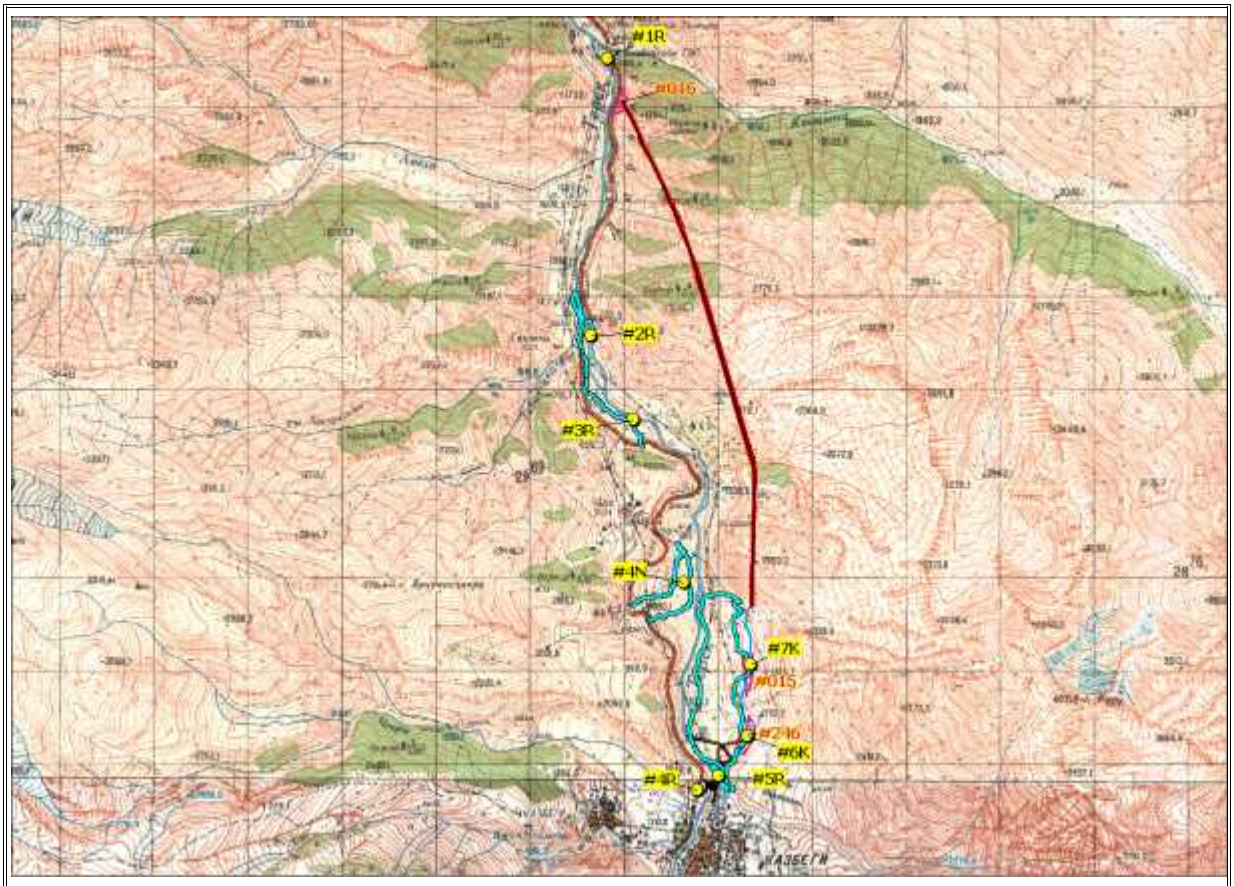
In process of EIA of the Kazbegi HPP, situated in the valley of the Khdistskali River, group of zoologists' experts visited the Dariali Pass two times (14-20 May and 4-8 June 2013). They have studied lower part of the impact area of the Dariali HPP – the confluence area of the rivers Tergi and Khdistskali. Apart from the theriologist (Dr. A.Bukhnikashvili – team leader) and ichthyologist (Dr. T.Kokosadze), the ornithologist (Dr. A.Abuladze), herpetologist (D.Bekoshvili) and entomologist (V.Petrov) have collected samples and data on the animals' presence and on habitats.

Moreover, areas of compensation sites within the Truso gorge and surroundings of the mountain Kabarjina were surveyed 15-24 July 2010 in frame of the project "The current status of biodiversity of the vertebrate animals in mountain regions (Great Caucasus) of Eastern Georgia" kindly supported by grant given to vertebrate lab of the Institute of zoology, Ilia State University, by Georgian National Science Fund of Rustaveli in 2010-2013. Results of this project published (Bukhnikashvili A., et al., 2013). Data of 2010-2013 can partly fill gaps in the results of the field survey of October 2013. Also, the scientific ornithological station of the Institute of Zoology of Georgian Academy of Sciences operated in the town Stepantsminda (Kazbegi) since 1975 till 1990 under leadership of Dr. A. Abuladze. Dr. A. Abuladze kindly provided own experience to authors of the report.

Timetable of the Field Survey

During our field survey on 4-8 October 2013, areas of proposed construction of the Dariali HPP were visited, as well as compensation sites

The right-hand bank of the Tergi river in the place where will be constructed the Project infrastructure are sufficiently covered by observation sites, taking into consideration survey carried out in the 2010-2013th.



Map 9. Field surveys on foot and observation points within the impact area of the Dariali HPP Project

Dark red line – diversion tunnels, Light blue line – diversion pipeline, Black polygon – headworks, Brown polygon – sedimentation basin, Orange line-flushing gallery and water spillway channel, Magenta hatched polygon – sites extracted from NP (#015, #016, #246), Green dashed line – border of the Kazbegi National park; Bright turquoise line – the surveys on foot , Yellow points – observation points

All the sites, pre-selected for zoological survey, were observed. 13 points were fixed with GPS and described in the field diary. Time of observations on each point was depending on the terrain, of an area location and of evidences of animal presence on it. Generally, it took from ten-twenty minutes up to several hour of the working time. Short surveys on foot were executed on every point of observation. The longer surveys on foot were executed in the places impassable for the car. In some places it was not much possibility to walk by foot because of very difficult rough terrain, in other places it was no necessity to make more surveys on foot because of well developed net of roads and of the population of human within the area of the Project. A length of the one survey is between several tens of meters and 8 km, total length of the 8 surveys on foot is around 19.2 km.

The zoological (in particular, ornithological and herpetological) investigations on 4-7 October 2013 were carried out in not proper time and in not favourable weather conditions. During all working days the weather was changeable, mainly windy, cold +5 - +15 ^{o}C, cloudy, with snow at night and light rains during the day time. Only, 5th October was sunny day.

Totally, during the fieldwork between 4th and 7th October, evidences of presence within the area of the consideration, were obtained for five species of mammals, at least 17 bird species, one species of reptiles and one amphibian species.

4-th October 2013

Transportation to town Stepantsminda (09:00-11:30);

Dariali Pass, river Tergi right-hand bank immediately above the Gveleti Bridge (Point # 2R) and the left-hand bank between the bridge and village Tsdo (# 3R). Middle part of the depleted flow site. Survey on foot about 1.9 km along the water edge in the Tergi River. Hydrobiological samples were collected in a few points. The bank was surveyed on the presence of the mammals' related with bank ecosystem and river water, like otter and water vole (*Arvicola terrestris*). Work time 12:10 – 17:30. Next - accommodation in the hostel; preparation for field works.

5-th October 2013

Field survey on two compensation sites – Truso Travertine Natural Monument and Abano Mineral Lake Natural Monument, which are situated at the village Ketrisi in Truso Gorge of the river Tergi upstream of the Kassara Jaws. Area of both compensation sites were surveyed on presence of any animals. Banks of the river Tergi were surveyed on the presence of the otter. Water in the Abano Mineral Lake (point #8A) was investigated on presence of benthos and plankton. Also, hydrobionts were collected on the left-hand bank of the river Tergi (point #6R). This point was selected as a control plot for future monitoring of hydrobionts biodiversity within the depleted flow area in Dariali Pass.

Two surveys on foot: 1 km at the Truso Travertine and about 600 m at the Abano Mineral Lake were executed, Observation are done on three points.

Time of observation 10:05 – 19:10;

6-th October 2013

Experts divided in two groups. The theriologist Dr. A. Bukhnikashvili and botanist Dr. D. Chelidze surveyed the compensation site Sakhizari Cliffs, and the ichthyologist Dr. T. Kokosadze with hydrobiologist worked in the river Tergi channel from the lower part of the study area – downstream of the tailrace tunnel outlet (Point #1R), up to the headworks of the Dariali HPP.

One survey on foot (about 8 km of length) was done in the compensation site Nature Monument of Sakhizari Cliffs

Survey on foot about 2.3 km of length and one observation point situated at the water's edge in place where river is branching were done on the left-hand bank of the river Tergi in vicinities of the village Tsdo. The bank was surveyed on the presence of the otter. Hydrobiological samples were collected at the point #4N.

Also, the construction site of the headworks was surveyed on both side of the river Tergi
Short survey on foot was done on banks of rivers Kuro and Tergi – about 130 m. The bank was surveyed on the presence of the otter. Hydrobiological samples were collected

Time of observation 10:10 – 18:30;

7-th October 2013

The theriologist Dr. A. Bukhnikashvili surveyed the sites extracted from the Kazbegi National Park #246 and #015 and right-hand bank of the river Tergi from the Stepantsminda town to the village Tsdo and river Kuro confluence place with Tergi River. One survey on foot, about 5.3 km was executed from the headworks location across both extracted sites and along the right-hand bank of the river Tergi. The area was surveyed on evidence of presence mammals, birds and reptiles occurring on the sites. The river bank was surveyed on the presence of the mammals' related with bank ecosystem and river water, like otter and water vole (*Arvicola terrestris*).

The ichthyologist Dr. T. Kokosadze with hydrobiologist worked in the river Tergi channel. They together with the hired local fisherman attempted to catch fish by a cast net in different places.
Time of observation 10:05 – 18:35;

8-th October 2013
Interview with locals and transportation to Tbilisi (13:00 -15:30);

Survey findings
The main results of observations (sites, data/time, GPS-data, elevation, number of animal species, with some short descriptions of visited locations, comments, etc.) are presented below. The terrain altitudes and coordinates of each observation point (latitude/longitude) are taken by the GPS Garmin Oregon and Magellan. The coordinates are given in the projection: UTM, WGS 84 for zone 38 of Northern hemisphere in metric mode. Time, generally, shows the moment of the observation start on the point, but not exactly.

Sites visited during the field survey
4-Oct-13
Weather: cloudy, time to time - light rain, +8 - +9 ^{o}C
Points ## and coordinates:

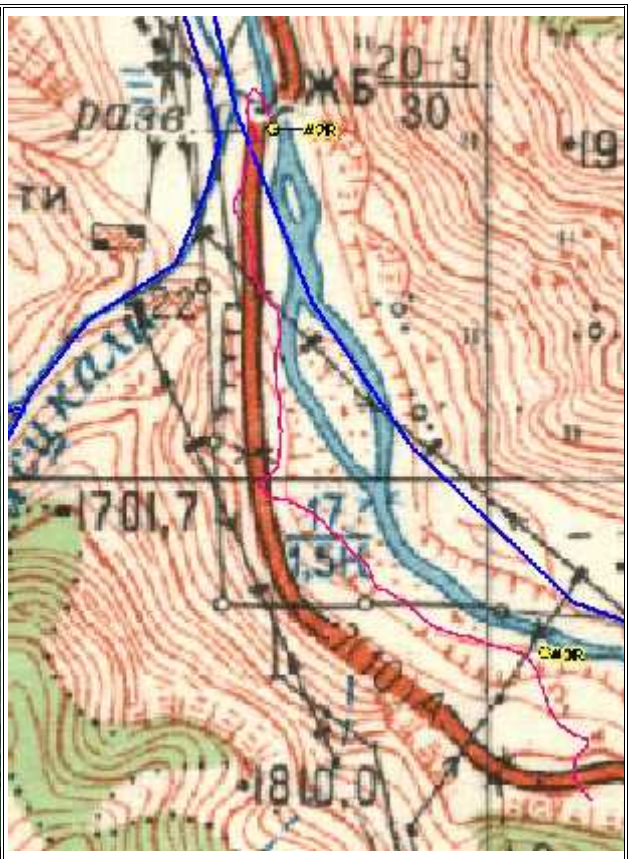
Point#	Time	Latitude	Longitude	Elevation
	4-Oct-13			
#2R	12:30	469499.83	4728680.50	1449
#3R	14:33	470020.96	4727681.25	1467

<u>*Site name and brief description:*</u> Dariali Pass, river Tergi right-hand bank immediately above the Gveleti Bridge (Point # 2R) and the left-hand bank between the bridge and village Tsdo (# 3R). Middle part of the depleted flow site. Survey on foot - about 1.9 km along the water's edge in the Tergi River. The point of confluence of the river Tibaistskali with the river Tergi downstream of the bridge was surveyed, also. Hydrobiological samples were collected in a few points. The bank was surveyed on the presence of the mammals' related with bank ecosystem and river water, like otter and water vole (*Arvicola terrestris*).


#2R river-bay, algae in the water


Point #2R Main current at the bridge

Survey on foot 4 Oct. 2013



Map 10. Survey on foot 4 Oct. 2013

The first river terrace is covered by remnants of the birch groves and by the degraded low grasses (secondary meadows) with sparse bushes and small suppressed trees. Small sites of the remnants of the secondary forest and bushes are located at the bottom of rocks within the floodplain.

Flow velocity is high on main current. The river-bed slope, generally, more than 3%. The bank is covered by pebble with large share of boulders.

At the point #2R in small river-bay, vascular water-plants and periphyton (or freshwater algae) on stones are fixed. Here were caught most of hydrobionts collected this day. One trout was observed from the bank.

The point #3R is located on the river Tergi left-hand bank in some downstream from the village Tsdo, within the future area of depleted flow. This observation point is placed at the water's edge. The bank was surveyed on the presence of the otter. Hydrobiological samples were collected. The floodplain is covered with secondary grassland. Banks are covered by pebble and large stones.

Animals:

No evidences of presence of the otter (*Lutra lutra*) were found.

One bird was recorded:

White Wagtail (*Motacilla alba*) – solitary bird;

One fish species was seen and visually determined in the river-bay with slow flow velocity:

Brown trout (*Salmo trutta),*

Hydrobionts:
Nematoda 3 specimens
Malacostraca 11 specimens
Ostracoda 9 specimens
Chironomidae 70 specimens
Trichoptera 2 specimens

5-Oct-13

Weather: Fair, slow wind, +14 - +15^{o}C

Points ## and coordinates:

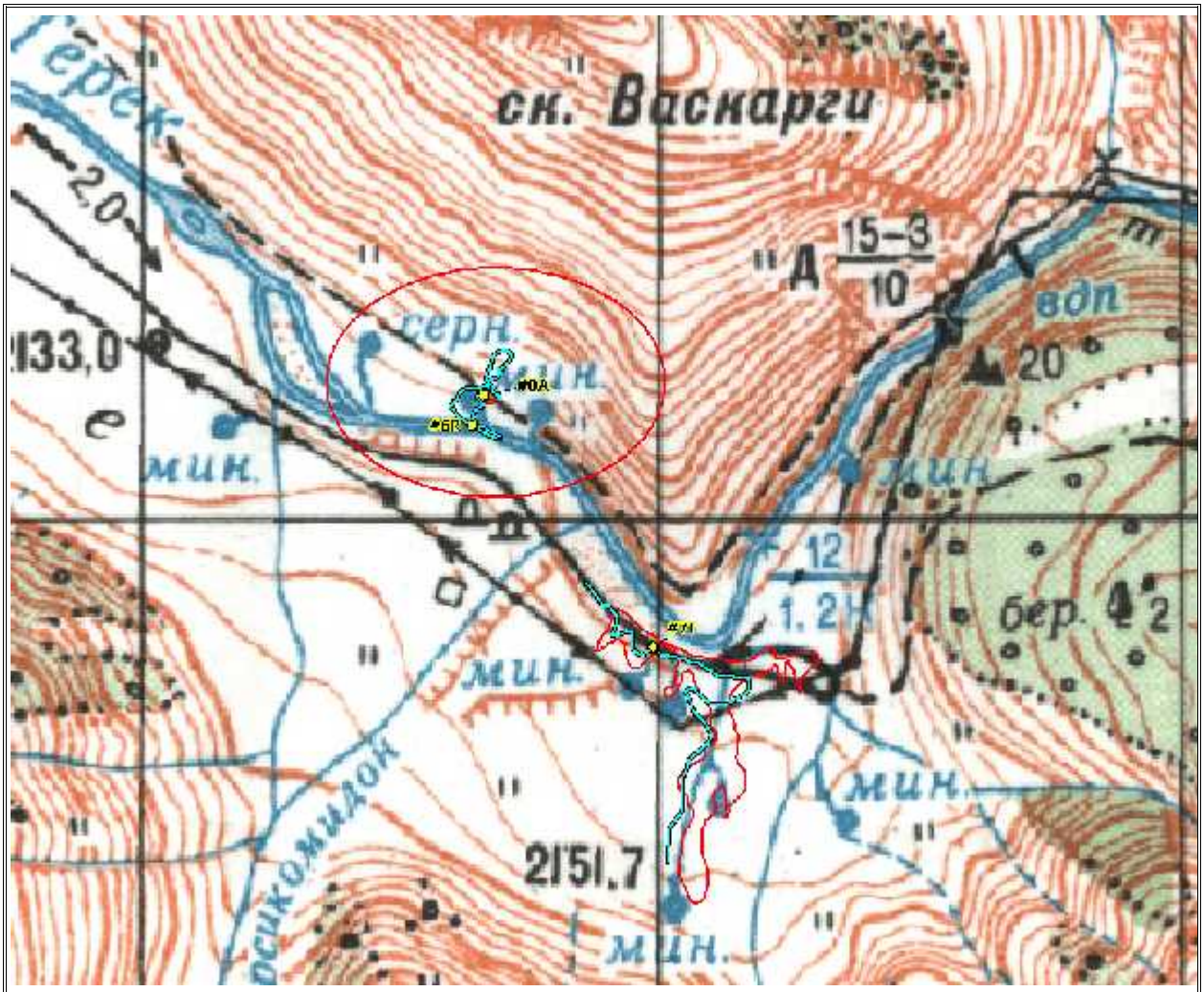
Point #	Time	Latitude	Longitude	Elevation
#7T	11:31	452897.30	4714769.83	2136
#8A	12:30	452571.03	4715252.01	2145
#6R	13:24	452550.00	4715193.03	2134

Site name and brief description:

Field survey on two compensation sites – Truso Travertine Natural Monument and Abano Mineral Lake Natural Monument, which are situated at the village Ketrisi in Truso Gorge of the river Tergi upstream of the Kassara Jaws. Terrain in surroundings of both these small compensation sites is covered with secondary grasslands used as pasture for local and transhumant livestock grazing. The remnants of the Caucasian high-mountain sub-alpine meadows, bushes and, krummholz one can find in dry ravines and on the slopes of mountains. Banks of the river Tergi were surveyed on the presence of the otter.

Truso Travertine Natural Monument

Vegetation cover on the Truso Travertine



Map 11. Survey on foot on compensation sites Abano Mineral Lake and Truso Travertine

The area of Truso Travertine Natural Monument is 4.2 ha. This site lies on the right-hand bank of the river Tergi, about 30 above the water's edge. Old car road crosses the Natural Monument. The surface of land presents limestone rock outcrop, covered with sparse grass. One survey on foot about 1 km of length was done, point #7T. Only one species was fixed – occasional visitor – small flock of the Eurasian Tree Sparrow (*Passer montanus*).

The Abano Mineral Lake Natural Monument lies on the opposite side of the river Tergi, in about 50 m above the water's edge (Point #8A). The area of the Natural Monument is 0.04 ha (less than normal backyard in Georgian villages!), actually, just water surface of the lake with narrow strip on banks are protected under status of Natural Monument (III category of IUCN). The surrounding areas comprise secondary meadow, pastures with rock outcrops. This site is lesser than Truso Travertine disturbed while road is not longer used. The high pressure of the grazing is still present.

The Abano Mineral Lake Natural Monument (2010th)

Hydrobionts collection point #8A (2013th)

Survey on foot, about 600 m of length, was done around the lake and on bank of the river Tergi. Footprints and burrow of red fox (*Vulpes vulpes*) and tracks of the stone marten (*Martes foina*), as well as burrows of four rodents were fixed during the survey. Nine bird species are recorded. The earthworms (Lumbriculidae) and larvae of insects (Chironomidae) were found in the mineral water of lake on the point #8A. No plankton organisms have been identified in the samples during the desktop treatment of collected material.

On the background - sheep herd at the Abano Lake

Tergi River bank, red arrow - point #6R

Next point of observation (#6R) was situated on the left-hand bank of the river Tergi, a little bit upstream from the place of confluence of small rivulet, which is flowing from the Abano Mineral Lake, with the river Tergi. This point was selected as a control plot for future monitoring of hydrobionts biodiversity within the depleted flow area in Dariali Pass. The bank of the river is covered by pebble. More than 120 specimens of seven different groups of benthic invertebrates were found there, No plankton organisms have been recorded

Animals:

No tracks of the otter (*Lutra lutra*) presence were found;

Red fox (*Vulpes vulpes*) - footprints and burrow

Stone marten (*Martes foina*) - tracks

Common Vole (*Microtus arvalis*) - burrows,
Daghestanian Vole (*Microtus daghestanica*) - burrows
Gudauri Vole (*Chionomys gud*) - burrows on rocks
Wood Mouse (*Sylvaemus fulvipectus*) – burrows

Nine bird species recorded:
Common Kestrel (*Falco tinnunculus*) - one bird
White Wagtail (*Motacilla alba*) – not counted
Grey Wagtail (*Motacilla cinerea*) – 3 birds
Black Redstart (*Phoenicurus ochruros*) – not counted
Twite (*Carduelis flavirostris*) – small flock, about 10 birds
Jay (*Garrulus glandarius*) – solitary bird
Red-billed Chough (*Pyrrhocorax pyrrhocorax*) – flock about 14-15 birds
Common Raven (*Corvus corax*) two birds

Hydrobionts:
in the mineral water of the lake Abano on the point #8A:
Chironomidae 4 specimens
Lumbriculidae 2 specimens

Invertebrates caught in the river Tergi on the point #6R:
Nematoda 8 specimens
Chironomidae 40 specimens
Simuliidae 3 specimens
Diptera (larvae) 2 specimens
Ephemeroptera 49 specimens
Trichoptera 16 specimens
Plecoptera 3 specimens

Den of the Red fox (*Vulpes vulpes*)

Fox footprints on the bank of Tergi river (point #6R)

	
Twite (*Carduelis flavirostris*) flock	Red-billed Chough (*Pyrrhocorax pyrrhocorax*) – flock

6-Oct-13

Weather: at the night - light snow, day - partly cloudy, windy, +9 - +10 ^{o}C (at #1R) to + 11-+13 C^{o} (at #4R and #5R)

Experts divided in two groups. The theriologist Dr. A. Bukhnikashvili and botanist Dr. D. Chelidze surveyed the compensation site Sakhizari Cliffs, and the ichthyologist Dr. T. Kokosadze with hydrobiologist worked in the river Tergi channel, in the lower part of the study area – downstream of the tailrace tunnel outlet (Point #1R), and in the upper part of the impact area, on the left-hand bank of the river, at the village Tsdo, and at the headworks of the Dariali HPP. Also, the last group (ichthyological) was engaged in searching of the tracks of the common otter (they are trained to find otter footprints and faeces).

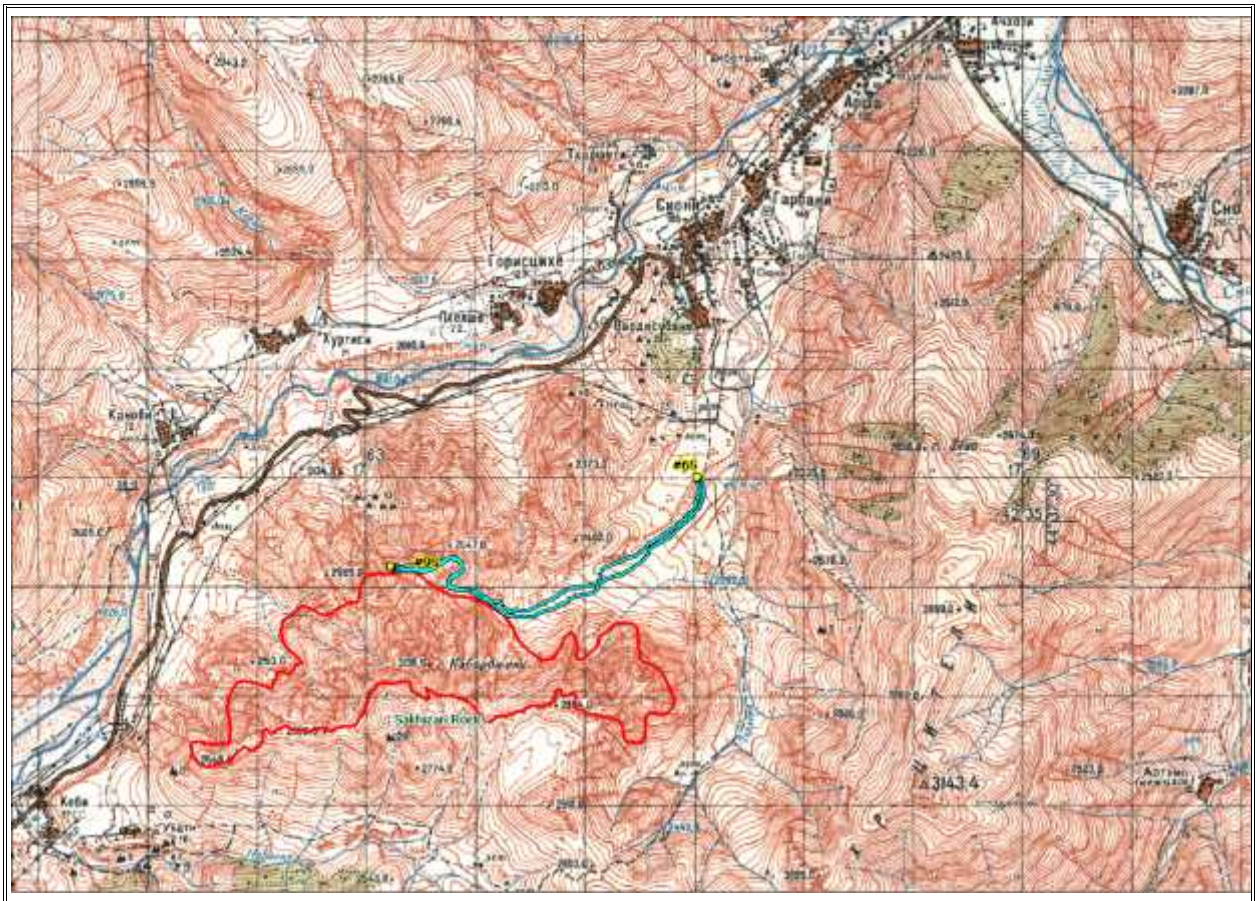
Points ## and coordinates on Sakhizari Cliffs:

Point #	Time	Latitude	Longitude	Elevation
#6S	10:10	465939.73	4715021.01	2052
#9S	14:15	463138.57	4714196.55	2390

Weather: at the night - snow, day - cloudy, strong wind, +9 - +10 ^{o}C

Site name and brief description: Compensation site Sakhizari Cliffs

The compensation site Nature Monument of Sakhizari Cliffs with area of 335.7 ha, is situated on the large, high mountain Kabarjina (3136 masl), with very rough terrain and natural vegetation. Press of livestock grassing is relative low. The upper reaches of the compensation site and its western part are covered with Caucasian high-mountain alpine meadows and Rhododendron bush thickets (point #9S). Lower reaches and the eastern part of the compensation site are covered with Caucasian high-mountain sub-alpine steppe-meadows (point #6S). This vegetation covers all sides of the Kabarjina Mountain from the river Tergi valley till the Rhododendron bushes belt.



Map 12. Sakhizari Cliffs Compensation site. Survey on foot.

According to information obtained during interview with locals, there are home-ranges of such protected species as are: Brown bear (*Ursus arctos*), Lynx (*Lynx lynx*) and Chamois (*Rupicapra rupicapra*), as well as wolves (*Canis lupus*) are known in this area.

One survey on foot about 8 km was executed on the northern edge of Sakhizari Natural Monument, first along the dry channel of temporary watercourse, a left tributary of the river Tarkhena, and next in rocks.

Point #6S sub-alpine steppe-meadow

Rocks

Animals:

Red fox (*Vulpes vulpes*) - footprints and burrow
Stone marten (*Martes foina*) – tracks, faeces
Common Vole (*Microtus arvalis*) - burrows,
Daghestanian Vole (*Microtus daghestanica*) - burrows
Gudauri Vole (*Chionomys gud*) - burrows on rocks
Wood Mouse (*Sylvaemus fulvipectus*) – burrows

Ten bird species were recorded:
Griffon Vulture (*Gyps fulvus*) – one bird in fly and sitting in the small cave
Golden Eagle (*Aquila chrysaetos*) – one bird in fly
Common Buzzard (*Buteo buteo*) - one bird
Hobby (*Falco subbuteo*) – solitary bird
Common Kestrel (*Falco tinnunculus*) – five solitary birds
Black Redstart (*Phoenicurus ochruros*) – not counted
Twite (*Carduelis flavirostris*) – small flock, about 8-9 birds
Eurasian Tree Sparrow (*Passer montanus*) - small flock, no counted
Red-billed Chough (*Pyrrhocorax pyrrhocorax*) – flock about 20 birds
Common Raven (*Corvus corax*) - two birds

Golden Eagle (*Aquila chrysaetos*)

Griffon Vulture (*Gyps fulvus*)

Points ## and coordinates within river Tergi channel:

Point #	Time	Latitude	Longitude	Elevation
#1R	11:05	469743.00	4731524.00	1297
#4N	12:44	470550.06	4725944.45	1551
#4R	16:27	470696.96	4723733.20	1717
#5R	17:45	470625.00	4723894.00	1708

Site name and brief description: the confluence point of Tergi and Khdistskali Rivers

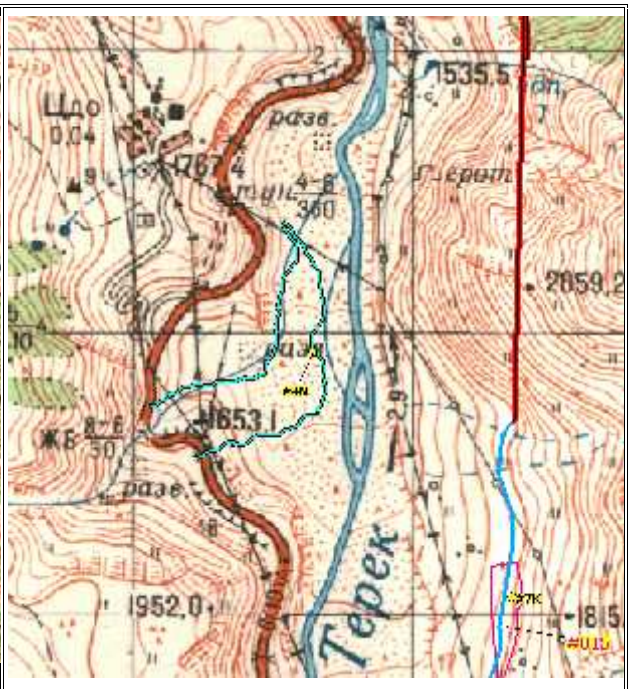
Point #1R is a first station within Dariali Pass this day. It is situated on the river Tergi right-hand bank, about 200 meters above the confluence point of Tergi and Khdistskali Rivers. Flow

velocity is high on main current. The bank is covered by pebble and boulders. Within floodplain and on the first river terrace, the riverine vegetation cover derivatives and the degraded low grasses (secondary meadows) with sparse bushes are spread. The bank was surveyed on the presence of tracks of otter. Attempt to collect hydrobiological samples in main current was done.

River Khdistskali, May 2013

River Amali, June 2013

Map 13. Observation point #1R



Map 14. Survey on foot 6 Oct 13 Point #4N

Animals: no tracks of otter's presence were found.

Three bird species were recorded:

White Wagtail (*Motacilla alba*) – not counted.

Grey Wagtail (*Motacilla cinerea*) – not counted

Common Blackbird (*Turdus merul*a) – one bird

Reptile:

Caucasian Lizard (*Darevskia caucasica*) – not counted

Amphibians:

Eurasian Marsh Frog (*Pelophylax ridibundus*) – not counted

Hydrobionts:
Neither plankton, nor benthos was found in the main stream of the river.

Site name and brief description: Tergi left-hand bank

Dariali Pass, river Tergi left-hand bank in vicinities of the village Tsdo, within the future area of depleted flow. Survey on foot about 2.3 km of length and one observation point situated at the water's edge in place where river is branching were done. The bank was surveyed on the presence of the otter. Hydrobiological samples were collected at the point #4N. The first river terrace is covered by remnants of the birch groves. The floodplain is covered with secondary grassland. Current in the branching channels is slower than in main stream. One can see periphyton on stones in such places. Banks are formed of pebble.

River Tergi at the village Tsdo

River Tergi at the village Tsdo

Animals: no tracks of otter's presence were found.

Two bird species were recorded:

White Wagtail (*Motacilla alba*) – not counted

Grey Wagtail (*Motacilla cinerea*) – not counted

Amphibians:
Eurasian Marsh Frog (*Pelophylax ridibundus*) – not counted

Hydrobionts:
No plankton organisms were found in the main stream of the river.
Benthos: Chironomidae 5 specimens.

Site name and brief description: Headworks construction site

The construction site of the headworks was surveyed on both side of the river Tergi. Observation point #4R is situated at the point of confluence of the river Chkheri with the river Tergi, on the right-hand bank of the last. The next observation point (#5R) was situated on the left-hand bank of the Tergi, 150 m upstream from the point of confluence of the river Kuro with the river Tergi. Flow velocity is high on main current. In less than one hundred meters downstream from the headworks construction site, the river is branching and flow velocity become slower. River Tergi banks are formed by pebble with great share of boulders. The river Kuro flows through the alluvium cone (talus train) formed by pebble and gravel with debris of rocks. The first river

terrace and floodplain are covered by degraded low grasses (secondary meadows) with sparse bushes, small suppressed remnants of the riverine vegetation.

Map 15. Survey on foot at the headworks

River Kuro

Short survey on foot was done on banks of rivers Kuro and Tergi – about 130 m. The bank was surveyed on the presence of the otter. Hydrobiological samples were collected at the point (#5R).

Animals: no tracks of otter's presence were found.

Two bird species were recorded:

White Wagtail (*Motacilla alba*) – not counted

Grey Wagtail (*Motacilla cinerea*) – not counted

Amphibians:
Eurasian Marsh Frog (*Pelophylax ridibundus*) – not counted

Hydrobionts:
No plankton organisms were found in the main stream of the river.
Benthos:
Chironomidae 3 specimens

Ephemeroptera 33 specimens
Plecoptera 4 specimens

7-Oct-13

Weather: Fair, slow wind, +12 - +13^{o}C

Experts divided in two groups. The theriologist Dr. A. Bukhnikashvili surveyed the sites extracted from the Kazbegi National Park #246 and #015 and right-hand bank of the river Tergi from the Stepantsminda town to the village Tsdo and river Kuro confluence place with Tergi River.

The ichthyologist Dr. T. Kokosadze with hydrobiologist worked in the river Tergi channel. They together with the hired local fisherman attempted to catch fish by a cast net in different places. The group moved from lower reaches upstream.

Then both groups were teamed up and displaced upstream of the impact zone and Stepantsminda town, to the river Snostskali confluence with river Tergi. In this place, river Tergi is branching, and as it is known to locals, in this place the local herd of trout is more or less constant. The only recorded trout was caught and released in Snostskali River.

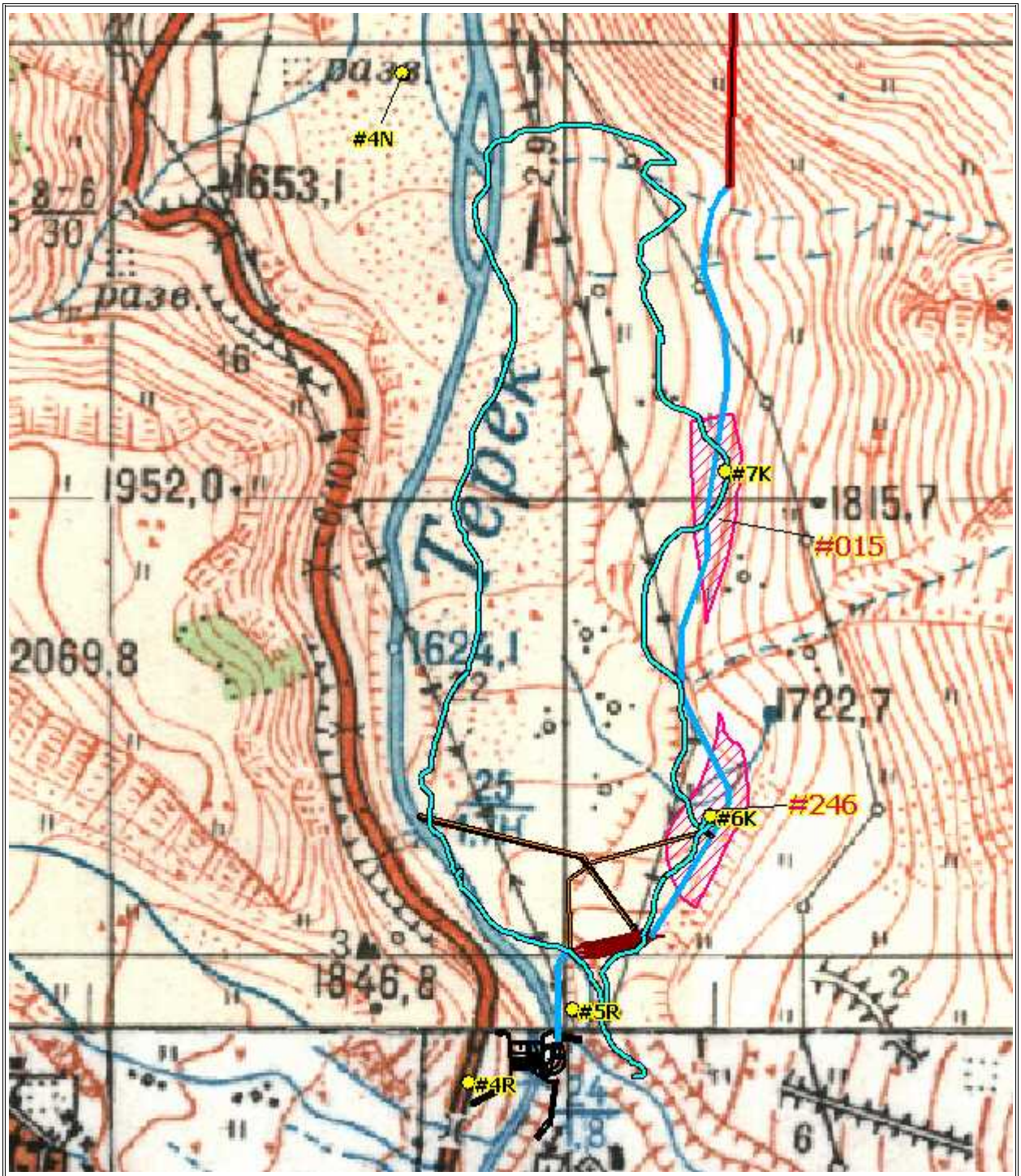
Points ## and coordinates:

Point #	Time	Latitude	Longitude	Elevation
#6K	11:10	471227.00	4724317.00	1709
#7K	12:35	471259.13	4725070.31	1721

Site name and brief description: Sites extracted from the Kazbegi National Park (#246 and #015). Construction corridor of the headrace pipeline is situated in both these sites. Construction site of the sedimentation basin and water spill canal from the basin to the river were inspected, too. One survey on foot, about 5.3 km was executed from the headworks location across both extracted sites along the headrace pipeline to the inlet of the headrace tunnel, after this to the river and along the right-hand bank of the river Tergi upstream to the mouth of the river Kuro. The area was surveyed on evidence of presence mammals, birds and reptiles occurring on the sites. The river bank was surveyed on the presence of the mammals' related with bank ecosystem and river water, like otter and water vole (*Arvicola terrestris*).

Extracted site #246

River Tergi floodplain at extracted sites



Map 16. Survey on foot on the extracted sites 7 Oct. 2013; Theriologist

The study area is located on the flattened erosional-denudational piedmont of the mountain Kuro, on old terrace of river Tergi valley. Both extracted sites and a larger part of the surveyed area are covered with degraded low grasses (secondary meadows) with sparse bushes and small suppressed trees of a Sea-buckthorn, of a Dog rose and a Barberries'. This area is for a long time pasture for the livestock of the inhabitants of the town Stepantsminda.

On the first terrace and at the water's edge, there are thicket of bushes and remnants of the secondary forest with admixture of Birch-trees. The bushes as well are used as pasture.

Animals:

Red fox (*Vulpes vulpes*) - burrow

Common Vole (*Microtus arvalis*) - burrows,
Daghestanian Vole (*Microtus daghestanica*) – burrows
Gudauri Vole (*Chionomys gud*) - burrows on rocks
Wood Mouse (*Sylvaemus fulvipectus*) – burrows

Eight bird species were recorded:
Common Kestrel (*Falco tinnunculus*) - one bird
Common Shrike (*Lanius collurio*) – 5 birds
Black Redstart (*Phoenicurus ochruros*) – not counted
Common Blackbird (*Turdus merul*a) – one bird
Water Pipit (*Anthus spinoletta*) – not counted
White-winged Snowfinch (*Montifringilla nivalis*) – 3 birds
Eurasian Tree Sparrow (*Passer montanus*) - small flock, not counted
Red-billed Chough (*Pyrrhocorax pyrrhocorax*) – flock about 20 birds

Extracted Site #015

Burrow of common voles

Ichthyologist, Dr. T.Kokosadze, with hydrobiologist and hired local fisherman, had done endeavor to catch fish using the cast net. In the previous days the landing net was used unsuccessful. The group moved by car from lower reaches of the impact zone at the point #1R up to town of Stepantsminda. They attempted to catch fish on all sites visited in the previous days. River channel and river banks are described above. The attempts were unsuccessful, too.

At 16 o'clock they united with other members of the experts' group, and had moved upstream of the town Stepantsminda, to the place of confluence of the river Snostskali with the river Tergi. After the confluence with the river Snostskali, river Tergi is branching on flattened, wide valley with well developed floodplain, covered by bushes and trees. Brown trout forms here more or less valuable population.

One adult trout was caught and released in the 17:35.
No tracks of otter were seen. No hydrobionts were collected.

	
River Tergi above the Stepantsminda town	Fishing process. Hired fisherman trawls the cast net

Section 5. Comparison of Sites Extracted from National Park vs. Compensation Sites

Extracted sites

A total of 8.77 ha land was allocated to "Dariali Energy" JSC for the construction of Dariali HPP on the basis of resolution #2247 of the government of Georgia of 18 November, 2011. The headrace pipeline to headrace tunnel and tailrace tunnel outlet will be constructed on following sites:

1. Plot #246 (code 740113246) with an area of 3.76 ha at the beginning of the pipeline route immediately below the weir/dam;
2. Plot #015 (code 740115015) with an area of 3.28 ha which is one km away from the weir/dam site;
3. Plot No 16 (code 740115016) with an area of 1.73 ha is at the downstream end of the project.

Plots #246 and #015 are on the right bank of the Tergi River downstream of Stepantsminda town. The land along with some private land is required to build the first section of the water delivery system (a buried pipeline) for the Dariali HPP. The two pieces of National Park land are taken from a small fragment area of the park which is itself surrounded by private land. The two areas situated on elevation around of 1700 masl, are covered by secondary meadow and Sea-buckthorn bushes. Plot #016 is at the downstream area on the elevation about of 1500 masl is covered by bushes. It will be used in operations for the switchyard and transformers. The land is immediately alongside the main road to the border and is between the road and step rock.

The Caucasian upper-mountain erosional-denudational landscape with pine forests and birch groves (133) was covering the bottom of the river Tergi valley within the Dariali pass from the village Pansheti to the Russian border.

All sites extracted out the Kazbegi National park (#246, #015 and #016) are situated within the landscape, which one can note as "Caucasian upper-mountain erosional-denudational landscape with pine forests and birch groves". This ecosystem was spread on the bottom of the river Tergi valley within the Dariali pass from the town Stepantsminda till the Russian border. This area in surroundings of Stepantsminda is treeless, covered with degraded low grasses (secondary meadows) with sparse bushes and small suppressed trees. Small sites of the remnants of the secondary forest and bushes and birch groves located at the bottom of rocks on the extracted site #016.

There cannot be large areas of the key-habitats of the endangered mammals within the Construction Area itself and within the sites extracted from National park.

Presence of five species is confirmed via direct observations and by tracks. Information on other four species is obtained during interview of locals. Two most common species - fox (*Vulpes vulpes*) and stone marten (*Martes foina*). Their presence is confirmed by footprints on extracted sites (#246 and #015). Presence of the most attractive mammals: East-Caucasian tur (*Capra cylindricornis*) and chamois (*Rupicapra rupicapra*) are known form published issues and from interview with locals. The East-Caucasian tur was seen by authors on the rocks above the tailrace tunnel outlet (close to extracted site #016) during the field survey in the May, 2013. The upper parts of the rocks which are occupied by East Caucasian tur and chamois, are considerable higher on the slopes than bottom of the Dariali Pass, and thus can not be considered as extracted site, and affected by the construction or operation of the Dariali HPP. As well, Otter is not recorded on sites extracted out of National park.

In result of an analysis of the published issues and field visits, the extracted sites are not defined as those having an important significance from the mammals' biodiversity preservation standpoint.

For the impact assessment only breeding bird species are of interest. Migrating species and occasional visitors have enough space to avoid negative impact. Breeding avifauna of the extracted sites is similar to those of the Dariali Pass area, with excluding of synanthropic and river-related species. About 12 common and abundant bird species are nesting on secondary meadows and on rocks above its. The Project area (Dariali Pass and extracted sites) is of importance for one listed in NRDL bird species local breeder the Bearded Vulture. The nest of this bird, situated on the high rock close to the tailrace tunnel at the extracted site #016, was seen in May of 2013. One can consider this bird as affected of the construction only conventionally, while the nest is on 200-250 m above the road, and adult bird with one younger was observed during the site visits.

Noteworthy is a venomous snake – the Dinnik's Viper (*Vipera dinniki*), which was fixed within the impact area, at the workers camp, near the extracted site #016, two times: in 2010 and 2013-th years. The Dinnik's Viper is only species of reptilian found in the study area, which is listed in the National Red Data list. Some individuals of this adder can be killed by workers or will be run over by a car. Personal of working crew should be instructed to how they must deal with the snakes. Harm to snake population in the Dariali Pass will be insignificant in case of implementation of proper mitigation measures.

The field survey was done on the sites #015 and #246 extracted from Kazbegi National park 7 October 2013. Construction corridor of the headrace pipeline is situated in both these sites. Both sites have length about 300 m and wide about 100-130 m. One survey on foot, about 300 m across each extracted site along the headrace pipeline was executed. The area was surveyed on evidence of presence mammals, birds and reptiles occurring on the sites. This area is located on the flattened erosional-denudational piedmont of the mountain Kuro. Both extracted sites and a larger part of the surrounding area are covered with degraded low grasses (secondary meadows) with sparse bushes and small suppressed trees of a Sea-buckthorn, of a Dog rose and a Barberries'. This area is for a long time pasture for the livestock of the inhabitants of the town Stepantsminda.

The following animals were fixed on the extracted sites during the site visit:
Red fox (*Vulpes vulpes*) - footprints and burrow
Stone marten (*Martes foina*) – tracks, faeces
Common Vole (*Microtus arvalis*) - burrows,
Daghestanian Vole (*Microtus daghestanica*) – burrows
Major's pine vole (*Microtus majori*)
Gudauri Vole (*Chionomys gud*) - burrows on rocks
Wood Mouse (*Sylvaemus fulvipectus*) – burrows

Eight bird species were recorded:
Common Kestrel (*Falco tinnunculus*) - one bird
Common Shrike (*Lanius collurio*)
Black Redstart (*Phoenicurus ochruros*) – not counted
Common Blackbird (*Turdus merul*a) – one bird
Water Pipit (*Anthus spinoletta*) – not counted
White-winged Snowfinch (*Montifringilla nivalis*) -3 birds
Eurasian Tree Sparrow (*Passer montanus*) - small flock, no counted
Red-billed Chough (*Pyrrhocorax pyrrhocorax*) – flock about 20 birds

The both three extracted form the Kazbegi National Park sites (#015, #016 and #246) can be referred as a natural habitat (in terms of the EBRD Performance Requirement - PR6) just conventionally. Character of vegetation (secondary meadows and bushes) and still continuing grazing of livestock are forcing ones to consider it rather as a modified habitat, than as a natural. The secondary meadow is overgrazed by the sheep and cattle. Grazing intensity is maximal during the transhumance sheep moving to summer pastures and back. Shrubs and screes in surroundings are in a better state. Lack of protection measures makes these sites de-facto non protected territory and not valuable for biodiversity protection.

Compensation sites

As compensation for exclusion of the three small sites from the National Park three additional areas has been assigned Natural Monument status and included them in the protected area. These are the Abano Mineral Lake (0.04 ha), Truso Travertine (4.2 ha) and the Sakhizari Cliffs (335.7 ha). Both together, Abano Mineral Lake and Truso Travertine, are two times smaller than extracted sites, but Sakhizari Cliffs is larger than extracted sites in more than 40 times, and are more better protected by the high elevations (2500-3100 masl) and by rough terrain.

The Compensation sites are of two different nature and significance for biodiversity conservation.

The Abano Mineral Lake and Truso Travertine are small mineralogical features of terrain. They are situated in close proximity of village Ketrisi and of the car road running to this village. This area is under human population influence for a long time. Terrain in surroundings of both these small compensation sites is covered with secondary grasslands used as pasture for local and transhumant livestock grazing. The remnants of the Caucasian high-mountain sub-alpine meadows, bushes and, krummholz one can find in dry ravines and on the slopes of mountains.

The area of Truso Travertine Natural Monument is 4.2 ha. This site lies on the right-hand bank of the river Tergi, about 30 above the water's edge. Old car road crosses the Natural Monument. The surface of land presents limestone rock outcrop, covered with sparse grass. One survey on foot about 1 km of length was done, point #7T.

With exception of rodents (wood mice and voles), two most common species - fox (*Vulpes vulpes*) and stone marten (*Martes foina*) are dwelling in surroundings of the compensation site Abano Lake. No other species, more or less important from biodiversity conservation standpoint, are using these sites regularly.

The compensation sites are different from bird ecology standpoint, also. Two sites within the Truso gorge (Abano Lake and Truso Travertine) are situated within the open valley of the river Tergi on the relative plane terrain, covered with secondary meadow. These sites are small and easy accessible for humans, feral and shepherds dogs and other raptors. No bird nests were found on both these sites. About 18 species were recorded there during breeding season here. Probably, their nests are situated in surrounding (rocks, river banks, and bushes) and birds use the sites as feeding grounds. Among these 18 species, 12 were recorded during ornithological excursions in last decades, and 6 species are known from published issues and birder reports. No one of recorded there bird species is protected by law, are Common Kestrel (*Falco tinnunculus*) and Peregrine Falcon (*Falco peregrinus*).

Field survey on two compensation sites – Truso Travertine Natural Monument and Abano Mineral Lake Natural Monument, which are situated at the village Ketrisi in Truso Gorge of the river Tergi upstream of the Kassara Jaws, was done 5 October, 2013.

On the Truso Travertine Natural Monument only one species was fixed – occasional visitor – small flock of the Eurasian Tree Sparrow (*Passer montanus*).

The Abano Mineral Lake Natural Monument lies on the opposite side of the river Tergi, in about 50 m above the water's edge (Point #8A). The area of the Natural Monument is 0.04 ha, actually, just water surface of the lake with narrow strip on banks are protected under status of Natural Monument. The surrounding areas comprise secondary meadow, pastures with rock outcrops. This site is lesser than Truso Travertine disturbed while road is not longer used. The high pressure of the grazing is still present.

Survey on foot, about 600 m of length, was done around the lake and on bank of the river Tergi. Footprints and burrow of red fox (*Vulpes vulpes*) and tracks of the stone marten (*Martes foina*), as well as burrows of four rodents were fixed during the survey. Nine common and quite abundant bird species are recorded. No protected by law species were seen over there.

The compensation site Nature Monument of Sakhizari Cliffs with area of 335.7 ha, is situated on the large and, high Kabarjina Mountain (3136 masl), with very rough terrain and natural vegetation. Press of livestock grassing is relative low. The upper reaches of the compensation site and its western part are covered with Caucasian high-mountain alpine meadows and Rhododendron bush thickets. The lower reaches and the eastern part of the compensation site are covered with Caucasian high-mountain sub-alpine steppe-meadows. This vegetation covers all sides of the Kabarjina Mountain from the river Tergi valley till the Rhododendron bushes belt.

Among mammals the most common species are rodents, fox (*Vulpes vulpes*) and stone marten (*Martes foina*). The large mammals are known form published issues and from interview with locals. So, locals listed chamois (*Rupicapra rupicapra*), wolf (*Canis lupus*), Brown bear (*Ursus arctos*) and lynx (*Lynx lynx*) as occurring on Sakhizari Natural Monument. The Sakhizari compensation site is only place, which could be considered as having significance for mammals as home-range and feeding area. The wolf, brown bear and lynx (according to locals) occur there.

The avifauna of this area is rich in comparison with both other compensation sites. During number of ornithological excursions since 1988 year totally 21 species were recorded during breeding season. Noteworthy species, which are nesting on elevations higher than 2500 masl, - Gueldenstaedt's Redstart (*Phoenicurus erythrogaster*) and Caucasian Great Rosefinch (*Carpodacus rubicilla*). Within the study area, only here are known endemic Galliformes: Caucasian Snow Cock (*Tetraogallus caucasicus*), Caucasian Black Grouse (*Tetrao mlokosiewiczi*). The nests of the large birds-of-prey: Bearded Vulture (*Gypaetus barbatus*), Griffon Vulture (*Gyps fulvus*) and Peregrine Falcon (*Falco peregrinus*) are known in this area. All of above noted species with exception of Caucasian Snow Cock and Peregrine Falcon are listed in the Georgian National Red Data List (2006) as threatened species. Other species noteworthy species are Eurasian Sparrowhawk (*Accipiter nisus*) and Peregrine Falcon (*Falco peregrinus*). The Compensation site Sakhizari is of importance for five bird species included in the National Red Data list, which have nests on this site. These species are as follows: Bearded Vulture, Griffon vulture, Caucasian black grouse, Gueldenstaedt's redstart, Caucasian Great Rosefinch. Ten other protected by law species use the mountain Kabarjina and Sakhizari as a stop-over site during migration. Surroundings of this area contain a foraging area of year-round visitor species - Golden Eagle.

Based on all available data, only the Sakhizari Natural Monument compensation site can be considered as the site, which has significance from the birds' biodiversity preservation standpoint.

One survey on foot about 8 km was executed on the northern edge of Sakhizari Natural Monument in 6 October 2013.

The following animals were fixed on the extracted sites during the excursion:

Red fox (*Vulpes vulpes*) - footprints and burrow

Stone marten (*Martes foina*) – tracks, faeces

Common Vole (*Microtus arvalis*) - burrows,

Daghestanian Vole (*Microtus daghestanica*) - burrows

Gudauri Vole (*Chionomys gud*) - burrows on rocks

Wood Mouse (*Sylvaemus fulvipectus*) – burrows

Ten bird species were recorded:

Griffon Vulture (*Gyps fulvus*) – one bird in fly and sitting in the small cave

Golden Eagle (*Aquila chrysaetos*) – one bird in fly

Common Buzzard (*Buteo buteo*) - one bird

Hobby (*Falco subbuteo*) – solitary bird

Common Kestrel (*Falco tinnunculus*) - one bird

Black Redstart (*Phoenicurus ochruros*) – not counted

Twite (*Carduelis flavirostris*) – small flock, about 8-9 birds

Eurasian Tree Sparrow (*Passer montanus*) - small flock, no counted

Red-billed Chough (*Pyrrhocorax pyrrhocorax*) – flock about 20 birds

Common Raven (*Corvus corax*) - two birds

In conclusion one can see, that the larger one compensation site Sakhizari Cliffs, can be considered as a Critical habitat in terms of the EBRD performance standards. It contains: home-ranges of Critical Endangered and Endangered species (Lynx, Chamois etc.), there are populations of narrow-ranged Vulnerable species, is important for number of migratory birds, and this area is rich in biodiversity of animal species. Two smaller compensation sites Abano Mineral Lake and Truso Travertine are mineralogical Natural monuments, but they can not have any importance in biodiversity conservation, because of small size and while they are surrounded by pasture (See Table 9).

Table 9. Comparison matrix

Sites under consideration / EBRD PR-6 criteria	Impact area - Dariali Pass	#246 Extracted site	#015 Extracted site	#016 Extracted site	Compensation site Abano Lake	Compensation site Truso Travertine	Compensation site Sakhizari -
high biodiversity value	no	no	no	no	no	no	**yes**
importance to the survival of endangered or critically endangered species	no	no	no	no	no	no	**yes**[2]
importance to endemic or geographically restricted species and sub-species	**yes** [3]	no	no	no	no	no	**yes**[4]
its importance to migratory or congregatory species	**yes**	no	no	no	no	no	**yes**
supporting assemblages of species associated with key evolutionary processes	no	no	no	no	no	no	no
supporting biodiversity of significant social, economical or cultural importance	no	no	no	no	no	no	no
importance to species that are vital to the ecosystem as a whole (keystone species)	no	no	no	no	no	no	no
	2	0	0	0 -	0	0	**4**

[2] Brown Bear (EN),
[3] Dinnik's viper,
[4] Caucasian Black Grouse and Caucasian Snowcock, possible, Kazbeg Birch Mouse (*Sicista kazbegica*) and Long-Clawed Mole-Vole (*Prometheomys schaposchnikovi*)

Section 6. Recommendations

On this stage of work it is possible to offer only general recommendations. It is necessary to carry out the detailed pre-construction survey in the field in area of the projected NHPPC to define all objects those are sensitive to impact of NCHPP construction and operation. Only after this it will be possible to produce the detailed recommendations for mitigation measures.

Conclusion

According to key performance standards of the European Bank of Reconstruction and Development (EBRD) the Performance Requirement - PR6 which covers Biodiversity Conservation and Sustainable Management of Living Resources is a key document for this assessment. EBRD PR-6 defines types of habitat as natural, modified or critical.

The Tergi river valley within the Dariali Pass (the impact area) and thus both three extracted form the Kazbegi National Park sites (#015, #016 and #246) can be referred as a natural habitat just conventionally. Character of vegetation (secondary meadows and bushes) and still continuing grazing of livestock are forcing ones to consider it rather as a modified habitat, than as a natural.

The Critical habitats are defined in EBRD PR-06 by:

- its high biodiversity value;
- its importance to the survival of endangered or critically endangered species;
- its importance to endemic or geographically restricted species and sub-species;
- its importance to migratory or congregatory species;
- its role in supporting assemblages of species associated with key evolutionary processes;
- its role in supporting biodiversity of significant social, economical or cultural importance to local communities; and
- its importance to species that are vital to the ecosystem as a whole (keystone species).

1. As one can see this area is not rich in biodiversity of animal species, and can not be considered as area having high biodiversity value.

2. This area contains one nest of one Vulnerable bird species Bearded Vulture (*Gypaetus barbatus*), and is of importance for population integrity of the one Vulnerable fish species - Brown Trout (*Salmo fario*) (as it written in the law – see Table 8). Two Endangered species of mammals Brown Bear (*Ursus arctos*) and Chamois (*Rupicapra rupicapra*) are reported in interview of locals as visitors to this area as well as Vulnerable East Caucasian Tur (*Capra cylindricornis*), which was seen by authors on the rocks above the tailrace tunnel outlet. Both Critical Endangered bird species - the Sacker (*Falco cherrug*) and Lesser Kestrel (*Falco naumanni*), as well as two Endangered bird species - Red-footed Falcon (*Falco vespertinus*) and Common Crane (*Grus grus*) are migratory species, which appear within the impact area only during spring and autumn passage. The third Endangered bird Cinereous Vulture (*Aegypius monachus*) is known as year-round visitor to this area, not related with this site in some important moments of life. So, as one can see, this site (the Project area) is not fully appropriate to the second criteria of the Critical habitat definition.

3. The Project area is situated within the ranges of distribution of following endemic and narrow ranged Vulnerable species: Kazbeg Birch Mouse (*Sicista kazbegica*), Long-Clawed Mole-Vole (*Prometheomys schaposchnikovi*), and Dinnik's viper (*Vipera dinniki*). Only last one is found within the impact area, both other do not occur within the impact area. Some individuals of this adder can be killed by workers or will be run over by a car. Personal of working crew should be instructed to how they must deal with the snakes. Harm to snake population in the Dariali Pass will be insignificant in case of implementation of proper mitigation measures. No changes in habitat quality, which can harm this species, are expected in results of the project.
4. The Project area is important for number of migratory birds, including Vulnerable Common Crane, especially during hard weather condition, but Dariali HPP construction and operation will not have negative impact on these species – no large habitat loss or changes are expected.
5. This area is not supporting assemblages of species associated with key evolutionary processes;
6. No significant social, economical or cultural importance to local communities is depending on the biodiversity in this area.
7. No animal species, which are of vital importance to the ecosystem as a whole (keystone species), are depending in their life-style on this area.

As one can see, the Dariali Pass, river Tergi section with depleted water flow and sites, extracted from the Kazbegi National Park (#015, #016 and #246) can not be fully considered as the Critical Habitat, according to the key performance standards of the European Bank of Reconstruction and Development.

In case of proper implementation of the mitigation measures, the negative impact on populations of the protected by law species could be minimized to the acceptable level and will not lead to irreversible changes in biodiversity of the region.

As for compensation sites – Abano Mineral Lake, Truso Travertine and Sakhizari Cliffs – the larger one, Sakhizari Cliffs, can be considered as site, which can be noted as a Critical habitat in terms of the EBRD performance standards. It contains: home-ranges of Critical Endangered and Endangered species (Lynx, Chamois etc.), there are populations of narrow-ranged Vulnerable species, is important for number of migratory birds, and this area is rich in biodiversity of animal species. Two smaller compensation sites Abano Mineral Lake and Truso Travertine are mineralogical Natural monuments, but they can not have any importance in biodiversity conservation, because of small size and while they are surrounded by pasture.

Section 7. References and Attachments

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