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Adjaristsqali Georgia LLC

TRANSMISSION GRID STRENGTHENING PROJECT

CONSTRUCTION OF AKHALTSIKHE - BATUMI 220KV POWER TRANSMISSION LINE

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT REPORT

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WB - World Bank

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Introduction

The Government of Georgia, acting through Ministry of Energy and the Georgian State Electrosystems (GSE), would like to strengthen grid access for South Western Georgia by constructing a 220 kV double circuit overhead power transmission line (OHL), connecting the sub stations in Akhaltsikhe and Batumi. The new transmission line will ensure more stable electricity supply in the region, reducing outages and enable the GSE to meet the growing demand for electricity, as well as enhance export opportunities. The new transmission line will also allow the planned hydropower plants on the Adjaristsqali River, the 178 MW Shuakhevi HPP and the 150 MW Koromkheti HPP, under development by Adjaristsqali Georgia LLC, to be connected to the grid.

Adjaristsqali Georgia LLC (AGL), is a special purpose vehicle/company set up for the development of the Adjaristsqali Hydropower Cascade after Clean Energy Invest AS (CEI, Norway), through competitive tender, was awarded the rights to develop the hydropower potential of the Adjaristsqali River and its tributaries in the Autonomous Republic of Adjara. The company AGL is presently owned by Clean Energy Invest AS (Norway), Tata Power International (India) and InfraVentures (IFC, a member of the World Bank Group). Considering that AGL will benefit from the construction of the transmission line, the company has agreed with the GSE and the Government of Georgia to fund the development of the engineering and environmental studies required for the construction of the 220 kV Akhaltsikhe-Batumi OHL, whereas the construction works are to be financed from the World Bank loan. The Mott MacDonald Ltd (UK) has been assigned to undertake the engineering design for the transmission line and DG Consulting Ltd (Georgia) has been assigned to conduct the Environmental and Social Impact Assessment (ESIA). The GSE will be responsible for the construction and operation of the 220 kV OHL and will own the line. The GSE will also be responsible for land acquisition. AGL's responsibility for developing the project will end when the technical and environmental studies are approved/accepted by the GSE. Construction of the OHL will be part of the World Bank financed Transmission Grid Strengthening (TGS) project.

The ESIA report was developed based on Terms of Reference issued to DG Consulting by AGL in June 2013. The ToR, scope and content of the ESIA have been refined during the scoping stage consultations and are reflected in the scoping report. This ESIA report is structured in accordance with the ToR, Georgian regulations and the WB OP4.01 Annex B.

Legal and Regulatory Requirements

The ESIA process has been undertaken in compliance with the relevant national and international requirements. The Law of Georgia on Environmental Impact Permit (2008) sets out the legal basis for issuance of an environmental permit, including implementation of an ecological examination, public consultations and community involvement in the processes. Granting of permission or refusal to issue a permit is based on examination of environmental documents presented to the Ministry of Environment and Natural Resources Protection (MoE) by the project proponent. Paragraph 6 of the law requires the project proponent to organize a public discussion of the ESIA prior to submission of the final version documentation to the Ministry.

TGS project is also required to meet the World Bank safeguard policies, including OP/BP 4.01 *Environmental Assessment*, OP/BP 4.12 *Involuntary Resettlement*, and OP 4.36 *Forests*. Decision on triggering of OP/BP 4.04 *Natural Habitats*, OP 4.09 *Pest Management*, OP/BP 4.11 *Physical Cultural Resources*, and OP/BP 47.50 *Projects on International Waterways* will be taken at a later stage of the project preparation. OP/BP 4.37 *Safety of Dams* is triggered although the TGS project does not finance construction/operation of dams. The reason for triggering this policy is that Adjaristskali Cascade Project includes construction of two high dams, and this project is associated with the World Bank financed TGS project.

The ESIA was also based on the World Bank Group's EHS General Guidelines and EHS Guidelines for Electric Power Transmission and Distribution, as technical reference documents with general and industry-specific examples of Good International Industry Practice. When one or more members of the

World Bank Group are involved in a project, these EHS Guidelines are applied as required by their respective policies and standards. In line with Georgian environmental legislation and standards, the new *Draft Sector Guidelines on EIA: Electric Power Transmission and Distribution* (prepared by Dutch consultants by the request of Georgian Ministry of Environment) have been used during the preparation of this ESIA.

In terms of technical standards and regulations, the OHL is designed according to EN 50341-1-2012 (Euro-Norms). This European Standard applies to new overhead electric lines with nominal system voltages exceeding AC 1 kV and with rated frequencies below 100 Hz. The design also considers *Rules of Installation of Electric Equipment - ПУЭ,* used by the GSE (Ministry of Energy, 1987).

In addition to the above standards, the GSE is following the regulations set up in the Presidential Decree #964 (dated 27 December 2009) *On the Protection Procedures for Electricity Grid Linear Facilities and Determination of its Protective Zones*. This document sets/regulates the procedures for the protection of power lines including the parameters (area, distances, width, clearances) of the safety zones, access roads, Right of Way (RoW) in forests and other treed/vegetated areas, conditions for locating/constructing buildings (other facilities) and conducting works in these protective/safety areas.

Environmental Screening and ESIA Process

Screening of the project has been undertaken to evaluate the need of conducting an ESIA study and the level of study. The screening stage was concluded based on the requirements of the Georgian legislation and the World Bank requirements.

According to the Law of Georgia on the Environmental Impact Permits (2008, Chapter II, Clause 4.1.k), projects related to construction of the high voltage transmission lines (above 35 kV) are subject to the State Ecological Examination and Environmental Impact Permitting (as a part of Construction Permit), and thus require a full scale ESIA.

According to the World Bank's OP/BP 4.01, an environmental screening of the project has been undertaken to classify it into a relevant environmental category, and to determine the appropriate extent and type of Environmental Assessment (EA) needed. Based on screening exercise undertaken at the pre-feasibility and routing study stage (including visual assessment and check-lists), it has been concluded that the TGS project involves substantial new construction and some sections of the transmission line are crossing green-fields and sensitive environmental areas (forests). The project has the potential to cause adverse impacts on the community and on the environment. It is clear that project implementation is associated with the need for private land acquisition with the possibility of affecting households and assets, and maybe with the need for physical relocation. So the project may impact sensitive areas and has the potential to have diverse types of environmental and social effects. Therefore, the TGS project is classified as environmental **Category A.** Its preparation requires conduct of a full scale ESIA, a public participation process that involves consultations at least at two stages of the EA process, and development of a Resettlement Policy Framework and Resettlement Action Plans (RAPs).

Public Participation

The Stakeholders Engagement Plan (SEP) for the OHL is prepared as a stand-alone document to document consultation efforts linked to the ESIA process and define a strategy to maintain an adequate stakeholder engagement throughout the life of the project, including a public grievance redress mechanism. The public consultation process for the construction of OHL started with initiation of scoping for the ESIA in June-July 2013. Scoping process considered meetings with the MoE, Ministry of Energy/GSE, meetings with regional (Autonomous Republic of Adjara, Samtskhe-Javakheti Region), municipal and local authorities (Akhaltsikhe, Adigeni, Keda, Khulo, Shuakhevi, Khelvachauri, Batumi), several NGOs and affected communities along the transmission line route. The various engagement and disclosure activities have been undertaken for the Project and are planned ahead during the disclosure period (tentatively January-February 2014). Project stakeholders consultation activities are reflected in a Minutes of the Meetings, and the outcomes considered (feedback) in this

ESIA report. The major concerns that were raised during scoping meetings in Tbilisi, Akhaltsikhe, Adigeni, Keda, Khulo, Shuakhevi, Khelvachauri and Batumi fell into several major categories:

Environmental:	-	Concern about impacts on flora and/or fauna, forests.
	-	Concerns about the potential impacts on landscapes and views.
Social:	-	Concern about potential health effects of high-voltage transmission lines
	-	Concern about having to relocate to a house farther away from the line.
	-	Concern about damage to existing houses from derelict towers.
Economic:	-	Concern that construction/maintenance could damage crops or affect grazing.
	-	Concern about loss of land to foundations and towers and to access roads.
	-	A desire that local workers be hired for construction and maintenance
	-	Concern about impacts on recreation at Beshumi new resort area
Cultural:	-	Concerns about impacts on the monuments and cemeteries.

Present draft ESIA report is now disclosed through the GSE's web page for public feedback. Consultation meetings on the draft ESIA report will be held in the capital city of Tbilisi and within the project area, where local stakeholders and people directly affected by the OHL construction will be able to participate. the ESIA report will then be finalized and re-disclosed.

Sensitive Environmental and Social Receptors and Potential Impacts

The TGS project area covers corridor from Akhaltsikhe towards Batumi through Goderdzi pass and Skhalta and Adjaristsqali rivers and finishes in Chorokhi valley below the confluence of Adjaristsqali and Chorokhi rivers. The OHL corridor avoids protected areas located in the mentioned part of Georgia, it passes in 9 km distance (closest distance) to Borjomi Kharagauli National park, which is located north from Akhaltsikhe. The project corridor also avoids Mtirala National park. The shortest distance to the park territory equals 2.7 km, in reality there is ridge separating national park from the project corridor. Because the project corridor mainly follows Skhalta and Adjaristsqali rivers, it is also away from a recently established National Park of Machakhela. As a result of screening and scoping process, it is concluded, that the project does not affect any legally protected areas. In terms of internationally recognised areas - about 10 km long lower section of the 150 km OHL RoW falls within the important international migratory corridor of birds, out of which the potential impacts of the OHL construction and operation may be significant within 5-6 km segment, where birds are known to fly closer to the earth surface.

Although being far from the protected areas, the Akhaltsikhe-Batumi transmission line passes through several sensitive forested areas and alpine meadows, where habitats have been carefully studied to identify receptors' sensitivity, avoid fragmentation and properly select relevant mitigation. The adverse environmental impacts of the proposed OHL construction will be generated by land clearance for RoW, earthworks for tower foundations and transportation of materials. The adverse social impacts of the OHL construction activities in populated areas will be related to land acquisition for towers foundation (which is minimized through avoiding the settlements), short term disturbances caused by noise, emissions, disruption of traffic patterns and limitation of access to sites, traffic safety etc. Usually, adherence to common good construction practices is sufficient for minimizing impacts. For sensitive environmental sites where magnitude of impacts and consequences are relatively high, specific protective, mitigation and offset measures are proposed.

Project Alternatives

Alternatives to the proposed transmission line were evaluated to determine whether they were reasonable and environmentally and socially preferable to the proposed action. The alternatives considered include the no-action alternative, alternative systems, design alternatives, route and tower location alternatives.

Under the **no-action alternative**, the OHL would not be constructed and all direct environmental and social impacts associated with construction and operation of the proposed electric transmission lines would be avoided. Planning and design of the section from Akhaltsikhe to Batumi started in 80-ies aiming to eliminate the Batumi “dead-end” through connecting it to Akhaltsikhe and making system grid more effective and reliable. However, after 1992 the construction became impossible due to political events in Georgia, and these plans have been postponed. So it is already more than 20 years of “no action” undergo. At the same time it is clear, that without the electric transmission infrastructure, the AGL and the GSE would not be able to provide electrical energy produced at the Adjaristsqali Cascade Hydropower Scheme (in particular Shuakhevi HPP, Koromkheti HPP, which are already under construction) to surrounding communities, Georgian grid and for the export to Turkey. So the consequences of “no-action” alternative for the proposed OHL project should be considered only in conjunction with “no-action” for the entire Adjaristsqali Cascade Hydropower Scheme, which is approved and already under construction.

The **system alternatives** are alternatives to the proposed actions that would make use of other existing, modified, or proposed electric transmission systems to meet the objectives of the TGS project. In this particular case the proposed OHL is related to elimination of the Batumi “dead end” of the grid, simply to “close” the system circuit, and also related to the construction of new HPPs in the area where the required power transmission capacities do not exist at all, and the new lines should be constructed anyway, simply to deliver produced power to the grid.

This TGS Project will be an integral part in the development of the Georgian State electricity grid. This work will provide a safe and secure link between Batumi and Akhaltsikhe whilst also allowing future connections to other area of Georgia such as in the north and far eastern side of the country. Two key positive effects of this work will be: secure provision of electricity to people even in the winter months and the generation of substantial sums of money from electricity sale to Turkey and the associated taxes that eventually filter back into the Georgian communities, which will help to ensure the sustainable social development of the area.

Two types of transmission line design, an underground cable and overhead transmission line can be considered for part or all of the transmission lines’ routes. As a **design alternative,** an underground cable system, though visually appealing in the long run, will cause more disruption during construction and decommissioning as it will involve a larger area for excavation and hence greater negative environmental and socio-economic impacts, especially in residential areas. In addition the line ROW runs through the areas prone to erosion and landslides in Zemo Adjara, making any extensive excavation activities in the area highly disruptive. So the reasons why underground options are not considered as alternatives to the project are, firstly, of technical nature, given the technical difficulties and complexity in terms of the safety and reliability of an underground line, secondly, due to significant cost, and thirdly, because the damage to environment from the trenching/earthworks and ancillary infrastructure required for underground cable is times higher than from OHL solution. These limitations are the reason why this type of project is not carried out in Georgia and is very seldom in Europe. Even for the section which has some potential to interfere with birds’ migratory route the cable alternative has been considered as having more significant impact comparably to impact on birds. The potential impact on birds may be effectively and more easily mitigated comparably to impact of continuous trenching onto geo-hazards in the area specially known for being prone to landslides.

There have been a large number of factors considered for selecting the **routing alternative and tower positions**. These factors include but not limited to: consideration of geotechnical, environmental and archaeological constraints and where the areas of natural parks, areas of scenic or historic value or posing geological hazards have been avoided; consideration of the most direct line possible to be taken, where sharp changes in direction should be avoided, with the minimum number of angle supports placed; consideration that the route line should follow natural lines created by topographic change, geology and vegetation that will help to minimise the visual impact. The project engineers have evaluated tower locations for the preliminary route and considered non-environmental factors such as the preferred and maximum spacing between the towers, as well as, environmental and social factors including avoiding or minimizing impacts to the local communities and agricultural lands.

Two alternative routes have been evaluated for the first section of the OHL at Akhaltsikhe (Zikilia) Substation between AP01 to AP05 - the Southern Alternative and the Northern Alternative (Alternative 1.1 and alternative 1.2 consistently). Eventually the Northern Alternative has been selected because it ensures that the **visual impacts** and **impact on communities** population will be significantly less for the entire operations of the line, i.e. entire lifetime of the project.

Two alternative routes have been proposed during the routing study for the section AP37 – AP60. One passes through Skhalta Gorge (Alternative 2.1). and the second follows unnamed gorge located between Skhalta and Adjaristskali rivers (alternative 2.2). The northern alternative route through the unnamed valley crosses non-impacted natural forest, which is the only area considered as a **natural habitat** remaining between Skhalta and Adjaristskali valleys. Based on reference sources and information collected at stakeholder consultations, the southern alternative through Skhalta valley (2.1) was chosen as a preferable alternative and is therefore being pursued.

Two alternative routes have been considered in the section from v.Otanaskhevi to v.Zamleti (AP 47 – AP 60; alternatives 3.1 and 3.2), which is located on south alternative section through Skhalta river gorge (2.2). The analysis of alternatives at this section clearly indicates that despite more difficulties in construction and slightly higher cost, the Alternative-3.1 has advantages in terms of reduction of river crossings, impact on **flora** and **fauna, social impact** on communities**,** impact **on landscapes and visibility,** as well as impact on **geo-hazards**.

There are two alternative routes considered for the last section (AP155–AP160; Alternatives 4.1 and 4.2) where the OHL approaches Batumi Substation. Considering the request of the local administration and population, expressed at the public consultation meeting in Khelvachauri, as well as number of **affected households,** the Alternative 4.2 has been developed along the right bank of Chorokhi River. Both alternatives are generally acceptable from environmental point of view, but may differ with respect to potential impacts on bird migration and requirements for land acquisition. Further evaluation of the environmental and social impacts and costs of their mitigation under these two options will be undertaken based on more detailed information that will be available at the detailed design stage.

Project Description

The OHL will start from existing Akhaltsikhe 500/400 kV back-to-back substation and will connect to existing Batumi 220 kV substation. The total length of the line is about 150 km and it will be a double-circuit line with Aluminium-cold Steel Reinforced (ACSR) conductors and an Optical Ground Wire (OPGW). Activities envisaged by the project include right-of-way acquisition, land clearing, arrangement of access roads to the towers/poles where required, construction of foundations and towers, stringing – installation of conductors, insulators, other equipment. Various features/sections of the project are located in each of the following municipalities: Akhaltsikhe, Adigeni, Khulo, Shuakhevi, Keda, Khelvarchauri and Batumi. The final design is based on the outcomes of the routing study, geo-technical and cadastral surveys, towers spotting and the present ESIA. The construction cost is estimated to be around 40 million USD.

The Routing Study has been undertaken in 2012-2013 to identify a preferred corridor for the construction of a proposed 220 kV overhead line connecting Akhaltsikhe and Batumi substations. The main considerations during the selection of route corridor were: the ease with which the route can be accessed for construction and maintenance; the constructability of the line taking into account the topography; environmental constraints; minimization of social impacts and ground conditions, including areas prone to landslides. The transmission line corridor practically follows the main river gorges, where the most population and infrastructure are concentrated. The corridor passes the plateau area in vicinity of Akhaltsikhe city located to the south from lesser Caucasus ridge. Then the corridor continues west, crosses the highland section near to the Beshumi Ski Resort and dives into the Skhalta River gorge. The corridor follows Skhalta River down to confluence with Adjaristskali River and after follows the river and main road down to Batumi, where overhead line will be connected to the existing substation in Batumi. The proposed corridor uses an existing line (called the 110 kV “Adigeni-Beshumi”) corridor for approximately 11 km of the route (east of Beshumi). Short sections of OHL are parallel to the public road. The tower heights will be at a minimum distance from the edge of road equivalent to the height of the tower.

Tower spotting work has been undertaken following the topography survey/walkover and in collaboration with the environmental and social constraints mapping. The concept developed largely avoids built up areas, thus minimizing the need for private land acquisition and resettlement. The line route itself has been chosen to avoid settlements and their associated infrastructure as well as tourist areas. The land parcels for pole foundations will be acquired and will become property of the GSE. Each tower needs up to 200 square meters of land dedicated for construction of foundations. The OHL route is designed in a way to go over the minimal number of living houses. However, excluding such incidence is not possible and the exact number of affected houses will be known once the detailed design of the OHL is produced. Houses and land plots falling within the RoW will have to be vacated. Relocation and compensation will be carried out following the guiding principles and compensation methodology provided in the Resettlement Policy Framework (RPF) and according to the site-specific Resettlement Action Plans (RAPs). Parcels required for installation and stringing will be impacted only for short period of time, accordingly the land parcel will be temporarily used and the compensation will be paid only for temporary damage if such happens as per the project's Resettlement Framework and corresponding Resettlement Action Plan. The significant number of parcels required for the positioning of poles is located on the State owned land, particularly forest land. For these parcels full topography information will be submitted to the National Forestry Agency (under the MoE) in order to exclude them from the State Forest Fund and transfer it to the GSE.

The transmission line towers will have around 300-400 m spans on average, be approximately 35 meters high, and require around 50-200 m^2 area for the foundation (depending on location, at steep slopes the bigger area may be required). The ROW of a transmission line includes land set aside for the transmission line and associated facilities, land needed to facilitate maintenance, and to avoid risks of fires and other accidents. It provides a safety clearance between the high-voltage lines and surrounding structures. The proposed OHL will require average 65-meter-wide RoW. The span will be determined during the design in order to ensure the line will maintain a minimum vertical clearance of 8.0 m from ground obstructions, roads, or trees.

During construction of the line the access roads will be used to bring workers and materials to the tower sites to conduct tree-cutting operations (where needed), construct foundations, assemble and raise the towers and install/string the conductors. Some local roads used by the local population and quite well-established will be partially used as access roads for the proposed line. Where needed, clearing for new access roads will be 4 to 5 meters wide.

Once constructed, the transmission line will require minimal maintenance. Yearly visual inspection of the OHL towers and conductors is expected to remove tree or branches where these start to grow too close to the OHL. The operation and maintenance of the transmission line will be based on accepted international standards. The GSE has its own specific procedures for the operation and maintenance of its lines.

ESIA Methodology

This ESIA addresses all the areas affected by the construction of the transmission line related to all phases of the project. The evaluation of impacts is proportionately based on an assessment of their extent (local/regional/national), duration (short, medium or long term effects) and reversibility (temporary or irreversible effects). The ESIA study has been undertaken in compliance with Georgian laws and requirements, international best practice including World Bank and the IFC standards and relevant WBG Guidelines and is covering the entire planned route including ancillary facilities/infrastructure such as access roads, substations, camp sites, etc.

This impact assessment accounts for all of the activities involved in the project, and describes direct, indirect and cumulative impacts on physical, biological and social-economic-cultural resources at the construction, operation and maintenance phases of the project. The following baseline data collection/survey methods have been applied and actions undertaken:

1. The study area has been defined from 500 m to 1000 m along the RoW centre line, wide enough to include all the territories likely to be significantly affected by the Project.
2. All relevant national and local agencies have been contacted to collect information on the baseline environment and sources of data and information on the existing environment are adequately referenced.
3. The desk study reviews and field reconnaissance/surveys were used in order to ensure the complex analysis of data collected and verification during the field surveys.

4. The social studies include collection of information via field surveys (general questionnaires) in all municipalities crossed by the power line or supporting infrastructure (access roads);
5. Visits by the environmental team to the line corridor in July-September 2013 for in-depth study of the physical and biological resources based on outcomes of the scoping stage and finalising the identification of potential receptors.

Detailed field works have been undertaken to study Flora in the project corridor. On the first stage (scoping stage), the entire OHL corridor was walked through by the botanists to provide general description of vegetation cover. It was followed by the second session of field surveys, when zones with similar ecosystems/ habitats were identified. The outcome of second assessment was used for production of Flora Constraints Maps passed to Engineers and used during the fine tuning of project corridor. The representative parcels in each zone were selected for detailed description of plant species, communities and vegetation coverage; the later was assessed using Drude's methodology. In total 35 parcels were described in detail for the corridor. Special attention was dedicated to the forested areas, as the significant part of the corridor is covered with different type of forests.

The detailed field works for Fauna baseline and impact assessment included rapid and detailed field surveys, Rapid survey was conducted through the walk over of entire project corridor and identification of most important and sensitive areas. The outcome of rapid assessment was used for production of Fauna Constrains Maps used during the fine tuning of project corridor. Later on detailed investigations of sensitive areas were conducted in order to identify the areas of high likelihood to impact sensitive fauna species. Transact method was used on this stage for identification animals vital activity signs.

Two detailed bird studies were accomplished prior to the ESIA stage in order to cover bird migration periods and identify sensitive areas in terms of migratory birds and especially raptors. Findings of mentioned studies plus surveys carried out in sensitive spots, created good basis for further impact analysis.

The following **direct/primary** impacts have been identified and analysed during the assessment:

- effects on land uses, people and property, geological features and characteristics of soils, fauna and flora, air quality, hydrology, uses of the water environment, acoustic environment (noise or vibration) - have been described and where appropriate quantified;
- effects on locations or features of cultural importance are described;
- effects on landscapes, on views and viewpoints are described and partially illustrated;
- effects on demography, social and socio-economic conditions in the area are described;
- effects on human health and welfare are described and where appropriate quantified (e.g. health risks arising from major hazards associated with the Project, changes in living conditions, effects on vulnerable groups).

The ESIA also covers any **indirect, secondary, cumulative, short-, medium- and long-term, permanent and temporary, reversible and irreversible, beneficial and adverse impacts** of the proposed OHL Project, determining their significance. For each major receptor the level of sensitivity has been determined and assessed together with parameters of impact consequences (such as extent, intensity, duration, probability) to evaluate overall significance of each particular impact. For each major receptor, with relevant possible impacts considered, the corresponding generic and specific mitigation measures are identified for the design, construction and operations phases of the Project. All these mitigation measures with corresponding monitoring are reflected in the Environmental and Social Management Plan.

Baseline Data

The baseline study of the conditions of physical, biological and socio-economic environment along the OHL route comprises outcomes of the desk review of publically available literature/studies/reports and the field survey of environmental and social components, which were considered sensitive to the proposed development.

Physical Environment - In terms of geology and geohazards - prominent feature of deposits in the project region is high erosion potential, especially due to action surface runoffs. This imposes high landslide risk in steep slope areas. Many new and relict landslides are recorded during the Routing Study (Mott MacDonalds, 2012). This is of particular importance for the OHL section between the Beshumi and Khelvachauri, which is known for steep slopes. Great number of active, relict and potential landslides is recorded on this section during Routing Study; many of them are large-scale. Winds blowing along the Adjaristskali River valley predetermine good ventilation and high quality of the air. The only sources of noise in the project area are – rivers and the road. No industrial sources of noise/vibration are available. Major land use types in the area are agricultural, which could be encountered along the entire project corridor. This comprises croplands, as well as meadows for *mowing* or pasture.

Biological Environment - In terms of **flora** the Caucasus biodiversity hotspot supports a large number of endemic plant species, where the unique biodiversity of this area is threatened by forest clearing, illegal hunting and plant collecting. There are no specific restrictions for development or human activities within the hotspot boundaries, however high sensitivity of the area itself has been considered during the environmental constraints mapping for routing/design and during the preparation of ESIA. As it has already been mentioned, the OHL line corridor avoids protected areas located in South-West part of Georgia. The desk study was conducted during the Summer 2013 followed by the field works for reconnaissance of proposed route 500-1000 m wide corridor inclusive the alternatives. The field work has clarified available information regarding the flora species within the corridor. The **habitats** are changing very rapidly in V shape deep gorges of Adjaristskali and Skhalta rivers. Within the proposed corridor practically all different types of habitats are observed, starting from riparian forests located near to the rivers, mixed forest covering the sharp slopes and alpine meadows at the tops of forested slopes. As a result of detailed botanical investigation of project corridor, five plant species included **in the Georgia Red List** were identified in the designed project corridor: *Juglans regia L., Ostrya carpinifolia Scop., Buxus colchica Pojark., Castanea sativa Mill., Ulmus glabra Hudds*. There are also few populations of some rare, endangered and endemic species in the project corridor. In terms of **fauna** the most important impact is expected on avifauna/birds and especially migratory birds, however impact on small mammals should be also considered during the construction period.

The ESIA has identified number of spots with medium and high sensitivity to flora and fauna species. In terms of flora species the highly sensitive areas are related either to alpine meadows or forests. Approximately 40km of forested areas are crossed by the OHL corridor. The most sensitive and valuable forest, where the human activities is very limited, was initially crossed by the alternative 2.1 which has been eventually rejected due to the impact on valuable forest. The selected corridor passes through the variety of forested areas, however, due to the character of anticipated works, no significant fragmentation of forest habitats is expected. Clearing of vegetation along the RoW will be required during construction, however natural regeneration will be allowed afterwards and only high growing trees will be eliminated permanently. Because the mild climate and high humidity are favourable for rapid natural re-vegetation in the project area, partial recovery of the land strip under the OHL is expected soon after the completion of construction, bringing impacts on terrestrial fauna to insignificant minimum. Overall, the area of Project’s impact on the forested land makes less than 0.2% (350 ha from 200 000 ha) of the total forest ecosystem in project affected municipalities. Furthermore, no plant or animal populations of the species occurring in the project area are significantly dependant on the forest stands falling within the RoW of the OHL. Therefore, construction and operation of the OHL will not affect habitats that are critical for the viability of the existing populations.

In regards of migratory birds, the Khelvachauri municipality is located on the one of the most important corridors of bird migration. The OHL projected route is very close to the mentioned corridor at the confluence of the rivers Adjaristskali and Chorokhi. Some sections of the OHL will cross this migration route, known as Batumi Bottleneck. The bottleneck is autumn flyway for migratory raptors. The development of re-routing alternative to avoid this sensitive area is impossible, as the final connection point - that is the Khelvachauri sub-station - is already built and operating there for decades. Therefore, the only option is to design the OHL towers and conductors applying best practice features to reduce the likelihood of bird collisions and electrocutions. This will include placing of conductors within the distance established to avoid electrocutions while perching, and equipping the cables with bird reflectors to increase their visibility and rescue collisions. Bird monitoring will be ensured at the OHL operation phase to check birds’ mortality rate, verify effectiveness of mitigation, and determine the need for additional measures. The bird studies have been conducted in Autumn 2012 and Spring 2013 in order to establish informative baseline and to propose adequate mitigation measures where/if necessary.

As for the protected bats, the number of bat species is higher in middle section of Adjaristskali river. Usually the bats populations are concentrated along the rivers close to the food base and where they live in tree hollows. The known bat migration corridors are not located within the proposed OHL corridor. It is well known, that the major impacts on bat's caused by the OHL lines are limited to EMF impacts interfering with radiolocation system of the bats. The risk of bat collision with OHL is usually negligible. The loss of habitat is caused by corridor clearance, where the aged, large size trees are removed from the corridor. This issue was well covered in constrains maps prepared during the design stage and route selection of the OHL line. The line corridor was moved to mountain slopes to minimize impact near to river banks. In case of Akhaltsikhe-Batumi 220KV line, the area of high EMF zone is rather limited, it rapidly decreases with increase of distance. The cumulative EMF effect is not an issue, as there are no high voltage lines in the project area sensitive to bats. Accordingly impact on bat population is defined as low.

Socio-Economic and Cultural Environment - Number of large and small scale settlements are scattered along the ROW, some of which will be crossed by the OHL, whilst others will be bypassed. Some industrial areas could be also found in proximity of larger towns. About 30 settlements are found within the 500 m corridor of the OHL. Of these 15 belong to Keda Municipality. All these settlements are mountainous. Great majority of population are ethnic Georgians. No indigenous people identified neither in Samtskhe-Javakheti nor in Adjara region. Agricultural land resources are rather limited in the region due to complex topographic conditions and comprise only 25% of the total territory. Arable lands are even more scant, comprising only about 15% of total agricultural lands. Availability of arable lands is very limited in middle and high mountainous municipalities of Khulo, Keda, Khelvachauri and Shuakhevi. The OHL corridor at some locations crosses public and private infrastructure or runs in the close proximity. These include public roads (main roads and secondary roads), water supply pipelines, BTC/SCP pipelines, other overhead lines, etc. The routing study has identified major infrastructural objects in the proximity of and within the proposed OHL corridor. Number of historical sites are located along the OHL route, such as late medieval religious structures in the vicinity of Didachara and Beghleti, medieval fortress in the Diakonidzeebi Village, medieval bridges near the villages of Zamleti and Okruashvilebi (Khulo Municipality), etc.; number of 19th century religious buildings in Keda Municipality; cemetery near the Mugareti Village (Akhaltsikhe Municipality), etc.

Potential Impacts and Mitigation Measures

The **construction of the OHL** requires limited land clearance: (a) only tower installation sites will be permanently occupied and cleared from vegetation; (b) for the sections between the towers tall trees will be felled, while the bushes and grass vegetation will be maintained unaffected. Adverse social impacts of construction activities are related to short term disturbances caused by noise, emissions, disruption of traffic patterns and limitation of access to sites, increased truck traffic and traffic safety, etc. All these impacts will be managed through relevant mitigation measures and proper community liaison mechanisms, as it is presented in Sections 8 and 9 of this report Beneficial social impacts for the local communities could be associated with some additional employment opportunities and the improved prospective for economic development due to better power supply conditions.

The **operation and maintenance of the proposed OHL** are related to number of specific environmental and social impacts: certain limitations to the land use within the RoW, avian collisions and electrocutions causing loss of bird species, impact of electro-magnetic fields (EMF) on workers and communities (are expected very low/negligible due to voltage doesn't exceed 220 kV), community and occupational health and safety risks associated with accidents, emergencies, risks of electrocution, risk of fire. Impacts of the maintenance works during operation phase are much less significant and diverse. However, all these impacts will also be managed through relevant mitigation measures and proper community liaison mechanisms, as it is presented in Sections 8 and 9 of this report.

The following **impacts on natural environment** are expected and mitigation proposed for the construction and operation phases:

Soils - Soils excavated for tower foundations will be used for backfilling excavations and will not be left exposed to wind or water for long periods. Construction traffic will follow defined temporary access routes to be established as part of the works so as to avoid damaging the soil structure in the wider area. Degraded areas will be re-planted with local species endemic to the area to improve ground cover and provide erosion control.

Geology and Geohazards - Prominent feature of deposits in the project region has high erosion potential, especially due to action of surface runoffs. This imposes high landslide risk in steep slope areas. Many new and relict landslides are recorded during the Routing Study. The alternatives ensure that landslide areas of high risks are avoided, and it is accomplished by the design team at the design stage. However, the erosion control measures and regular observations and landslides monitoring during the routine maintenance are considered.

Drainage, Surface Waters and Water Resources – During the design the route has been selected with consideration of minimum river crossings and only very few towers located in the floodplain. The towers within a floodplain will be constructed in a way that existing water flow regimes in rivers, streams and other natural or manmade channels will be maintained or not affected. The contractors will develop and implement run-off and erosion control measures, especially in mountainous, hilly terrain areas and on slopes. Implement these measures for both construction and operation periods to avoid surface water siltation. This is especially true for the towers located on the floodplains, stream terraces and hill slopes. Silt fences will be placed downgradient of all areas of exposed soil within ROW to capture sediment in runoff.

Access Roads - Temporary access roads will be ripped and rehabilitated after the completion of the construction phase where these would not serve either the on-going maintenance of the OHTL or the local community. In general, vehicles and equipment will travel across unprepared ground, with no preparation or road construction unless efforts are needed to control erosion or excess land disturbance.

Traffic and Transport - The transport of heavy and abnormal loads will be undertaken out of normal working hours whenever possible. The locating of access roads and design of detours shall be undertaken in consultation with the local community. Impacts on structures along access roads (i.e. cracks on houses) associated to vibration will be assessed, including a baseline of pre-project conditions, and mitigated.

Air Pollution, Noise, Liquid and Solid Wastes, Materials Usage - these impacts are temporary/short term during the construction phase and are addressed in ESMP through applying common management practices and mitigation measures.

Flora and Fauna, Loss of Biodiversity and Impact on Habitats - The OHL route is designed in a way that doesn't affect any critical habitats or endangered species. Considering the very limited footprint of the project (towers foundations only) and the remaining low vegetation along the RoW, it allows to reduce the impact on flora. In order to further mitigate impacts on biodiversity, the pre-construction survey and Contractor's Biodiversity Management Plan will ensure that there is minimum clearing of vegetation and the Reinstatement Management Plan will ensure that re-vegetation of disturbed areas occurs following construction.

Avifauna/Birds - Considering that the proposed project is located close to the bird migration route, in addition to design solutions keeping low profile along the slopes within the migration corridor, towers and cables are designed up to best practices to minimize bird's collision and electrocution cases. The cables will be equipped with bird reflectors to increase their visibility and farther rescue bird collisions. Bird monitoring will be ensured on the OHL operation phase to verify effectiveness of mitigation and determine the need for additional measures.

Landscape and Visual Impact - From the perspective of a traveller, these would be temporary effects, occurring only when passing through areas within the viewshed of the OHL. For residents living within the viewshed of the transmission line, the change in landscape would be significant only for those living within two kilometres of the OHL, considering the lattice structure of the towers. In addition to the mitigation already incorporated into the design of the line route (reducing viewsheds), the awareness raising through public consultation should also help to lessen adverse reaction to the OHL.

The following **impacts on socio-economic environment** are expected and mitigation proposed for the construction and operation phases:

Displacement and Relocation of Project Affected Parties Construction of the OHL will require physical relocation of the small amount of the project affected people as well as temporary restriction of land use leading to crop loss. All cases of resettlement will be handled by the GSE according to the RPF through the development and implementation of RAPs. Mobilization of works contractor to a construction site will not be allowed until the site-specific RAP is implemented to the satisfaction of the World Bank.

Land Use - The impact on crops will be reduced either by undertaking the construction works after the crops harvest or by compensating for all damaged crops. Farmers will be compensated for any disruption to or loss of crops and land arising from the construction. Awareness campaigns will be undertaken to ensure that farmers are aware that the RoW can be used for grazing and arable crop farming but not for tree planting. It has been constantly explained at the public meetings with the community representatives along the OHL that most farming and grazing activities of low height crops will be allowed in the RoW.

Employment of Local Labour/Gender Issues - The use of local labour should be maximised during the operational phase of the projects (e.g. in providing security, undertaking vegetation control, etc.) and training provided so as to provide capacity building. As an enhancement measure, it is recommenced that equal employment opportunities are given to women within the project skills requirements and that the procurement of local products and services is maximized.

Electro-Magnetic Fields - amongst the negative social impacts on local communities, impact of EMF on workers and households residing close to the high voltage power transmission lines should be considered. Mitigation: the sanitary protection zones and safe distance of transmission line facilities and substation from the residential and public areas should be regarded. Monitoring of the sanitary protection zones and safe distances will be undertaken annually, as well as measurements of the EMF strength at the boundaries of the sanitary zone.

H&S, Emergency Situations and Accidents - line break along the transmission line may cause fatalities among the local residents and/or their animals. Mitigation: earthing and lightning protection system of transmission lines will be installed according standards; Emergency Response Plan developed by the GSE and preparedness ensured. Safety requirements and signs installation fulfilled and PPE provided to the operating personnel, permanent monitoring and maintenance of transmission lines.

It is considered feasible to mitigate and manage the majority of impacts associated with the project through appropriate environmental and social management together with the monitoring, specified in the Environmental and Social Management Plan that represents the outcome of this ESIA process.

Environmental and Social Management Plan

The Environmental and Social Management Plan (ESMP) for this project consists of Environmental and Social Mitigation Plan, developed to clearly identify mitigation measures and management practices that should be implemented to minimize, reduce or eliminate the adverse impacts identified in the ESIA, and the Monitoring Program for the monitoring over the implementation of mitigation measures and of the residual impacts at the construction and operation phases of the Project, following the best management practices.

Generic environmental and social management practices, as well as specific mitigation measures for the OHL, are identified and presented in Environmental and Social Mitigation Plan matrix. The **Mitigation Plan** will be provided to prospective bidders for the construction contracts, to ensure that detailed environmental and social mitigation measures and costs are included into their technical and financial proposals. The GSE will ultimately be responsible for ensuring that the Mitigation Plan is implemented on site via **Monitoring Program** and its own Environmental and Social Management System (ESMS), which considers environmental and social supervision capacities/resources (within the GSE, or contracted out to Supervision Consultant) for the monitoring over the construction and operation of the Project and operation of the Line.

Environmental and social impact mitigation measures have to be further developed upon Pre-Construction Survey undertaken by selected/awarded Contractor before proceeding with initial stages of construction (i.e., RoW clearance, topsoil stripping for foundations, arrangement of access roads, conductors stringing, etc.), to ensure that they consider and carefully plan the implementation of each mitigation measure under their responsibility. Documents to be prepared by Contractor and cleared by the GSE prior to contractor's mobilization to each discrete work site include: Waste Management Plan, Traffic Management Plan, Pollution Prevention Plan, Biodiversity Management Plan, Reinstatement Plan, and Health & Safety Management Plan (including working on heights and prevent electric caution, etc.).

In response to environmental impacts identified and mitigation proposed during this ESIA study, the Monitoring Program has been developed as an integrated part of Environmental Management Plan. Environmental and social monitoring is needed to verify the effectiveness of the proposed mitigation measures in reducing impacts and also to allow mitigation measures to be refined or developed as needed to address actual impacts and future effects/developments. The Monitoring Program describes the parameters to be monitored, the activities to be executed, locations, time and frequency of monitoring activities. The monitoring will comprise supervision and surveillance to check whether the contractor is meeting the provisions of the contract during construction. Environmental supervision and monitoring, as part of the Developer's (GSE) ESMS are to be conducted throughout all phases of TGS project. It is assumed that the GSE through the qualified environmental staff and a consulting company will be responsible for all monitoring activities, and that the results would be reported to the GSE, the Ministry of Energy, MoE and other stakeholders as appropriate. The GSE will be responsible for reporting on the outcomes of environmental and social monitoring and the status of contractor's compliance with ESMP to the Bank as part of the monthly reporting on the progress of the TGS project.

Operation of the Transmission Line

As it has already been mentioned above, the GSE will be responsible for the construction and operation of the OHL and will own the line. The operational phase of the project will involve the commissioning of the line and maintenance of the ROW, the power lines and the towers. The operation and maintenance of the transmission line will be based on accepted international standards, such as those of the International Electro-Technical Commission (IEC). The GSE also has its own specific procedures for the operation and maintenance of its lines as set out in the *GSE Rules and Regulations*. The main activities to be carried out during the operating life of the transmission line include: routine running maintenance (surveillance of the condition of the transmission line, towers and ROW), emergency maintenance (when/if accidents), and major maintenance (vegetation control, repairs, replacements). The GSE maintains a department that is responsible for the operation and maintenance of its transmission network. The GSE will maintain an EHS Management System for operations in line with the principles of ISO 14000 to ensure continuous identification and management of environmental, social and health and safety issues associated with the TL.

1. INTRODUCTION

1.1 Project Background

The Government of Georgia, acting through its Ministry of Energy and the Georgian State Electro-systems (GSE), would like to strengthen grid access for South Western Georgia by constructing a 220 kV double circuit overhead power transmission line connecting the sub stations in Akhaltsikhe and Batumi. The new transmission line will ensure more stable electricity supply in the region, reducing outages and enable GSE to meet the growing demand for electricity, as well as enhance export opportunities. The new transmission line will also allow the hydropower projects on the Adjaristsqali River, the 178 MW Shuakhevi project and the 150 MW Koromkheti project, developed by Adjaristsqali Georgia LLC to be connected to the grid. The location of proposed OHL is presented in Figure 1.2.1.

Adjaristsqali Georgia LLC (AGL), is a special purpose vehicle/company set up by CEI for the development of the Adjaristsqali Hydropower Cascade after Clean Energy Invest AS (CEI, Norway), through competitive tender was awarded the rights to develop the hydropower potential of the Adjaristsqali River and its tributaries in the Autonomous Republic of Adjara. The company AGL, developing the Adjaristsqali cascade, is presently owned by Clean Energy Invest AS (Norway), Tata Power International (India) and InfraVentures (IFC, a member of the World Bank Group). Considering that AGL will benefit from the construction of the transmission line, the company has agreed with GSE and the Georgian Government to fund the development of the engineering and environmental studies required for the construction of the 220kV Akhaltsikhe-Batumi Project, whereas the construction works are planned to be funded by the World Bank. The Mott MacDonald Ltd (UK) has been assigned to undertake the engineering design for the transmission line and DG Consulting (Georgia) have been assigned to conduct the Environmental Social Impact Assessment (ESIA).

GSE will be responsible for the construction and operations of the 220 kV transmission line and will own the line. GSE will also be responsible for land acquisition. AGL’s responsibility for developing the project will end when the technical and environmental studies are approved by GSE.

1.2 Development and Structure of the ESIA Report

Based on screening exercise undertaken at the pre-feasibility and routing study stage (including visual assessment and check-lists), it has been concluded that the Project involves substantial new construction and some sections of the transmission line are crossing green-fields and sensitive environmental areas (forests). Project has the potential to cause adverse impacts on the community and on the environment. It is clear that project implementation is associated with the need for private land acquisition with the possibility of affecting households and assets, and maybe with the need for physical relocation. So the Project may impact sensitive areas and has the potential to have diverse types of environmental and social effects. Therefore this project is considered to be a **Category A** project and requires full scale ESIA, public participation process, and the Resettlement Action Plan (RAP).

The purpose of the Environmental and Social Impact Assessment (ESIA) process is to ensure that the project is designed and developed in a manner that avoids, reduces and mitigates negative environmental and social impacts, while maximizing project benefits. Prior to making a funding decision, the World Bank and the Georgian government have to be assured that:

- The elements of the investment program would meet Georgian national requirements and existing international financial institution standards, particularly WB and IFC.
- The project includes all necessary mitigation measures to minimize any significant adverse change in environmental, health and safety, and socioeconomic conditions.
- Appropriate public consultation and disclosure are undertaken in line with Georgian national law as well as the WB requirements thus ensuring all reasonable public opinions are adequately considered prior to a commitment for financing.

In accordance with Georgian legislation and the WB requirements, the overall scope of this ESIA includes:

- Scoping and identification of key environmental and socioeconomic issues.

- Definition of baseline conditions of key environmental and social resources that could be affected by the project.
- Consultation with people who may be affected by the project and other stakeholders.
- Assessment of positive and negative impacts of the proposed project on environmental and socioeconomic resources, including analysis of project alternatives.
- Planning of management practices and mitigation measures that are sufficient to avoid, reduce, or compensate for significant adverse environmental and social impacts.
- Development of monitoring program to verify whether the mitigation is properly implemented and is effective in accomplishing its goals.

The tasks of the scoping/inception phase, have been primarily focused on identifying the impacts caused to be assessed (and how) and which of these are significant and most important, as well as the geographical area of influence to be considered for each of the different environmental and social parameters. The method used for ESIA scoping on this project comprised the desk study and the visits by the social and environmental teams in June-July 2013 to the sections of the line (from Akhaltsikhe to the west through Adigeni, Khulo, Keda, Shuakhevi, Khelvachauri, to Batumi). Meetings have been held with officials in the municipalities along the route, as well as in Tbilisi with relevant ministries, other interested parties including non-governmental organizations and local population. The major concerns that were raised during scoping meetings fell into several categories:

Environmental:
- Concern about impacts on flora and/or fauna, forests.
- Concerns about the potential impacts on landscapes and views.

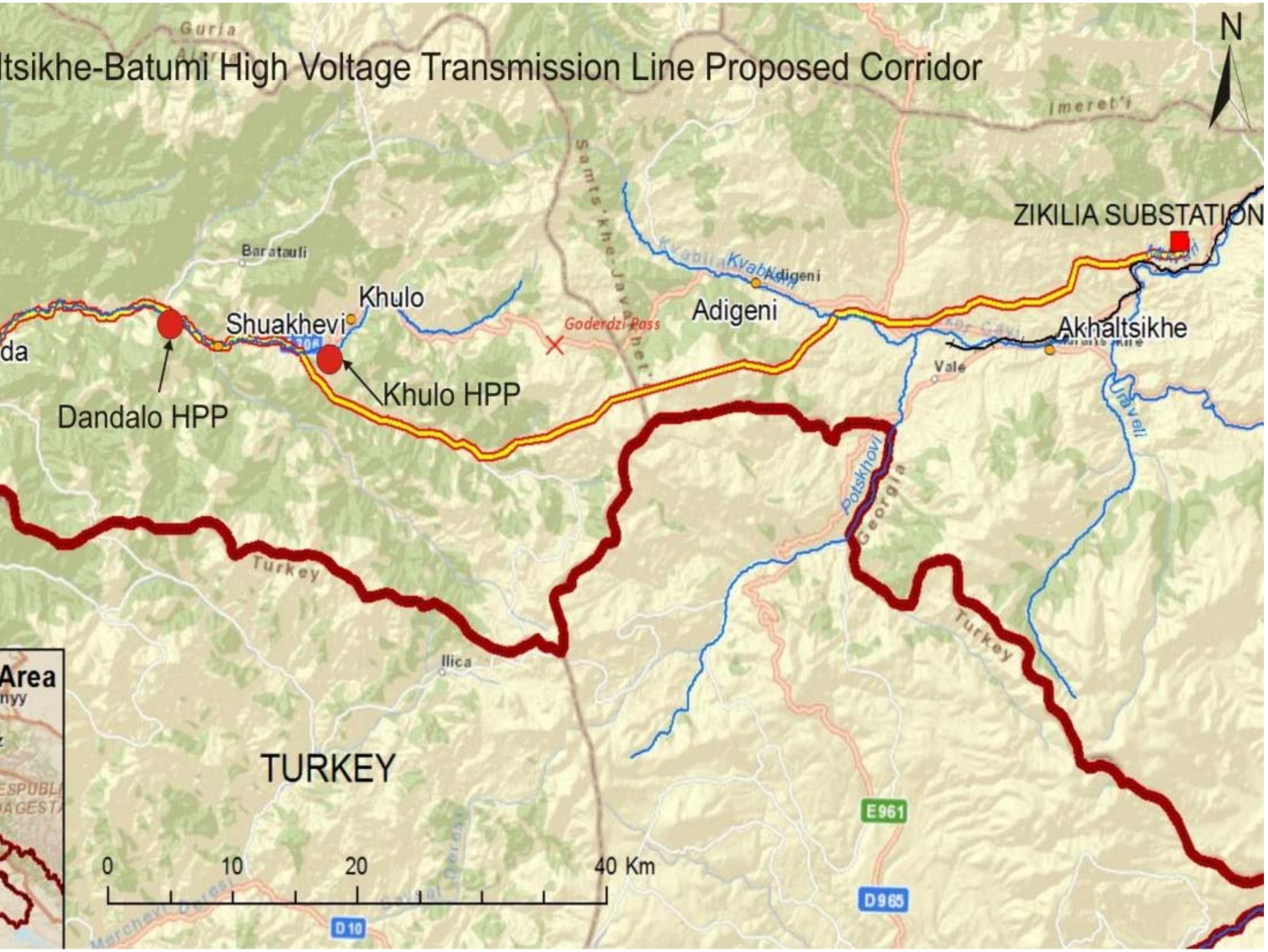
Social:
- Concern about potential health effects of high-voltage transmission lines
- Concern about having to relocate to a house farther away from the line.
- Concern about damage to existing houses from derelict towers.

Economic:
- Concern that construction/maintenance could damage crops or affect grazing.
- Concern about loss of land to foundations and towers and to access roads.
- A desire that local workers be hired for construction and maintenance
- Concern about impacts on recreation at Beshumi new resort area

Cultural:
- Concerns about impacts on the monuments and cemeteries.

This ESIA for the 220 kV Akhaltsikhe-Batumi Transmission Line is intended to address the above issues meeting the Georgian legislation and the World Bank/IFC requirements, identifying all environmental and social impacts and relevant mitigation measures, and ensuring effective stakeholder consultation and disclosure process. Besides, the project during the construction and operation phases, should meet both Georgian and WB's EHS regulations, and in case if there are some discrepancies, the strongest requirements should apply.

The content of the report is structured in accordance with the initial and revised ToR, Georgian regulations, the requirements of the WB OP4.01 (Annex B) and international best practice.


ltsikhe-Batumi High Voltage Transmission Line Proposed Corridor
N
Guria
Imereti
ZIKILIA SUBSTATION
Baratauli
Khulo
Shuakhevi
Adigeni
Akhaltsikhe
Goderdzi Pass
Khulo HPP
Dandalo HPP
Vale
Turkey
Georgia
Potskhovi
Ilica
TURKEY
E961
D965
D10
0
10
20
40 Km
Area

2. Legal and Policy framework

2.1 Georgian Legislation

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

In Georgia, the Ministry of Environmental and Natural Resources Protection (MoEP) is responsible for regulating the natural environment. The MoEP implements all policies designed for the protection and conservation of the environment and for the sustainable use and management of Georgia's natural resources. This includes controlling activities that have a potential adverse impact on the environment and natural resources and issuing environmental licenses and permits. The following Georgian laws and regulations are applicable to the Project:

Law of Georgia on Environmental Impact Permit
The Law gives a complete list of activities subject to ecological examination (Article 4, Chapter II) and defines environmental examination through the EIA process as an obligatory step for obtaining authorization for implementation of the planned development. The legislation sets out the legal basis for issuance of environmental permits, including implementation of an ecological examination, public consultations and community involvement in the processes. According to the established procedure the granting permission for, or refusal to issue, a permit is based on the findings of the EIA report and associated environmental documentation presented to the MoEP by the project proponent. Paragraph 6 of the law requires the applicant to organize and undertake public consultation of the EIA report prior submission of the final version of the document to the MoEP.

Law of Georgia on Protection of the Environment
The Law regulates the legal relationship between the State and persons/legal entities in terms of the environmental protection and/or utilization of natural resources on all Georgian territory including its territorial waters, airspace, continental shelf and special economic zones. The Law covers environmental education, environmental management, economic sanctions, licensing, standards, environmental impact assessment and related issues. The law considers various aspects of ecosystem protection, protected areas, global and regional environmental management, protection of ozone layer, biodiversity and the Black Sea, as well as aspects related to international cooperation.

Law of Georgia on Licenses and Permits
The Law regulates activities which may result in increased hazard to human life or health, involves interests of importance to the State or public, or connected to consumption of State resources. The Law defines the full list of activities which require licenses and permits, and sets out the rules for granting, amending and abolishing licenses and permits. The objective and main principles in the regulation of activities via licenses or permits are as follows:

- the security and protection of human health;
- the security and protection of the conditions and cultural environment of humans;
- protection of state and public interests

In compliance with this law, the license or permit issued by a foreign country under an international agreement or law is recognized by Georgia and has the status similar to that granted to the documents issued by Georgia.

Law of Georgia on Ecological Examination
The Law makes an ecological examination obligatory for issuance of development permits. An objective of the Law is to preserve the ecological balance through the incorporation of environmental requirements, sound use of natural resources and sustainable development principles. Demonstration of sustainable ecological outcomes is necessary in order to obtain a development permit. The review of and decisions related to ecological examination is regulated by the MoEP.

Law of Georgia on Water
The Law regulates the major general legal relationships with respect to Georgia's water resources as follows:

- Between the State and physical/legal entities in the field of water protection, study and consumption;
- State and physical/legal entities involved in water protection, study and use on land, underground, continental shelf, territorial water and especially active economic zones;
- State and physical/legal entities involved in commercial water production and international trade in water;
- Defines the competences of autonomous republics, local government and self-government for water related issues;
- State and physical/legal entities involved in groundwater protection, study and use consistent with requirements of the law of Georgia on “Natural Resources”;
- State and physical/legal entities involved in the protection of aquatic life, study, reproduction and use, in compliance with the law of Georgia on Fauna; and
- Regarding the use and/or consumption of fauna, flora, forest, land and other natural resources whilst utilizing water.

Consistent with the legislation, water within the territory of Georgia owned by the State can be abstracted only for consumption. Any actions directly or indirectly violating the State ownership rights for water are prohibited.

Law of Georgia on Soil Protection
The Law aims at ensuring preservation of integrity and improvement of soil fertility. It defines the obligations and responsibility of land users and the State regarding the provision of soil protection conditions and ecologically safe production. The Law sets the maximum permissible concentrations of hazardous matter in soil and restricts the use of fertile soil for non-agricultural purposes, the execution of any activity without prior striping and preservation of top soil, open quarry processing without subsequent re-cultivation of the site, terracing without preliminary survey of the area and approved design, agricultural activities that could lead to overgrazing, wood cutting, damage of soil protection facilities, and any activity that could potential deteriorate soil quality (e.g. unauthorized chemicals/fertilizers, etc).

Law of Georgia on Protection of Atmospheric Air
The Law regulates protection of the atmospheric air from adverse anthropogenic impact within the whole Georgian territory (Part I, Chapter I, Article 1.1). Adverse anthropogenic impacts are any human induced effect on atmospheric air causing or capable of causing a negative impact on human health and environment (Part II, Chapter IV, Article II.I).

Civil Code of Georgia
The Civil Code governs private civil relations, determines rights of ownership, family and neighboring tenements and establishes inheritance rules in Georgia. Ownership rights enable the proprietor to freely manage any assets owned. The Civil Code gives the proprietor the right to alienate any assets with rights to build, usufruct or servitude. The Civil Code defines the rights of neighboring tenements with regards to establishing bordering facilities, plants, fences and any disturbances.

Land use and Land Acquisition Policies/Legislation
The Constitution of Georgia recognizes universally acknowledged human rights, including those pertaining to private ownership and its protection. The Constitution creates a foundation for the legislative basis of possession of immovable property and recognizes the right of ownership and also permits expropriation for public needs, where necessary, whilst facilitating the payment of relevant compensation. In certain cases of public need, the State may take private lands into State ownership or take actions that otherwise affect private land. Several laws govern the process and these are presented in the following sections.

Law of Georgia on Privatization of State-owned Agricultural Land
This Law regulates the privatization of state-owned agricultural land. On the basis of this law, either leased or unleased state-owned agricultural land can be subject to privatization. However, the categories of agricultural lands listed as follows are not subject to privatization:

a. Grazing lands except grazing lands leased before enacting the law;

b. Cattle-driving routes;

c. First sub-zone (strict regime zone) for the sanitary protection zone of water supply bodies;

d. Forest fund land used for agricultural purposes;

e. Recreation lands;

f. Lands allocated to historical, nature and religious monuments;

g. Protected areas;

h. Agricultural lands being used by budgetary institutions and legal entities of public law in the form of usufruct.

The privatization of agricultural lands in categories b, c, d and e is still allowed but only in the event of a decision being made by the Georgian Government and if appealed by Georgian Ministry of Economic Development.

Law of Georgia on Entitlement of Ownership Rights to Lands Possessed (Employed) by Physical and Legal Persons of Private Law

The Law defines general terms and procedures for entitlement of the right to land ownership. Although ownership rights cannot be bestowed onto the following lands;

- Cattle-driving routes;
- Cemetery and pantheon;
- Water field (stock);
- Sanitary and protection zones;
- Protected areas;
- Historical, nature and religious monuments;
- Recreation parks, forest-parks, squares and others;
- Land containing water reservoir, hydraulic works and sanitary-protection zones of these objects;
- Lands of special purpose (allocated for defence and mobilization);
- Lands accommodating community infrastructure units (transport and underground utilities, water-supply, sewage, communication and power-supply systems);
- Land parcel of public use (playground, street, passage, road, pavement, shore) and recreation sites (park, forest-parks, squares, alley, protected area);
- Lands accommodating state-owned objects, including parcels which contain state property not subjected to privatization according to Georgian Law on Privatization of State Property;
- Lands allocated for construction and operation of oil and gas mains, as well as any associated over- and under-ground structures and facilities.

Law of Georgia on Registration of Rights to Real Estate

The Law provides an organizational and legal basis for the registration of ownerships rights, encumbrance and mortgage on real estate, as well as the liabilities of the registration authority. Pursuant to the Law, ownership rights related to real property, mortgage, usufruct, servitude, lease, sub-lease, rent, sub-rent, lending are subject to registration in the Public Register.

The Law of Georgia on Rules for Expropriation of Ownership for Necessary Public Needs

The Law defines terms, rules and procedures for the expropriation of assets necessary in the public interest. Expropriation requires the Presidential decree and a court decision. The decision of the court gives a detailed description of the expropriable property and due compensation to the owner. The Law states the public interests which allow expropriation of assets. These are the construction/installation of: a) Roads and highways; b) Railways; c) oil, gas and oil product pipelines;

d) Power transmission and distribution lines; e) Water supply, sewage and storm water drainage systems; f)Telephone lines; g) Premises and objects of public needs; h) Works required for national defence; i) Mining and reserve development. After issuance of the Presidential decree a person seeking for expropriator's right announces in the central and local printed media about the project, its scope, area coverage and brief description of the potentially expropriable property. All affected landowners also shall be informed about the dates of application to the court and action proceeding. An expropriator should endeavor to obtain property in agreement with the owner. Prior to negotiation the expropriator evaluates the property and determines an estimated compensation sum or other property compensation according to fair market price. Agricultural lands are to be evaluated together with price of crops that could be yielded by the owner throughout the current agricultural year.

Law of Georgia on Compensation of Land Substitute Costs and Damages due to Allocating Agricultural Land for Non-Agricultural Purposes

The Law specifies requirements for compensating the government and affected private landowners in the event of degradation of land quality. Annex 1 to the Law gives compensation sums of such damage per 1 hectare of land by territorial units. The Law does not allow for remuneration due to damage of buildings, perennial plants or one-year crops.

Labour Legislation

Applicable Georgian Labour Laws are as follows:

- Labour Code of Georgia (2006) governs the rights of the employees in all enterprises, institutions and organisations. This law establishes the requirements regarding human rights and creation of safe and healthy working environment including health and safety conditions, social security and insurance; and
- Law of Georgia on Employment (2001) regulates the employment policy of Georgia, including protection of the unemployed in terms of economic, social and legal issues. For the protection of the unemployed, this law promotes employment programs.

Environmental and Social Impact Assessment in Georgia

The ESIA process will follow the relevant national and international requirements. The law of Georgia on Environmental Impact Permit sets the legal basis for issuance of an environmental permit, including implementation of an ecological examination, public consultations and community involvement in the processes. Granting of permission or refusal to issue a permit is based on examination of environmental documents presented to the MoE by the project proponent. Paragraph 6 of the law requires the project proponent to organise a public discussion of the ESIA prior to submission of the final version documentation to the Ministry.

The permit application/issuance procedure for the Project, including ESIA coordination, establishment of the timeframes for information disclosure and public review and discussion in accordance with Georgian Law will include the following steps:

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

2. Within one week after publishing the information in the newspapers, the project proponent will submit the ESIA report (hard copy and electronic version) to the MoEP. A period of 45 days is allowed for public comment on the ESIA. Between 50 and 60 days after publication, the project proponent will hold a series of meetings to receive comments from stakeholders (which may include government agencies, local authorities, NGOs, community members). Within five days of the meetings, the project proponent will submit minutes of the meetings (summary of comments and discussions) to the MoEP.

3. All comments received from the stakeholders at the meeting or in writing will be reviewed and addressed in the final version of the ESIA. A copy of all written comments, the minutes together with a comment-response section will be included in the final ESIA as an Appendix. The final ESIA will be submitted to the MoEP and made available to the public, along with a

project location map, an executive summary, and the any necessary reports on emissions and allowable limits. The permit is to be issued or denied within 20 days from registration of the submission.

The ESIA will include a robust methodology for the assessment of effects and the identification of significance that will take into account the 'magnitude' of the impact (duration, spatial extent, reversibility, likelihood and ability to comply with national standards) and the 'sensitivity' of the receiving environment, including local communities. Sensitivity will be based on combination of desktop studies and site specific surveys; these will include a review of the local population (including proximity / numbers and vulnerability) and presence of sensitive biological and physical features on the site and surrounding areas. The significance of impacts will be discussed in the context of both before and after any proposed mitigation. Where feasible the following hierarchy of mitigation measures will be applied: alternatives/site selection, elimination through design, application of best practice management and monitoring techniques, compensate/offset.

The ESIA process will result in the following outputs:

- Production of ESIA report to support national permitting process and international financing;
- Land Acquisition Policy Framework (LAPF) to support economic and physical resettlement requirements; and
- Environmental and Social Management and Monitoring Plan (ESMMP) to support ongoing implementation of environmental and social management issues through the construction and operation phase and to support the transfer of obligations to relevant parties such as the construction contractor.

This will require that a formal Environmental Management System (EMS) is developed by the Owner to oversee the implementation of required mitigation measures, auditing and reporting. Effective stakeholder consultation and disclosure is the cornerstone of the approach proposed to be implemented for the Project. The public consultation and disclosure programme is an on-going process and is set out in the Project's Stakeholder Engagement Plan which identifies who are the relevant stakeholders, their relevance to the Project, how and when they will be consulted and results of consultation activities.

2.2 World Bank and IFC Policy Requirements and Guidelines

The Project is required to meet the international standards of the World Bank Group. The IFC Performance Standards are considered for the preparation of the ESIA and corresponding management plans as reference of good international practice. The international environmental and social safeguard policies of these organisations are outlined below, as are the main international conventions that Georgia is a signatory.

Following the World Bank's Operational Policy 4.01, Environmental Assessment (EA), one of ten Safeguard Policies, the World Bank undertakes environmental screening of each proposed project to determine the appropriate extent and type of environmental assessment needed. The Bank classifies proposed projects into one of four categories, depending on the type, location, sensitivity, and scale of the project, as well as the nature and magnitude of its potential environmental impacts.
The different categories are listed below:

a) Category A project is likely to have significant adverse environmental impacts that are sensitive, diverse, or unprecedented. These impacts may affect an area broader than the sites or facilities subject to physical works. The EA for a Category A project examines the project's potential negative and positive environmental impacts, compares them with those of feasible alternatives (including the "without project" scenario), and recommends any measures needed to prevent, minimise, mitigate, or compensate for adverse impacts and improve environmental performance. For a Category A project, the borrower is responsible for preparing a report, normally an Environmental Impact Assessment (or a suitably comprehensive regional or sectoral EA).

b) Category B project has potential adverse environmental impacts on human populations or environmentally important areas - including wetlands, forests, grasslands, and other natural habitats - which are less adverse than those of Category A projects. These impacts are site-specific; few if any of them are irreversible; and in most cases mitigation measures can be designed more readily than for Category A projects. The scope of EA for a Category B project may vary from project to project, but it is narrower than that of Category A assessment. Like Category A, a Category B EA examines the project's potential negative and positive environmental impacts and recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental performance. The findings and results of EA for Category B projects are described in the project documentation (Project Appraisal Document and Project Information Document).

c) Category C project is likely to have minimal or no adverse environmental impacts. Beyond screening, no further EA action is required.

d) Category F or FI project involves investment of Bank funds through a financial intermediary (FI), in subprojects that may result in adverse environmental impacts.

The combined Shuakhevi and Transmission Line Projects have the potential to cause adverse impacts on the community and on the environment therefore, and in line with Lender classification, this project is considered to be a Category A project. However, it is considered feasible to mitigate and manage the majority of impacts associated with the project through appropriate environmental and social management together with the monitoring to be specified in the ESMP and related plans that will be the outcome of this ESIA process.

International environmental and social safeguard standards are typically embodied by the World Bank environmental and social safeguards Operational Policies (OP). A summary of the key objectives of relevant safeguards policies are provided below:

Operational Policy 4.01 – Environmental Assessment**:** provides the framework for World Bank environmental safeguard policies and defines the project screening and categorization in order to determine the level of EA required. For category A and B projects, the policy requires public consultation and disclosure to be undertaken as part of the EA process. If indigenous people are found to be affected, in addition to consultation, it is necessary to prepare a plan to avoid or mitigate adverse impacts on such groups and ensure that they have access to project benefits to the extent that they wish to. Finally the policy sets out requirements to comply and report on implementation of any environmental management plans i.e. mitigation measures, monitoring programme.

Operational Policy 4.04 – Natural Habitats: outlines the World Bank policy on biodiversity conservation taking into account ecosystem services and natural resource management and use by project-affected people. Projects must assess potential impacts on biodiversity and the policy strictly limits circumstances under which conversion or degradation of natural habitats can occur as well as prohibiting projects which are likely to result in significant loss of critical natural habitats.

Operational Policy 4.11 – Physical Cultural Resources*:* this policy sets out the World Bank requirement of avoiding or mitigating adverse impacts resulting from project developments on cultural resources.

Operational Policy 4.12 – Involuntary Resettlement: the World Bank aims to avoid involuntary resettlement where possible. Where the acquisition of land or other assets is necessary, the policy sets out requirements for participation in resettlement planning, mandates compensation for assets at replacement cost, and expects the borrower to see that incomes and standards of living of affected persons are improved or at least restored to what they were prior to displacement.

If the Project is being implemented with support of the IFC, the requirements of the IFC Performance Standards (PS) will need to be met. The IFC Performance Standards are the key documents through which the IFC manage the quality and level of assessment required for the projects which they finance. As mentioned above, the IFC Performance Standards are being considered for this project as reference of good practice. The following Performance Standards are relevant to this Project:

- PS1 Social and Environmental Assessment and Management Systems;

- PS2 Labour and Working Conditions;
- PS3 Pollution Prevention and Abatement;
- PS4 Community Health, Safety and Security;
- PS5 Land Acquisition and Involuntary Resettlement;
- PS6 Biodiversity Conservation and Sustainable Natural Resource Management; and
- PS8 Cultural Heritage.

PS 7 addresses indigenous peoples and is excluded because no indigenous peoples will be affected by the Project so it does not apply.

Specific reference will also be made to the following World Bank Group guidelines:

- IFC General EHS Guidelines (April 2007);
- IFC Environmental, Health and Safety Guidelines (EHS) for Electric Power Transmission and Distribution (April 2007).

Specific legislation and guidelines applicable to particular disciplines that will be considered during the ESIA process will be detailed in the relevant sections of the ESIA Report.

2.3 EU Regulations and International Conventions

Georgia is considered a non-EU country (i.e. not a candidate or a potential candidate country) rather its relations with the European Union are shaped via the European Neighbourhood Policy (ENP.

The EU environmental legislation comprises of approximately 300 legal instruments, mostly in the form of Directives, covering environmental protection, polluting and other activities, production processes, procedures and procedural rights as well as products. The key EU environmental directives that are considered to be applicable to the Project are listed below:

- Council Directive 85/337/EEC (amended by 97/11/EC) on Environmental Impact Assessment (EIA)
- Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Flora and Fauna (Natura 2000) – The Habitats Directive
- Council Directive 78/659/EEC on the quality of fresh waters needing protection or improvement in order to support fish life
- Council Directive 79/409/EEC on conservation of wild birds Law on Protection of Environment (1996, amend 2000, 2003, 2007)
- Council Directive 2008/98/EC on waste (Waste Framework Directive)
- Council Directive 1999/31/EC (as updated by 2003/33/EC) on the Landfill of Waste 91/689/EEC (amended by 94/31/EEC) controlled management of hazardous wastes

  96/62/EC Framework Directive on Ambient Air Quality Assessment and Management (and Daughter Directives 99/30/EC (NOx, SO2, Pb and PM10), 00/69/EC (benzene, CO), 02/3/EC: Ozone, 2008/50/EC on ambient air quality and cleaner air for Europe
- 94/55/EC ADR Framework Directive regarding the transport of dangerous goods by road, as amended
- Council Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy" or, in short, the EU Water Framework Directive

The following international laws and conventions have been ratified by Georgia and are of relevance to this Project:

- Convention on International Trade in Endangered Species of Wild Fauna and Flora (1973)
- Convention on Wetlands of International Importance Especially as Waterfowl Habitat (1971)
- Vienna Convention for the Protection of the Ozone Layer (1985)
- Convention on the Protection of the Black Sea Against Pollution (1992)
- United Nations Framework Convention on Climate Change
- Convention on Access to Information, Public Participation in Decision Making and Access to Justice in Environmental Matters (1998)
- Convention on Long-Range Transboundary Air Pollution (1979)
- United Nations Convention to Combat Desertification (1994)
- Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (1989)
- Convention on the Conservation of Migratory Species of Wild Animals (1979)
- Agreement on the Conservation of Bats in Europe (EUROBATS) (2001)
- Agreement on the Conservation of African-Eurasian Migratory Waterbirds (2001)
- UN (Rio) Convention on Biological Diversity (1992)
- Paris Convention on the Protection of the World Cultural and Natural Heritage (1972)
- European Convention on the Protection of the Archaeological Heritage (1992)
- Convention for the Protection of the Architectural Heritage of Europe (1985).

The Project should also meet the following International Labour Organisation (ILO) core labour standards, all of which have been ratified by Georgia:

- Forced labour (C105)
- Child Labour (C182)
- Discrimination (C111)
- Freedom of Association and the Right to Organise (C 87)
- Equal Remuneration (C100)
- Minimum Age (C138).

Specific legislation and guidelines applicable to particular disciplines that will be considered during the ESIA process will be detailed in the relevant section of the ESIA Report.

2.4 Technical and Environmental Standards and Regulations

In terms of technical standards and regulations, the 220kV Akhaltsikhe-Batumi overhead power transmission line is designed according to EN 50341-1-2012 (Euro-Norms). This European Standard applies to new overhead electric lines with nominal system voltages exceeding AC 1 kV and with rated frequencies below 100 Hz. The design also considers the standards used by GSE “*Rules of Installation of Electric Equipment”,* (Ministry of Energy 1987) & Presidential Decree No 964 27th December 2009.

In addition to the above standards, the GSE is following the standards set up in the Presidential Decree #964 (dated 27 December 2009) “On the Protection Procedures for Electricity Grid Linear Facilities and Determination of its Protective Zones” . This document sets/regulates the procedures for the protection of power lines including the parameters (area distances, width, clearances) of the protective zones, access roads, RoWs in forests and other treed/vegetated areas, conditions for locating/constructing buildings (other facilities) and conducting works in these protective areas. The document is based on Law of Georgia “On Normative Acts” (Clause 18, paragraph 2) and its objective is to facilitate the uninterrupted functioning of the power grid, to ensure safe operations, to meet the requirements of the sanitary and safety norms, to prevent accidents. According to Clause 3.1.a.a.b., the width of the protective zone for the 220kV OHL RoW is 25m from the edge conductors on each side (technically more precisely - from the parallel projection of the edge conductors to the land surface). Clause 3.2 a.b.a. regulates the tree felling/clearing width in forests, forested areas and parks – which is distance between edge conductors plus distance equal to maximum height of forest trees in that particular area, to the both sides of the line. Other clauses of the Decree regulate distances to water bodies, buildings in settlements, motor roads, other OHLs, restrictions for building/construction development, planting/agriculture, other works/activities within sanitary zones, safety requirements, etc., etc.

In terms of environmental regulations - the procedures of changing the land category of State Forest Fund should be implemented according to the regulations set out in the Decree of the Minister of Environmental Protection and Natural Resources of Georgia №5 dated February 15, 2010 “On the Rule of Assignment of Category of Specific Purpose for State Forest Land”. At present the order is cancelled and its provisions are reflected in the “Rule of Forest Use” approved by resolution №242 of the Government of Georgia dated August 20, 2010, namely, Chapter V1 was added to the mentioned rules – “Use of State Forest Fund for Specific Purpose”.

The decision on the granting of right of forest use for specific purpose within State Forest Fund and tree felling within the mentioned territory is made by the Ministry of Environment and Natural Resources of Georgia. In case of special tree felling on slopes of inclination of 35º or more wood extraction is allowed only for the construction of projects of special state importance.

Legal entity or project proponent interested in forest use for special purpose submits application to a respective Ministry, which sends the application and attached documents to the Ministry of Culture and Protection of Monuments for consent. If the issue could be agreed with other interested bodies (if necessary), the Ministry of Environment and Natural Resources Protection starts decision making process.

The application for the granting of forest use right for special purposes should contain the following:

1. Motivation of the necessity of forest use for special purpose, goal and term of such special use;
2. For private legal entities and individual entrepreneurs – statement from the Register of Entrepreneurs and Non-Entrepreneur (Non-Commercial) Legal Entities, verified copy of founding documents;
3. Detailed measurement scheme of the selected area for special purpose use in UTM coordinate system, which should be verified by the consultant/company who completed the measurement scheme;
4. Justification of the necessity of tree felling;
5. Information on presence of species included in the Red List of Georgia in the selected area.

Exclusion of land from the State Forest Fund is conducted according to the resolution №240 of the Government of Georgia dated August 13, 2012 on “the Rule of Demarcation of the State Forest Fund”.

The Ministry of Economy and Sustainable Development of Georgia sends the information and documentation related to the correction of the borders of the State Forest Fund to the Ministry of Environment and Natural Resources Protection for consent and for the projects at the territory of Autonomous Republic of Adjara – to the Adjara Forestry Agency within the system of Division of Environmental Protection and Natural Resources of the Government of Autonomous Republic of Adjaria. After receiving the consent, the Ministry of Economy decides on the correction of the borders of the State Forest fund and applies to National Agency of Public Register for the correction of the borders of the State Forest Fund.

Apart of above regulations it should be noted that the Ministry of Environment and Natural Resources Protection in cooperation with Dutch experts prepared the “Sector Guidelines on EIAs for Electric

Power Transmission and Distribution" which are under review at the moment and expected to be adopted by the Ministry in October-November 2013. The recommendations of these guidelines have been considered during the preparation of this ESIA.

2.5 The Gaps between Georgian legislation and WB requirements

The following gaps/differences between the World Bank guidelines and the Georgian national environmental legislation are relevant to the proposed OHL project:

- Screening and Classification: The Bank's guidelines provide detailed description of procedures for screening, scoping and conducting EIA and explain a complete list of stages, which are not envisaged under the Georgian national legislation.
- Considering ecological risk, cultural heritage, resettlement and other factors, the Bank classifies projects supported by them under categories A, B and C. As mentioned, in the Georgian national legislation, EIA is carried out only if a developer seeks to implement projects listed in the Governmental Decree on the Procedure and Terms of the Environmental Impact Permit. This list is compatible with the category A projects of the Bank classification. According to the Georgian legislation EIA is not required in other instances, while the World Bank guidelines may require limited EA or Environmental Reviews for the B category projects, as well.
- Environmental Management Plans: The Georgian legislation does not specify format of environmental management plans (EMPs) and stage of their provision for the projects subject to EIA and do not request EMPs for the projects not requiring EIAs. The World Bank guidelines require EMPs for Category A and B projects and provide detailed instructions on the content.
- Involuntary Resettlement: The national legislation does not take into account the issue of involuntary resettlement at any stage of environmental permit issuance. The Georgian legislation considers social factor only with regard to life and health safety (e.g. if a project contains a risk of triggering landslide, or emission/discharge of harmful substances or any other anthropogenic impact). Thus, the national legislation does not consider resettlement as an issue in the process of issuing environ-mental permits, unlike the Bank which takes a comprehensive approach to this issue.
- Responsibility for the EIA: While the Bank's document establishes the responsibility of a Borrower for conducting the environmental assessment, the Georgian national legislation provides for the responsibility of a project implementation unit to prepare the EIA and ensure its consultation. According to the Georgian legislation the MoE is responsible for monitoring of project implementation and compliance with the standards and commitments provided in the EIA with a less clearly defined role in relation to EMPs. The "Project Proponent" is responsible for implementing "self-monitoring" programs for the projects subject to the EIA. The WB guidelines stress the role of EMPs, which are important for all categories of projects and the Project Proponent is requested to ensure inclusion of monitoring schemes and plans in the EMPs. Monitoring of performance compliance against the EMPs is an important element of the WB requirements.
- Consultation: The Bank provides for consultations for A and B Category projects (at least two consultations for Category A projects) and requires a timetable of consultations from the Borrower. Until recently the national legislation contained only a brief reference to this issue without providing real tools for its fulfilment. The amendments to the Governmental Decree On the Procedure and Conditions of Environmental Impact Assessment established the requirement of public consultation of the EIA, which obligates a developer to (i) ensure public consultation of the EIA, (ii) publicate the information, (iii) receive comments within 45 days, (iv) arrange consultation not later than within 60 days of the publication date, invite stakeholders and determine the consultation venue).

In order to cover these gaps and differences, the environmental and social impact assessment for the proposed OHL Project follows the World Bank Group policies and is in compliance with its procedures and guidelines.

3. Project Description

3.1 Need for the Project

The Government of Georgia (Georgian State Electrosystem), would like to strengthen the national power transmission system and the grid access for South Western Georgia by constructing a 220 kV double circuit transmission line connecting the substations in Akhaltsikhe and Batumi. The new transmission line will ensure more stable electricity supply in the region, reducing outages and enable GSE to meet the growing demand for electricity, as well as enhance export opportunities. The new transmission line will also allow the hydropower projects on the Adjaristskali River, the 178 MW Shuakhevi HPP and the 150 MW Koromkheti HPP, developed by Adjaristsqali Georgia LLC (AGL) to be connected to the grid.

Work on strengthening the transmission network in the Caucasus began in the 1980s. The proposed 220kV line, that is the subject of this ESIA, was originally designed as part of a larger plan to connect the electricity systems of the all three South Caucasus countries, and to improve reliability of the Georgian power system. Planning and design of the section from Akhaltsikhe to Batumi started in 80-ies aiming to eliminate the Batumi "dead-end" through connecting it to Akhaltsikhe and making system grid more effective and reliable. However, after 1992 the construction became impossible due to political events in Georgia, and these plans have been postponed. The project that was planned at that time is now proposed to be completed and extended by adding two new Adjaristskali HPPs (Shuakhevi and Koromkheti). The proposed project would extend Georgia's system according to Georgia's power sector development plan, enhancing export opportunities to Turkey through the new Akhaltsikhe substation, connected to the Turkish grid at Borchka using a 400 kV overhead line.

3.2 General Project Description

The planned activities include the construction of the 220 kV overhead power transmission line (OHL) Akhaltsikhe - Batumi to strengthen/improve entire Georgia power transmission system, to meet the growing demand for electricity, to connect the hydropower plants at Shuakhevi and Koromkheti to the Georgian grid and to enhance export opportunities.

The 220 kV overhead transmission line will start from existing Akhaltsikhe 500/400kV Back to Back substation and will connect to existing Batumi 220kV substation. The total length of the line is approximately 150 km and shall be a double-circuit line with ACSR conductors and an OPGW. The proposed OHL will be connected with substations at Shuakhevi and Koromkheti hydropower plants which are currently under construction and possibly connected to Beshumi ski resort substation after its modification.

The activities envisaged by the project include right-of-way acquisition, land clearing, arrangement of access roads to the poles/towers where required, construction of foundations and towers, stringing – installation of conductors, insulators, other equipment. All activities related to construction and operation phases are described in details in subsections below.

The main permitting authority in Georgia, issuing construction permits, is the Ministry of Economy and Sustainable Development of Georgia (MoESD). The GSE as project developer is planning to apply for the Construction Permit in January-February 2014, after the public consultations are undertaken in accordance to the requirements of Georgian legislation and the World Bank. This ESIA Report will be a part of the GSE application package and will be passed by MoESD to the Ministry of Environment and Natural Resources Protection of Georgia (MoEP) to conduct Ecological Examination based on experts' conclusions and the outcomes of public participation process. Special separate permit should be obtained for the RoW clearing in forested areas from the National Forestry Agency (of MoEP). All the above procedures are described in details in Section 3 "Legal and Regulatory Framework" of this report.

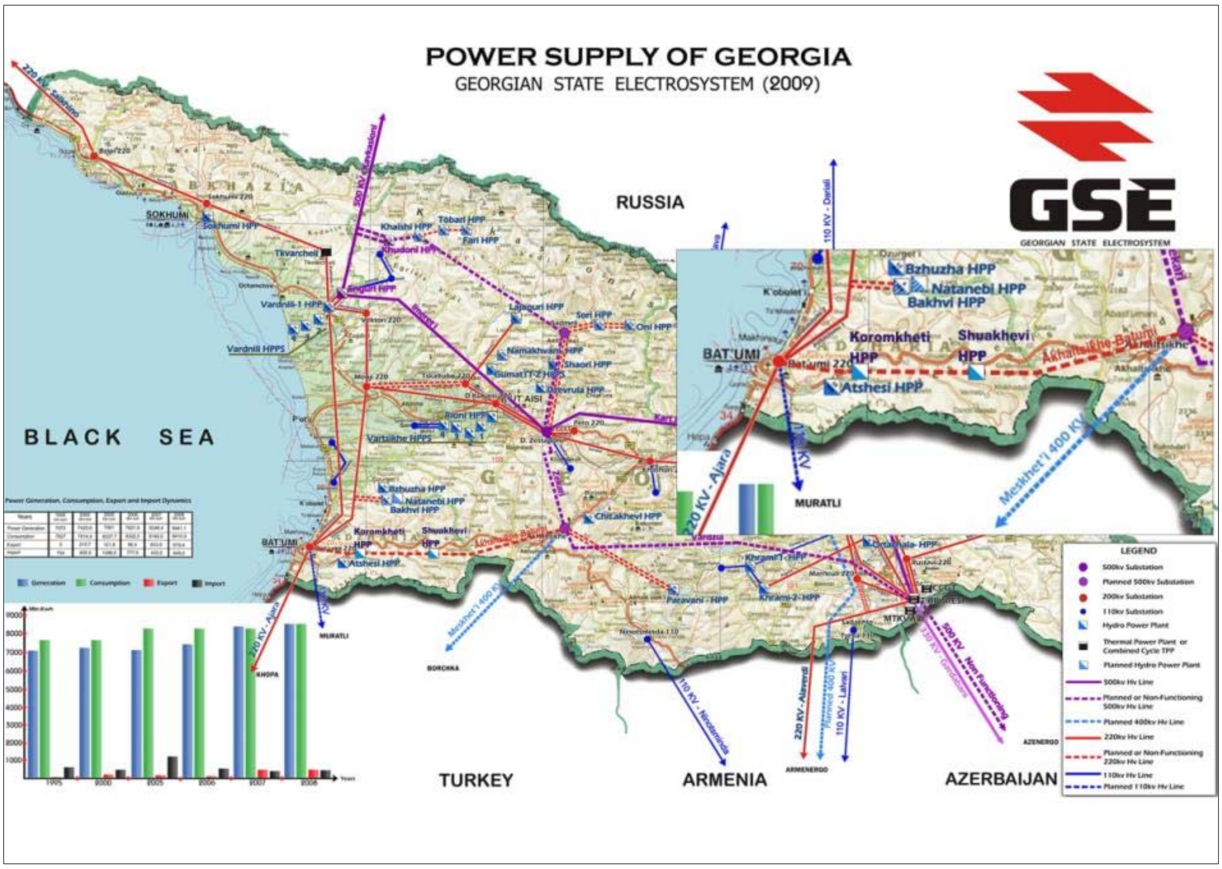


Figure 3.2.1 The Power supply system of Georgia with indication of new proposed line

3.3 Location and RoW

Various features/sections of the project are located in each of the following municipalities: Akhaltsikhe, Adigeni, Khulo, Shuakhevi, Keda, Khelvachauri, Batumi. The final design is based on the outcomes of the routing study, geo-technical and cadastral surveys, towers spotting and the present ESIA. The construction cost is estimated to be around 40 million USD. The map below illustrates the intended route from Akhaltsikhe through Shuakhevi and down to Batumi.

The Routing Study has been undertaken in 2012-2013 to identify a preferred corridor for the construction of a proposed 220 kV overhead line connecting Akhaltsikhe and Batumi substations. The main considerations during the selection of route corridor were: the ease with which the route can be accessed for construction and maintenance; the constructability of the line taking into account the topography; environmental constraints; and ground conditions, including areas prone to landslides. Special attention was given to Social sphere in order to minimize the impacts on local population, agricultural land visual and cultural heritage impacts.

The transmission line corridor practically follows the main river gorges, where the most population and infrastructure are concentrated. The corridor passes the plateau area in vicinity of Akhaltsikhe city located to the south from lesser Caucasus ridge. Then the corridor continues west, crosses the highland section near to the Beshumi mountain and ski resort and dives into the Skhalta river gorge. The corridor follows Skhalta river down to confluence with Adjaristskali river and after follows river and main road down to Batumi, where overhead line will be connected to the existing substation in Batumi.

The corridor crosses different landscape zones, starting from dry grasslands in Akhaltsikhe municipality, forested areas near the village Ude and goes up to the alpine zone. At Beshumi resort it passes small size ridges covered with alpine grasslands. After Beshumi the OHL passes through mixed woodlands, deep v- shape river gorges, mountain slopes rocky outcrops - full range of different landscapes from riparian forests to alpine meadows. In lower part of the Adjaristskali river gorge, the landscapes becomes more hilly, than mountainous covered with dense vegetation typical for subtropical zones, mixed forests are changed to small meadows, valleys etc. Near to Khelvachauri town, population becomes denser, and the line passes through agricultural lands, pastures and forests heading to its final destination.

In terms of administrative districts - the OHL will pass through the territories of the following municipalities: Akhaltsikhe, Adigeni, Keda, Shuakhevi, Khulo and Khelvachauri. The proposed OHL route/corridor is shown on the map (Figure 1.2.1). The proposed corridor uses an existing line (called the 110 kV 'Adigeni-Beshumi') for approximately 11km of the route (east of Beshumi). Tower spotting work has been undertaken following the topography survey/walkover and in collaboration with the constraints mapping. The selected corridor largely avoids built up areas, thus minimising the need for land acquisition and resettlement. The line route itself has been chosen to avoid settlements and their associated infrastructure as well as tourist areas.

Mostly, the areas of tower installation could be accessed through regional and internal roads, which in majority of cases are gravelled or unpaved (dirty). Only in some areas widening of existing village and dirty roads as well as construction of new access tracks will be required because existing roads are very narrow and turning radii cannot allow safe operation of project related vehicles. In such places, the roads will be widened where possible or alternative sections will be required. Specific section of the present report is dedicated to activities for road widening, possible impacts and impact mitigation related with those activities.

It is considered, that the land parcels for pole foundations will be acquired and will become property of GSE. Each tower needs up to 200 square meters of land dedicated for construction of foundations; It is not expected, that the power line will go over the living houses and clearance of this corridor will be required. If such case is unavoidable, than the land parcels required for establishment of power line corridor will be also purchased.

Another portion of land will be used during the construction activities i.e. for assembly of towers and their installation. Required parcels for this activity will be impacted only for short period of time, accordingly the land parcel will be temporarily used and the compensation will be paid only for temporary damage if such happens.

Important issue is clearance of the corridor under power lines. Several type of clearances are considered:

- The clearance of vegetation under the poles (approximately 200 m^2) – all vegetation will be removed and area will be maintained clear during the operation period;
- The clearance of vegetation on the area where pole should be placed and then lifted for installation (approximately 30 meters wide and 50 meters long – 1500 m^2) – all vegetation including crops will be removed during construction and reinstated after the pole is installed;
- the clearance at full width (65 m wide), when all vegetation is removed except than grass and bushes (In case of agricultural land such clearance is not required);
- Narrow corridor for clearance – which is 6 meters wide and will be used at construction stage for conductor pulling and clearance for the vegetation 6 meters wide for access roads to towers.
- The corridor clearance under access road – 6 m wide corridor will be cleared and maintained during operation period.

Approximately 70% - 80% of parcels required for the positioning of poles are located on state owned land, this will be a majority. In terms of quantity, approximately 130 poles are located on the forest land (land under management of forestry department of Georgia). For this parcels full topography information will be submitted to the forestry department of Georgia in order to exclude them from the state forest fund and transfer it to the GSE. Approximately 15% (40-50 poles) of the parcels required for the towers is located on private land – mostly those are agriculture and pasture lands. The acquisitions of such parcels will be carried out in accordance to the RAP. The parcels will be described in detail, cadastral survey will be carried out and the compensation values will be established in accordance to the Georgian legislation and WB standards. The project area location within the country is presented on Figure 3.3.1

Figure 3.3.1 Project location and area coordinates

3.4 Associated transmission lines and connections

The new overhead power transmission line is proposed to be 220kV, **double circuit**, 6 ACSR conductors (one conductor 300/67 mm2 per phase, with composite insulators and one OPGW with 48 fibres), connecting Akhaltsikhe new back-to-back substation with Batumi (Khelvachauri) substation (total length about 150km). Additional connections are planned in the future with the Shuakhevi HPP and Koromkheti HPP - both currently under construction. These additional connections will be built and operated by HPP operators in accordance to the requirements of National legislation and relevant IFI requirements, because the IFI's are involved in the identified projects and the IFI requirements are applicable to the projects.

3.5 Technical Standards and Norms applied

The 220 kV Akhaltsikhe-Batumi overhead power transmission line is designed according to EN 50341-1-2012 (Euro-Norms). This European Standard applies to new overhead electric lines with nominal system voltages exceeding AC 1 kV and with rated frequencies below 100 Hz. The design also considers the standards used by GSE "*Rules of Installation of Electric Equipment - ПУЭ»,* (Ministry of Energy, 1987).

3.6 Project Components

The main components of the transmission line will be routing and right-of-way clearing, towers spotting, preparing access roads to tower location where needed, concrete works for foundation of the towers, erecting of the transmission line towers and stringing of the transmission line conductors. The project does not include construction of substations, because the OHL line will connect existing substations. The transmission line towers will have around 300-400 m spans in average, be approximately 35 meters high and require around 50-150 m^2 area for the foundation (depending on type of pole to be used and topography – maximum $200m^2$ (worth Scenario) of area is considered).

3.6.1 Right of Way

The ROW of a transmission line includes land set aside for the transmission line and ancillary infrastructure, land needed to facilitate maintenance, and to avoid risks of fires and other accidents. It provides a safety clearance between the high-voltage lines and surrounding structures.

The proposed 220 kV transmission line will require average 65-meter-wide RoW. According to GSE regulations ("*Rules of Installation of Electric Equipment - ПУЭ»,* Ministry of Energy, undated) the standard distance between the outer boundary of the road (if in parallel with OHL) and the ROW centerline is the height of tower plus 5m. So preferably, the transmission line route (tower centerline) will be at least 40 meters from the edge of the roadway, and at least 25 meters from the outer boundary of any other OHL RoW. Therefore, the maximum width of the intended transmission line corridor for construction will be 65 meters. Figure 3.6.1 shows the typical 220 kV OHL RoW cross section.

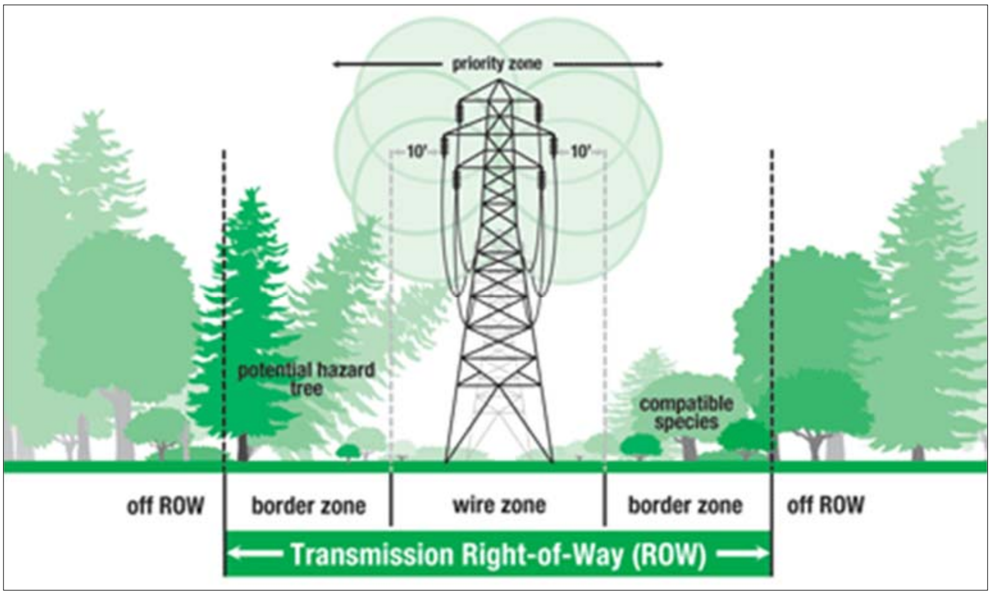


Figure 3.6.1 Typical Cross section of 220 kV OHL RoW

Clearing of trees and removal of other obstructions, where present, will occur within about 30-35 each side of the transmission line (centre line), forming a clear corridor about 65 meters wide (15 meters wire zone and 25 meters from vertical projection each side from outermost wire). The actual width of the corridor in which trees will be cleared will governed by a complex formula in *Rules of Installation of Electric Equipment-ПУЭ,* Annexes 1 and 2 (Ministry of Energy, undated-2). The formula is based on the distance between the outermost lines, the distance between a line and the tops of trees, the possible horizontal movement of slack lines, and tree crown radius after 25 years of growth.

The typical vegetation clearing will be performed depending of type of clearance required. Debris will be removed for disposal so it does not present a fire hazard. In some cases, where the line traverses a valley, vegetation clearing may be limited or even unnecessary since the line may pass over existing vegetation with sufficient clearance and the towers can be accessed independently. Where the route crosses agricultural land, clearance requirements are expected to be maintained easily, so there should be no restrictions on ongoing agricultural activities. In general, construction will follow the Georgia norms specified by Ministry of Energy ("*Rules of Installation of Electric Equipment - ПУЭ»* undated).

3.6.2 Transmission Towers

Double circuit towers have been recommended to minimise line corridor width requirements and therefore the associated land take and disturbance to people and wildlife.

Based on the length, proposed line routing, ground configuration, and depending on location, function and availability – the following four different types of towers are proposed:

- Normal suspension tower (2NS)

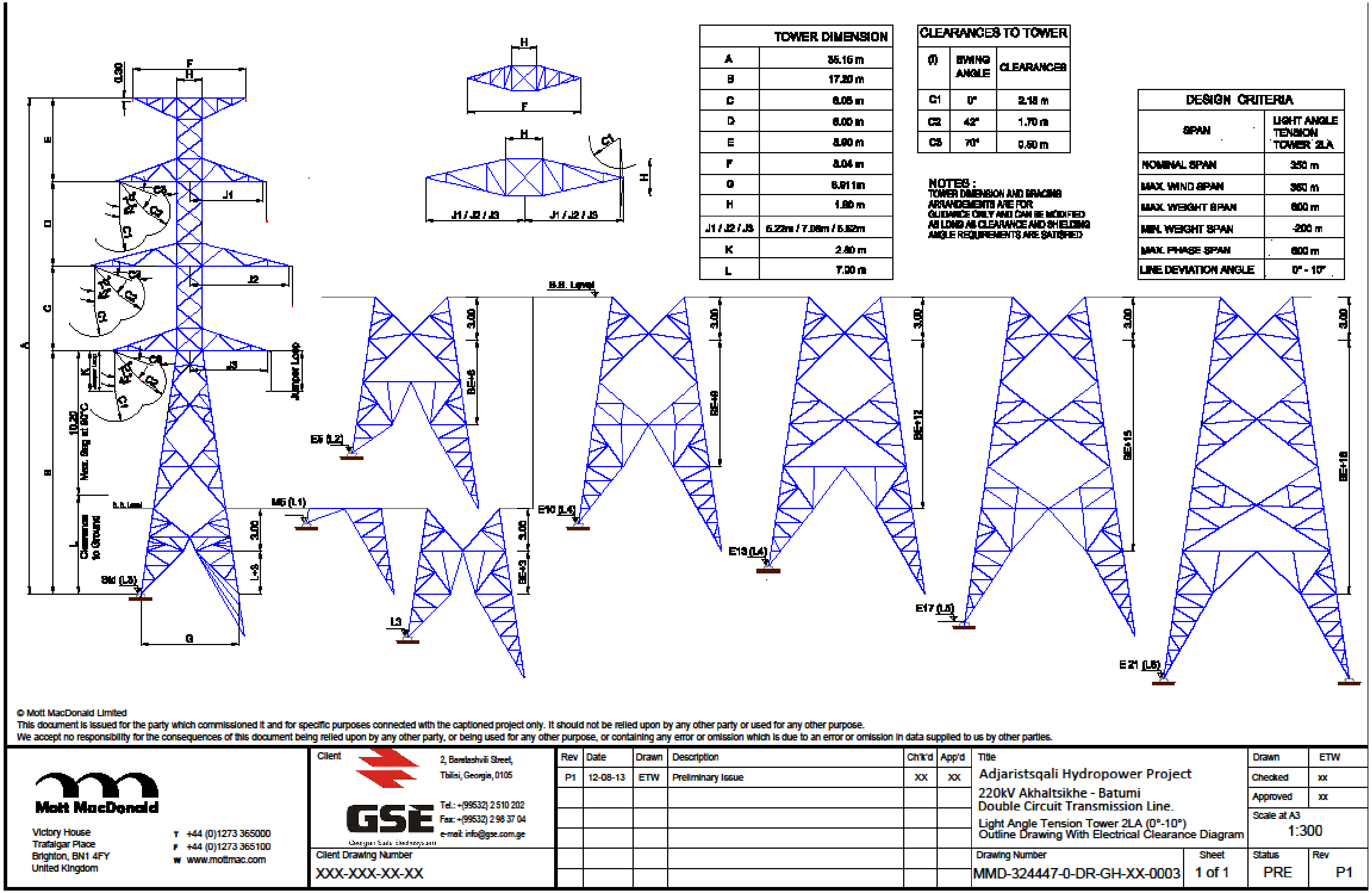
- Light angle tension tower (2LA) for angles up to 30°
- Medium angle tension tower (2MA) for angles 10°-30°
- Heavy angle tension tower 2HA90/DE (for angels 60°-90°)
- Heavy angle tension tower 2HA60 (for angels 30°-60°)

Tower Types		
Normal Suspension Tower (2NS)		
Angle of deviation	0	0-2
Wind span	m	350
Weight span - maximum	m	800
Weight span - minimum	m	245
Foundation footprint (average)	m	8.0 x 8.0
Light Angle Tension Tower (2LA)		
Angle of deviation	0	0-10
Wind span	m	350
Weight span - maximum	m	800
Weight span - minimum	m	-200
Foundation footprint (average)	m	8.5 x 8.5
Medium Angle Tension Tower (2MA)		
Angle of deviation	0	10-30
Wind span	m	350
Weight span - maximum	m	800
Weight span - minimum	m	-200
Foundation footprint (average)	m	9.5 x 9.5
Heavy Angle Tension Tower (2HA90/DE)		
Angle of deviation	0	60-90
Wind span	m	500
Weight span - maximum	m	800
Weight span - minimum	m	-300
Foundation footprint (average)	m	12.5 x 12.5
Heavy Angle Tension Tower (2HA60)		
Angle of deviation	0	30-60
Wind span	m	500
Weight span - maximum	m	800
Weight span - minimum	m	-300
Foundation footprint (average)	m	11.0 x 11.0

Schematic drawing of towers is given on the Figure 3.6.2 - Figure 3.6.4 below.

The proposed project will include construction of 360 foundations and conducting of high-voltage lines between all the towers.

New steel towers will be placed at intervals ranging from 300 to 500 meters depending on topography; towers will be closer when there is little or no relief and farther apart in hilly or mountainous terrain. The interval will be determined during the design in order to ensure the line will maintain a minimum vertical clearance of 8.0 m from ground obstructions, roads, or trees. In-line towers will be 35 meters high and corner towers will be 39 meters high. Towers accessories such as anti-climbing device, complete set of indication and warning plates, etc. are included in the scope of supply.

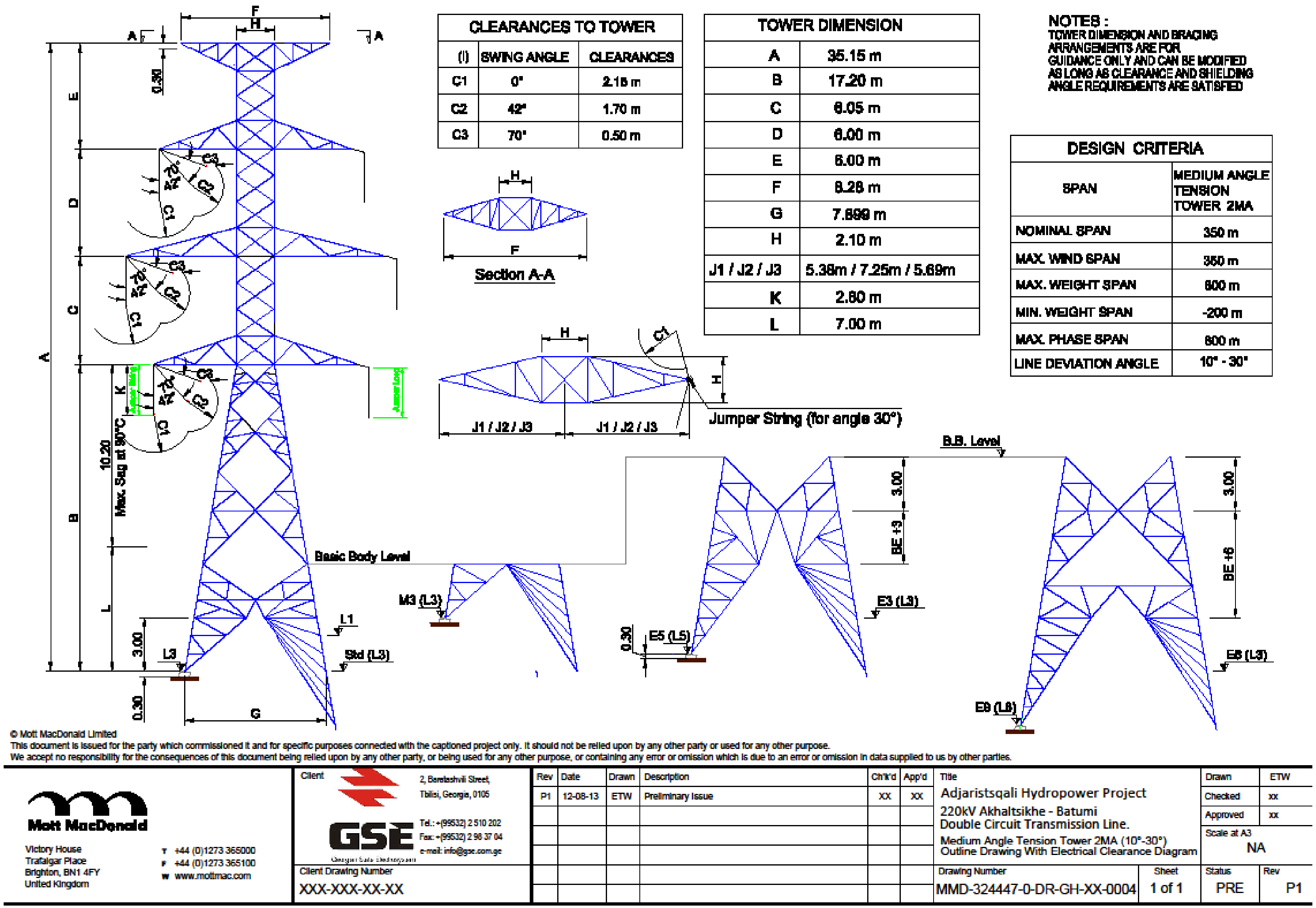


TOWER DIMENSION	
A	35.16 m
B	17.20 m
C	6.05 m
D	6.00 m
E	5.90 m
F	5.04 m
G	6.911m
H	1.80 m
J1 / J2 / J3	6.22m / 7.06m / 5.52m
K	2.80 m
L	7.00 m

CLEARANCES TO TOWER		
(I)	SWING ANGLE	CLEARANCES
C1	0°	2.15 m
C2	42°	1.70 m
C3	70°	0.50 m

DESIGN CRITERIA	
SPAN	LIGHT ANGLE TENSION TOWER 2LA
NOMINAL SPAN	350 m
MAX. WIND SPAN	350 m
MAX. WEIGHT SPAN	600 m
MIN. WEIGHT SPAN	-200 m
MAX. PHASE SPAN	600 m
LINE DEVIATION ANGLE	0° - 10°

Figure 3.6.2 Schematic drawing of towers



CLEARANCES TO TOWER

(I)	SWING ANGLE	CLEARANCES
C1	0°	2.15 m
C2	42°	1.70 m
C3	70°	0.50 m

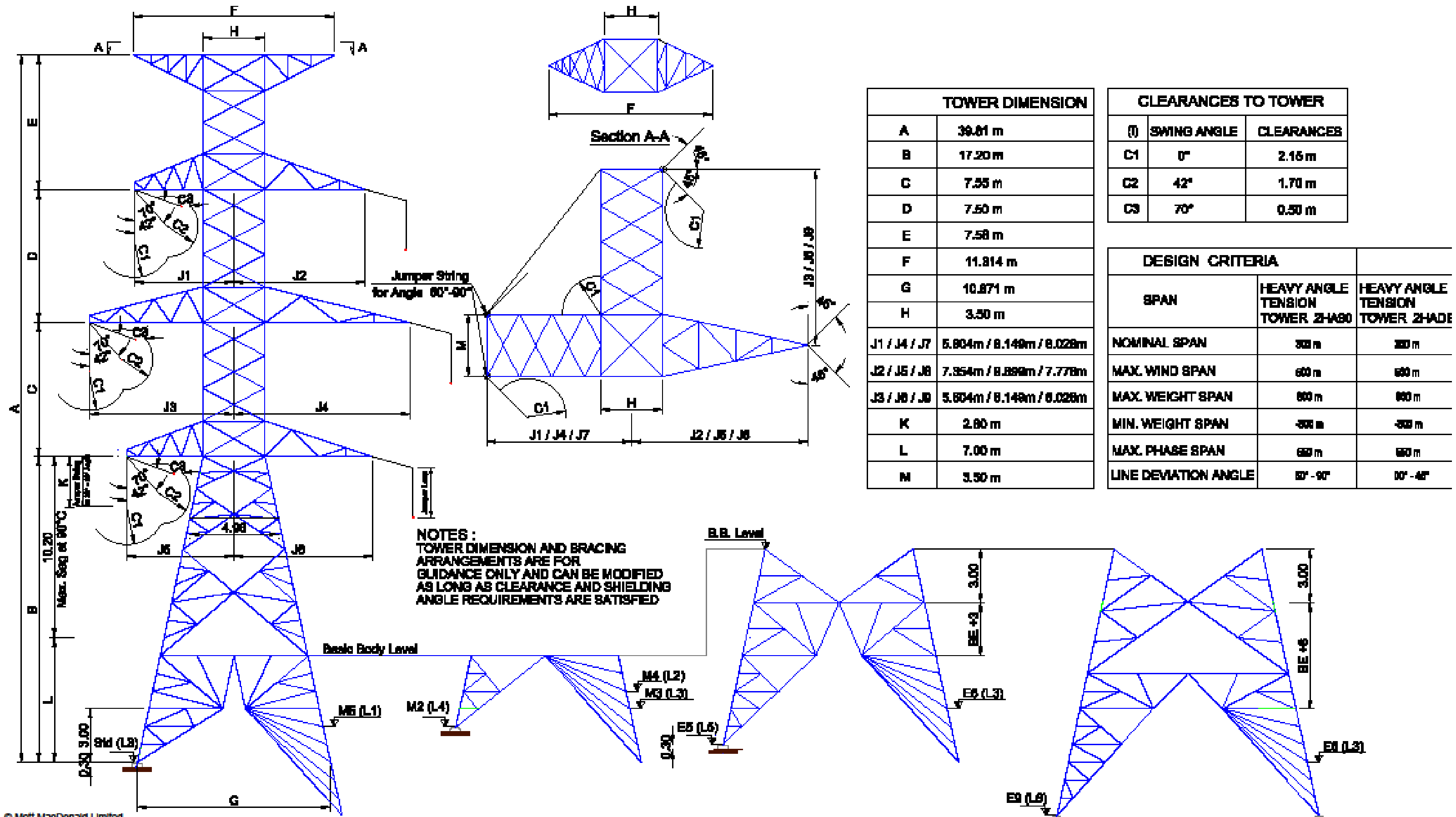
TOWER DIMENSION

A	35.15 m
B	17.20 m
C	6.05 m
D	6.00 m
E	6.00 m
F	8.28 m
G	7.699 m
H	2.10 m
J1 / J2 / J3	5.38m / 7.25m / 5.69m
K	2.60 m
L	7.00 m

DESIGN CRITERIA

SPAN	MEDIUM ANGLE TENSION TOWER 2MA
NOMINAL SPAN	350 m
MAX. WIND SPAN	350 m
MAX. WEIGHT SPAN	600 m
MIN. WEIGHT SPAN	-200 m
MAX. PHASE SPAN	600 m
LINE DEVIATION ANGLE	10° - 30°

Figure 3.6.3 Schematic drawing of towers



TOWER DIMENSION	
A	39.81 m
B	17.20 m
C	7.55 m
D	7.50 m
E	7.58 m
F	11.814 m
G	10.871 m
H	3.50 m
J1 / J4 / J7	5.804m / 8.149m / 6.028m
J2 / J5 / J8	7.354m / 8.899m / 7.778m
J3 / J6 / J9	5.804m / 8.149m / 6.028m
K	2.80 m
L	7.00 m
M	3.50 m

CLEARANCES TO TOWER		
(I)	SWING ANGLE	CLEARANCES
C1	0°	2.15 m
C2	42°	1.70 m
C3	70°	0.50 m

DESIGN CRITERIA		
SPAN	HEAVY ANGLE TENSION TOWER 2HA90	HEAVY ANGLE TENSION TOWER 2HADE
NOMINAL SPAN	300 m	300 m
MAX. WIND SPAN	600 m	600 m
MAX. WEIGHT SPAN	800 m	800 m
MIN. WEIGHT SPAN	-300 m	-300 m
MAX. PHASE SPAN	650 m	650 m
LINE DEVIATION ANGLE	60° - 90°	00° - 45°

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Client Drawing Number: XXX-XXX-XX-XX

Rev	Date	Drawn	Description	Ch'k'd	App'd
P1	07/08/13	ETW	Preliminary Issue	XX	XX

Title: Adjaristsqali Hydropower Project
220kV Akhaltsikhe - Batumi Double Circuit Transmission Line.
Heavy Angle Tension Tower 2HA90/DE (60°-90°) Outline Drawing With Electrical Clearance Diagram

Drawn: ETW; Checked: xx; Approved: xx; Scale at A3: NA
Drawing Number: MMD-324447-0-DR-GH-XX-0005; Sheet: 1 of 1; Status: PRE; Rev: P1

Figure 3.6.4 Schematic drawing of towers

3.6.3 Conductors

Conductors are the cables that transport the electrical power from a power station to the consumers. Generally, three conductors for each electrical circuit are strung on a supporting structure. Conductors are fabricated primarily of twisted metal strands, but newer conductors may incorporate ceramic fibres in a matrix of aluminium for added strength with lighter weight. The phase conductors for transmission lines will consist of aluminium conductor strands with steel reinforced stranded core (ACSR). The conductor will be manufactured in accordance with EN 50341-1-2012 (Euro-Norms), "*Rules of Installation of Electric Equipment (ПУЭ* standards) or other recognized standards.

Based on the type and size of conductors used in existing 220kV systems in Georgia, the following conductor sizes will be used to maintain uniformity in operation and maintenance practices, including maintaining optimum spare parts inventory:

Single conductor 300/67 mm² with associated fittings such as stockbridge vibration dampers, mid span joints, repair sleeves, etc.

Minimum clearance between phase conductors	m	1.4
Minimum vertical clearances from the line conductors at maximum sag to ground or for various crossings:	m	
Normal ground	m	7.0
Ground in populated areas	m	8.7
Roads and streets	m	8.7
Grown trees	m	3.0
Trees which can be climbed	m	3.0
To residential or other buildings with fire resistant roofs having a slope to the horizontal of more than 150°	m	3.7
To residential or other buildings with fire resistant roofs having a slope to the horizontal of less than 150°	m	5.7
Power lines (above)	m	2.0
Telecommunication lines	m	2.0
Minimum horizontal clearances		
Highway	m	40.0
Main roads	m	40.0
Angle of crossing roads	(0)	< 20
Additional requirements for the vertical clearances:		
Minimum horizontal clearances between the line conductors at maximum sag under calculated conductor swing and objects close to the line		4.0

3.6.4 Insulators

Insulator design will be based on the installation of composite polymer type insulators. Insulator strings will be supplied including insulators and associated hardware.

3.6.5 Grounding Rods and Wires

The ground wires are constructed to protect the electrical line from the effects of short circuits on the power system and lightning strikes.

All structures will be permanently and effectively grounded. Individual structure grounding will be made with grounding rods, radial grounding cables or grounding coils. At structure sites with high ground resistivity, such as sand, gravel or rock formations, supplementary radiating grounding or ring shaped ground electrode may be installed. It is anticipated that grounding rods will be solid, copper-clad steel rods with a minimum diameter of 16 millimetres (mm) and 3 m long with provision for coupling together with a suitable clamp for connection of grounding. Grounding wires will be of copper or 7 x 3.25mm galvanized steel wire running from each support structure to the ground wire.

3.6.6 Foundations

Foundations will be designed for all the specified structure types for a variety of soil conditions, both for dry and fully submerged conditions and for rock. Foundations will be of concrete, with a minimum height above ground of 400mm. In flooded areas the height of concrete foundations for lattice structures will be at least 1,200 mm aboveground to ensure protection of the steel against the corrosive effects of water. The minimum depth of the foundations will be 1,200 mm for lattice structures. Using tower average measurements of 10.0 m X 10.0 m at the base of footings,a total of 100 sq. meters is used as the estimated footprint for construction purposes.

3.6.7. Static Optical Ground Wires (OPGW)

Fibre optics will be used for all relaying, voice and data communications between the power plant and the substations. Static wire will be concentric lay stranded aluminium clad steel conductor according to ASTM including a 48 fiber single-mode optical ground wire (OPGW).

One OPGW 70 ACS with 48 fibres with associated fittings and accessories such as joint boxes, vibration dampers, ODF, etc.

3.6.8 Access Roads

Access roads will be needed to obtain access to the new tower locations. During construction of the line access roads will be used to bring workers and materials to the tower sites to conduct tree-cutting operations (where needed), construct foundations, and assemble and raise the towers. Some local roads used by the local population and quite well-established will be partially used as access roads for the proposed line. Where needed, clearing for new access roads will be 6 meters wide; in general, vehicles and equipment will travel across unprepared ground, with no preparation or road construction unless efforts are needed to control erosion or excess land disturbance. If expansion or construction of access roads require any land acquisition, it will be conducted in accordance with the RAP.

Access to tower locations will be made by driving on unimproved access “roads” from existing road crossings over the ground to the right-of-way. Neither permanent nor temporary paved/gravel access roads are proposed in the right-of-way.

3.6.9 Materials and Other Utilities

Structures and accessories that will be used temporarily or permanently during the project include towers, poles, guy lines, tensioning cables, conductors, insulators, grounding rods and wires, static optical ground wires, etc. All materials required for the transmission lines installation are expected to meet the minimum requirements of the Codes and Standards, including applicable EN 50341-1-2012 (Euro-Norms) and GSE “*Rules of Installation of Electric Equipment – ПУЭ”* standards. These Codes and Standards will apply to manufacturing, testing and installation of the project components.

Castings, carbon steel plates and shapes, forgings, fastenings (screws, bolts, studs and nuts), fabrics, cork, paper, wood, adhesives, rubber, cement, resin, corrosion inhibitors, paints, lubricants, rating plates, nameplates and labels, and other materials will also be used during the different phases of the project provided that they are designed to:

- meet internationally recognized safety standards;
- minimize the risk of fire and any consequential damage;
- prevent accidental contact with live parts; and
- be capable of continuous operation or as required with minimum attention and
- maintenance under the conditions prevailing in the tropical climate.

The list of minimum/sample required equipment necessary for construction of the OHL with proposed parameters is given below:

- Excavator 130 HP – 3;
- Bulldozer – 3;
- 16 t crane – 3;
- 25 t crane – 1;
- Tractor-lifter;
- Self-unloading truck – 2;
- Car carrier 18-20 t – 1;
- Brigade truck vehicle with winch – 2;
- Brigade 4WD vehicle with winch – 1;
- Equipment for installation of line and fiber cables – 1-1;
- Pressing aggregates of lines and holders – 3;
- Wood cutting saw and other required equipment.

3.7 Project Activities

3.7.1 Mobilization Phase

Mobilization of equipment, materials, and construction personnel, together with final design will commence when all necessary permits and approvals have been obtained. The Mobilization Phase will include establishing offices and material storage areas in the project area, assembling equipment; and procuring construction workforce and materials. The Mobilization Phase is anticipated to last approximately two-three months. It is anticipated that materials and equipment will be imported for the construction phase, through the Port of Batumi and delivered to the storage areas by container trucks.

Location for the construction camps will be identified by selected Contractor, at the mobilization stage. Number of camps could be 2 or 3. In reality these are more equipment yards, used for storage of equipment and vehicles, fuelling, etc. rather than camps. It is expected, that workers involved in construction activities will be accommodated through renting of houses with sanitation, however as option they can be placed in rented or constructed construction camps. The selection of alternatives is up to the contractor, however the accommodation facilities should consider HSE requirements applicable for construction and recommendations given in the present ESIA report. About 25-30 people will be accommodated in one camp. The camp facilities if constructed will be constructed using mobile living units in standard containers, will have power and sanitary facilities, warehouses, car parking and repair facilities etc. The camp will be securely fenced and guarded to avoid unauthorized entering.

The filling material can be supplied to Contractor from the licensed quarries only (several such quarries are located in the Adjaristskali River valley). The unauthorised use of natural resources like soil from borrow pits, gravel from river channels etc. will be strictly prohibited.

The contractor will have in place a procedure to ensure that it will not mobilize equipment, start works or damage existing crops or structures without ensuring the adequate permits, land access rights, RAP issues, and evidence that the land owner/user has been informed in advance.

3.7.2 Construction Phase

The construction of the **transmissions line** will require the creation of some temporary access roads to the transmission construction sites. The construction of the transmission towers themselves will require some localised vegetation clearance. Materials arising from the excavation for the tower foundations (soil, rock etc.) would either be spread in appropriate areas surrounding the line or removed to another site as agreed. The foundations will be prefabricated concrete pad & chimney type or alternatively mixed on site. Following tower erection, conductor stringing, which may involve the use of a mobile crane, will occur and may result in the need for tree cutting along the Right of Way (RoW).

The works will be sequenced as follows: removal of the upper layer of soil (topsoil), rehabilitation-construction of access roads (as needed), processing of tower foundations, arrangement of gravel lining, installation of concrete foundations with ground refilling, arrangement of grounding contour, preparation of installation areas of towers, transportation of towers, installation of towers, installation of lines and optical-fibre cables, cleaning of construction territory from construction and other waste, laying of stored topsoil.

Construction of the transmission line, structures, and temporary facilities, will require the use of various types of equipment and manual labour. Activities can be described as follows:

- Tower Spotting;
- Clearing of Right-of-Way ;
- Clearing and Excavation of Tower Base and Foundation;
- Clearing of Tower Track;
- Storage and Transportation of Equipment and Material;
- Erection of Towers and Stringing of Transmission Lines;

Construction of the proposed transmission line will utilize skilled, semi-skilled, and unskilled labour. A temporary workforce of approximately 80 workers is anticipated. The majority of the labour force will be recruited from within the country and will include the maximum use of qualified personnel from the local communities as per Local Recruitment Plan to be prepared by the contractor. It is anticipated that the construction phase will last approximately 15 months.

3.7.3 Tower Spotting

Tower spotting is the determination of the individual sites for the installation of the towers. Activities that will be undertaken along with tower spotting include final survey and soil investigation. These activities necessitate intrusive access and some clearing of vegetation, leading to possible destruction of crops. Geotechnical survey and tower spotting are carried out to identify the optimum foundation design for each tower.

The selection of the foundation design type will follow the collection and analysis of the data of each tower location after soil investigations. At this stage minor adjustments may be made to the final tower location, due to the vertical profile of the transmission line corridor, and to avoid buildings that may have been constructed subsequent to the collection of baseline data on structures in the proposed ROW. Such adjustments will be limited to a few meters in either direction.

During this stage the contractor will also ensure and document that the proper permits are in place and that the land user/owner has been informed in advance. Whenever possible the land user/owner will be invited to participate in the process to help minimize adverse impacts linked to the location of the towers.

3.7.4 Clearing of Right-of-Way

The transmission line does require the removal of trees at certain. Through the use of the avoidance and/or mitigation measures specified in the ESIA and detailed in the contractor's ESMP, a key target is to avoid areas of known outstanding beauty, important habitats, or areas that have archaeological remain or cultural heritage. Through pre-construction surveys, areas where Red List Trees are located or areas where archaeology are found, these areas will by marked, noted on project plans and avoided. A key task of the project is to conduct construction activities and erect the transmission line with minimal affect to sensitive areas. The requirements and procedure for such activities is described in detail in the impact analysis section of the present report (Please see Section 7).

The construction and operation of the proposed line will require a right-of-way of approximately 25 m on each side of the edge wire. The right-of-way will therefore be of width of 65 m. This total of 65 m wide corridor, which will run the total length of the transmission line, shall be cleared of vegetation to a height of approximately 1m above ground level.

Trees considered being potentially capable of threatening the proposed transmission line beyond the 25m width on each side of the edge wire will be cut down or pruned as appropriate. These will be trees, which could damage the transmission line if they fall on it or whose branches may grow so big as to affect function and safe operation of the transmission line. All vegetation clearance will be done by physical means, and no chemicals will be used for the vegetation control.

3.7.5 Clearing and Excavation of Tower Base and Foundation

The proposed tower base areas will be cleared. These will be selected spots within the ROW for mounting the towers. The area to be cleared for a single tower will be made up of the approximate dimensions of the tower base (from 10x10m to 13x13m), however this depends on number of factors). The total tower base area as stated before will depend on type of pole to be installed, and topography at each tower location. The present report considers 200 m² as maximum impact area required for each pole - worth scenario.

Tower foundations will vary according to the prevailing geology. The towers will have concrete footings with foundation depths of 2–3 m or more depending on the nature of soils at the selected tower spots. A majority of them will have footings of the pad and chimney type, which will be excavated mechanically. This method involves constructing a concrete pad at the base of the excavation area, after which each foot of the tower is erected within its own 'chimney' of steel reinforced concrete. After about two days, the formwork will be removed, and the excavation will then be backfilled to original ground level and the ground surfaces of the tower sites will be graded in order to provide gentle drainage away from the tower legs in order to avoid the collection of water at the tower bases which may lead to the development of stagnant water pools. Where necessary, (particularly on hillsides), terracing, cribbing or riprap may be used to provide protection for tower foundations.

In areas prone to flooding (swampy areas) a raft foundation for transmission line towers may be used. The raft foundation is similar in concept to the pad and chimney foundation except that all four feet of each tower would be set on a single raft of concrete.

3.7.6 Storage and Transportation of Equipment and Material

During construction, the materials will be transported to the site via public roads and access tracks. Vehicle movements will be minimal since the work camps will be sited close to the proposed sites. As mentioned before camp's location, size and other parameters will be defined by the construction contractor, however the contractor must take into account HSE requirements applicable to camps.

The locations of the work camps cannot be specified now but their construction will not involve extensive vegetation clearance. In addition, the work camp will be constructed:

- At least 1 km from natural water courses and marshlands; and

- At least 1 km from settlements and on relatively flat area

The location of the work camp will not impact negatively on cultural properties, and on forest resources. It will also be located so as to avoid the destruction of crops and buildings.

3.7.7 Erection of Towers and Stringing of Transmission Lines

After transporting the steelwork and its components from the yards to the site, erection of the transmission towers will proceed. Once the towers are erected, the conductors and shield wires will be strung and appropriately ‘tensioned’ to provide the minimum clearance between ground level and the wires.

The proposed line is expected to cross over other power and transmission lines, highways, roads, and rivers and streams. Guard structures will be used when installing the conductor to ensure that the line does not cause hazards and nuisances to the public and construction staff alike. Due notification will be communicated to the appropriate authorities in cases where these lines will have to cross roads and utility lines.

Once the towers have been erected and the lines strung, tests and measurements shall be carried out to ensure that the line performs as expected. Minimum distances such as clearances between the lines and the ground level shall be checked and the lines shall be ‘tensioned’ as per specification. After the construction of the line, the soil conditions along the right-of-way will be assessed for such problems as compaction and erosion, and the mitigation will be taken as appropriate. Areas of bare soil are expected to be recolonised by native cover plants to stabilize the soil, reduce erosion and prevent invasion by undesirable plant species.

The line will be fitted with an optic fibre cable (OPGW), which will be used for system protection and control and communication purposes.

Line conductor installations/stringing will be accomplished using two basic techniques. In drivable terrain, the conductors will be on rollers at the end of a section. The line conductor will be played out between the towers using a four-wheel drive vehicle with a specialized pole that will pull the line conductor from tower to tower while driving along the right-of-way. Once the line conductor is played out, it will be pulled to the required tension to maintain a minimum clearance requirement. Figure 3.7.1 shows typical ground-based conductoring.

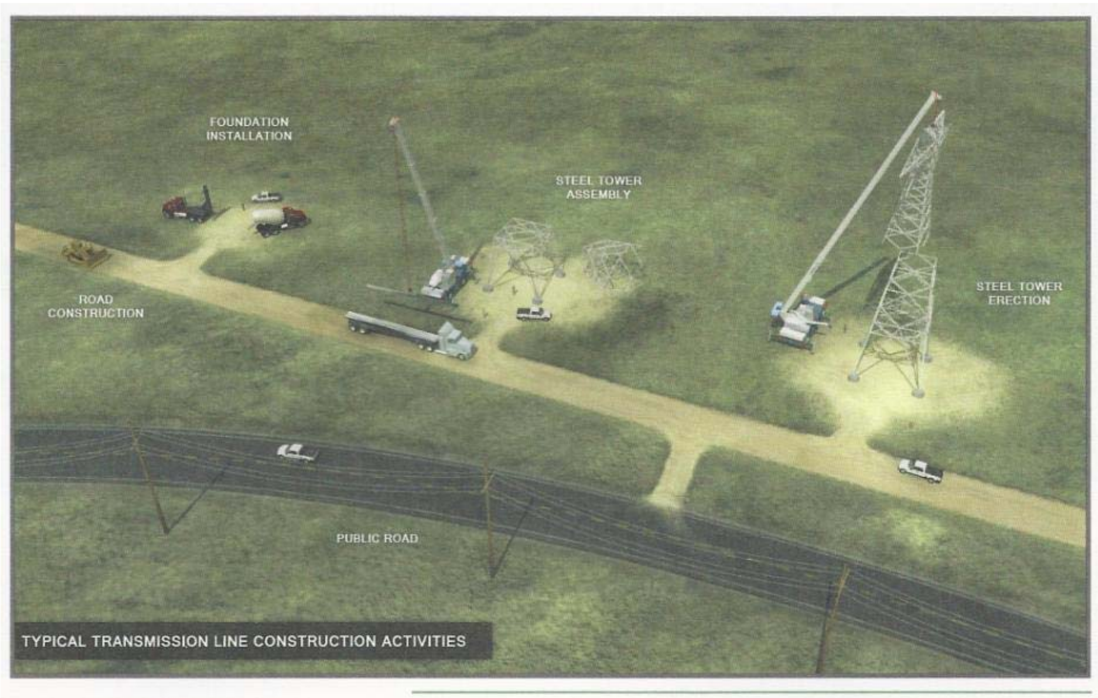


Figure 3.7.1 Typical picture of construction works

Figure 3.7.2 View of the pole assembled near to foundation

3.7.8 Operations Phase

Once constructed, the transmission line will require minimal maintenance. Yearly visual inspection of the OHTL towers and conductors is expected. After a period of many years, the entire system would need a detailed survey and overhaul. There may be a requirement for occasional visits to remove tree or branches where these start to grow too close to the OHTL. Access rights may need to be retained to allow for maintenance works in the future.

The operational phase of the project will involve the commissioning of the line and maintenance of the ROW, the power lines and the towers. The operation and maintenance of the transmission line will be based on accepted international standards, such as those of the International Electrotechnical Commission (IEC). The GSE has its own specific procedures for the operation and maintenance of its lines as set out in the 'GSE Rules and Regulations'.

The main activities to be carried out during the operating life of the transmission line include surveillance of the condition of the transmission line, towers and ROW; routine and emergency maintenance and repairs; and vegetation control. Vegetation control measures will be done manually. All operations will be managed in accordance to E&S Management System requirements prepared in accordance to the requirements and recommendations set in the present report fully compliant with local legistation and WB requirements.

The GSE maintains a department that is responsible for the operation and maintenance of its transmission network. The department carries out its duties through the activities described below:

This consists of routine maintenance carried out by the maintenance department to ensure the integrity and safety of the lines. The maintenance activities carried out here include:

- **Foot patrol:** The Line Maintenance team carries out routine physical examination of the transmission line and its component parts to ensure the safety, security and integrity of the line. Such activities are carried out at least twice a year.
- **Security patrol:** This is done to check on segments of the line close to populated areas for signs of vandalism, tampering, and general security of the lines. It is to ensure an early detection of and rapid response to acts of vandalism and to rectify such situations as promptly as possible.

- **Tower auditing and repairs:** This provides a means of assessing the ageing process of towers. It starts one year after the commissioning of a line section and follows an one-year cycle. In a cycle of tower auditing, 10% of all suspension towers and all dead-end towers are thoroughly examined. As the line ages, it is subjected to wear and tear resulting in fatigue which may not be noticeable by a distant visual inspection. Detection and tightening of loose bolts on supports and hardware can reduce premature wear and indicate for replacement of worn components before failure.

In the course of operation, defects that are identified are repaired. Such defects may include the replacement of defective conductors, flashed over insulators, defective dampers, vandalized components, signs, and maintenance of access roads and ROW.

These are scheduled maintenance programs that are carried out on the transmission line to counteract the effects of the ageing of towers, lines and other accessories. The repairs may also arise out of the running maintenance activities. These maintenance programs usually become necessary as a result of the lines running through harsh environments. Some of the activities carried out under the major maintenance program include:

- Replacement of insulation of sections of the transmission line.
- Treatment of rust and re-painting of tower components.
- Replacement of corroded towers and transmission line components.
- Replacement of conventional bolts and nuts with anti-theft fasteners where necessary.
- Rehabilitation of access roads and tracks.

In forested areas, the right-of-way will require vegetation control measures to maintain clearance for transmission lines and to maintain access to the towers. Vegetation control will be conducted mechanically, with cutting activities occurring every 6 to 8 years. Herbicides will not be used for vegetation control. An example of a cleared corridor in forested terrain is shown in Figure 3.7.3

Figure 3.7.3 Example of a cleared corridor in forested terrain

Access to towers locations will be achieved by driving to existing road crossings and entering the right-of-way by driving over the ground or by driving along dirt access roads (where they exist along the existing sections of the line). Neither permanent nor temporary paved/gravel access roads will be established and maintained in the right-of-way. In all cases, access through private properties will be arranged with prior information to the land user/owner and after accomplishment of all procedures defined by RAP or LRF documents prepared and adopted for the present project in accordance to WB Recommendations.

These are activities relating to correction of sustained line faults. These could span a whole spectrum of minor faults (e.g. insulator failure) to such major defects as tower failures. Some of the activities carried out under this program include the construction of temporary by-pass line to replace collapsed sections of lines, reconstruction of the collapsed section, and aerial and ground patrols to locate sustained line faults.

3.7.9 Decommissioning

The transmission line is likely to remain in place for many years and therefore any decommissioning works would be a long time in the future. Operation of the transmission line is not limited and expected to continue. Decommissioning of the transmission line infrastructure is not very likely at least during nearest, 25 years, but rather a long-ranging repair or exchange of line components. Decommissioning of technical installations comprises dismantling, decontamination of materials and site, shipment and final disposal of materials as well as site rehabilitation.

Towers should be dismantled and removed and materials recycled/re-used as far as possible. Disposal of materials can take place either by selling, re-use or depositing. Any areas disturbed would be restored to pre-project conditions and/or to conditions acceptable to the Ministry of Environment.

If required, GSE (or the current operator if different) would develop a Closure Plan within two years prior to decommissioning for submittal to the Ministry of Environment for review and approval. All environmental impacts associated with the decommissioning process would be minimised through the implementation of an environmental management plan as part of the Closure Plan. The Closure Plan would demonstrate that GSE (or the current operator if different) is fully committed to its responsibilities and the degree of planning and input required to protect the local and regional environment of the project area.

4. Analysis of Project Alternatives

Alternatives to the proposed transmission line were evaluated to determine whether they were reasonable and environmentally and socially preferable to the proposed action. The alternatives considered include the no-action alternative, alternative systems, design alternatives, route alternatives, towers location alternatives.

4.1 No-action Alternative

Under the no-action alternative, the 220 kV Akhaltsikhe-Batumi overhead power transmission line would not be constructed and all direct environmental and social impacts associated with construction and operation of the proposed electric transmission lines would be avoided. Planning and design of the section from Akhaltsikhe to Batumi started in 80-ies aiming to eliminate the Batumi "dead-end" through connecting it to Akhaltsikhe and making system grid more effective and reliable. However, after 1992 the construction became impossible due to political events in Georgia, and these plans have been postponed. So it is already more than 20 years of "no action" undergo. At the same time it is clear, that without the electric transmission infrastructure, AGL and GSE would not be able to provide electrical energy produced at the Adjaristsqali Cascade Hydropower Scheme (in particular Shuakhevi HPP, Koromkheti HPP, which are already under construction) to surrounding communities, Georgian grid and for the export to Turkey. So the consequences of "no-action" alternative for the proposed OHL project should be considered only in conjunction with "no-action" for the entire Adjaristsqali Cascade Hydropower Scheme. Once the decision on construction of HPPs has been made – then the OHL construction became unavoidable. The OHL represents the main attribute/implication of HPP construction. Another argument is that: the "no action" for this OHL is already undergoing for the recent 20 years that starts threatening power supply reliability and effectiveness of the entire Georgia grid due to Batumi "dead end". So the implication/result of "no action" alternative will be: a) more power cuts and accidents on Batumi branch, b) HPPs without connections to the substations and c) undermined/lost export potential.

4.2 System Alternatives

System alternatives are alternatives to the proposed actions that would make use of other existing, modified, or proposed electric transmission systems to meet the objectives of the Project. A system alternative in general makes unnecessary to construct all or part of the proposed transmission line, although significant modifications or additions to old/existing transmission system are usually required to increase existing capacity or provide the necessary delivery. Such modifications or additions would result in environmental and social impacts which could be similar to, or greater than that associated with new construction under the proposed project. In this particular case the proposed 220 kV Akhaltsikhe-Batumi overhead power transmission line is related to elimination of the Batumi "dead end" of the grid, simply to "close" the system circuit, and also related to the construction of new HPPs in the area where the required power transmission capacities do not exist at all, and the new lines should be constructed anyway, simply to deliver produced power to the grid.

4.3 Design Alternatives

Two types of transmission line systems, an underground cable system and overhead transmission line can be considered for part or all of the transmission lines' routes. An underground cable system, though visually appealing in the long run, will cause more disruption during construction and decommissioning as it will involve a larger area for excavation and hence greater negative environmental and socio-economic impacts, especially in residential areas. In addition the line ROW runs through the areas prone to erosion and landslides, making any extensive excavation activities in the area highly disruptive.

So the reasons why underground options are not considered as alternatives to the project are, firstly, of technical nature, given the technical difficulties and complexity, in terms of the safety and reliability of an underground line. These limitations are the reason why this type of project is not carried out in Georgia and is very seldom in Europe.

The environmental implications of this type of solution are also important. In fact, the installation of an underground line section would require the opening of a considerably continuous large trench for the installation of the cables, to which would be necessary an additional access route, contiguous and parallel, throughout this ditch, to allow the traffic and operation of any vehicle or equipment that would be needed to service or repair the line. If there were no further issues to consider, only the need of this continuous and naked strip, that could reach 15 meters wide, largely opened in excavation due to land relief, it would be enough to produce very significant impacts on landscape and soil use (in particular, on terraced slopes prone to erosion and landslides) that would led to a negative assessment of this hypothetical alternative in an area with the geologic characteristics such as the Adjaristskali valley.

Also, the need of cable joints would have to be considered, with the installation of inspection chambers, with a surface expression that would expand the mentioned negative effects, at least in 500 metres, for that being the maximum length of cables available for this purpose, and, especially, the need to install an underground line transition between the underground line and the overhead power line on a 20 x 40 m platform (forcing to a much higher expression earthwork, due to soil characteristics and orography, which could reach almost to the size of half a football field), thus, not existing in vicinity a location capable to effectively mitigate the visual effects and soil occupation of this technical installation.

Additionally to the abovementioned aspects, pertaining to the construction phase, it should be noted that the accessibility to underground cables joints and inspection chambers will have to be maintained throughout the power line shelf life, so that dedicated access corridors should also be maintained.

The crossing of the Adjaristskali River through an insulated cable on the riverbed would require the establishment of special structures for the protection of the power line, possibly through concrete boxes, which is considered less feasible in technical and financial terms. Important issue is that the environmental impact caused by trenching, excavation, filling of trench will be much higher, considering high risk to geohazards in the area, characteristics of river hydrology and, river bed geology, than in case of overhead line, although it could solve the visual impacts caused by construction of OHL.

It is also more difficult to locate trained manpower for continued maintenance of the underground cables. In addition, the cable systems are more expensive to operate and have higher maintenance costs as compared to overhead transmission lines.

Although it is already a relatively marginal issue in relation to the strict environmental analysis, it is important to mention the increased direct costs that the construction of a power line with these characteristics would have relatively to the conventional overhead line. There are several factors contributing to this cost increase and not all of them are easily foreseeable, namely those that are related to the geological conditions found in the opening of the ditch for the underground line and the land price needed to ensure the permanence of that ditch and adjacent path; however, its value can be estimated between 10 to 15 times higher per kilometre of line to build, for the underground line comparatively to the costs of an overhead power line.

The proposed design of the transmission lines is an overhead transmission line system. Technically, this option is simple as compared to underground cable system as trained manpower is available. Tower heights maybe elevated when the ROW nears a built up or urban area. Economically, construction and operation & maintenance costs of overhead transmission lines are lower. Socially, this system causes relevantly less problems as it poses no threat to existing utilities (water supply, telephone lines, gas lines etc.) as no large scale digging/excavation is involved.

So the underground alternative, even in a partial section, is considered environmentally, technically and economically unfeasible due to expected environmental impacts related to high risk of geo hazards. However, it can be used in case of OHL construction in specific area is unacceptable due to cultural heritage, unacceptable or unavoidable environmental impacts on critical habitats, unacceptable alteration of views in touristic zones etc.

4.4 Route Alternatives

There are a large number of factors needing to be considered for selecting the line route and tower positions. This would include but not be limited to:

- Consideration of geotechnical, environmental and archaeological constraints. These areas of natural parks, areas of scenic or historic value or posing geological hazards are to be avoided;
- The most direct line possible to be taken. Sharp changes in direction should be avoided, with the minimum number of angle supports placed.
- The route line should follow natural lines created by topographic change, geology and vegetation that will help to minimise the visual impact.
- Consideration to the width of the line corridor should be given to clearance distances to avoid any obvious infringements;
- Consideration should be given for areas suitable for stringing equipment and laydown areas.
- To minimise visual Impact, the line should be hidden, as far as possible, amongst natural contours.
- It is desirable to avoid open expanses of water and marshland. The overhead line should not go too close to shores of rivers or natural lakes.
- In moderately open wooded valleys the apparent height should be as low as possible with views of the line broken by trees. (This will help to minimise the exposure of the number of towers)
- In forested land, a sinuous cut or angle near important views is preferable to a straight one so the line cannot be viewed fully along the route.
- It is preferable to avoid breaking the sky line. Tree or hill backgrounds should be chosen in preference to sky backgrounds wherever possible. Where the line has to cross a ridge, secure this opaque background as long as possible and cross obliquely when a dip in the ridge provides an opportunity. Where it does not, the line should cross directly, preferably between belts of trees.
- Minimize acquisition of private lands and adverse impacts on agricultural lands and inhabited areas.

Alternative Routes between Zikilia AP01 - Substation AP05 - (Alternative 1.1 and 1.2)

Two alternative routes have been evaluated for the first section of the OHL at Akhaltsikhe (Zikilia) Substation between AP01 to AP05 - the Southern alternative and the Northern alternative (alternative 1.1 and 1.2, Figure 4.4.1).

The Southern Alternative corridor starts from northern part of Zikilia Substation where the 200kV new Akhaltsithe – Batumi 220kV line will be connected to the existing hub. Then the corridor goes south, turns around the substation and continues to the west to Mugareti Village. The corridor passes in between the Mugareti and Persa villages, through narrow gap between the settlements.

The Northern Alternative corridor starts from the same northern hub/connection of Zikilia substation to the north-west, reaching mountain foothills, and then turns to south-west, crosses deep seasonal gorge, climbs to the next mountain ridge and approaches the narrow path between Mugareti and Persa villages (mentioned above) with different angle, affecting less houses.

Both alternatives have been evaluated in terms of environmental and social impacts expected during construction and operation phases. Both alternatives are technically viable and the length is practically the same (the Northern Alternative is a bit longer), however, the number of poles required for construction will be practically similar - accordingly, the footprint will be the same in both cases. In terms of construction difficulty, the Northern Alternative is slightly more difficult, however there are no specific constrains in terms of access to construction area. The impact during the construction stage will be similar, except minor difference due to access length to the Northern Alternative. The impact on flora and fauna will be similar during the construction and operation of the power line, because the, baseline environmental conditions, habitats, flora and fauna characteristics are similar in both cases (no specific difference in terms of receptors and their sensitivity) and expected impact can be considered as correlation of route length.

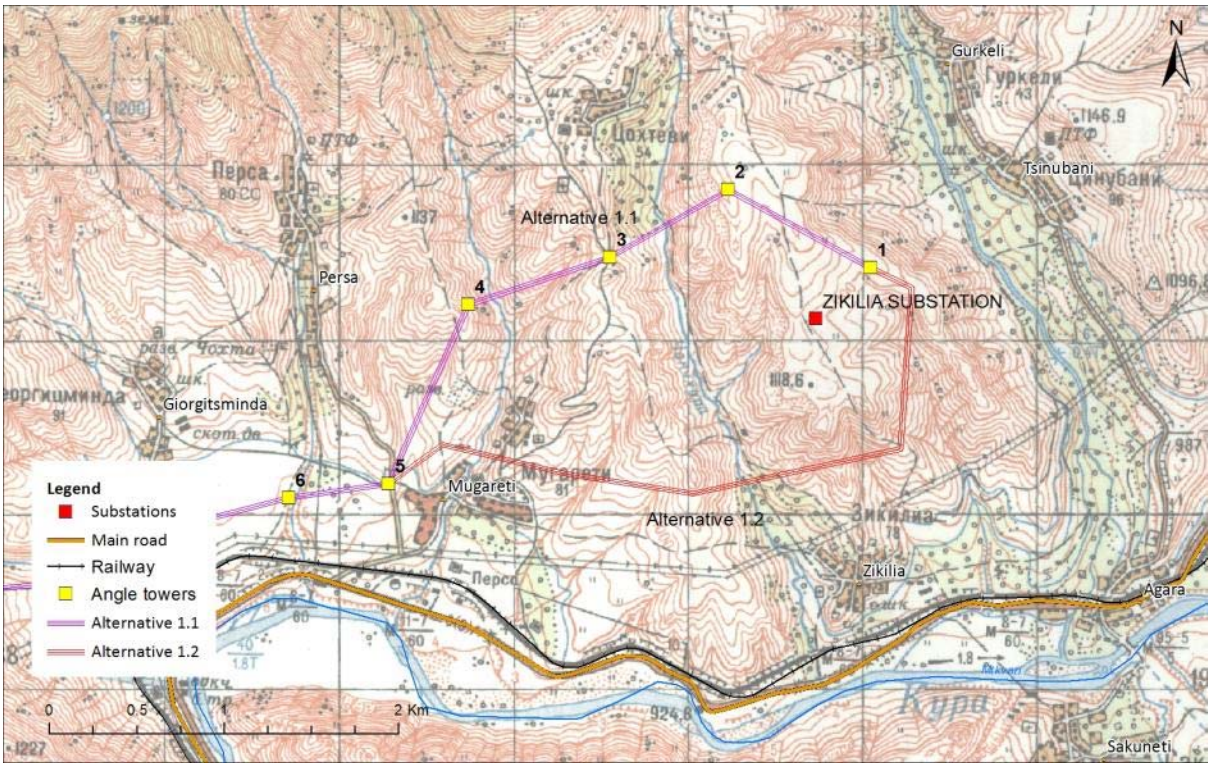


Figure 4.4.1 Alternatives 1.1 and 1.2 between Zikilia AP01 to Mugareti AP05

The difference is in impact on **landscapes, visibility and the population**. The Northern Alternative is visible only from the places used for cattle grazing, where practically there is no population or public area. In case of South Alternative, the parts of OHL will be visible from Borjomi-Akhaltsikhe road and several settlements adjacent to the road. Accordingly, there will be more visual impacts in case of Southern Alternative.

The social impact on communities at the construction stage is similar in both cases. However, impact of Northern Alternative during the operation will be less in v.Persa and v.Mugareti and especially for v.Mugareti population, because in case of Southern Alternative, 1.2 km of the line will run parallel to living houses in Mugareti.

The analysis of alternatives at this section clearly indicates the advantages of Northern Alternative. Although the Northern Alternative requires a bit more efforts at construction stage, and thus causes a bit more impact on natural environment, it happens only during the short construction period (2-3month). But eventually the Northern Alternative ensures that the visual impacts and topography; environmental constraints, impact on communities will be significantly less for the entire operations of the line, i.e. entire lifetime of the project.

Alternative Routes between Beshumi AP37 – Zamleti– AP60 (Alternative 2.1 and 2.2)

Two alternative routes have been proposed during the routing study, one (Southern Alternative 2.2) passes through Skhalta Valley and second (Northern Alternative – 2.1) follows unnamed gorge located between Skhalta and Adjaristskali rivers (please see Figure 4.4.2). Based on reference sources and information collected at stakeholder consultations, the Southern Alternative through Skhalta Valley was considered as preferable alternative and is therefore being persuaded. The

Northern Alternative route through the unnamed valley crosses untouched, almost virgin natural forest, which is the only area considered as natural habitat remaining between Skhalta and Adjaristskali valleys. The evaluation of mentioned alternative routes, has clearly indicated, that Alternative 2.2 definitely has less impact and is selected as preferred alternative.

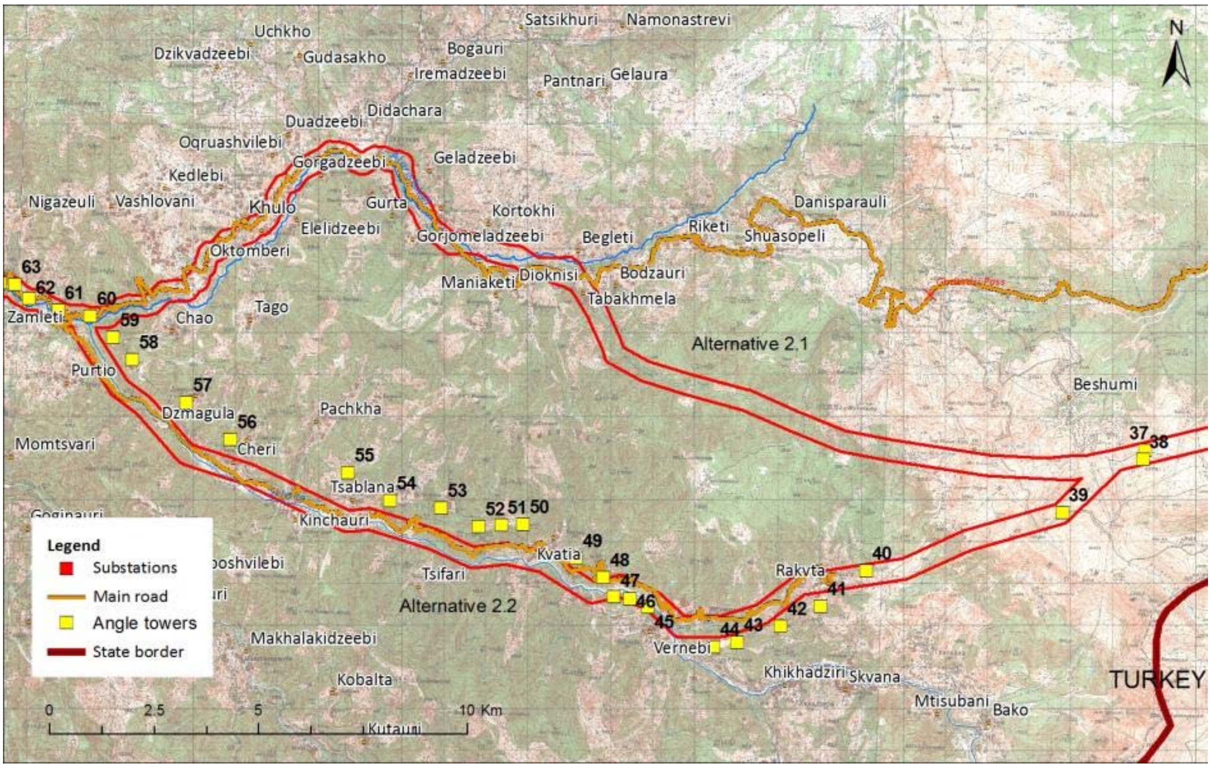


Figure 4.4.2 Alternatives 2.1 and 2.2. between Beshumi AP – 37 and Zamleti AP 60

Alternative routes between v.Otanaskhevi and v.Zamleti (AP47–AP60, Alternative 3.1 and 3.2)

Two alternative routes have been considered in the section from v.Otanaskhevi to v.Zamleti (AP47 – AP60, Alternatives 3.1 and 3.2). The Alternative-3.2 follows river valley and considers several river-crossings with angle towers located on the slopes and on the first terrace of Skhalta River. The Alternative-3.1 is running along the right bank of the river, not crossing the river, and passing over the northern gorges (seasonal tributaries) with poles located on the hills.

From construction and technical point of view, most probably Alternative-3.2 is a bit simpler as access is relatively easy due to close proximity to existing road; however, this is not a big advantage in very rugged terrain. The access to the northern hills is a bit more difficult, but in most cases some access roads already exist. From perspective of impact on flora and fauna the alternatives can be described as follows:

- The area is considered sensitive and impact on **flora** will be more with Alternative-3.2. The line mostly will be at low altitudes and the full width clearance of vegetation will be required. Also it should be mentioned, that the forest on the left bank of the river is less impacted due to the difficult access to these areas and vegetation cover is more dense. The less impact on flora is expected in case of Alternative-3.1 at the all stages of the project, and the required forest clearance will be less. The forest cover here is less dense and some hills represent the meadows, allowing to avoid tree cutting for towers. Important issue for Alternative-2 is that the line conductors will be very high from vegetation in places where the OHL corridor passes over the gorges and natural depressions, accordingly sanitary cutting of trees during the line
- The maintenance will be significantly less than in case of Alternative 3.2.

- In terms of **fauna**, and especially avifauna, the Alternative-3.1 looks also better. The area is outside of the important bird migration routes, however in terms of local movement, birds usually follow the river valley at low altitudes, increasing the risk of collision on Alternative-3.2 significantly. The risk of collisions with conductors on mountain slopes is significantly less. In terms of impact on protected species, in case of Alternative-3.2 the construction activities close to riverbanks may impact otter populations significantly. The same applies to other mammals. The forest on the right bank of the river is already fragmented because of the villages and agricultural activities, - so in case of Alternative 3.2 the fragmentation of habitat may increase and have more severe impact.

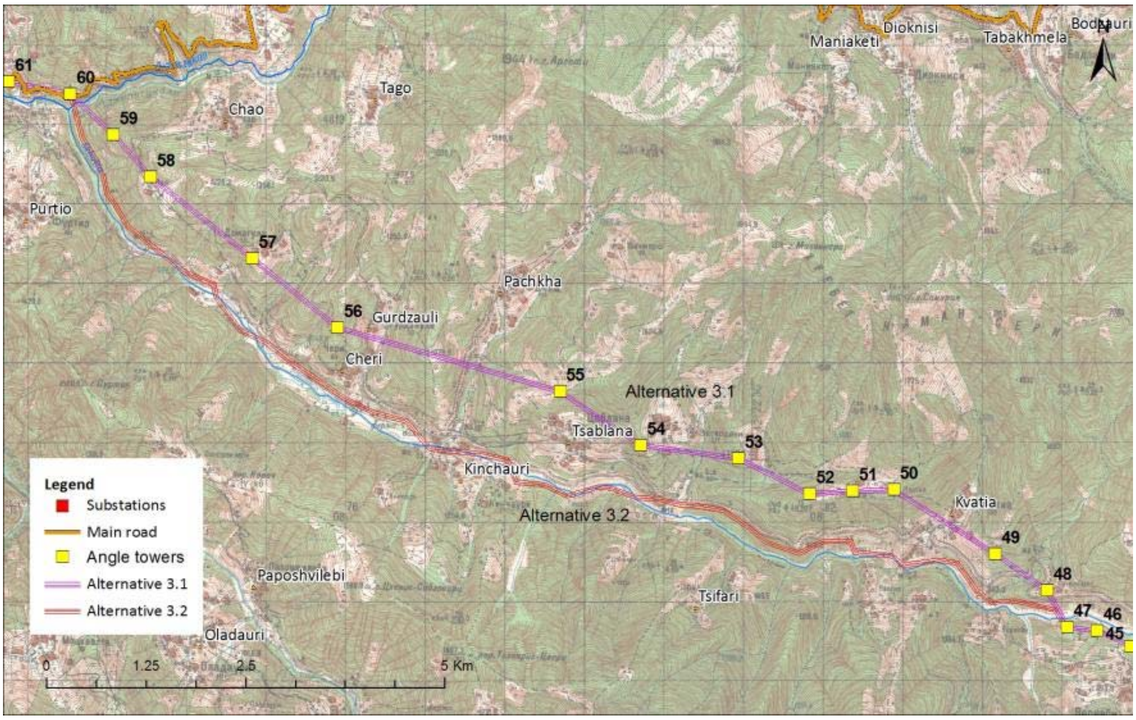


Figure 4.4.3 Alternatives 3.1 and 3.2. between Otanaskhevi AP47 and Zamleti AP 60

In terms of impact on **communities**, the Alternative-3.1 is also preferable. The Alternative-1 crosses less populated bank of the river, but even in this case the corridor is close to the existing road and in populated areas impact on households is unavoidable. In case of Alternative-3.1 quite long OHL section runs close to the populated areas, having direct impact on agricultural land, though in most cases avoiding living houses at the safe distance. In case of Alternative-3.1 corridor fully avoids villages Kinchauri, Cheri and Makhalakuri.

The impact on **landscapes and visibility** in case of Alternative-3.1 is also less, as distance from the road, where the most receptors travel, is sufficient, and practically OHL line will be invisible from most parts of road, while the Alternative-3.2 with its cleared corridor will be fully visible from the motor road.

It should be noted separately, that in terms of impact on **geo-hazards**, the Alterantive-3.1 allows to avoid the critical landslide at Village Tsablana (AP53-AP54), which in case of Alternative-3.2 may lead to a serious complications.

As a conclusion, the Alternative-3.1 is preferred option in terms of environmental and social impacts.

Alternative routes between Zemo Jocho AP155 and Batumi Substation AP160 (Alternatives 4.1 and 4.2)

There are two alternative routes considered for the last section where the OHL approaches Batumi Substation. Alternative-4.1 corridor from AP155 goes downhill along agricultural parcels of tangerine plantations, approaches and crosses motor road and through populated area of Khelvachauri town enters the substation, where it will be connected to the existing transformer facilities. Alternative-4.2 from the same pole AP155 goes down to Makho Bridge and follows the secondary road and bank protection structures along the Chorokhi River till substation.

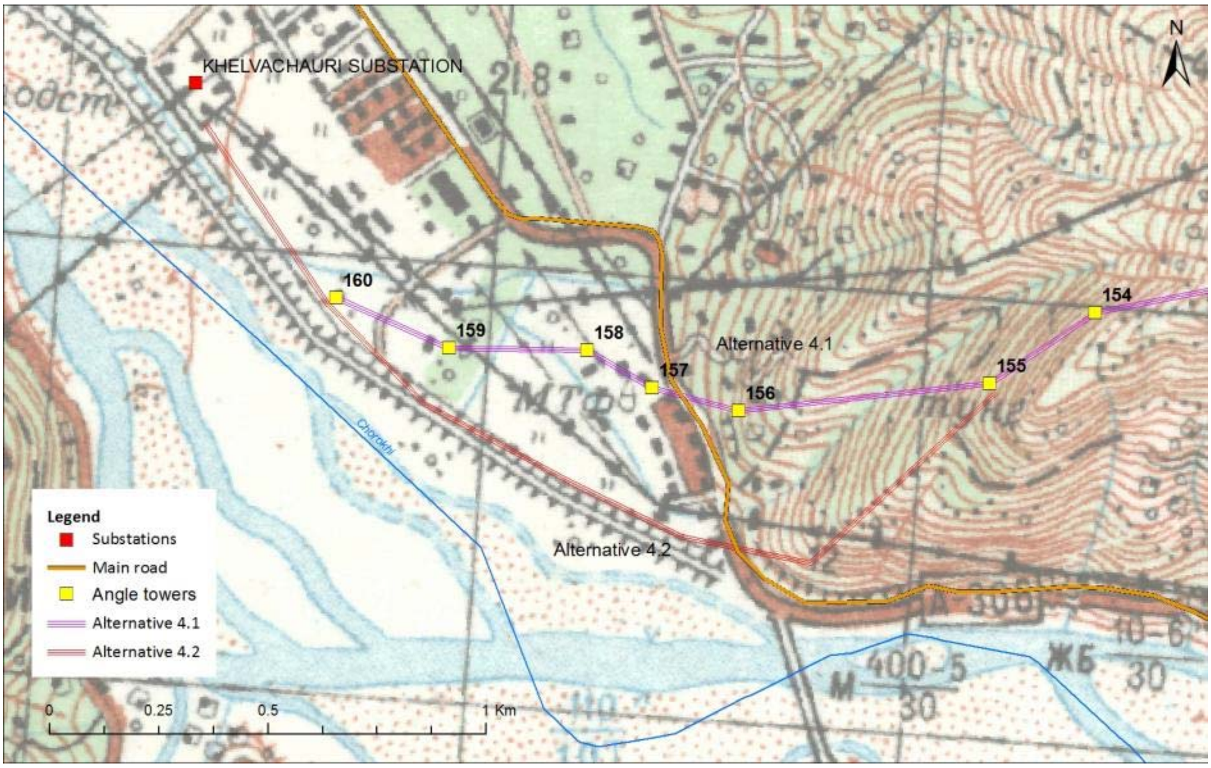


Figure 4.4.4 Alternatives 4.1 and 4.2. Zemo Jocho AP155 and Batumi substation AP 160

Both alternatives consider crossing of populated area. Alternative-4.1 goes through densely populated zone, where direct impact will affect at least 10 households. Based on preliminary information, 3 to 5 families could be displaced and others will be impacted because of close proximity of line corridor. Based on social impact assessment, in case of Alternative-4.2 the number of affected households is definitely less.

From prospective of construction difficulties, both alternatives can be considered as similar, may be Alternative-4.2 is easier, but this needs further investigation of technical and constructability issues, where the location of another OHL from Batumi substation to Muratli should be considered.

In terms of impact on flora, the alternatives are similar, and it is not expected, that there will be some impact as whole area is cultivated. In terms of impact on migratory birds, the line will be parallel to the Chorokhi River which is preferred corridor for migratory birds. It is not expected that impact on bird species is more in case of Alternative-4.2 than in case of alternative-4.1. After investigation of routes in detail it is likely to approve that the special mitigation measures will be required in both cases, accordingly the impact on birds can be effectively mitigated.

Considering the request of the local administration and population, expressed at the public consultation meeting in Khelvachauri, as well as number of affected households, the Alternative-4.2 is more preferable, but the final decision requires more investigation and justification both from engineering and avifauna point of view. The justification can be provided only after the detailed land cadastre study is conducted.

4.5 Tower Location Alternatives

The Engineers (Mott MacDonalds) and its contractors evaluated tower locations for the preliminary route and considered non-environmental factors such as the preferred and maximum spacing between the towers, as well as, environmental and social factors including avoiding or minimizing impacts to the local communities or environmental resources, such as in areas of high residential congestion.

Some generally applicable guidelines have been considered during the structures/towers positioning. These include but not limited to:

- Towers, wherever possible, should be positioned near the most vertical elements in the landscape at edges of woodland, hill slopes, small groups of trees, and hedgerows along the route.
- Angle towers to be positioned where they would not have a large visual impact and with responsibility to ensure that suitable terrain exists for the location of suspension towers along each section.
- Towers should preferably be located on field boundaries rather than free standing in fields.
- When crossing flat landscape characterised by wide visual field and a clear definition or land pattern, it is preferable to use taller towers with longer span lengths.
- In complex, picturesque landscapes support heights should be adjusted to be set against the background and to avoid intruding into the skyline.
- For crossings of top of a hills or mountains, the use of lower structures should be considered
- Conductor pulling positions need to be considered at some angle tower locations.

5. ESIA Methodology

This ESIA addresses all the areas affected by the construction of the transmission line related to all phases of the Project. The evaluation of impacts is proportionately based on an assessment of their extent (local/regional/national), duration (short, medium or long term effects) and reversibility (temporary or irreversible effects). The ESIA study has been undertaken in compliance with Georgian laws and requirements, international best practice including World Bank and the IFC standards and WB Guidelines, and is covering the entire planned route including ancillary facilities.

Energy transmission projects have impacts on physical, biological and social-economic-cultural resources in the construction and operation/maintenance stages of the project. This impact assessment addresses all of the activities involved in the project, including specific technologies. The ESIA furthermore defines direct, indirect and cumulative impacts.

5.1 Methodology for screening and scoping process

The following methodology has been used, and actions undertaken, for the screening of background information and scoping of potentially significant impacts for this project:

- Screening and categorization of the Project against Georgian legislation and the WB requirements in terms of need for the full scale ESIA and project category.
- Preliminary screening of potential impacts and major receptors during the Routing Study undertaken in 2012-2013 by Mott MacDonald
- The social team in June-July 2013 have worked along the proposed OHL corridor, when number of meetings was held with municipalities, village representatives and local population.
- Initial Environmental reconnaissance of the corridor in June-July 2013, in order to describe the baseline environmental conditions, carry out specialized detailed surveys by the groups of flora, fauna, forest resource and other specialists.(the detailed information regarding performed activities are given in specific sections describing results of field works)
- Detailed desk study of the existing literature/academic sources on the existing environment, reviews of other studies/projects conducted in the areas where the line will run.
- Meetings with officials in the Ministry of Environment Protection and Natural Resources, including representatives of the Forestry Department, Agency for Protected Areas and the Environmental Permits Department, as well as inquiries to the Ministry of Culture.
- Meetings with various NGOs, including the Green Movement of Georgia and Green Alternative.
- Visits by the social team to all 6 municipalities, crossed by the OHL and total of 22 villages along the transmission line corridor. These visits included presentations to stakeholders and interest groups, as well as interviews and discussions with approximately 10% of the population (as recommended by good practice guidelines) in villages crossed by the power line.
- Preparation of the Scoping Report. Determination of the scope of assessment and the content of the ESIA report based on outcomes of the scoping stage.

5.2 Public Participation

The Stakeholders Engagement Plan for the 200kV Akhaltsikhe-Batumi overhead power transmission line (OHL) is prepared as a stand-alone document, based on WB OP4.01 (14-18) and IFC PS1 requirements (25-36), as well as the IFC Good Practice Handbook for Stakeholders Engagement,. The purpose of the SEP is to provide a consultation and participation strategy which:

- Identifies people/communities affected by the project, other interested parties;
- Ensures that such stakeholders are appropriately engaged on environmental and social issues;
- Maintains a constructive relationship with stakeholders during project implementation; and
- Meets legal requirements related to consultation, including grievance mechanism.

The public consultation process for this OHL Project started with initiation of scoping for the ESIA in June-July 2013. Scoping process considered meetings with the Ministry of Environmental and Natural Resources Protection (various departments), Ministry of Energy/GSE, meetings with regional (Republic of Adjara, Samtskhe-Javakheti Region), municipal and local authorities (Akhaltsikhe, Adigeni, Keda, Khulo, Shuakhevi, Khelvachauri, Batumi), several NGOs and affected communities along the transmission line route.

The various engagement and disclosure activities have been undertaken for the Project and are planned ahead during the disclosure period (tentatively January-February 2014). Project stakeholders consultation activities are reflected in a Minutes of the Meetings, and the outcomes considered (fed back) in this ESIA report. The major concerns that were raised during scoping meetings in Tbilisi, Akhaltsikhe, Adigeni, Keda, Khulo, Shuakhevi, Khelvachauri and Batumi fell into several major categories:

Environmental:	- Concern about impacts on flora and/or fauna, forests.
	- Concerns about the potential impacts on landscapes and views.
Social:	- Concern about potential health effects of high-voltage transmission lines
	- Concern about having to relocate to a house farther away from the line.
	- Concern about damage to existing houses from derelict towers.
Economic:	- Concern that construction/maintenance could damage crops or affect grazing.
	- Concern about loss of land to foundations and towers and to access roads.
	- A desire that local workers be hired for construction and maintenance
	- Concern about impacts on recreation at Beshumi new resort area
Cultural:	- Concerns about impacts on the monuments and cemeteries.

5.3 Methodology for baseline study

Baseline data for the physical, biological and socio-economic conditions have been developed specifically for the Akhaltsikhe-Batumi 220 KV OHL by special groups of environmentalists, biologists, air, soil and water quality specialists/chemists, ecologists, sociologists, cultural heritage and archaeology specialists.

The following baseline data collection/survey methods have been applied and actions undertaken

- The study area has been defined widely enough to include all the territories likely to be significantly affected by the Project.
- All relevant national and local agencies have been contacted to collect information on the baseline environment and sources of data and information on the existing environment is adequately referenced.
- The desk study reviews of existing scientific and other literature sources and field reconnaissance / surveys were used in order to ensure the complex analysis of data collected and verification during the field surveys.
- The social studies include collection of information via field surveys (general questionnaires) in all municipalities crossed by the power line or supporting infrastructure (access roads);
- Description of uncertainties in the data and any difficulties encountered, where surveys have been undertaken as part of the Environmental Studies to characterize the baseline environment.

- Field works conducted by the environmental team in the line corridor in August – October 2013, in order to verify the information collected from the reference materials and describe the present conditions of physical and biological resources based on outcomes of the scoping stage and finalising the identification of potential receptors.

The data sources reviewed include scientific literature/publications, open data sources and specific reports such as Adjaristsqali Hydropower ESIA (Mott MacDonald, 2012), 220 kV Transmission Line Routing Study (Mott MacDonald, 2012), other ESIA's for power transmission projects in the region inclusive 400 kV from Akhaltsikhe to Turkish border, and 220 Batumi-Muratli and 110 kV line from Akhaltsikhe to Beshumi,.

The environmental baseline study included a number of field surveys implemented for certain environmental components, which were considered sensitive to the proposed development. In particular, it comprises the following topics:

- Landscapes and visual receptors
- Soils and ground conditions
- Botanical survey of the corridor;
- Fauna and Ornithology
- Protected areas
- Land use
- Cultural heritage and archaeology
- Socio-economic data

The results of specialized baseline studies and field surveys of the specialist groups were interpreted and placed using GIS mapping technology, in order to simplify understanding and interpretation of collected data.

Methodology for detailed botanical survey of the corridor

The desk study was conducted during the summer 2013 followed by the field works for reconnaissance of proposed route 500m wide corridor inclusive the alternatives. The field work has clarified available information regarding the flora species within the corridor. The study was conducted by the specialists of DG Consulting headed by Maryam Kimeridze and David Chelidze, botanists with wide experience working in areas covered by the project.

The preliminary botanic description of the territories within the project impact zone has been accomplished through review of large amount of references inclusive published books, articles and unpublished data as well as on own experience and knowledge. The information gained from the reference materials was verified during the special field studies. The additional baseline information was also collected during the field works. The field works included initial walkover through the corridor by experience botanist team, who were identifying specific habitats in OHL corridor and describing the extent. During the analysis of collected information, the sensitivity zones were identified for each section. After the information from initial walk over was analysed, specific zones were identified, to carry out more detailed (in depth) study of vegetation cover. The representative parcels have been selected, and vegetation cover was described using specific methodology (Drude's Scale). The detailed descriptions for each parcel regarding the species, the coverage intensity, and number of individual plants on each sensitive parcels were prepared. This detailed information was used to fill the existing gaps (white spots) and provide full picture of baseline to be used as basis for proper ESIA study. The need for such detailed study was indicated during the screening and scoping process.

The reference materials found mostly being outdated, and detailed survey of representative plots was carried out for verification of collected information during the field works. The plots for detailed botanical survey were selected in wide project corridor (500m wide), however in some cases, the team was going out of the initial corridor, where important natural features were noticed. The methodology used for selection of plots, was based on impressions of field survey botanists, in order to select the representative parcels for the sections and in some cases for specific character of the plots. The location of the selected land plots are presented on Figure 6.2.2 and Figure 6.2.3.

As a result of this survey there were identified important species of flora and vegetation within the project corridor and adjacent areas with various conservation value (Red Data Book, Red List, endemic, rare) plant species distributed within the project impact area, including the economically valuable plants. Detailed description of the Phytocoenosis in the project impact area is provided 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 used in descriptions 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.

After the completion of detailed botanical survey of the Project corridor, the detailed characteristics of sensitive areas have been analysed. Based on the information gained from literature review and field surveys the moderate and high sensitive areas have been identified.

Methodology for detailed survey of fauna and avifauna

Survey methods used for establishment of fauna baseline for the project included a desk study of publicly available reference materials and field surveys along the project corridor, these two having different objectives.

The objectives of the desk study were: description of main wildlife habitats and animal species in the project region, revealing of sensitive habitats and species requiring particular attention or protection, identification of major wildlife data gaps and provision of basic information for proper planning and implementation of field surveys. The desk study was undertaken bearing in mind these objectives, prior to implementation of field surveys.

As it is widely recognized that OHLs represent a significant threat to birds and due to sensitivity of the project corridor in this terms, it was decided to focus field surveys with notable efforts mostly around birds to ensure proper identification of all potentially sensitive bird areas within the project ROW. In this regards, two sizable bird surveys of the OHL route were planned and implemented in a way to cover spring and autumn bird migration and all more or less sensitive areas of the corridor; though, rapid survey of other fauna representatives has been also undertaken along the entire project corridor.

The rapid wildlife assessment of the OHL corridor has been undertaken in summer 2013. It comprised entire project corridor, with the objectives to describe wildlife habitats along the OHL route, identify which sensitive fauna habitats reported/unreported in the literature could fall within the project ROW and determine territories disturbance of which should be avoided not to cause significant impact on wildlife. The "walkthrough" method was used to achieve these objectives. Animal species and signs of their vital activity (traces, droppings, dens, feather, etc.) encountered during the survey within or near the corridor were recorded.

The general faunistic overview of the project region has been prepared, as well as the comprehensive description of the wildlife for the project corridor. The information provided is a combination of the desk review and field survey findings. The results of the field surveys are organized in a way to create clear picture of the project-specific details. Sections giving a review of protected species for the project ROW and summarizing main findings are also provided. Wildlife sensitivity maps are prepared for the project corridor to highlight sensitive wildlife areas.

Methodology for cultural heritage and archaeology survey

Information on archaeological and cultural heritage sites have been collected from scientific publications, various field-works including the site reconnaissance field surveys conducted within the framework of the current ESIA project, legislative acts of the Georgian Ministry of Culture and Monument Protection, various Internet resources and interviews with local population. Based on these information, the sites have been mapped and listed, indicating names, categories, location and dates of the sites. Identified sites have been mapped within approximately 5-6 km corridor along the proposed Akhaltsikhe-Batumi 220 kV transmission line. The numbers on the map marked with asterisks (…*) correspond to the sites, which are of immovable national importance monuments according to the decree (#3/133) of the Minister of Culture and Monument Protection of 30/3/2006.

Methodology for socio-economic study

The socio-economic baseline study along the Project route was carried out through review of existing information from state statistics department, different studies previously carried out within the scopes of different projects conducted by local and international institutions. The survey provides information regarding average conditions of local population in all six municipalities crossed by the power line corridor. The field survey using detailed questionnaires was carried out in the villages and towns along the project corridor. The collected data was analysed, collated, and summary findings were verified with available statistical data.

5.4 Impact identification

The area of study covers the planned transmission route including associated infrastructure that will be built to facilitate the construction of the transmission line as well as all territories where the construction or operation of the power line can cause the noticeable impacts.

The following direct/primary impacts have been identified and analysed during the assessment:

- effects on land uses, people and property, geological features and characteristics of soils, fauna and flora, hydrology, uses of the water environment, acoustic environment (noise or vibration) air quality have been described and where appropriate quantified;
- effects on locations or features of cultural importance are described;
- effects on landscapes, on views and viewpoints are described and partially illustrated;
- effects on demography, social and socio-economic conditions in the area are described;
- effects on human health and welfare are described and where appropriate quantified (e.g. health risks arising from major hazards associated with the Project, changes in living conditions, effects on vulnerable groups).

The following indirect/secondary impacts have been identified and analysed during the assessment:

- temporary, short term effects caused during construction or during time limited phases of project operation;
- permanent effects on the environment caused by construction, long term effects on the environment caused over the lifetime of Project operations;
- effects which could result from accidents, abnormal events or exposure of the Project to natural or man-made disasters;
- effects on the environment caused by activities ancillary to the main project (access roads, etc);
- cumulative effects on the environment of the Project together with other existing or planned developments in the locality;
- appropriate identification of geographic extent, duration, frequency, reversibility and probability of occurrence of each effect;

The major concerns that were raised during scoping fell into several major categories:

- Environmental:
  - Concern about impacts on flora and/or fauna.
  - Concerns about the potential impacts on landscapes and views.
- Social:
  - Concern about potential health effects of high-voltage transmission lines on residents who live in houses near the line or other people who spend time near the lines.
  - Concern about having to relocate to a house farther away from the line.
  - Concern about damage to existing houses from derelict towers.
- Economic:
  - Concern that construction and maintenance of the line could damage crops or interfere with grazing.
  - Concern about loss of land to foundations and towers and to access roads.
  - A desire that local workers be hired for rehabilitation and construction of the foundations and towers.
- Concern about impacts on recreation at Beshumi new resort area
- Cultural:
  - Concerns about impacts on the monuments and cemeteries.

The ESIA covers the direct impacts and any indirect, secondary, cumulative, short-, medium- and long-term, permanent and temporary, reversible and irreversible, beneficial and adverse impacts of the proposed OHL Project.

5.5 Methodology for impact rating

The following impacts' evaluation methods have been used during the assessment:

- significance or importance of each predicted effect was evaluated in terms of its compliance with legal requirement and the number, importance and sensitivity of environmental and social receptors affected;
- where effects are evaluated against legal standards or requirements, local, appropriate national or international standards have been used and relevant guidance followed;
- significance of each effect is explained and the methods used to predict effects and the reasons for their choice, are described;
- the level of treatment of each effect is appropriate to its importance, the discussion is focused on the key issues and avoids irrelevant or unnecessary information;
- appropriate emphasis has been given to the most severe, adverse effects of the Project.

A general method for rating the significance of environmental impacts was adopted to ensure consistency in the terminology of significance, whether for a beneficial or an adverse impact.

The significance of an impact is defined as a combination of the consequence of the impact occurring and the probability that the impact will occur. The criteria used to determine impact consequence are:

- Extent - the area in which the impact will be experienced (local, regional, national /international);

- Intensity - the magnitude or size of the impact (none, low, medium, high);
- Duration – the timeframe for which the impact will be experienced (none, short-term, medium-term, long-term)

The combined score of these three criteria corresponds to a Consequence Rating (Not significant, Very low, Low, Medium, High)

Once the consequence is derived, the probability of the impact occurring will be considered, using the probability classifications (the likelihood of the impact occurring) – improbable, possible, probable, definite. The overall significance of impacts will be determined by considering combinations of consequence and probability, using the following ratings – insignificant, very low, low, medium, high, very high.

The impacts will also be considered in terms of their status (positive or negative impact), sensitivity of the receptor and the magnitude of the change.

6. Physical and Natural environment - Baseline Conditions

6.1 Physical Environment

6.1.1 Climate and Meteorological Conditions

The project corridor crosses the eastern and western parts of the country, which significantly differ in climate conditions. Largely, the Eastern Georgia is characterized with moderately humid climate which is transient into continental at places, whilst climate in the Western Georgia is humid maritime subtropical as is significantly influenced by humid air masses intruding form the Black Sea. In general it could be said that climate becomes more humid and warmer from east-to-west of the corridor (Figure 6.1.1 and Figure 6.1.2). However, several climatic zones could be distinguished there due to complex topographic conditions and depending on distance to the Black Sea.

According to the climatic map of Georgia, the east most section of the transmission line will run through mountain steppe climatic sub-zone characterized with cold, not very snowy winter and long, warm summer. This climate is formed over major part of Akhaltsikhe Municipality and in relatively lower part of Adigeni Municipality. Mean annual temperature of the ambient air in this zone comprises 8-9°C; though monthly mean varies from - 4°C in January to 18-20°C in August. Mean annual precipitation is around 500-600 mm/y, which is unevenly distributed throughout the year. Rainfall period is late spring-early summer, when about half of annual precipitation falls. Climate in the mid-mountain zone in Adigeni Municipality is transient from humid maritime to humid continental. It is characterized with cold snowy winter and long summer; upper mountain zone, which adjoins Khulo Municipality (Adjara), is colder and snowier in this climatic sub-zone.

In the south - west part of Georgia (Adjara Region) the transmission line will be built in the area, which is distinguished due to humidity and high amount of atmospheric precipitation. The west most section of the corridor, which is in Khelvachauri Municipality and the closest to the Black Sea, is particularly humid. Atmospheric precipitation there is over 2500 mm/y and it mostly falls out as a rain. Amount of precipitation is lower in mountainous areas; however, it is still well over 1000 mm. Annual distribution of precipitation is uneven on this section as well; however, different from the eastern ROW section, most precipitation falls out in during winter months, as a snow in upper elevations. As such, snow conditions are rather challenging in Shuakhevi, Keda and Khulo Municipalities, where snow cover is rather thick and heavy. The snowiest area is Khulo Municipality, where snow cover can last up to three months. Mean annual temperature on Adjara section varies from 10°C to 14°C. Mean temperature in winter months at relatively lower elevations and closer to the sea is can be 6-8°C, meantime when in highlands it falls to 1-3°C. Summer temperature is in the range of 22-25°C in the west most part and around 18-19°C in the central part.

Table 6.1.1 summarizes climate characteristics for the project ROW, whilst Figure 6.1.1 and Figure 6.1.2 give graphical representation of temperature and precipitation variability along the route.

The very important issue in terms of power line construction is wind characteristics which impacts overall design of OHL. The wind data are not available for all route sections. According to available data, the windiest area for the OHL route is Khulo, where winds blow about 85% of time throughout year. Winds are stronger mostly in winter time in all project areas. Khulo is again distinguished with higher wind velocities, mean maximum of which reaches 3.6 m/sec in January and 2.1 m/sec in July there. Though, estimated maximum wind velocities of various recurrence time are higher for Akhaltsikhe (Table 6.1.1).

Table 6.1.1 Ambient air temperature, Precipitation and humidity pattern

Administrative Unit	Mean Annual Air Temperature, °C	Precipitation		Mean Annual Air Humidity, %
		Total annual, mm	Diurnal maximum, mm	
Akhaltsikhe	9.0	513	62	69
Adigeni	8.0	594	48	69
Khulo	10.4	1228	133	70

Shuakhevi	11.8	1180	138	74
Keda	12.7	1652	210	77
Khelvachauri	14.1	2590	256	79

Figure 6.1.1 Mean annual air temperature along the route

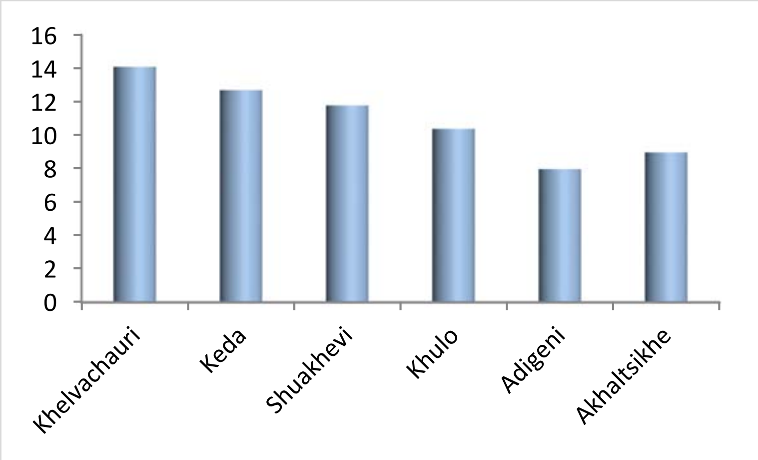


Figure 6.1.2 Mean annual precipitation along the route

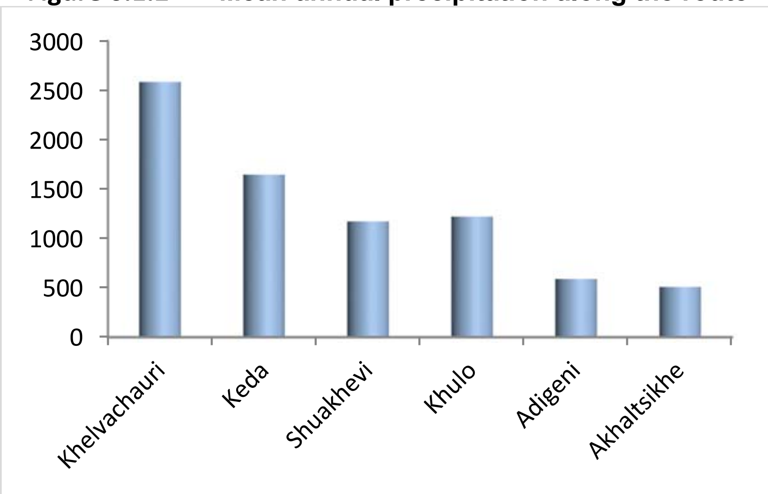


Table 6.1.2 Wind characteristics for the OHL route

Administrative Unit	Wind Velocity, m/sec								
	January		July		Maximum Likely Wind Velocity for Recurrence Time of:				
	Max	Min	Max	Min	1 year	5 years	10 years	15 years	20 years
Akhaltsikhe	2.2	0.7	3.2	1.0	19	23	27	28	29
Adigeni	3.6	0.6	3.3	1.0	17	15	20	21	21
Khulo	3.8	2.1	2.6	1.6	14	18	19	20	21
Shuakhevi	n.d.	n.d.	n.d.	n.d.	15	18	19	20	22
Keda	2.0	0.3	2.2	0.6	16	20	22	23	24
Khelvachauri	n.d.	n.d.	n.d.	n.d.	21	25	27	28	28

Table 6.1.3 Revealing wind directions

Administrative Unit	maximum speed and main directions of wind, m/sec										
	Jan	Jul	N	NE	E	SE	S	SW	W	NW	Still
Akhaltsikhe	-	-	-	-	-	-	-	-	-	-	-
Adigeni	2,0/0,3	2,2/0,6	1	9	26	8	6	19	29	2	56
Khulo	-	-	-	-	-	-	-	-	-	-	-
Shuakhevi	3,8/2,1	2,6/1,6	26	21	1	1	24	20	3	4	14
Keda	3,6/0,6	3,3/1,0	2	1	8	5	2	4	44	34	56
Khelvachauri	2,2/0,7	3,2/1,0	5	16	17	11	7	18	20	6	42

The main parameters which should be considered during the design process are presented in documents prepared by the ministry of economic development of Georgia (Order 1-1/1743) “Construction Climatology”. The values for different likelihood of winds are established based on information given in the Table 6.1.2.

The detailed information regarding relative humidity along the proposed corridor is presented in Table 6.1.4.

Table 6.1.4 Recurrence of wind directions and still during year along OHL corridor

Administrative Unit	Recurrence of wind directions and still during year, %								
	N	NE	E	SE	S	SW	W	NW	Still
Akhaltsikhe	5	16	17	11	7	18	20	6	42
Adigeni	2	1	8	5	2	4	44	34	56
Khulo	26	21	1	1	24	20	3	4	14
Shuakhevi	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Keda	1	9	26	8	6	19	29	2	56
Khelvachauri	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.

The main climatic parameters which should be considered during the OHL design process are presented in document approved by the ministry of economic development of Georgia (Order 1-1/1743) “Construction Climatology”. These meteorological parameters important for OHLs include wind velocity, relative humidity of ambient air, maximum daily precipitation and snow cover.

Values for maximum wind velocities of different likelihood are in the Table 6.1.2. The detailed information regarding relative humidity of ambient air along the proposed corridor is presented in Table 6.1.4. Consideration of these parameters is important for the OHL design

The maximum daily precipitation figures in the corridor vary significantly (Table 6.1.1). This is an important parameter to be considered during the evaluation of construction process and planning of required mitigation measures.

Table 6.1.5 The relative humidity of ambient air by months along OHL corridor

Administrative Unit	Relative humidity of ambient air, %												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean
Akhaltsikhe	75	74	69	65	66	66	64	63	66	71	76	78	69
Adigeni	75	73	70	62	64	67	65	64	67	70	75	70	69
Khulo	69	69	68	64	66	72	77	75	74	70	66	65	70
Shuakhevi	74	74	70	66	68	74	78	78	79	75	76	76	74
Keda	78	76	73	70	73	76	80	82	83	81	79	77	77
Khelvachauri	79	78	77	75	76	78	82	84	84	82	80	78	79

In terms of snow cover to be considered the situation along the power line route varies significantly. In Akhaltsikhe and Adigeni Municipalities the snow cover in average stays for 60-70 days a year and the weight of snow cover is relatively low. In Khulo Municipality, the snow stays up to 93 days; moisture content and respectively snow cover weight is also higher there. In other sections of the power line the snow conditions become milder towards the sea coast direction. The summary information regarding snow cover along the route is presented in Table 6.1.6 below.

Table 6.1.6 The snow cover parameters along power line route

Administrative Unit	Weight of snow cover, kPa	Duration of snow cover, day	Water content in snow cover, mm
Akhaltsikhe	0.68	63	49
Adigeni	0.68	69	60
Khulo	1.69	93	222
Shuakhevi	1.14	61	125
Keda	1.30	45	127
Khelvachauri	0.50	18	-

6.1.2 Landscapes and Land Use

Landscapes

The project corridor passes through all types of landscapes typical for mountainous areas of the south Georgia and sub-tropical, mountainous/hilly landscaped of Adjara. Part of the route passes near to 6 densely populated towns and villages, whilst other part crosses either nature areas which are practically preserved to natural condition or sparsely populated sites. Major landscape features of the project corridor are:

- Urban landscapes near larger and small towns, which are distinguished with developed public infrastructure and industrial areas at places. These are mostly municipal centers and large villages
- Rural and agricultural landscapes in surroundings of small villages, which are presented with residential, arable and pasture lands. These landscapes widely spread throughout the project length
- Partly modified or unmodified nature areas, which notably differ in features. These are comprised by:
  - Semi-arid steppes, covering middle mountainous areas and foothills in Akhaltsikhe and Adigeni Municipalities. Vegetation in these areas presented by steppe grass and semi-arid shrubbery.
  - Forest landscapes: these are sparse along the OHL section in Akhaltsikhe Municipality, where only small fragments of deciduous forests are preserved, and these are heavily modified due to human activity. Contrary to this, high value forest fragments and continuous forests could be encountered from the upper lands of the Adigeni Municipality throughout the Khelvachauri Municipality. These are deciduous, dark coniferous, or mixed forests, major part of which are of high value. .
  - Sub-alpine zone, which is crossed in Khulo Municipality, the area of Beshumi Resort.
  - Wide and open valleys of large rivers and narrow gorges of small rivers. Riparian forests grow at places in floodplains of the Mtkvari, Potskhovi, Adjaristqali and Chorokhi Rivers and their tributaries. Riparian forests are significantly modified at places (e.g. in Akhaltsikhe Municipality)

Description of Major Landscapes and Land use

The ecosystems of the entire Caucasus area are highly diverse and include a broad range of landscapes, from semi-deserts and arid shrub lands to mesophylic relict broadleaf forests and alpine grasslands. These landscapes and ecosystems accommodate a variety of plant and animal species representing a mixture of Mediterranean, Eastern European, and Near Eastern floras and faunas, combined with a high proportion of regional endemics (reaching 20-30 percent of the total species number in certain taxonomic groups) (UNDP, 2007)

The Caucasus Ecoregion has been identified by Conservation International as one of the world's 25 biodiversity hotspots due to high species diversity and significantly threatened local ecosystems (UNDP, 2007). This demonstrates the ecological importance and fragility of this area. This diversity of the Eco region is well-reflected over the corridor of the transmission line which passes through two administrative regions and six administrative districts. The total length as it was described previously equals 150 km (approximately). The line corridor runs from mountainous highland around Akhaltsikhe city, passes over the ridge to western direction and dives down to the narrow gorge of the Skhalta River; then it follows the Adjaristskali River gorge and ends in Khelvachauri substation.

The main landscapes of Akhaltsikhe district are moderately dry sub-tropical plains, humid and moderately humid mountain forest, mountain steppe, and subalpine zones. These include:

- River floodplains with riparian forests.

- Terraced river valleys, with mountain steppe and phryganoid vegetation.
- Middle mountains with hornbeam-oak and beech forests.
- Volcanic mountains with beech-coniferous and pine forest
- Subalpine meadows.

Figure 6.1.3 Typical landscape view in Akhaltsikhe municipality

Figure 6.1.4 The Potskhovi river valley on the border of Akhaltsikhe and Adigeni municipalities

In Akhaltsikhe Municipality the proposed route starts from the existing Zikilia Substation and follows sloppy mountain hills. The landscape here varies significantly from hilly and plain plateau area to the rocky volcanic cliffs near to village Klde. Vegetation here is mainly represented as dry steppes, with limited amount of grass vegetation and sometimes shrubs and small size fragmented forests.

The valleys and plateau here are characterized with deep guiling processes, where the hills and moderately flat valleys are crossed by deep channels and gorges generated from surface run off.

The land use pattern in vicinity of Akhaltsikhe area is characterized with medium to high fertility and mostly is used for agriculture, however in most cases, the irrigation is required. The significant amount of agricultural land was irrigated in the past, but at present stage the irrigation systems are out-dated, the pumping costs are high, and accordingly most part of such parcels are used as pasture land. The territories on the slopes of mountains are mostly used as pastures by local communities. Since the kettle breeding is one of the most popular sectors, the importance of pastures is high; however, pastures are not cultivated and naturally grown grass is used.

The part of ROW in Adigeni Municipality is located on the Akhaltsikhe depression. Towards the west the ROW altitude gradually increases reaching the maximum at the border of Adigeni and Khulo Municipalities, where the Goderdzi Cross is located. The landscapes on this section are formed under subtropical mountain climate which is transient to semi-continental, characterized with cold winters and warm summers.

Figure 6.1.5 Typical view of village in Adigeni municipality

Figure 6.1.6 Water fall and mountain stream in highland part of Adigeni municipality

The land use pattern in the area strongly depends on topography, soil fertility and altitude. Major part of the land within the depression is mostly flat or with low inclination; the significant part of such parcels are used for agriculture, which is mostly irrigated due to relatively dry climate. The irrigation schemes in the area are deteriorated, and part of the agricultural land originally used for potato, crop and vegetable cultivation are used as pastures.

At higher altitudes, on mountainous slopes, the landscape becomes more forested. The forests are significantly impacted and modified due to active tree cutting and logging activities in the past. The crop growing activities in mentioned areas are much less, and fragmented forests are mostly used as pastures for local cattle.

Higher than tree belt, the impressive alpine zone landscapes are opened. The hilly grasslands are used as summer pastures. Some seasonal farms are located in the area used by local farmers during the summer periods, when they move cattle to mountain pastures. The landscapes on this ROW section are typical for alpine zones, the slopes are covered with rich grass cover accommodating variety of grass species; however, the grassland is significantly impacted by overgrazing. The slopes are cut with deep canyon type channels of mountain streams. The surface of slopes is impacted by the surface run off and wind erosion; gullying processes are very significant in those areas. The power line corridor bypasses Beshumi skiing resort and near to Village Rakvta goes down to the Skhalta River gorge.

Figure 6.1.7 Typical view of landscape in Beshumi skiing resort area

Figure 6.1.8 Alpine meadows near to skiing resort

From alpine zone, the power line corridor dives to the Skhalta valley crossing step slopes and deep gorges covered with mixed forests, which is changed with decrease of altitude. The climate in the gorge becomes sub-tropical, typical for mountainous Adjara. River gorges are narrow V shape, and slopes are very sharp covered with dense vegetation. The forests on the slopes are typical for south-west Georgia, and dominated by oak, hornbeam and beech.

Figure 6.1.9 Fragmented pine forest down to Skhalta Valley

Figure 6.1.10 View of Skhalta river gorge from Alpine zone

The landscapes can be grouped as follows:

- Foothills with Colchic vegetation.
- Colchic middle mountains with beech, beech-dark coniferous forests, with evergreen understory.
- Caucasian upper-mountain landscape with beech and pine forests.

In terms of land use only small part of the land is cultivated or populated. The most part, as mentioned before is covered by the forests. The villages are located close to the rivers in deep gorges along the main roads. Croplands are mostly used for cultivation of crops, beans and vegetables.

Figure 6.1.11 View of typical village in Skhalta valley

Below the confluence of Skhalta River with Adjaristskali, the river gorge becomes wider, the forested slopes are less sharp; however, the main character is similar to landscapes in Skhalta and Adjaristskali valleys. The power line corridor here is parallel to existing infrastructure because the road, villages, agricultural plots – all are located as narrow corridor along the Adjaristskali river.

The landscapes here are more modified by anthropogenic press, the cultivated land plots are visible more frequently and forests are more fragmented. The villages are bigger and in general more territory is used for agriculture purposes, however the steep slopes of mountains are still forested. Practically all section down from Adjaristskali and Skhalta river confluence down to Khelvachauri town is similar.

Figure 6.1.12 Adjaristskali river valley

The landscapes in Khelvachauri Municipality become more sub-tropic typical for the Black Sea coastal areas. The river gorge becomes wider and floodplain is developed between mountain slopes. The most part of land in the river floodplain and terraces is used for growing subtropical fruits like lemons, tangerines, oranges; croplands used mostly for vegetable growing are also typical for the section. Some industrial facilities, buildings, warehouses are also located in mentioned valleys. The vegetation here is mostly modified and the natural landscape practically does not exist in 2-5 km from the river channel; however, fragmented forests still cover slopes of surrounding mountains.

Figure 6.1.13 View of Adjaristskali river valley upstream from Khelvachauri

Figure 6.1.14 View of Chorokhi River valley after the confluence with Adjaristskali

6.1.3 Geology and Geohazards

The entire OHL corridor will be built on the south slopes the Adjara-Imereti Mountain Range. This mountain system is mainly formed by Middle and Late-Eocene deposits. Eocene rocks are presented by sandstone, conglomerate, volcanic rocks, marls, limestone, basalt, etc. Small area in the eastmost part (Akhaltsikhe) is formed by sandstone, clay and conglomerate of Oligocene deposits. Besides, quaternary deposits could be also encountered over river floodplains and terraces of major rivers.

Prominent characteristic of deposits in the project region is high erosion potential, especially due to action of surface runoffs. This imposes high landslide risk in steep slope areas. Many new and relict landslides were known in the area based on reference materials. This was confirmed by the Routing Study carried out within the scope of present overhead line development project (Mott MacDonalds, 2012). The study was carried out because of particular importance for the OHL section between the Beshumi and Khelvachauri, which is known for steep slopes. Great number of active, relict and potential landslides is recorded on this section during Routing Study; many of them are large-scale. On the other hand, the ROW section between the Akhaltsikhe Sub-Station and Beshumi is not so vulnerable to landslides: few landslide sites are reported there and these are mostly small scale, which could be easily bypassed.

The Routing Study (Mott MacDonalds, 2012) provides rather detailed landslide assessment; however, the report suggests further investigation of some sites along Beshumi-Khelvachauri section to identify routing alternatives. The alternatives have to ensure that landslide areas of high risks are avoided. It is expected, that is most likely to be accomplished by the design team at the detailed design stage.

Survey Methods

Geological and geomorphological description of the project region and corridor is based on review of existing scientific and geology information. Number of reference materials is used for description of major geological formations and land formation process for the project region.

Similar to this, various publications and geohazards maps are used to describe geohazards risks for wider project region. Though, more specific information is also provided from the Routing Study (Mott MacDonald, 2012), which contains rather detailed description of geohazards along the project route and was used for identification of area for pole installation.

Overview of Geological Settings

Mtkvari-Kvabliani Basin
The Mtkvari-Kvabliani River basin is situated in the Adjara-Trialeti zone of the Lesser Caucasus. Main geomorphological elements of the basin within the project corridor are the Akhaltsikhe depression, western slopes of the Arsiani Ridge, Meskheti Ridge.

The Meskheti Ridge is mainly formed by Mid Eocene volcanogens, though Neogene lava also spread in its southern part.

The Arsiani ridge is formed by shales, sandstones, Later Tertiary Goderdzi layers and Eocene volcanogenic sediments. Western slopes of the ridge are deeply cut by Kvabliani and Potskhovi rivers. Signs of old glaciation could be found on mountain tops.

The Akhaltsikhe (Samtskhe) depression represents a tectonic erosive intermountain depression, bounded by the Meskheti Ridge from the north, the Erusheti Ridge from the south, the Arsiani Ridge from the west and the Trialeti Ridge from the east. Elevation of the depression varies in the range of 900 m and 1000 m above sea level. It is formed by complex of Eocene, Oligocene and Miocene sediments; these are overlaid by alluvial and pro-aluvial-de-aluvial Quaternary deposits.

Middle Eocene (P_2^2b) is represented with massive rough fragmented volcanic breccia, tuff, lava layers, mostly sub-alkaline, alkaline and limy base basalts, rarely andesite and andesite basalts, dolerite, trachyte, tuff conglomerates, olistostrome, tephrite and sandy-aleuritic turbidite and also dellenite.

Upper Eocene (P_2^3) is represented by foraminiferal and lirelepic marl, rough grained quartz-arkose and graywacke sandstones, clay (carbonized, bituminized, shale), conglomerate middle layers, conglomerate-breccia, marl, andesite basalt, limestone, sub-alkaline basalt, tracyite, lava and pyroclastolite.

Quaternary sediments are represented mostly by boulder-pebbles and are characterized by high water content. They are of alluvial origin in river floodplains, and have pro-aluvial-de-aluvial character in other areas.

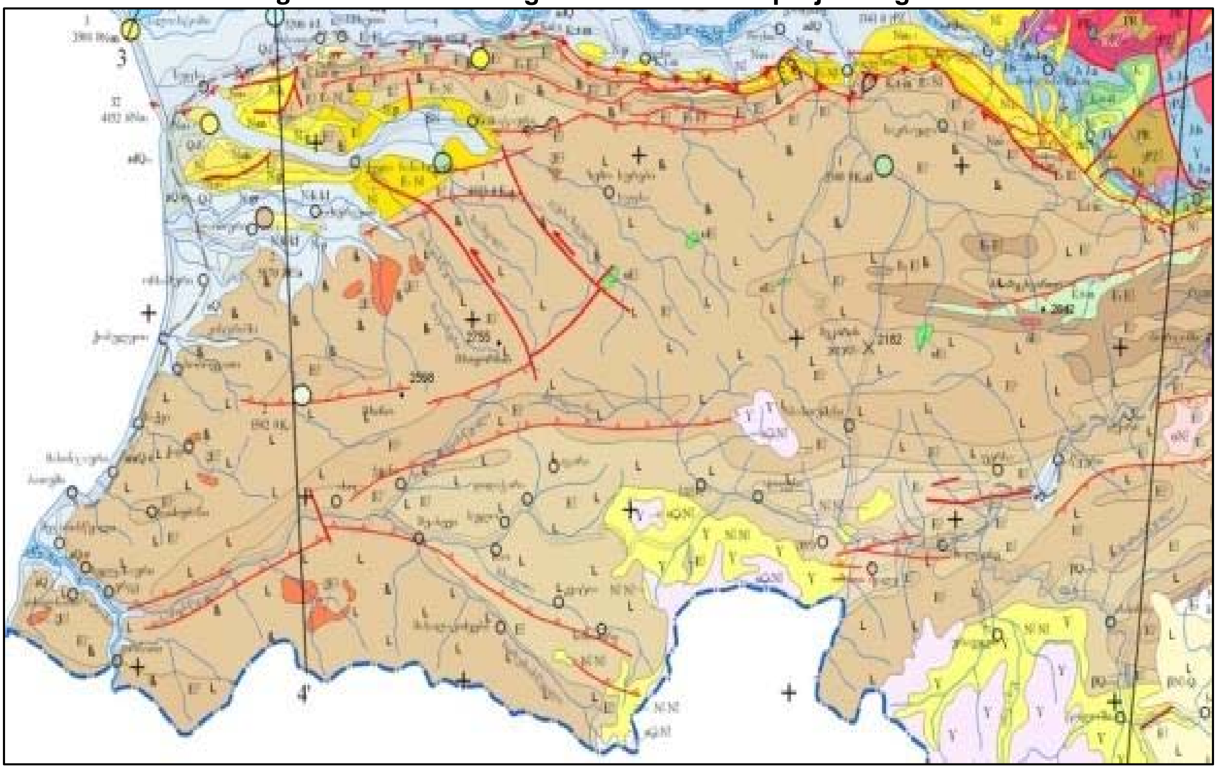
Adjaristskali Basin

Adjaristskali Basin is formed by rugged mountain system of the Adjara-Trialeti, in the west part of the central sub-zone of the Lesser Caucasus. Main geomorphological elements of the basin are the Adjara-Imereti, Arsiani and Shavsheti Mountain Systems, Adjara depression and coastal lowlands.

Main geological formations of the Adjaristskali Basin are Paleogene and Neogene volcanogens. Upper part of the basin on the western slopes of the Arsiani Ridge is formed by Late Eocene basalt, andesite-basalt lava, marl, coarse grained quartz containing sandstone, various clays, conglomerate, breccia and limestone. Medium and lower streams are structured by Eocene and Oligocene tuffs, tuff-breccia, andesite, argillite and other volcanogenic rocks. River floodplain is covered by modern and Late Pleistocene Quaternary alluvial sediments. Proluvial-deluvial Quaternary sediments spread in other areas over major part of the basin. Rocky outcrops of pre-Pleistocene period could be encountered on ridges of the Adjara-Imereti and Arsiani Mountains. Intrusive syenite and syenite-diorite rocks could be also encountered in some places. Number of tectonic faults are recorded within the basin. Major among them are situated along the Adjaristkali and Skhalta riverbeds.

Figure 6.1.15 below shows distribution of described geological elements in the project regions.

Figure 6.1.15 Geologic structure of the project region



Source: Geologic Map of Georgia, State Department of Geology, 2003

Geohazards

Samtskhe-Javakheti Region

Geohazards risks are moderate in the Samtskhe-Javakheti Region. These are mainly connected with complex geomorphological structure and complicated relief of the region. Geohazards recorded in the region include landslides, rockfall, mudflows and erosions. The most wide spread and accordingly most important in the administrative boundaries of the region and the project area are landslides (Figure 6.1.17).

In general, it could be stated that Akhaltsikhe and Adigeni districts are in relatively high landslide risk zone in Samtskhe-Javakheti Region (Figure 6.1.16), though landslide risk in these territorial units are much lower than in Adjara Region. Two high landslide risk areas are identified along the project corridor (encircled in violet in Figure 6.1.17). These are situated along the Kvabliani Valley, near the Benara Village and at higher datum near Adigeni Town. One more high risk area north from the start point of the project corridor is relatively distanced.

Geotechnical assessment in the frames of the Routing Study (Mott MacDonald, 2012) revealed several landslide areas within the project corridor and its close proximity (see Figure 6.1.18 and Figure 6.1.19). Assessed risk of landslide activation varies between low to critical; though, landslides are mainly small scale on this section. The routing is made in a way to avoid large high risk landslide and erosive areas.

Adjara Region

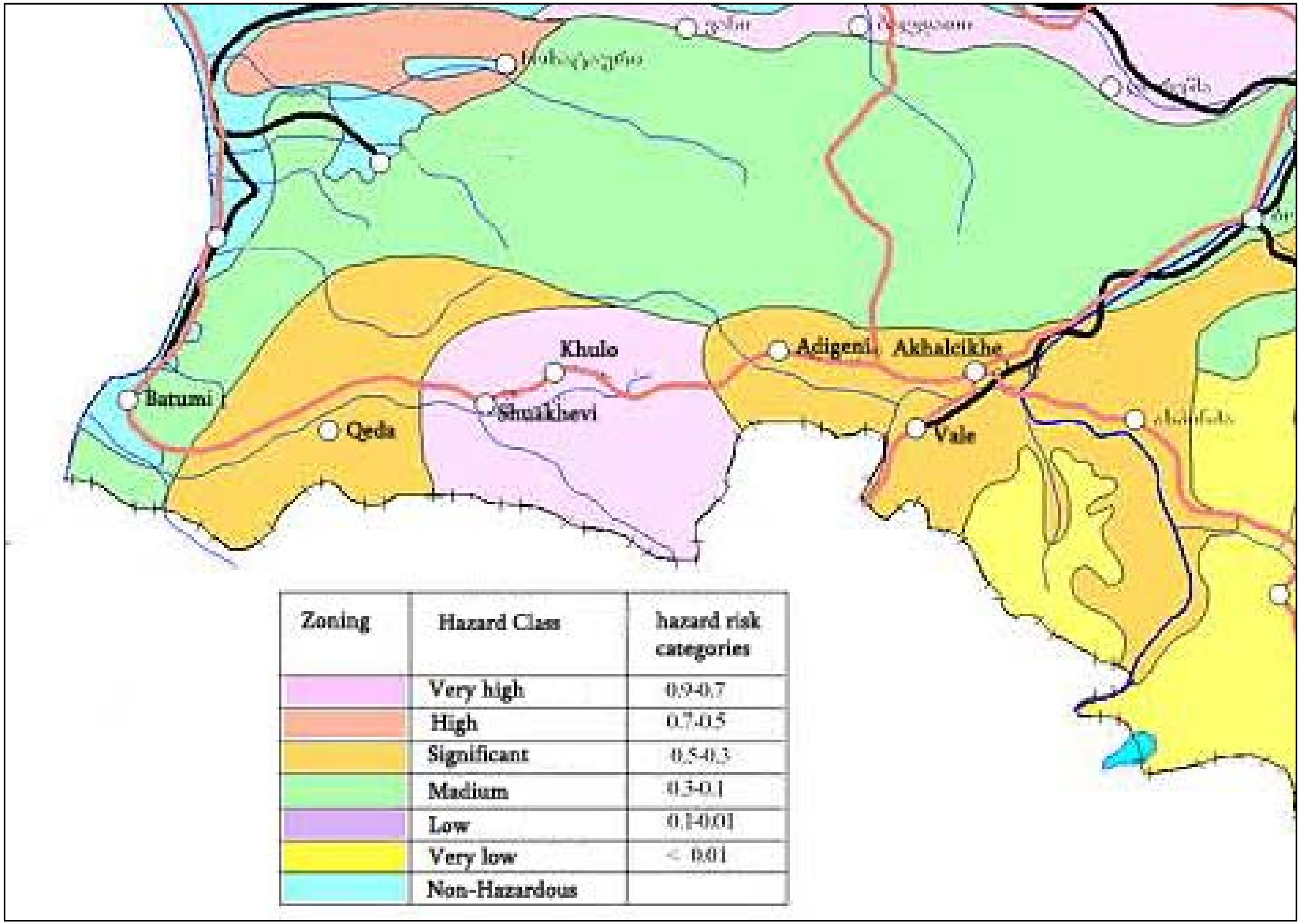
Adjara is considered as one of the most vulnerable regions in Georgia in terms of geohazards. This is determined by its location, terrain and climate conditions. Adjara region is situated within the deep regional fault zone separating the Adjara-Trialeti Mountains and Georgian block. Respectively this is highly seismic zone, which together with complicated relief and humid climate generate high risk for modern geomorphological processes such are landslides, rock falls, mudflows, erosion, etc. Together with natural conditions, various economic activities often provoke development and activation of geohazards.

Among geohazards most wide spread in the Adjara region are landslides, great number of which are recorded practically in entire Adjara, and the Adjaristskali basin among them (Figure 6.1.18). Big number of landslides is possibly originated by the earthquakes in the above mentioned regional fault zone (NEA, 2013).

Zoning of the Adjara Region by landslide risks is shown on Figure 6.1.16. As the figure shows, most part of the project corridor will be built in very high or significant landslide risk areas, especially on territories of Khulo and Shuakhevi Municipalities. Rather spacious area in the upper Skhalta basin as well as some smaller size territories along the Adjaristskali river are considered to be particularly high risk landslide zones.

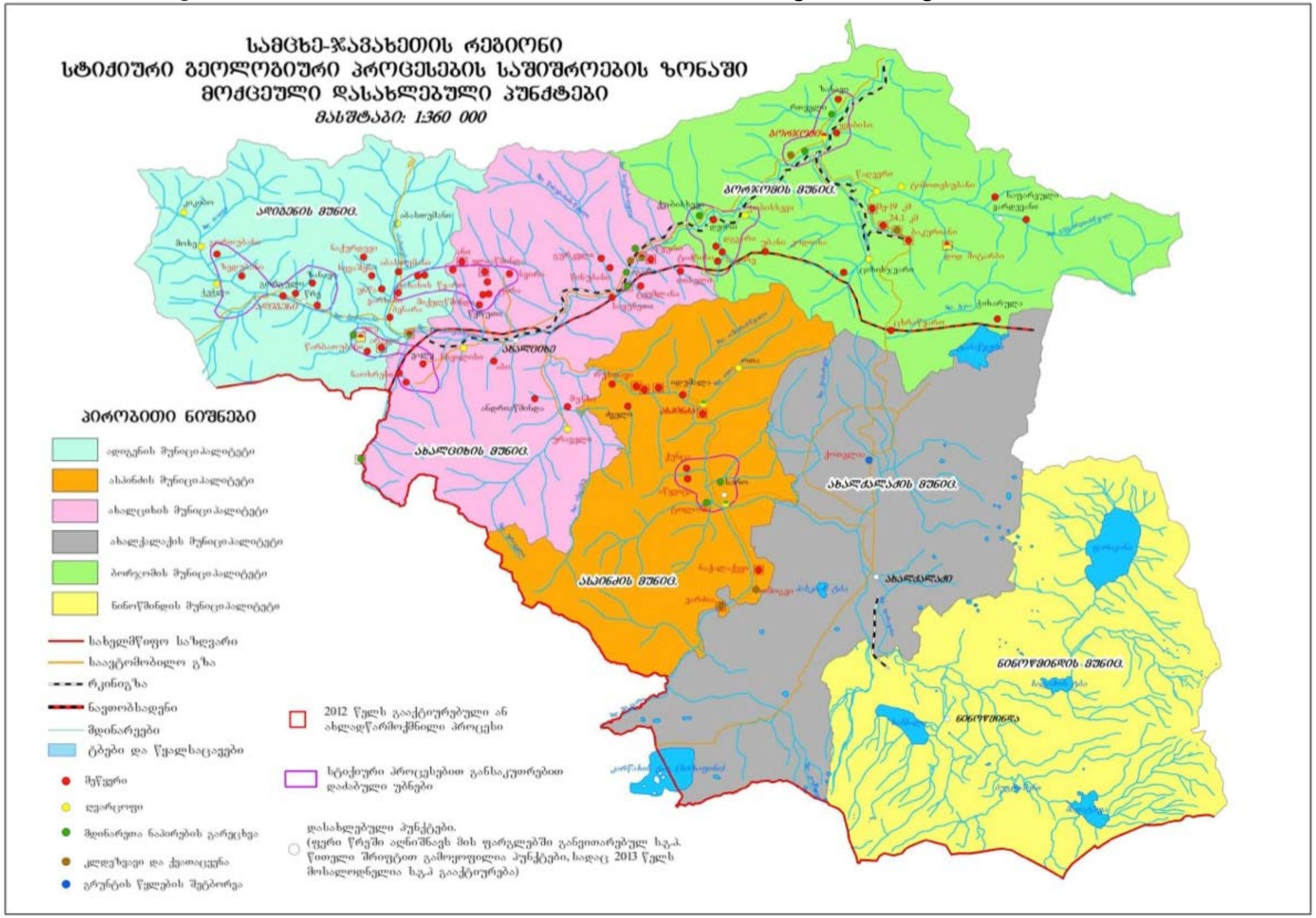
Landslide maps prepared during the Routing Study (Mott MacDonald, 2012) show that landslides cover most part of entire corridor from the Goderdzi Pass to Batumi Sub-Station. In most cases landslide risk is medium to major, and very limited sites with critical landslide risk are identified. However, in difference to the Samtskhe-Javakheti region, many landslides are large-scale on this section and create significant obstacles for the engineering and construction activities (Figure 6.1.19 - Figure 6.1.25).

Figure 6.1.16 Zoning of the project region by landslide damages and hazard risks



Adapted from Zoning Map of Georgian Territory by Landslide Damages and Hazard Risks

Figure 6.1.17 Settlements of the Samtskhe-Javakheti Region within geohazard risk zones



Source: NEA, 2013

Figure 6.1.18 Settlements of the Adjara Region within geohazard risk zones

Source: NEA, 2013

Figure 6.1.19 Landslide Map for Project Corridor, Akhaltsikhe Sub-Station-Benara Village (Mott MacDonald, 2012)

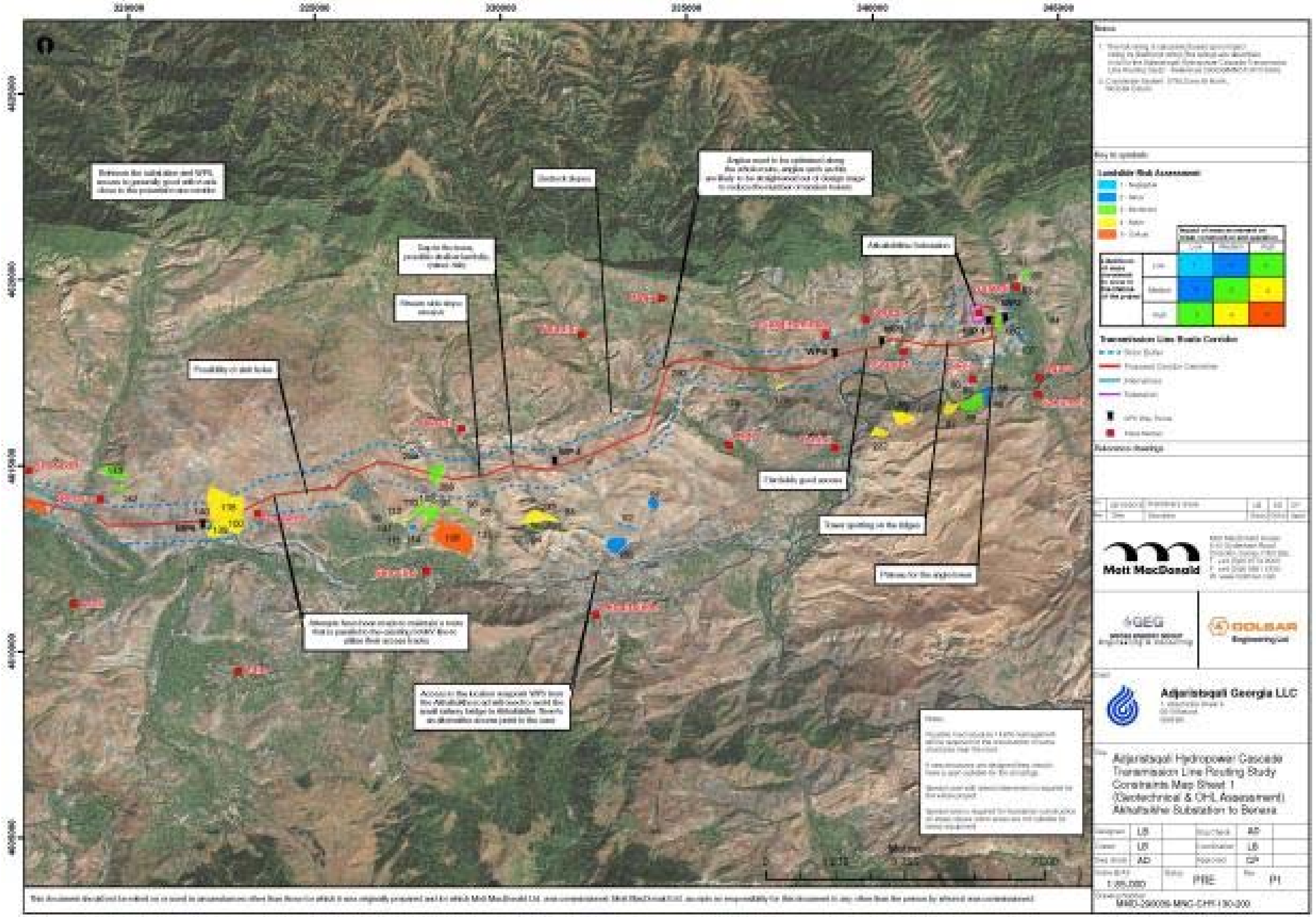


Figure 6.1.20 Landslide Map for Project Corridor, Benara-Tower 38 (Mott MacDonald, 2012)

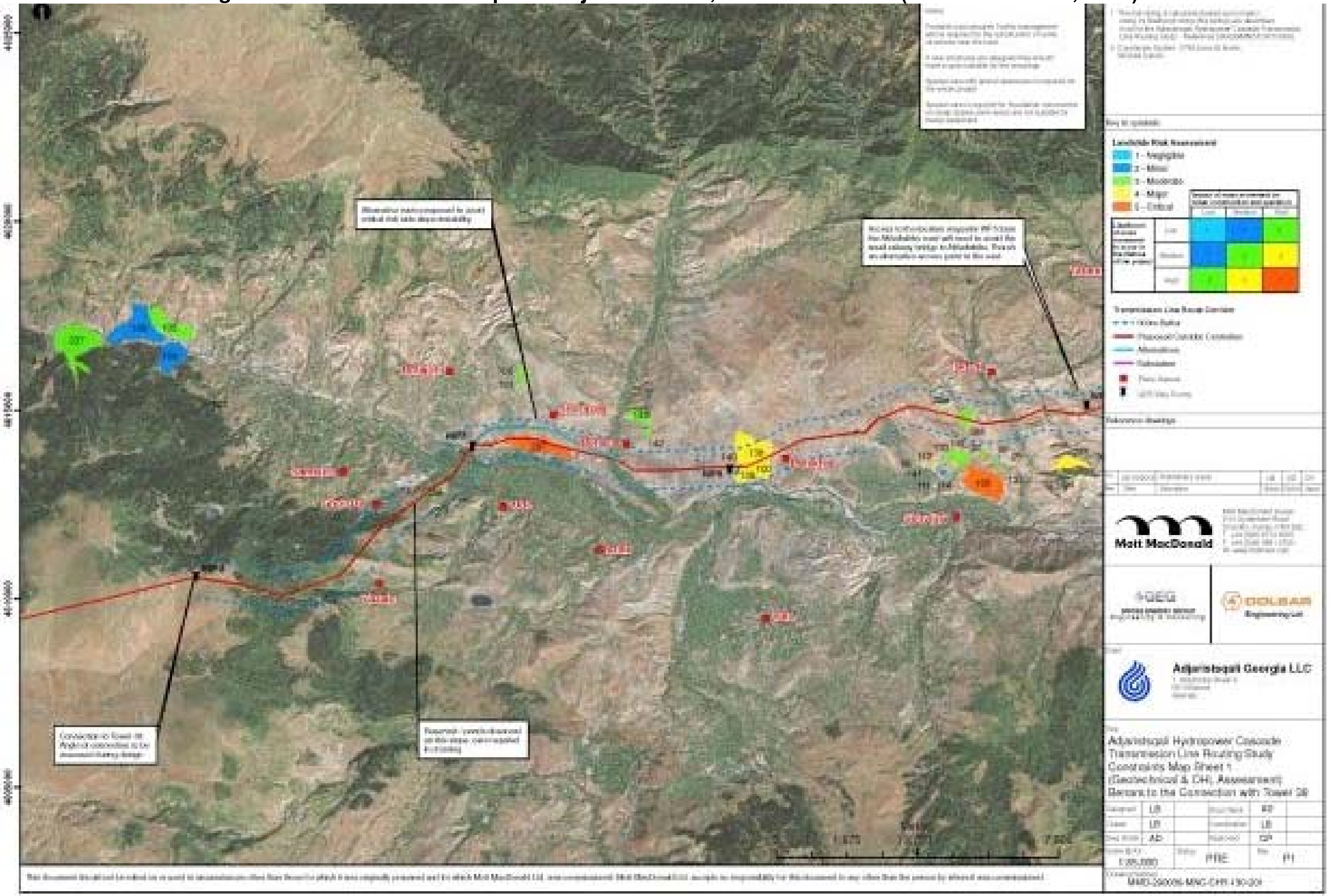


Figure 6.1.21 Landslide Map for Project Corridor, Tower 38 - Beshumi (Mott MacDonald, 2012)

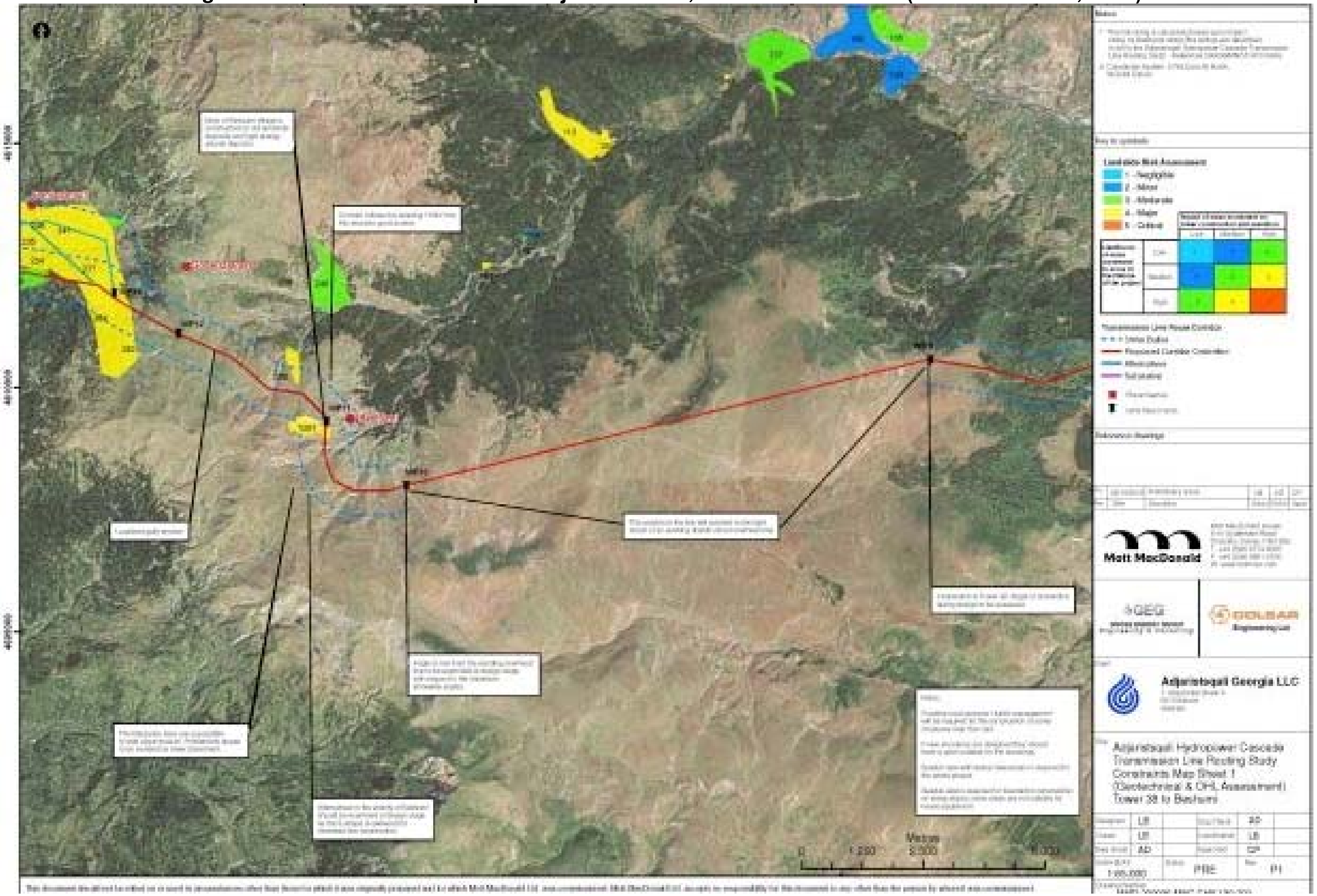


Figure 6.1.22 Landslide Map for Project Corridor, Beshumi-Didachara (Mott MacDonald, 2012)

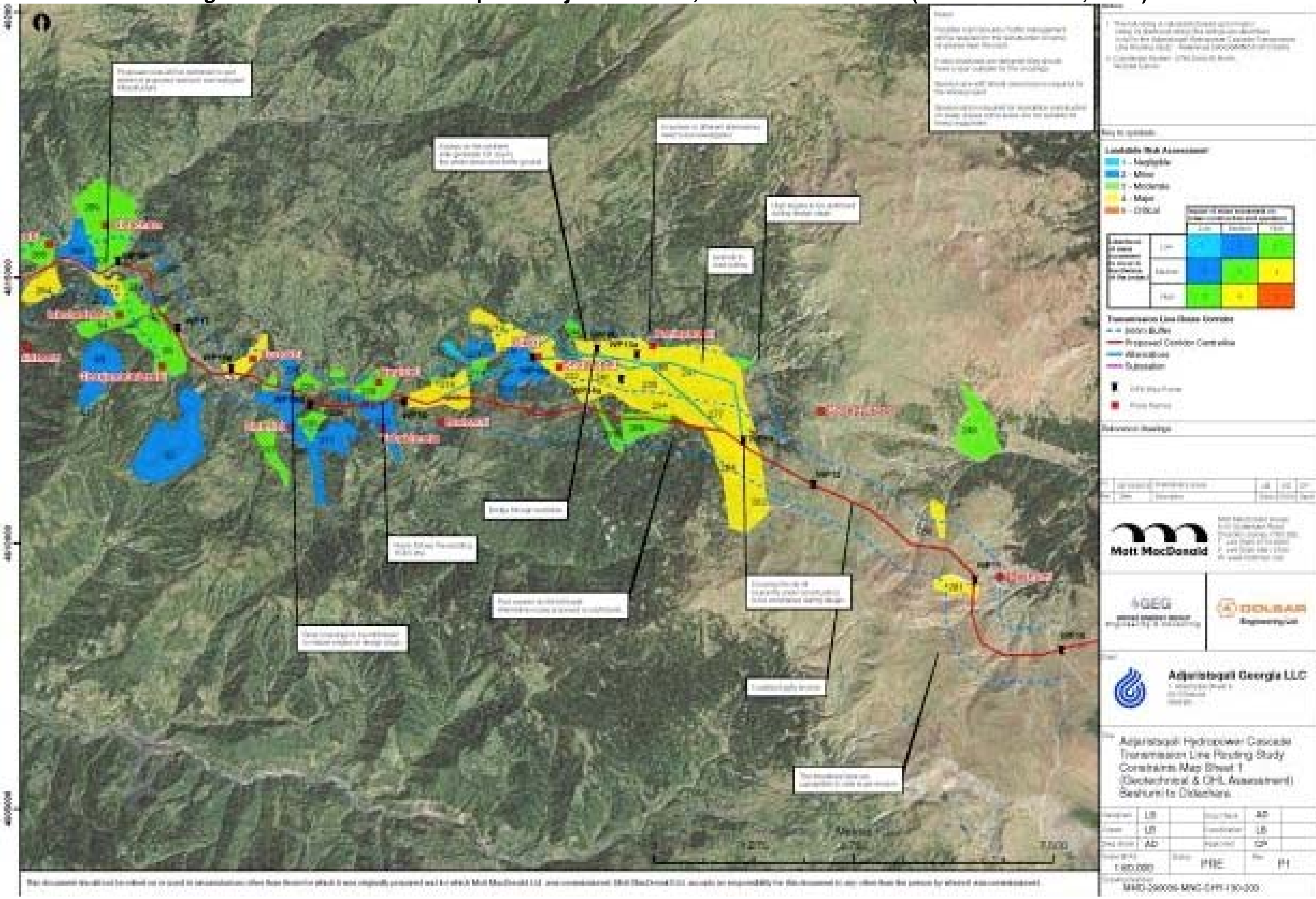


Figure 6.1.23 Landslide Map for Project Corridor, Didachara-Shuakhevi (Mott MacDonald, 2012)

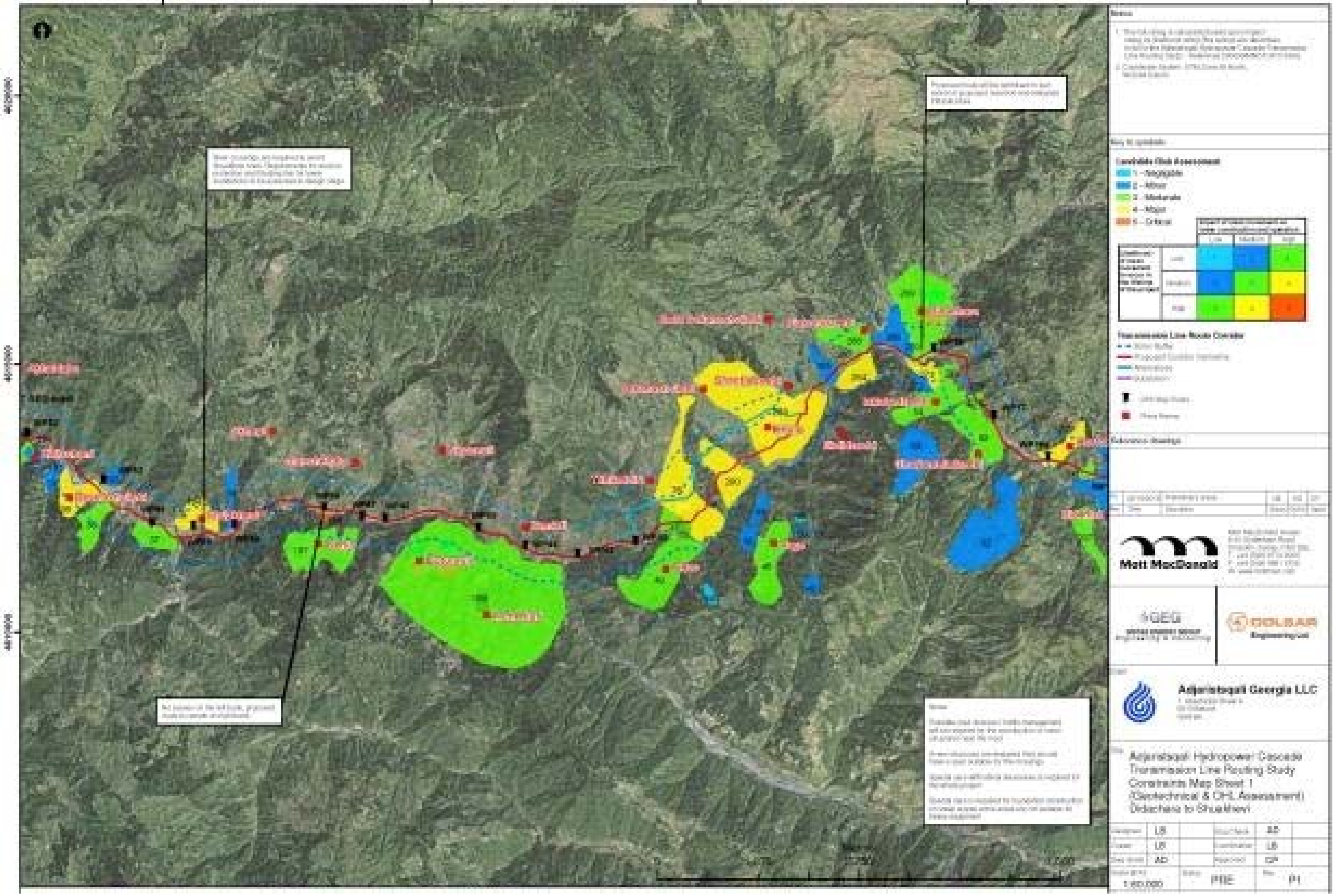


Figure 6.1.24 Landslide Map for Project Corridor, Shuakhevi-Keda (Mott MacDonald, 2012)

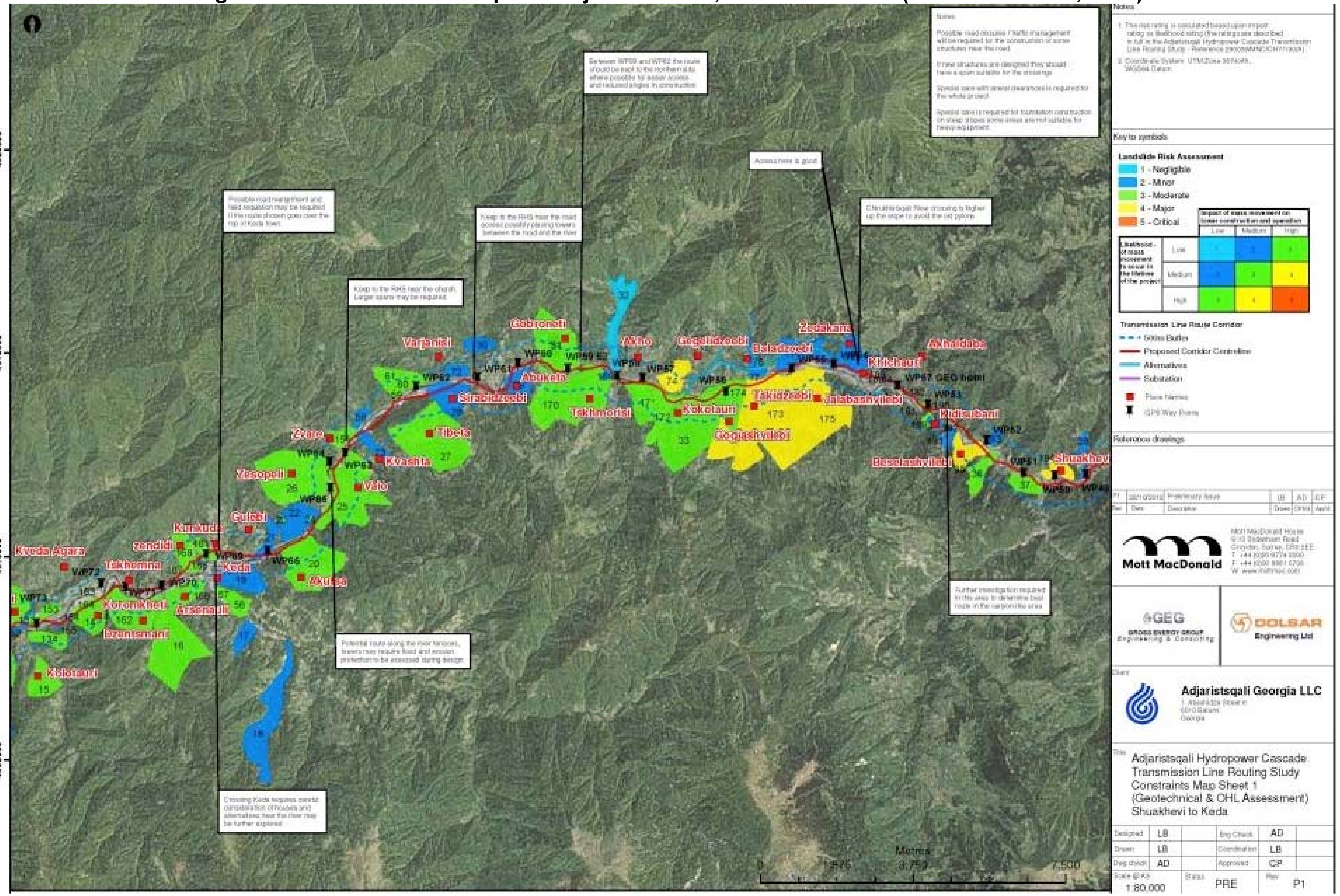
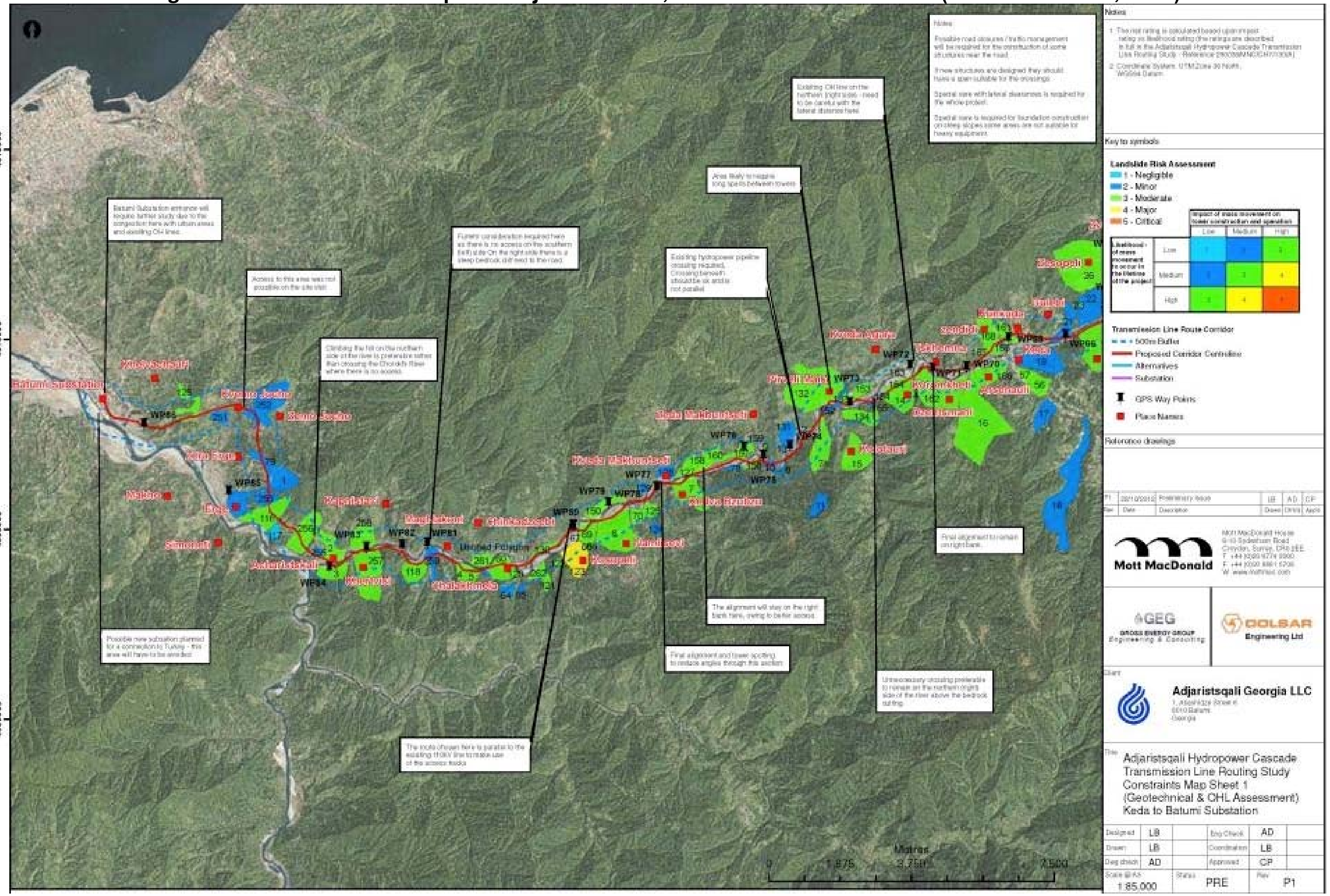


Figure 6.1.25 Landslide Map for Project Corridor, Keda-Batumi Sub-Station (Mott MacDonald, 2012)



6.1.4 Soil cover

The soil cover of entire project corridor was examined and studies through reconnaissance of representative sections. The descriptions for each section were made based on internationally recognized classification. Soil cover of the designed power line consist from the following soil types: red soils, yellow-brown soils, brown forest soils, mountain meadow soils and cinnamon soils. The description of these soil types and their distribution throughout the OHL corridor is provided below.

Red soils

Red soils are mainly spread in the Khelvachauri municipality between Chorokhi substation and village Khertvisi.

The red soils in Georgia are mostly encountered in south-western part of humid subtropical zone, in the regions of Ajara and Guria up tu 300 m asml. These soils are also spread in the regions of Samegrelo and Aphkhazeti located in north-western part of Georgia, adjacent to the black sea coast. Red soils are formed on basic magmatic rocks, mainly on andesite and there weathered products. The red soils are characterized by red colour, claying and usually have deep well-developed profile. Soil profile has the following structure: A-AB-B-BC-C.

Red soils have acid reaction. pH value mainly varies between 4 and 5. Humus content is average or high. Type of humus is fulvatic. Soil sorption capacity is low to average. Among absorbed cations exchangeable hydrogen is dominant. Red soils are characterized by heavy clayey, clay or heavy clay texture content.

Red soils are widely used in agriculture. These soils are cultivated under subtropical perennial crops, like citruses, tea and other. Red soils are poor in nutrients: calcium, magnesium, potassium, phosphorous and nitrogen. Due to stated, the agricultural value of the soils is not high and they require organic and mineral fertilizers on a regular basis.

Yellow-Brown soils

Yellow-brown soils, within the project corridor are encountered from vil. Khertvisi of Khevachauri municipality to the village Pushrukauli of Khulo municipality.

In Georgia yellow-brown soils are spread in Western Georgia in humid subtropical zone, from 400 to 1000 masl. Yellow-brown soils are mainly developed on magmatic neo-effusives – andesite, andesite-basalt bases.

Yellow-brown soils are characterized by well-defined humic horizon and yellow-brown coloured alluvial horizon. Soil profile usually has the following structure: A-AB-B_1-B_2-C_1-C_2 or A-B_1-B_2-C_1-C_2 or A-AB-B-B_1-B_2-BC.

Yellow-brown soils have acid reaction. pH value normally varies between 5.0 and 5.5. The most acid is humic horizon. In deeper layers acidity is gradually declined. These soils are rich in humus. Humus content is high even in subsoil layers. Texture content is heavy clay.

Yellow-brown soils are rich in nitrogen as they have high humus content, but they contain less phosphorous and potassium. Because of their good physical properties they are characterized by high water permeability, which has great importance in minimization of soil erosion.

The most of yellow-brown soils are covered by forests. Relatively small area is cultivated under permanent crops – vinegrapes, fruits etc. In some areas the plots with Yellow-brown soils are used for cultivation of tobacco.

Brown Soils

Brown soil are emerging yellow-brown soils and are spread through the project corridor until the upper limit of forest cover within the administrative borders of Khulo and Adigeni municipalities.

Brown soils belong to the most widespread soil types in Georgia. They occupy approximately 18.1% of country territory.

Brown soils are developed under warm and temperate climate conditions. In study area these soils are mainly developed on magmatic rocks, sandstones, marl and shiver.

Brown soils are characterized with non-differentiated profile and *clayed* metamorphic B horizon. Soil profile usually has the following structure: A-Bm-C.

Brown soil has weakly acid reaction, which lowers with increase of soil depth. Besides that, most acid reaction has top horizon. Soils have average humus content and deeply humified. Soils have adequate nitrogen content.

According to texture content brown soils belong to medium and light clayey soils, rarely heavy clayey soils.

Mountain-meadow soils

Mountain-meadow soils are spread along the project corridor in highland zones, from 2100 masl until 2500 masl within the administrative borders of Khulo and Adigeni municipality under natural subalpine and alpine pastures and hay lands.

Mountain-meadow soils are dominant soils in Georgia. They cover about 25.1 % of the territory of Georgia.

Mountain-meadow soils are characterized by non-differentiated profile. Soil profile usually has the following structure: A_s-A-B-BC-C.

Mountain-meadow soils are formed under cold climate conditions with long winter and cool summer. They are characterized by humic horizon with well-developed vegetative cover. Illuvial horizon contains considerable amount of gravel. The following horizon is characterized with elevated content of rock debris.

Mountain-meadow soils have acid or slightly acid reaction, high and deeply humified horizons. In lower horizons humus content is high than 1%. Humus type is fulvatic or humate-fulvatic. Mountain-meadow soils can be clayey or clay texture content.

Mountain-meadow soils are used under pastures and hay lands, therefore a rational use of pasturelands are essential to protect soil from erosion. This issue should be considered during the construction and maintenance activities on the proposed power line, because the soil protection needs special measures to be undertaken in those areas.

Cinnamonic soils

Cinnamonic soils are spread within the power line corridor from vil. Ude, Adigeni Municipality until vil. Zikilia, Akhaltsikhe municipality.

Cinnamonic soils are spread in Eastern Georgia in subtropical forest-steppe zone, mainly from 500 until 1300 masl.

Cinnamonic soils are characterized by well-differentiated profile. Soil profile usually has the following structure: A-$B_{(Ca)}$-BC(BC_{Ca})-C_{Ca}.

Cinnamonic soils have well-formed humus horizon with heavy texture content, slightly alkaline or neutral reaction, gradual increase of alkalinity by the depth. Humus content is low or average, but soils are deeply humified. Type of humus is humate.

Cinnamonic soils are highly fertile and together with chernozem soils belong to the sot fertile soils of Georgia. Cinnamonic soils are considered as one of the best soils for vine and fruit cultivation with its agronomic properties. Also, they are used for different cereals like wheat, barley, corn and etc.

6.2 Biological Environment

6.2.1 Protected areas and areas of special environmental importance

Major part of the OHL will be built within one of the ecologically sensitive areas of the Western Lesser Caucasus, which together with neighbouring Trialeti Ridge is recognized as priority conservation areas (PACs) and important wildlife corridor having significant role for biodiversity preservation and gene exchange (WWF, 2006). Besides, the westmost section of the route crosses well-known bird migration flyway called Batumi Bottleneck.

Four protected areas are established in close proximity to the project corridor to preserve natural ecosystems and biodiversity there. These include:

- Borjomi-Kharagauli National Park little north of the OHL section in Akhaltsikhe Municipality,
- Mtirala,
- Kintrishi, and
- Machakhela protected areas on the Adjara territory.

Neither of these protected areas will be crossed by the proposed transmission line, which will be built in rather safe distance from them. The OHL will approach Machakhela National Park the closest of the listed protected areas, and minimum distance to the Park boundaries and the ROW will be more than 1 km.

The location of the mentioned protected areas and layout of the project corridor is given in Figure 6.2.1. Brief overview of each protected area is provided in the following paragraphs.

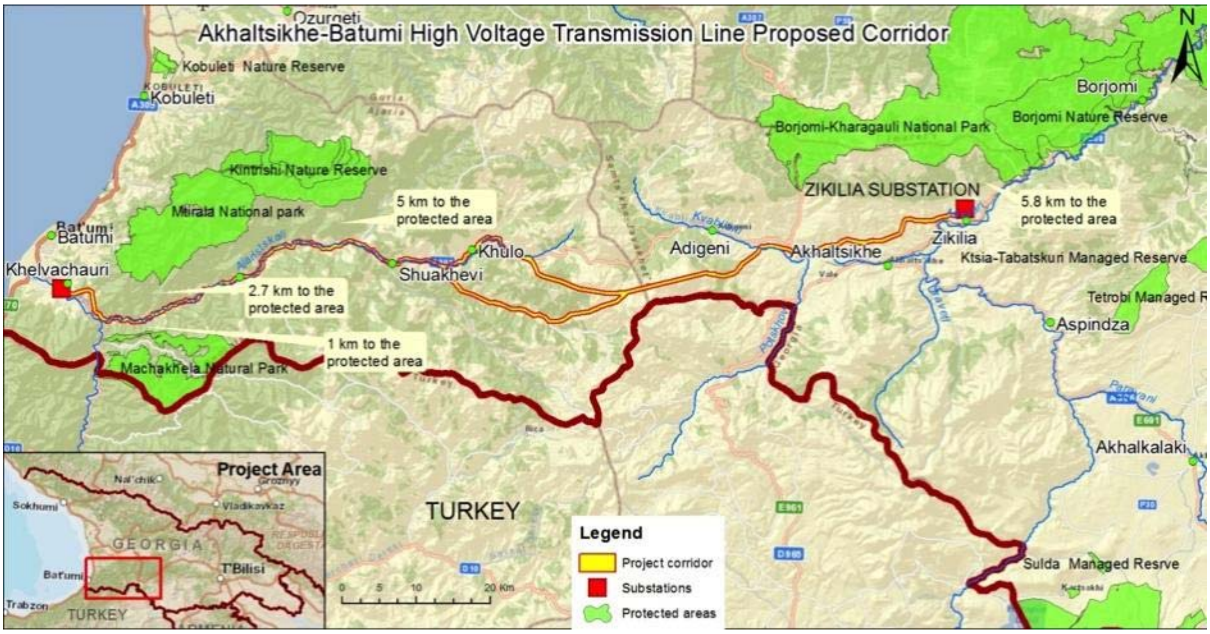


Figure 6.2.1 Boundaries of protected areas in vicinity of project corridor

Borjomi-Kharagauli National Park

Borjomi-Kharagauli National Park is the largest protected area in the central part of the country. The total area of the Park is 61,235 ha, of which around 15,000 ha has a strict nature reserve status. Besides, about 150,000 ha of surrounding territories are considered as National park Support Zone to help with main conservation and nature protection objectives of the of the Park.

The main purpose of the Borjomi-Kharagauli National Park is the conservation of well-preserved mountain ecosystems in the central part of the Lesser Caucasus, namely in the central zone of the Achara-Trialeti Range.

Major ecosystems of the Borjomi-Kharagauli Park are primary mountain forest and sub-alpine and alpine meadows typical of the Central Lesser Caucasus. Forests are presented dark coniferous, deciduous and mixed woods. Mixed deciduous forests are formed by chestnut *(Castanea sativa)*, beech *(Fagus orientalis)*, hornbeam *(Carpinus orientalis)*, Caucasian lime *(Tilia begoniifolia)*, Colchis oak *(Quercus hartwissiana)*, and ash *(Fraxinus excelsior)*. Highland forests are mainly presented by dark coniferous species such Oriental spruce *(Picea orientalis),* Nordmann fir *(Abies nordmanniana)* and pine *(Pinus sosnowskyi). S*ub-alpine forests, shrubberies and meadows could be found at higher elevations; Caucasian rhododendron *(Rhododendron caucasica), which is known as a habitat of the Caucasian Black Grouse, often grows there.*

Fauna of the Borjomi-Kharagauli is diverse as well. Among large mammals there could be found Gray wolf (*Canis lupus*), lynx *(Lynx lynx)*, Brown bear *(Ursus arctos)*, Roe deer *(Capreolus capreolus),* Caucasian Red deer *(Cervus elaphus)* and Wild boar *(Sus scrofa)*.

Many reptiles are found in the National Park, including the Caucasian Agama (*Laudakia caucasica*) and Greek Tortoise (*Testudo graeca*).

Birds include the rare species of Golden eagle *(Aquila chrysaetos)*, Griffon vulture *(Gyps fulvus),* Black vulture *(Aegypius monachus)* and Caucasian Black grouse *(Tetrao mlokosiewiczi).*

In 2007 the Borjomi-Kharagauli National Park became a member of the European Network of Protected Areas – PAN Park.

The section of the proposed OHL from the Akhaltsikhe Sub-Station to AP28 will run along south boundary of the Park, minimum in about 6 km distance.

Kintrishi and Mtirala Protected Areas

The protected areas of Kintrishi are situated the north to the project corridor, on the section between AP81 and AP110, with minimum 5 km distance from the project ROW. Kintrishi protected areas are established in upper basin of the Kintrishi River, over 13,893 ha. They include the Kintrishi Strict Nature Reserve (10,703 ha) and Kintrishi Protected Landscape (3,190 ha) in its central part.

Mtilara National Park is adjacent to the Kintrishi Reserve. It is also situated the north to the OHL route, between AP106 and AP135, in 1.7 km from the route. Total area of the Park is ca. 15,700 ha.

These protected areas are established within priority conservation area (PCA) of the West Lesser Caucasus (WWF, 2006) to preserve biological diversity, landscapes and unique Cholchic forests of Sub-tropical zone. Besides, they are part of well-known bird migration flyway (so called Batumi bottleneck). Respectively, these protected territories are distinguished due to high biodiversity which together with widely distributed plant and animal species include rare, endemic and relict species, some of them protected nationally and/or internationally.

Factually entire territory is covered with Cholchic forests with domination of beech. Other forest forming species include chestnut, oak, hornbeam, lime tree, etc. Some flora species are relict. These include: Common yew *(Taxus baccata)*, Medvedev's birch (*Betula medwedewi), Rhododendron* (*Rhododendron ungernii),* Pontine Oak *(Quercus pontica),* Colchis bladdernut (Staphylea colchica), chestnut (*Castanea sativa), box tree (*Buxus colchica) etc. In total over 100 dendrofloral species are recorded within the Kintrishi and Mtirala Protected Areas.

As mentioned, the protected areas are crossed by bird migration flyway. Respectively, it is distinguished with abundance and diversity of birds, especially raptors. Among raptors recorded in the Kintrishi protected area are: Booted Eagle (*Aquila pennatus),* Steppe buzzard (*Buteo buteo*), Northern Goshawk (*Accipiter gentilis*), Eurasian Sparrowhawk (Accipiter nisus), Eurasian Hobby (*Falco* *subbuteo*), Common Kestrel (*Falco tinnunculus*), Imperial Eagle (*Aquila heliaca*), etc. Besides, the Caucasian Grouse (*Lyrurus mlocosiewiczi) is found in these areas.*

The reserve provide shelter to brown bear (Ursus arctos), Lynx (*Lynx lynx*), Gray wolf (*Canis lupus),* Wild Boar (*Sus scrofa*) *etc. There are numerous small mammals as well.*

Kintrishi River and its tributaries provide habitat for various fish. Amphibians including the Southern Crested Newt (*Triturus karelinii*), Common Toad (*Bufo bufo)*, Marsh Frog (*Rana ridibunda), etc.* widely spread in these humid forests. Among reptiles most prominent is Caucasian Viper (*Vipera kaznakovi*), which is protected locally and internationally.

Machakhela National Park

Machakhela National Park was established recently, in 2012. It comprises 8733 ha in middle streams of the Machakhela River, which is a transboundary basin shared between Georgia and Turkey. The proposed OHL will avoid territory of this protected area from the north between AP103 and AP145. The minimum distance to the project ROW will be ca. 1.1-1.5 km.

The National park was created to protect well-preserved Cholchic ecosystems and to promote integration of ecosystems of South-West Georgia and North-East Turkey.

About 75% of the Park's territory is covered by well-preserved Cholchic forests, dominant wood forming species of which is beech. Similar to Kintrishi and Mtirala protected areas, Machakhela Park is a part of the West Lesser Caucasus PAC and Batumi flyway. Flora and fauna diversity is rather similar to the above mentioned protected areas, due to close proximity.

6.2.2 Flora

As it was described in the section dedicated to the landscapes, the habitat specifics are changing very rapidly in V shape deep gorges of Adjaristskali and Skhalta rivers. Within the 500 meter wide proposed corridor practically all different types of habitats are observed, starting from riparian forests located near to the rivers, mixed forest covering the sharp slopes and meadows at the tops of forested slopes sometimes used as a hey lands. In General it should be stated, that Adjara section is richer and more complicated in terms of vegetation cover, especially large size tree cover and number of protected and endangered species, however the section located in Adigeni municipality should not considered as less valuable.

The description of flora in project corridor

The area of OHL is extended over geo-botanic district of Meskheti and Arsiani Ridges of the geo-botanic zone of Akhaltsikhe depression (Project territory is located in Akhaltsikhe and Adigeni Districts) and Ajara-Guria geo-botanic district of the geo-botanic zone of the Lesser Caucasus (project territory is extended over Khulo, Shuakhevi, Keda and Khelvachauri Districts of Adjara.

Geo-botanic District of Meskheti and Arsiani Ridges of the geo-botanic zone of Akhaltsikhe depression covers the southern slope of Meskheti Ridge (within the limits of Meskheti; the eastern border runs along the meridian of village Atskuri) and eastern slope of Arsiani Ridge (within the borders of Georgia), with the territory adjacent to Akhaltsikhe Depression (northern part of the depression).

The geology of the territory is dominated by the Tertiary rocks (slates, sandstones) and volcanogenic strata (tufa, tufa-breccia), material of Goderdzi stratum - lavas. The gorge of the river Dzindze (Arsiani Ridge) is built with tufa and tufa-breccia.

The dominant relief in the region is erosive one. There are also volcanogenic forms, landslide formations, forms of accumulation (flat-bed river basins). The hypsometric elevation of the area is from 1000-1300 m (depression) to 2850 m (mount Mepistskaro) above sea level.

The hydrographic network of the region is presented by the river Mtkvari and its left tributaries - the Kvabliani, Potskhovi and other small streams.

The vegetation cover of the region is diversified. The impact of a human's economic activity and anthropogenic impact in general, on the vegetation of the old terraces of the Mtkvari river and its tributaries and lower sections of mountain slopes has always been significant (cutting and burning down the forests to expand agricultural plots, chaotic cattle grazing in the forests and over the forest edge, overloading the pastures with cattle, frequent foreign invasions, etc.). The result is the virtually destroyed natural vegetation (mostly oak and mixed-leaved forests) and the soil cover washed-down from the slopes. As time passed, the representatives of semi-xerophilous and xerophilous vegetation have become common on the rocky and treeless sites (they are migrants from the local xerophytic centres and neighbouring Asia Minor) giving rise to the origination of the steppe vegetation and xerophilous complexes.

The peculiar nature of the natural environment and strong anthropogenic impact on the natural vegetation have resulted in a specific vegetation zoning, which is close to the transitional type from Kolchic to East-Caucasian zoning (is one of the variants of the latter). The mentioned type of zoning is presented by forest and sub-alpine zones. There is also an Alpine zone developed over mount Mepistskaro.

Akhaltsikhe to Beshumi Section

The forest zone includes the territory from the Akhaltsikhe depression up to 1800-1850 masl. In the lower part of the forest zone (up to 1200-1300 m above sea level), which should be (still) considered a sub-zone of oak forests (*Quercus iberica*), vast areas are occupied by the vegetation of mostly later stages of anthropogenic digression of the oak forests and mixed-leaved forests. This vegetation is presented by hemi-xerophilous and xerophilous complexes, in particular, astragalus *(Astragalus microcephalus)* and prickly-thrift *(Acantholimon armenum)*, ephedra *(Ephedra procera)*, groupings of semi-desert vegetation (dominants - *Nitraria schoberi, Reaumuria kusnetzovii*), bushes of fustic *(Cotinus coggygria)*, buckthorn *(Rhamnus pallasii)*, beard-grass *(Botriochloa ischaemum)* and wormwood-and-beard-grass *(Artemisia fragrans, Botriochloa ischaemum)* steppes, etc. The basic forests - oak *(Quercus iberica)*, hornbeam-oak *(Carpinus caucasica, Quercus iberica)* and mixed-leaved forests (Georgian oak, hornbeam, field maple (*Acer campestre)*, box elder *(Fraxinus excelsior)*, Indian cedar - *Ostrya carpinifolia. etc.*) are survived mostly as small plots and fragments.

The phyto-landscape from 1200-1300 m to 1800-1850 m, is dominated by coniferous forests (sub-zone of the coniferous forests). Spruce *(Picea orientalis)* forests grow on vast areas. There are fir-and-spruce *(Abies nordmanniana, Picea orientalis)*, beech-and-spruce *(Fagus orientalis, Picea orientalis)* and pine-and-spruce *(Pinus sosnowskyi, Picea orientalis)* forests growing here. Pure fir *(Abies nordmanniana)* forests are relatively limited, with beech forests *(Fagus orientalis)* even more limited (both formations ate mainly growing in the western part of the region). The pine (*Pinus sosnowskyi)* forests are of great expansion. Mostly the basic pine and oak forests are growing over the dry slopes of southern, southeastern and southwestern expositions (with Georgian oak (*Quercus iberica*) in the lower part and Persian oak (*Quercus macranthera*) in the upper part). The slopes of northern, western and northeastern expositions are dominated by the above-mentioned dark-coniferous forests (spruce, fir-and-spruce, beech-and-spruce, fir forests). Out of other formations, there are temporal (derivative) pine forests *(Pinus sosnowskyi)*, hornbeam *(Carpinus caucasica)*, and rarely - beech *(Fagus orientalis)* forests growing here.

The dark-coniferous and pine forests in the region are quite diversified in a typological respect. Dry and dryish forest types (associations) are dominant, as a result of dry climate. The most widely spread forest associations include the following species: spruce forest with the cover of mountain fescue *(Festuca montana)*, spruce forest with moss cover *(Hylocomium splendens)*, spruce forest with shamrock cover *(Oxalis acetosella*)*,* spruce forest with dry *(Piceetum siccum)* and other from the spruce forest; pine forest with broom cover *(Cytisus caucasicus)*, pine forest with lathyrus cover *(Lathyrus roseus)*, pine-tree forest with false brome grass cover *(Brachypodium silvaticum),* pine-tee forest with yellow azalea *(Rhododendron luteum)* sub-forest, pine-tree forest with gramineous herb cover, dry pine-tee forest *(Pinetum siccum)*, etc.

The steppe vegetataion and xerophilous complexes grow over the dry slopes of southern and south-eastern expositions in the sub-zone of the coniferous forest, up to 1600-1700 m above sea level (almost the same species as in the sub-zone of the oak forests), but their representatives do not grow over vast areas in the phito-landscapes.

Sub-alpine and Alpine Zone from Beshumi to Skhalta

The sub-alpine zone spreads from 1800-1850 m to 2500 m above sea level. In the lower part of the zone (up to 2000-2100 m above sea level), the sub-alpine high-mountainous forests grow with eastern spruce *(Picea orientalis)*, Caucasian pine *(Pinus sosnowskyi)*, Persian oak *(Quercus macranthera)* and birch *(Betula litwinowii)* forests. In the western part of the region, there is also oriental beech forest *(Fagus orientalis)*. The area of sub-alpine forest is significantly reduced because of anthropogenic influence, and the forest structure is disturbed.

The sub-alpine meadows occupy a vast area. The numerous different poly-dominant gramineous herb meadow are dominating here. Sub-alpine tall herbaceous cover grows in fragments over the slopes of the northern exposition.

From sub-alpine bushes, there grow Caucasian rhododendron bushes *(Rhododendron caucasicum)*, with its cenoses developed over the slopes of a northern exposition. On the southern exposition slopes there are small sections and fragments of juniper bushes *(Juniperus depressa)* growing. The alpine zone is developed only over the slopes of mount Mepistskaro (3850 m). The vegetation cover here is presented mainly by alpine poly-dominant gramineous herb meadows.

The project region is famous for a rare natural event as called fossilized forest ‘Goderdzi flora’. After the volcanic eruption, the subtropical forest of the ancient time (Sarmatic-Pontic Ages of the Neogene) was buried under the volcanic ash. The forest included palm trees, bay species, magnolias, Myrtaceae, Sapindaceae and others of evergreen plants, total of about 90 species. Fossilized and semi-fossilized tree branches and leaf prints are survived in the volcanogenic tufa.

Vegetation from Skhalta to Khelvachauri

The vegetation in Adjara is fairly diverse. This is determined by the different natural conditions of the area as well as quite complex history of flora and vegetation development. Adjara, as many researchers have indicated, is the richest province of Kolkheti relict flora. The majority of the elements typical for Kolkheti flora are found in the region. Moreover, there are such relict species, which grow only within Adjara, i.e. – Medvedev's birch, ground laurel – *Epigaea gaulterioides*, etc. The elements of European forest flora are abundantly mixed with Kolkheti vegetation.

The Adjara flora, as all vegetation typical for mountainous countries, is characterized with vertical belting. According to Ketskhoveli (1959), the following belts are prominent in the area:

1) Hydrophytic grass and humid forests with natural climbers – 0-250 m above the sea level;
2) Forests with evergreen Colchic understory and natural climbers – from 150-250 m to 450-500 m above the sea level;
3) Middle mountain belt with a couple of sub-belts – from 500 m to 2000 m above the sea level; and
4) High mountainous, sub-alpine and alpine belts.

The above belts are characterized by different vegetation, which are briefly described below.

Adjara lowland – coastal line is the southern end of Kolkheti lowland. The width of the area fluctuates within 2-5 km from Kobuleti, becomes even narrower to the south and the foothills directly follow the seaside. The latter part of Adjara is prominent for the large amount of precipitations. The seeping of precipitations occurs only in the upper layers of ground due to high level of water. The same partially results in lack of flow of the precipitations from the surface or slight flow. These conditions and many other factors caused the bogging of the major part of Kolkheti lowland.

The mentioned Adjara lowland, generally as the lowest part of Kolkheti lowland, was covered with forested marshes, grass and sphagnum wetland vegetation. These types of vegetation are developed on the wetland meadow, peat-boggy, bog-slit and boggy podzol soils. Their majority, especially forested wetlands, is at present dried and plantations of tea, citruses (lemons and tangerines) and other technical crops are cultivated.

Forested marshes were more abundant in the mentioned vegetation complexes. Only fragments of these forests have been preserved on small areas for now. Alder - *Alnus barbata*, is dominant in this forests. Caucasian wingnut – *Pterocarya pterocarpa* and in relatively dry areas - hornbeam (*Carpinus caucasica*) and Imeretian oak (*Quercus imeretina*) are also present. The understory is commonly formed by buckthorn (*Frangula alnus*), hawthorn (*Crataegus microphylla*), cranberry (*Viburnum opulus*), etc. At some areas with thinned forests blackberry and lianas (such as greenbrier (*Smilax excelsa*), silk vine (*Periphloca graeca*), wild grape (*Vitis silvestris*), ivy (*Hedera colchica*), etc.) have become dominant.

Alder formations are found mainly on humid ground, although it is undeveloped in greatly bogged areas. Alder formations are rich with grass synusias formed by typical components of bog vegetation, such as: Imeretian sedge, wetland iris, sedges, cattails, etc. Alder formations with fern, mixed grass and mosses occupy less area. Alder formations with rhododendron are even less abundant on relatively drier areas. The mentioned alder species occurs more or less abundantly in Adjara lowland and middle mountain forests, i.e. hornbeam and beech formations up to 1500 m above the sea level and at some areas – especially in the upper zone of its development it forms co-dominant cenoses with mountain alder (*Alnus incana*) on small areas.

Fairly diverse leaved forests were abundant in Adjara lowland and foothills. At present only their fragments remain on relatively small areas. Such forests are formed by hornbeam, Imeretian oak, ash (*Fraxinus excelsior*), Khertvisi oak (*Quercus hartvissiana*), elm (*Ulmus elliptica*), lime (*Tilia caucasica*), persimmon (*Diospyros lotus*), at some areas – by beech, chestnut, etc. These forests are characterized with well-developed understory, which at some areas is formed by deciduous shrubbery: pontic azalea (*Rhododendron luteum*), buckthorn (*Rhamnus imeretina*), spindle tree (*Evonymus latifolia*), bladder nut (*Staphylea colchica, St. pinnata*), hazel nut (*Corylus avellana, C. pontica*), etc and at some areas – by evergreen understory, such as: holly (*Ilex colchica*), rhododendron (*Rhododendron ponticum*), Colchic holly (*Ruscus hypophyllum*), etc. In these forests, especially – within lowlands liana vegetation is also abundant – Colchic ivy, silk vine, wild grape and greenbrier. In some thinned areas the vegetation is so abundant, that access is impossible. The described forests are located up to 500 m above the sea level.

The intact nature of Adjara Colchic forests has been disrupted. They are either cut or transformed into arable land. Even if forests remain, they are re-established on forest clearings, because growth is very intensive on the lowland of the Western Georgia. Alder and hornbeam should be especially noted in this term. According to Ketskhoveli (1959), the grass vegetation of such forests is fairly diverse, ferns and forb grasses are especially abundant.

Georgian oak forests do not occur in Adjara. It is substituted with Tchorokhi oak (*Quercus dscorochensis*). The forests with Tchorokhi oak dominance are spread on dry slopes of Adjaristskhali and Tchorokhi ravines. The major part of these forests is very thinned and, as a rule, trimmed. Due to hay lack the population uses woody fodder for livestock feeding. These forests resemble Georgian oak forests spread in Kolkheti in structure, but, according to Kolakovski (1961), Minor Asian xerophyle species occur in its structure. Fragments of mountain xerophyle oak forests are represented in these oak forests. It is also important, that tragacanth astragal was found in those forests.

The area above described vegetation belongs to the middle mountain zone. The zone borders according to Ketskhoveli (1959) range from 500 m to 2150 m above sea level (masl). This zone is very rich with plant communities reflected in occurrence of the numerous tree and shrub species as a result of diverse ambient conditions and impacts of human's economic activities.

The landscape importance of this zone is associated with the beech forests, however as pointed by Dolukhanov (1957), beech forests are common in the middle montane zone, but do not exist in the areas where annual precipitation is less than 500 mm. The principal coenotype of this formation can be found from seaside to subalpine zone, although based on Gulisashvili (1955), altitudinal zone of the beech forests with high productivity beech stands is extended from (900) 1000 m to 15000 (1600) masl, while according to Dolukhanov (1957), the optimal distribution area of beech forests is limited within the altitudinal range of 800-1300 masl. This forest type is characterized by absolute domination of the principal coenotype, though it is not seldom that in the phytocoenosis the major species is admixed with hornbeam, wych elm, chestnut – particularly in the lower montane zone, lime-tree, etc. The beech often forms co-dominated phytocoenosis with spruce and fir.

Beech forests with evergreen understory are widely distributed around Adjarian highlands. Such forests are typical for the entire Kolkheti and are mainly associated with humid areas. The understory is formed by Pontic rhododendron (*Rhododendron ponticum*), Black Sea holly (*Ilex colchica*), cherry-laurel (*Laurocerasus officinalis*), in some areas – by *Rhododendron ungernii, etc*. The wet territories also host the beech forests with fern understory. In this type of beech forests the live cover is formed by ferns *Matteuchia struchiopteris, Athyrium filix-femina, Driopteris filix-mas,* sometimes by *Phyllitis scolopendrium,* etc. The later species are also found in other types of beech forests, though their share in the phytocoenosis is minor.

On the less humid slopes, the complex of foregoing type beech forests comprises beech shrubs. In these forests the understory are formed by deciduous bushes, e.g. yellow azalea (*Rhododendron luteum*), Caucasian whortleberry (*Vaccinium arctostaphyllos*), common hazel (*Corylus avellana*), some blackberry species, etc. Such beech forests have well-developed herbaceous sinusia. The sinusia, as well as the deciduous beech shrublands in general, are richer in terms of species composition comparing to the other beech forest types. Floristically quite rich are also the beech forests with tall herbaceous vegetation and fescue (*Festuca montana*) understories. These two forest types are developed in the different ecological environments, although both of them are of minor importance in Adjarian beech forest landscapes.

The beech forests with dead ground cover are quite widely distributed in Adjara, as well as around entire West Georgia. In such beech forests, according to Kolakovski (1961), other tree species have only minor shares, while bushes and herbs almost do not exist. Based on Dolukhanov (1938), this type beech forest provides the most favourable ecological conditions for growth and development of the beech, and is characterized by high productivity. In general lianas are seldom met in such environment, however some liana species, e.g. Colchic ivy, are permanent components of the beech forests.

Hornbeam forests are often found in combination with beech formations, particularly in the lower part of beech distribution area, approximately up to 1100 masl. Individual hornbeams admixed to the beech forest may be met even at higher altitudes. The hornbeam stands develop in the various edaphic conditions. For example, on the lowland hornbeam grows in the podzol soils, and in other areas – in the humus-rich carbonate and brown forest soils. Structurally and floristically hornbeam forests are similar to the beech ones and comprise the analogous forest types, but are developed over significantly smaller areas. In Adjara, as well as around the entire West Georgia, hornbeam forests are often replaced with black alder stands mainly due to human's economic activities. Specifically the alder is extensively propagated after felling of the hornbeam forests that often results in formation of the mixed alder and hornbeam stands.

According to the allowable data (Ketskhoveli, 1935, 1959; Dolukhanov, 1953; Kolakovski, 1961; Gulisashvili, 1964; Jorbenadze, 1969), in Adjara and particularly in its beech and hornbeam formation, the smaller areas are occupied with the chestnut forests. Here it should be noted that with lower abundancy, the chestnut is represented in almost all forest types developed at the foothills and within the middle montane zone. The forests of the later zone is characterized with occurrence of the yew (*Taxus baccata*), which usually belongs to the understory.

The coniferous forests are quite extensively distributed in Adjara within the altitudinal range from 900-100 m to 2000 m, although the pine forests are also found at significantly lower elevations, over the southern slopes of lower reaches of Adjaristskanli River. Adjarian pine forests are distributed fragmentally and are formed with domination of *Pinus kochiana*. The pine forests have open canopies, and thus shrub and herbaceous synusiae are well developed. The forests with closed canopies are formed by spruce (*Picea orientalis*) and fir (*Abies nordmanniana*), and therefore in these forests shrub and herbaceous understories are seldom. Typologically, such forest type is associated with beech forests. The fir in combination with the beech often forms co-dominant coenoses, which are quite common in Adjarian highland. Another coniferous forests extended over the larger areas are represented by pure spruce, spruce-and-fir and pure fir stands. In Adjara, such coenoses mostly are found at the upper tree line.

Specific type scrub named by locals as "Shqeriani" is developed in some valleys of Adjara elevated higher than 1000 m above sea level. This scrub type first was described by Golitsin (1939, 1948), and afterwards respective term was established in the botanical references. Such phytocoenoses are created with participation of tertiary relics of Colchic flora, e.g. cherry-laurel, Pontic rhododendron (*Rhododendron ponticum*), Medvedev's birch (*Betula medwedewi*), *Rhododendron ungernii,* Pontic oak (*Quercus pontica*), *Epigaea gaulterioides*, bilberry, azalea, holly, viburnum, broom, etc. Due to closed pattern of the shrub canopy, the herbaceous cover is weakly developed, although the ferns are quite abundant.

Golitsin considers such type scrub as a constituent of original as well as relic phytocoenosis due to co-occurrence of the tertiary relicts, and especially of epigea. At the same time, he negates Sinskaya's (1933) opinion that such scrubs had an anthropogenic origin and were developed over the former distribution areas of the burnt forests. Ketskhoveli (1959) considers Sinskaya's opinion more correct and states that majority of the scrubs constitute the forest elements including epigea, which according to Shishkin (1930) is a typical component of the understory of Lazistan's beech forests. Furthermore, Ketskoveli (1959) notes that Shqeriani has been distributed on Adjara-Imerety Range, slopes of Mt. Lomi and in the valleys of Nenskra, Nakra and other rivers of Upper Svaneti. After destruction of the forests in these areas, the bushes forming understory remained, which were further enforced in such extent that made impossible regeneration of the major forest species.

The area above the forests described above is occupied by subalpine zone, which upper boundary is elevated in average up to 2200-2300 m asl. Here is represented formation of meadows, scrubs and subalpine forests. As around the entire Georgian highlands, two forest types – crook-stem and sparse forests are distributed in this zone of Adjara. Here sparse forests are mainly formed by red-bud maple (*Acer trautvetteri*), birch (*Betula litwinowii*), etc. In these forests the area between scarcely grown trees is covered with herbs and the ground surface is mainly tussocked. In Adjara the subalpine sparse forests are seldom and mainly are of secondary origin.

The crook-stem forests are more common in Adjara, and in general are distributed over the north and west slopes, mainly in areas with deep and long-lasting snow cover. This type forest is mainly formed by the foregoing birch species, mountain-ash, some species of willow gene, etc. Synusiae of herbaceous and shrub plants is well-developed. Among shrubs, the principal species is Georgian snow rose (*Rhododendron caucasicum*), while the herbaceous synusia mainly is composed of tall herbaceous plants.

Similarly to the entire West Georgia, in Adjara the crook-stem forests are often formed by beech. Mainly are also developed similar types of crook-stem birch forests, although more common are beech forests with herbaceous understory, where live ground cover is composed of herb and fern synusiae. These beech forests are so distinguished from the same of middle montane zone, that some researchers, e.g. Dolukhanov (1957), consider them as independent formation.

In the West Georgia, and particularly in Adjara and Guria, crook-stem forests are also formed by Medvedev's birch and Pontic oak. However such forests are mainly distributed within the middle montane zone. This type forest is distinguished with evergreen shrub sinusia, in subalpine zone – with domination of Georgian Snow Rose (*Rhododendron caucasicum*), and at lower areas – with participation of Pontic rhododendron, cherry-laurel, ilex, etc.

The most part of subalpine forests in Adjara highland has been felled and the secondary meadows have been developed on their former forest areas. This is a reason that the upper forest boundary in this part of Georgia is ended with spruce and fir forests. Restoration of subalpine forests is important and strategic issue for the country. Their value is obviously high, because this type forests secure lower located forests from avalanches, as well as are important for protection of the soil and regulation of water regimes.

Rhododendron scrubs formed by *Rhododendron caucasicum* are well-developed in subalpine forest complex, as well as within the alpine zone, particularly on the slopes with the north and west aspects. These habitats are associated with the mountain peat soils. Rhododendron scrubs are relatively homogenous and poor in terms of species composition. This stems from the specific coenotic structure of rhododendron scrubland. The floristic components of this formation comprise whortleberry (*Vaccinium myrtillus*)*,* red bilberry (*V. vitis-idaea*)*, Oxalis acetosella*, and numerous other species including ferns and lichens. The rhododendron scrubs mainly grow at considerably steep slopes, however more seldom, e.g. at some sections of Arsiani Range, are found on the plain terrain in the form of specific type rhododendron scrubs termed in the references (K. Kimeridze, 1969) as Peat and Hilly Rhododendron Scrubland. This vegetation is associated with the areas of deep and long-lasting snow cover. The subalpine zone also hosts fragmentally distributed juniper shrubs, which according to available information (Ketskhoveli, 1935; Nizharadze, 1948, etc.) are derivatives of the pine forest.

Another characteristic component of Adjarian highland flora is represented by tall herbaceous plants. Abundance of this vegetation is associated with the favourable environmental conditions reflected in the moist humus-rich and thick soils as well as the soil's optimal thermal regime during vegetation season. Usually such herbs grow within formation of subalpine forests and rhododendron scrubs, as well as in upper montane zone in a form of independent synusia. Quite often the tall herbaceous plants are of poli-dominant nature and comprise *Heracleum sosnowskyi, Campanula lactiflora, Delphinium flexuosum, Inula grandiflora, Doronicm macrophyllum, Senecio platyphyloides, Pyretrum macrophyllum, Aconitum nasutum*, etc. This vegetation is mainly composed of dicotyledons, while monocotyledons, and particularly representatives of grass and sedge genes, are found very seldom. Therefore, as a rule, the ground cover is not tussocked.

Despite abundance of the phytomass, the tall herbs are useless for haying and grazing, but may be used for preparation of silo that awards this vegetation an agricultural importance. The tall herbaceous vegetation of this type is also rich with medical, technical and decorative plants.

The herbaceous plants mainly grow on subalpine meadows, which are of wider distribution around the project zone. This type of vegetation, as well as the mountain meadows in general, is characterized by diverse typology and rich composition of species. However, due to long term use of these areas for grazing and resulting extensive loads, the native vegetation is altered and is represented by types formed in result of pastoral digression. On Arsiani Range mainly are distributed matgrass and bentgrass along with poli-dominant thin herbaceous meadows with Alchemilla and other species. The described forms are developed on mountain-meadow tussock soils. On Shavsheti Range and humid slopes of Adjara-Guria Range are quite widely distributed the broad-leave herb and grass meadows. In addition, similar meadows are extended over the smaller areas of Arsiani Range, mainly in combination with forests, at the upper tree line. Such meadows are characterized by slightly tussoked secondary mountain-meadow soils.

Alpine vegetation is typically expressed throughout the Great Caucasian Ridge; in Adjara Highland it nowhere creates the entire continuous zone and is developed mainly on mountain crests at a height of over 2300m above sea level. In the mentioned above belt, vegetation period lasts for 2-3 months and thermal condition favorable for plant growth is provided only on ground surface area. Therefore, alpine plants are, as a rule, low, but in some types of meadows they are spread close to the ground. Alpine snowbeds, which are made up from fine miscellaneous herbs, have utmost importance in phytolandscapes. The paramount components of this vegetation are as follows: *Sibbaldia parviflora, S. semiglabra, Campanula tridentata, Taraxacum stevenii,* several species of lady's mantle – Alchemilla and etc. Cereals and sedges together with fescue and mat grasses participate in small numbers. The basic coeno types of these formations represent *Festuca sulcata* and *Nardus glabriculmis. Zerna adjarica, Poa alpina, Phlem alpinum* and others mix with them in relatively low number. Among the described above vegetation complex other types of vegetation, in particular, such as sedge grasses, grained forbs and others are represented, however, they are spread on comparatively small area. Rhododendrons grow in some places within the mentioned formation complex of alpine meadow, but in this area these evergreen bushes are much lower in comparison with subalpine rhododendrons.

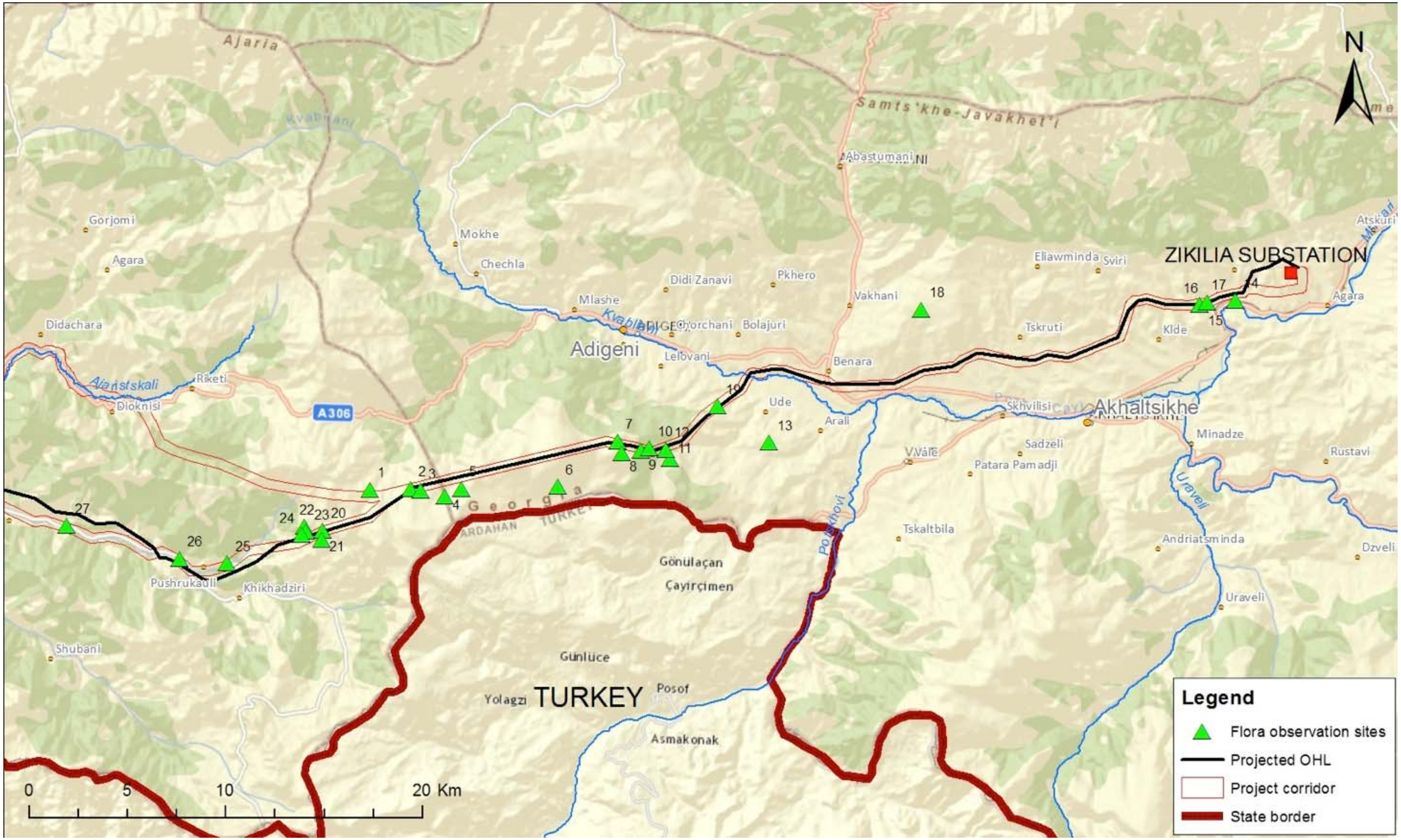


Figure 6.2.2 Location of studied land plots within project area, Sheet 1

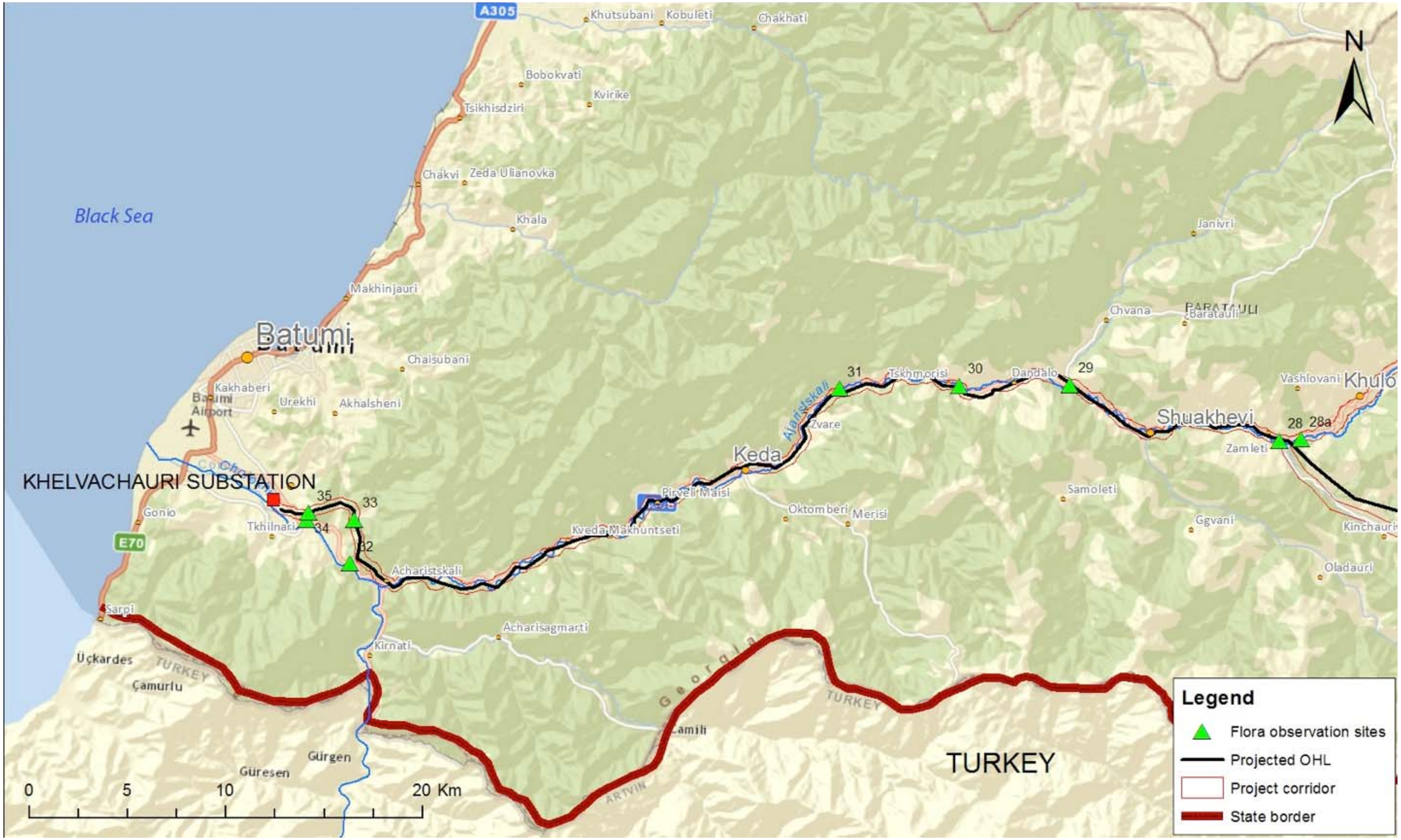


Figure 6.2.3 Location of studied land plots within project area, Sheet 1

Plot 1. Degraded cereals and forbs meadow

Type of Vegetation Cenosis	**Degraded forb meadow**
Conservation Value	**Low**
Location	Arsiani Ridge, Beshumi
Site No	1
Assessed plot area, m2	10
GPS coordinates	**X** 295781 **Y** 4608152
Datum, masl	2069m
Exposure	East
Slope	5-10^0
Structure of cenosis	
Height of grass layer, cm	10-20
Coverage of grass layer, %	60-70
Coverage of moss layer, %	_
Number of higher plant species	19
Number of moss species	_
Species	**Abundance/thickness on the Drude Scale**
Grass layer	
Festuca varia	Soc
Sibbaldia parviflora	Cop^3
Trifolium ambiguum	Cop^2
Phleum alpinum	Cop^1
Trifolium canescens	Cop^2
Alchemilla sp.	Cop^2
Plantago saxatilis	Sp^3
Prunella vulgaris	Sp^2
Sedum spurium	Sol
Hieracium pilosella	Sp^1
Ajuga orientalis	Sol
Plantago major	Sol
Scleranthus uncinatus	Sol
Myosotis alpestris	Sol
Poa alpine var. vivipera	Sol
Herniaria caucasica	Sol
Lotus caucasicus	Sol
Bellis perennis	Sol
Scrophularia olumpica	Unic
Moss layer	
Moss species not found	_

Across this section, the randomly distributed following species, listed below, compose tall (80-100 cm) groupings: *Cirsium caucasicum, Hesperis matronalis, Helichrysum plicatum, Digitalis schischkinii* (Endemic of Caucasus), *Euphorbia macroceras, Rumex arifolia, Urtica dioica*. It is worth to mention *Daphne pontica* among bush plants. The mentioned territory represents habitat of medium conservation value.

Plot 1. *Helichrysum plicatum*

Plot 1. *Cirsium caucasicum*

Plot 1. *Hesperis matronalis*

Plot 2. Cereals and forbs meadow (degraded by grazing)

Type of Vegetation Cenosis	**Degraded forb meadow**
Conservation Value	**Lowland**
Location	Beshumi
Site No	2
Assessed plot area, m2	10
GPS coordinates - spherical//UTM	**X** 297876 **Y** 4608198
Datum, masl	2184m
Exposure	Southwest
Slope	0-50
Structure of cenosis	
Height of grass layer, cm	10-40
Coverage of grass layer, %	70-80
Coverage of moss layer, %	_
Number of higher plant species	15
Number of moss species	_
Species	**Abundance/thickness on the Drude Scale**
Grass layer	
Festuca varia	Cop^3
Festuca ovina	Cop^2
Alchemilla sp.	Cop^3
Trifolium ambiguum	Cop^2

Achillea millefolium	Cop[1]
Ranunculus sp.	Sp[2]
Taraxacum stevenii	Sp[1]
Carex sp.	Cop[2]
Myosotis alpestris	Sol
Phleum alpinum	Cop[1]
Polygonum carneum	Sol
Cirsium echinus	Sol
Tripleurospermum caucasicum	Sol
Veronica gentianoides	Sol
Onosma caucasica	Unic
Moss layer	
Moss species not found	_

Plot 2. Cereals and forbs meadow

Plot 3. Swampy meadow

Type of Vegetation Cenosis	**Wetland meadow**
Conservation Value	**Lowland**
Location	Beshumi
Site No	3
Assessed plot area, m2	10
GPS coordinates - spherical//UTM	**X** 298367 **Y** 4608088
Datum, masl	2176
Exposure	_
Slope	00
Structure of cenosis	
Height of grass layer, cm	60
Coverage of grass layer, %	10-20
Coverage of moss layer, %	_
Number of higher plant species	5
Number of moss species	_
Species	**Abundance/thickness on the Drude Scale**
Grass layer	
Carex sp.	Cop[3]
Juncus effusus	Sp[3]
Alisma plantago-aquatica	Sp[1]

Lemna minor	Flouted on water surface
Lemna trisulca	Flouted on water surface
Moss layer	
Moss species not found	_

Plot 3. Swampy meadow

Plot 3. *Juncus effusus*

Plot 4. Bushland with raspberry and blackberry

Type of Vegetation Cenosis	**Bushes of Raspberry blackberry**
Conservation Value	**Medium**
Location	Beshumi, near Tago's shanty
Site No	4
Assessed plot area, m2	10
GPS coordinates - spherical//UTM	**X** 299590 **Y** 4607822
Datum, masl	2118
Exposure	Northwest
Slope	0-50
Structure of cenosis	
Height of shrubbery layer, cm	100
Height of grass layer, cm	40-60
Coverage of shrub layer, %	90
Coverage of grass layer, %	60-70
Coverage of moss layer, %	_
Number of higher plant species	13
Number of moss species	_
Species	**Abundance/thickness on the Drude Scale**
Shrub Layer	
Rubus idaeus	Cop^3
Rubus sp.	Cop^3
Grass layer	
Cirsium caucasicum	Cop^1
Inula grandiflora	Sp^3
Senecio kolenatianus-kavkasiis endemi	Sp^2
Hesperis matronalis	Sp^3
Rumex arifolius	Sp^3
Veratrum lobelianum	Sp^2
Driopteris filix mas	Sp^1

Stachys balansae	Sp[1]
Galium verum	Sol
Viola kupfferi	Sol
Onosma caucasica	Sol
Moss layer	
Moss layer was not found	_

Plot 4. *Inula grandiflora*

Plot 4. *Veratrum lobelianum*

Plot 5. Forb meadow with Festuca varia/Festucetum variae

Type of Vegetation Cenosis	**Forb meadow with Festuca varia/Festucetum variae**
Conservation Value	**Medium**
Location	Beshumi, near Tago's shanty
Site No	5
Assessed plot area, m^2	10
GPS coordinates - spherical//UTM	**X** 300430 **Y** 4608203
Datum, masl	2018
Exposure	West
Slope	50
Structure of cenosis	
Height of grass layer, cm	60
Coverage of grass layer, %	80-90
Coverage of moss layer, %	_
Number of higher plants' species	16
Number of moss species	_
Species	**Abundance/thickness on the Drude Scale**
Grass Layer	
Festuca varia	Soc
Cynosurus cristatus	Cop[3]
Cares sp.	Cop[3]
Festuca ovina	Cop[2]
Phleum alpinum	Cop[1]
Trifolium ambiguum	Cop[1]
Alchemilla sp.	Sp[2]
Ranunculus sp.	Sp[2]

Lotus caucasicus	Sp[1]
Tripleurospermum caucasicum	Sp[1]
Trifolium canescens	Cop[1]
Sibbaldia parviflora	Sp[2]
Carum caucasicum	Sp[1]
Polygala alpicola	Sp[1]
Polygonum carneum	Cop[1]
Dactyllorhiza urvilleana (CITES)	Sol
Moss Layer	
Moss species has not been found	_

Plot 5. Cereals and forbs meadow with Festuca varia/Festucetum variae

Plot 5. *Dactyllorhiza urvilleana*

Plot 6. Cereals and forbs meadow with Festuca varia/Festucetum variae

Type of Vegetation Cenosis	**Forb grass meadow - *Festucetum variae***
Conservation Value	**Low**
Location	Ude shanty
Site No	6
Assessed plot area, m^2	10
GPS coordinates - spherical//UTM	**X** 305348 **Y** 4608203
Datum, masl	2146
Exposure	Southeast
Slope	5-100
Structure of cenosis	
Height of grass layer, cm	60
Coverage of grass layer, %	80-90
Coverage of moss layer, %	_
Number of higher plants' species	14
Number of moss species	_
Species	**Abundance/thickness on the Drude Scale**
Grass layer	
Festuca varia	Soc
Agrostis planifolia	Cop[3]
Phleum pratense	Cop[2]
Achillea millefolium	Cop[1]

Tripleurospermum caucassicum	Sp^2
Cerastium polymorphum	Sp^2
Myosotis alpestris	Sp^1
Cirsium echinus	Sol
Rumex arifolius	Sol
Koeleria caucasica	Cop^1
Helictotrichon pratense	Sp^3
Pastinaca armena	Sol
Papaver orientale	Sol
Hyosciamus niger	Unic
Moss Layer	
Moss	_

Plot 6. *Papaver orientale*

Plot 6. Cereals and forbs meadow with Festuca varia/Festucetum variae

Plot 7. Cereals and forbs meadow

Type of Vegetation Cenosis	**Cereals and forbs meadow**
Conservation Value	**Medium**
Location	At River Shavshicveri
Site No	7
Assessed plot area, m^2	10
GPS coordinates - spherical//UTM	**X** 308380 **Y** 4608203
Datum, masl	2103
Exposure	Northeast
Slope	0-50
Structure of cenosis	
Height of grass layer, cm	20-30
Coverage of grass layer, %	70-80
Coverage of moss layer, %	_
Number of higher plants' species	20
Number of moss species	_
Species	**Abundance/thickness on the Drude Scale**
Grass layer	
Festuca sulcata	Sp^1
Agrostis planifolia	Sp^3

Trifolium alpestre	Sp^2
Alchemilla sp.	Cop^1
Trifolium canescens	Sp^2
Lotus caucasicus	Sp^2
Sibbaldia parviflora	Sp^2
Veronica gentianoides	Sp^1
Centaurea cheiranthifolia	Sol
Ranunculus sp.	Sp^2
Cirsium echinus	Sol
Stachys germanica	Sol
Nardus stricta	Sp^2
Koeleria caucasica	Sp^1
Festuca varia	Sp^1
Pedicularis eriantha	Sol
Erigeron alpinus	Sol
Gymnadenia conopsea (CITES)	Sol (10m^2-Si 15 egzemplari)
Polygonum carneum	Sol
Viola kupfferi	Unic
Moss Layer	
Moss	_

Plot 7. *Gymnadenia conopsea*

Plot 7. *Centaurea cheiranthifolia*

Plot 8. Cereals and forbs mesophilic meadow developed in pine forest window

Type of Vegetation Cenosis	**Cereals and forbs mesophilic meadow developed in pine forest window**
Conservation Value	**High**
Location	At River Shavshicveri
Site No	8
Assessed plot area, m^2	10-25
GPS coordinates - spherical//UTM	**X** 308595 **Y** 4608203
Datum, masl	2076
Exposure	Southeast
Slope	0-5^0
Structure of cenosis	
Max. DBH (sm)	30
Medium DBH (sm)	25
Maximum Height of Trees (m)	8

Medium Height of Trees (m)	6
Number of Trees on Sample area	10
Coverage of Tree-tier (%)	20
Coverage of shrub layer, %	10
Height of shrubbery layer, cm	100
Coverage of grass layer, %	80-90%
Height of grass layer, cm	60-80sm
Coverage of moss layer, %	_
Number of higher plant species	21
Species	**Abundance/thickness on the Drude Scale**
Tree-tier	
Pinus kochiana	Sp^{3}
Acer tratvetteri	Sp^{2}
Shrub Layer	
Juniperus depressa	Sp^{1}
Grass layer	
Festuca varia	Cop^{3}
Koeleria caucasica	Cop^{2}
Helictotrichon pratense	Cop^{2}
Phleum pratense	Cop^{1}
Plantago lanceolota	Sp^{3}
Rhinanthus major	Sp^{2}
Trifolium canescens	Sp^{3}
Betonica grandiflora	Sp^{1}
Orobus hirsutus	Sp^{1}
Trifolium pratense	Sp^{2}
Geranium bohemicum	Sp^{1}
Pyrethrum punctatum	Sp^{1}
Cynosurus cristatus	Sp^{3}
Tephroseris subfloccosa-kavkasiis endemi	Sol
Aetheopappus pulcherrimus	Sol
Gladiolus dzavakheticus-kavkasiis endemi	Sol
Gymnadenia conopsea (CITES)	Unic
Papaver orientale	Unic
Moss layer	
Moss species not found	_

Plot 8. *Juniperus depressa*

Plot 8. *Gladiolus dzavakheticus*

Plot 8. *Aetheopappus pulcherrimus*

Plot 8. *Gladiolus dzavakheticus*

Plot 8. Cereal and forbs mesophilic meadow developed in pine forest window

Plot 8. *Acer tratvetteri*

Plot 9. Oakwood

Type of Vegetation Cenosis	**Oak forest**
Conservation Value	**Medium**
Location	Adigeni district
Site No	9
Assessed plot area, m^2	25
GPS coordinates - spherical//UTM	**X** 309579 **Y** 4608203
Datum, masl	1894
Exposure	Southeast
Slope	5-100
Structure of cenosis	
Max. DBH (sm)	30
Medium DBH (sm)	25
Maximum Height of Trees (m)	10
Medium Height of Trees (m)	8
Number of Trees on Sample area	12
Coverage of Tree-tier (%)	50
Coverage of shrub layer, %	60
Height of shrubbery layer, cm	200
Coverage of grass layer, %	70

Height of grass layer, cm	50
Coverage of moss layer, %	_
Number of higher plant species	20
Species	**Abundance/thickness on the Drude Scale**
Tree-tier	
Quercus iberica	Cop^1
Pinus kochiana	Sp^3
Acer pseudoplatanus	Sp^2
Fraxinus excelsior	Sp^2
Acer trautvetteri	Sp^1
Sorbus caucasigena	Sp^1
Shrub Layer	
Corylus avellana	Cop^2
Rosa canina	Sp^3
Grass layer	
Calamagrostis arundinacea	Sp^3
Geranium sylvaticum	Sp^3
Polygonum carneum	Sp^2
Verbascum blattaria	Sp^1
Betonica grandiflora	Sp^1
Rumex crispus	Sp^1
Cephalaria gigantea	Sol
Grossheimia macrocephala	Sol
Silene wallichiana	Sol
Astrantia maxima	Sol
Pimpinella rhodantha	Sol
Briza elatior	Sol
Moss layer	
Moss species not found	_

Plot 9. *Grossheimia macrocephala*

Plot 9. *Silene wallichiana*

Plot 9. Oakwood (*Quercus iberica*)

Plot 10. The Pine forest

Type of Vegetation Cenosis	**Pine forest**
Conservation Value	**Medium**
Location	Adigeni district
Site No	9
Assessed plot area, m2	25
GPS coordinates - spherical//UTM	**X** 309998 **Y** 4608203
Datum, masl	1881
Exposure	South
Slope	5-10^0
Structure of cenosis	
Max. DBH (sm)	Max. DBH (sm)
Medium DBH (sm)	Medium DBH (sm)
Maximum Height of Trees (m)	Maximum Height of Trees (m)
Medium Height of Trees (m)	Medium Height of Trees (m)
Number of Trees on Sample area	Number of Trees on Sample area
Coverage of Tree-tier (%)	Coverage of Tree-tier (%)
Coverage of shrub layer, %	Coverage of shrub layer, %
Height of shrubbery layer, cm	Height of shrubbery layer, cm
Coverage of grass layer, %	Coverage of grass layer, %
Height of grass layer, cm	Height of grass layer, cm
Coverage of moss layer, %	Coverage of moss layer, %
Number of higher plant species	Number of higher plant species
Species	**Abundance/thickness on the Drude Scale**
Tree-tier	
Pinus kochiana	Sp^3
Fagus orientalis (axalgazrda)	Sp^1
Sorbus caucasigena (axalgazrda)	Sp^1
Shrub Layer	
Corylus avellana	Sp^3
Rosa canina	Sp^2
Grass layer	
Phleum pratense	Sp^3
Cephalaria gigantea	Sp^2

Coronilla varia	Sp[2]
Pimpinella rhodantha	Sp[2]
Thalictrum buschianum-kavkasiis endemi	Sp[1]
Dactylis glomerata	Sp[1]
Linum usitatissimum	Sol
Moss layer	
Moss species not found	_


Plot 10. Pine forest


Plot 11. Swampy meadow

Plot 11. Swampy meadow

Type of Vegetation Cenosis	**Wetland meadow**
Conservation Value	**Low**
Location	Adigeni district
Site No	11
Assessed plot area, m2	10
GPS coordinates	**X** 311075 **Y** 4608203
Datum, masl	1717
Exposure	_
Slope	0^0
Structure of cenosis	
Height of grass layer, cm	60
Coverage of grass layer, %	70-80
Coverage of moss layer, %	_
Number of higher plant species	2
Number of moss species	_
Species	**Abundance/thickness on the Drude Scale**
Grass layer	
Juncus effusus	Soc
Lemna trisulca	Flouted on water surface
Moss layer	
Moss species not found	_

Plot 12. Oakwood

Type of Vegetation Cenosis	**Oak forest**
Conservation Value	**Medium**
Location	Adigeni district
Site No	12
Assessed plot area, m2	25
GPS coordinates - spherical//UTM	**X** 310866 **Y** 4608203
Datum, masl	1685
Exposure	East
Slope	10-200
Structure of cenosis	
Max. DBH (sm)	30
Medium DBH (sm)	20
Maximum Height of Trees (m)	10
Medium Height of Trees (m)	7
Number of Trees on Sample area	8
Coverage of Tree-tier (%)	60
Coverage of shrub layer, %	50
Height of shrubbery layer, cm	200
Coverage of grass layer, %	20
Height of grass layer, cm	30
Coverage of moss layer, %	_
Number of higher plant species	11
Species	**Abundance/thickness on the Drude Scale**
Tree-tier	
Quercus iberica	Cop^{2}
Acer campestre	Cop^{1}
Fraxinus excelsior	Sp^{3}
Ulmus glabra	Sp^{1}
Carpinus caucasica	Sp^{3}
Picea orientalis	Sol
Shrub Layer	
Corylus avellana	Sp^{3}
Philadelphus caucasicus	Sol
Rosa canina	Sp^{3}
Rubus sp.	Sp^{3}
Grass layer	
Linaria schelkovnikowii-kavkasiis endemi	Sol
Moss layer	
Moss species not found	_


Plot 12. *Linaria schelkovnikowii*


Plot 12. Oakwood (*Quercus iberica*)


Plot 12. *Philadelphus caucasicus*

Plot 13. Astragalus scrubland

Type of Vegetation Cenosis	**Astragalus scrubland**
Conservation Value	**Medium**
Location	Area nier the village Ude
Site No	13
Assessed plot area, m2	10
GPS coordinates - spherical//UTM	**X** 316097 **Y** 4608203
Datum, masl	1400
Exposure	West
Slope	25-300
Structure of cenosis	
Height of shrubbery layer, cm	50
Height of grass layer, cm	20-30
Coverage of shrub layer, %	5-10
Coverage of grass layer, %	10-20
Coverage of moss layer, %	_
Number of higher plant species	7
Number of moss species	_
Species	**Abundance/thickness on the Drude Scale**
Shrub Layer	
Astragalus microcephalus	Cop^2

Grass layer	
Salvia verticillata	Sp[2]
Achillea millefolium	Sp[2]
Stachys atherocalyx	Sp[1]
Salvia nemorosa	Sol
Teucrium polium	Sol
Polygala transcaucasica	Sol
Moss layer	
Moss species not found	_

Plot 13. Astragalus scrubland (*Astragalus microcephalus*)

Plot 14. Cereals and forbs meadow

Type of Vegetation Cenosis	**forb meadow**
Conservation Value	**Low**
Location	Nier the Akhalcikhe in Village Mugareti,
Site No	14
Assessed plot area, m2	10
GPS coordinates - spherical//UTM	**X** 339852 **Y** 4608203
Datum, masl	343
Exposure	South
Slope	$0\text{-}3^0$
Structure of cenosis	
Height of grass layer, cm	30
Coverage of grass layer, %	30-40
Coverage of moss layer, %	_
Number of higher plant species	7
Number of moss species	_
Species	**Abundance/thickness on the Drude Scale**
Grass layer	
Aegilops tauschii	Cop[3]
Medicago minima	Cop[3]
Achillea millefolium	Cop[2]
Falcaria vulgaris	Sol
Phlomis tuberosa	Sol
Echium vulgare	Sol

Sanguisorba officinalis	Sol
Moss layer	
Moss species not found	_

Plot 14. *Phlomis tuberosa*

Plot 15. Shallow bushland, Pyretum salicifoliae

Type of Vegetation Cenosis	**Shallow bushland, Pyretum salicifoliae**
Conservation Value	**High**
Location	Nier the Akhalcikhe in Village Giorgicminda
Site No	15
Assessed plot area, m2	10-25
GPS coordinates - spherical//UTM	**X** 338009 **Y** 4608203
Datum, masl	800
Exposure	North-east
Slope	5-100
Structure of cenosis	
Max. DBH (sm)	10
Medium DBH (sm)	7
Maximum Height of Trees (m)	6
Medium Height of Trees (m)	5
Number of Trees on Sample area	5
Coverage of Tree-tier (%)	20
Coverage of shrub layer, %	200
Height of shrubbery layer, cm	30
Coverage of grass layer, %	20
Height of grass layer, cm	40
Coverage of moss layer, %	_
Number of higher plant species	20
Number of moss species	_
Species	**Abundance/thickness on the Drude Scale**
Tree-tier	
Pyrus salicifolia	Sp^3
Prunus divaricata	Sp^1
Shrub Layer	
Crataegus pentagyna	Sp^2
Berberis vulgaris	Sp^2
Juniperus rufescens	Sp^1

Arceutobium oxycedri	Sol
Elaeagnus angustifolia	Sp^1
Cytisus caucasicus	Sp^1
Cotoneaster meyeri	Sp^1
Quercus iberica (dajaguli)	Sol
Grass layer	
Teucrium polium	Cop^2
Botriochloa ischaemum	Cop^3
Cerinthe minor	Sp^1
Salvinia nemorosa	Sp^2
Rhinanthus pectinatus	Sol
Inula germanica	Sol
Plantago lanceolata	Sp^2
Phlomis pungens	Sol
Echium vulgare	Sol
Teucrium chamaedrys	Sp^1
Moss layer	
Moss species not found	–

Plot 15. *Pyretum salicifoliae*

Plot 15. *Pyretum salicifoliae*

Plot 16. Pine forest with admixture of spruce and smoke tree understory

Type of Vegetation Cenosis	**Pine Spruce mix with undergrowth with smoke tree (*Cotinus coggygria)***
Conservation Value	**High**
Location	Near Akhaltsikhe City, Village Giorgicminda
Site No	16
Assessed plot area, m2	50
GPS coordinates - spherical//UTM	**X** 338009 **Y** 4608203
Datum, masl	1000
Exposure	North-east
Slope	$70-80^0$
Structure of cenosis	
Max. DBH (sm)	25
Medium DBH (sm)	20
Maximum Height of Trees (m)	12
Medium Height of Trees (m)	10
Number of Trees on Sample area	20

Coverage of Tree-tier (%)	70
Coverage of shrub layer, %	50
Height of shrubbery layer, cm	200
Coverage of grass layer, %	10
Height of grass layer, cm	10
Coverage of moss layer, %	50
Number of higher plant species	11
Species	**Abundance/thickness on the Drude Scale**
Tree-tier	
Pinus kochiana	Cop^2
Picea orientalis	Cop^1
Shrub Layer	
Ligustrum vulgare	Sp^3
Rosa canina	Sp^2
Cotinus coggygria	Sp^2
Cotoneaster meyeri	Sp^1
Swida australis	Sp^1
Grass layer	
Oxalis acetosella	Sp^1
Fragaria vesca	Sp^1
Moss layer	
Moss species not found	Sp^3

Plot 16. Pine forest with admixture of spruce and smoke tree understorey

Plot 16. Pine forest with admixture of spruce and smoke tree understorey

Plot 16. Pine forest with admixture of spruce and smoke tree understorey

Plot 17. Shallow shrubland between hayfields and pasture land

Plot 17. Shallow bushland between hayfields and pasture land

Type of Vegetation Cenosis	**Sparse scrub between hay - pastures**
Conservation Value	**Low**
Location	Near Akhaltsikhe City, Village Tatanisi
Site No	17
Assessed plot area, m2	10-25
GPS coordinates - spherical//UTM	**X** 338419 **Y** 4608203
Datum, masl	1028
Exposure	South
Slope	$5\text{-}10^0$
Structure of cenosis	
Height of shrubbery layer, cm	200
Height of grass layer, cm	40
Coverage of shrub layer, %	10
Coverage of grass layer, %	30
Coverage of moss layer, %	_
Number of higher plant species	10
Number of moss species	_
Species	**Abundance/thickness on the Drude Scale**
Shrub layer	
Rosa canina	Sol
Cotinus coggigria	Sol
Pirus salicifolia (dajaguli)	Sol
Grass layer	
Festuca sulcata	Cop^1
Dactylis glomerata	Cop^1
Onobrychis transcaucasica	Sp^2
Trifolium campestre	Sp^2
Consolida orientalis	Sol
Achillea millefolium	Sp^1
Medicago minima	Sp^1
Moss layer	
Moss species not found	_

Plot 18. Cereals and forbs meadow-pasture land

Type of Vegetation Cenosis	**steppe forbs and sheep's fescue**
Conservation Value	**Low**
Location	At the crossing of Kvabliani and Potskhovi Rivers
Site No	18
Assessed plot area, m2	10
GPS coordinates - spherical//UTM	**X** 323835 **Y** 4608203
Datum, masl	1063
Exposure	South
Slope	0-30
Structure of cenosis	
Height of grass layer, cm	20-50
Coverage of grass layer, %	70-80
Coverage of moss layer, %	_
Number of higher plants' species	20

Number of moss species	_
Species	**Abundance/thickness on the Drude Scale**
Grass layer	
Festuca sulcata	Soc
Aegilops tauschii	Cop^3
Melandrium boissieri	Sp^3
Tragopogon coloratus	Sp^1
Salvia aethiopis	Sp^2
Anthemis candidissima	Sp^2
Conium maculatum	Sol
Lathyrus aphaca	Sp^2
Dactylis glomerata	Sp^2
Rumex crispus	Sol
Onobrychis transcaucasica	Sp^1
Trifolium campestre	Sp^2
Verbascum thapsus	Sol
Consolida orientalis	Sol
Melilotus officinalis	Sp^1
Achillea millefolium	Sp^1
Medicago minima	Sp^1
Sisymbrium officinale	Sp^1
Capsella bursa-pastoris	Sp^1
Convolvulus arvensis	Sol
Nostoc commune	Sp^2
Moss layer	
Moss species not found	_

Plot 18. Cereals and forbs meadow-pasture land

Plot 19. Spruce, pine shallowly among bushland, agro landscape

Type of Vegetation Cenosis	**Scrub light pine, spruce, agricultural lands**
Conservation Value	**Medium**
Location	Surroundings of Village Ghordze
Site No	19
Assessed plot area, m^2	25-50
GPS coordinates - spherical//UTM	**X** 313489 **Y** 4608203
Datum, masl	1346
Exposure	North-East

Slope	$15-20^0$
Structure of cenosis	
Height of shrubbery layer, cm	400
Height of grass layer, cm	30
Coverage of shrub layer, %	30
Coverage of grass layer, %	20
Coverage of moss layer, %	_
Number of higher plant species	6
Number of moss species	_
Species	**Abundance/thickness on the Drude Scale**
Shrub Layer	
Crataegus orientalis	Sp^2
Berberis vulgaris	Sp^2
Juniperus rufescens	Sp^1
Rosa canina	Sp^1
Cotoneaster meyeri	Sol
Grass Layer	
Astragalus microcephalus	Sp^1
Moss Layer	
Moss species has not been found	_

Around this section *Picea orientalis* - PBH-70-80 cm, height - 8-10m and *Pinus kochiana*, PBH-80cm, height -8m, are also shallowly represented among bushland.

Plot 19. Spruce, pine shallowly among bushland, agro landscape

Plot 19. Hawthorn bushland (*Crataegus orientalis*)

Plot 20. Degraded cereals and forbs meadow

Type of Vegetation Cenosis	**Degraded forb meadow**
Conservation Value	**Medium**
Location	Beshumi, Tetrobi shanty
Site No	20
Assessed plot area, m^2	10
GPS coordinates	**X** 293383 **Y** 4608203
Datum, masl	2089m
Exposure	South-West
Slope	$30-35^0$

Structure of cenosis	
Height of grass layer, cm	10-20
Coverage of grass layer, %	60-70
Coverage of moss layer, %	_
Number of higher plants' species	20
Number of moss species	_
Species	**Abundance/thickness on the Drude Scale**
Grass Layer	
Festuca varia	Soc
Sibbaldia parviflora	Cop^3
Trifolium ambiguum	Cop^2
Phleum alpinum	Cop^1
Trifolium canescens	Cop^2
Alchemilla sp.	Cop^2
Plantago saxatilis	Sp^3
Prunella vulgaris	Sp^2
Sedum spurium	Sol
Hieracium pilosella	Sp^1
Ajuga orientalis	Sol
Plantago major	Sol
Scleranthus uncinatus	Sol
Myosotis alpestris	Sol
Poa alpine var. vivipera	Sol
Herniaria caucasica	Sol
Lotus caucasicus	Sol
Bellis perennis	Sol
Scrophularia olumpica	Unic
Nonea intermedia (kavkasiis endemi)	Unic
Moss Layer	
Moss species has not been found	_

Plot 20. *Nonea intermedia*

Plot 20. Degraded cereals and forbs meadow

Plot 21. Degraded cereals and forbs meadow-pasture land

Type of Vegetation Cenosis	**steppe forbs and sheep's fescue**
Conservation Value	**Low**
Location	Beshumi, Tetrobis shanty
Site No	21

Assessed plot area, m^2	10
GPS coordinates	**X** 293314 **Y** 4608203
Datum, masl	2037m
Exposure	South-West
Slope	$25\text{-}30^0$
Structure of cenosis	
Height of grass layer, cm	10-20
Coverage of grass layer, %	60-70
Coverage of moss layer, %	_
Number of higher plants' species	20
Number of moss species	_
Species	**Abundance/thickness on the Drude Scale**
Grass Layer	
Festuca varia	Soc
Sibbaldia parviflora	Cop^3
Trifolium ambiguum	Cop^2
Phleum alpinum	Cop^1
Trifolium canescens	Cop^2
Alchemilla sp.	Cop^2
Plantago saxatilis	Sp^3
Prunella vulgaris	Sp^2
Sedum spurium	Sol
Hieracium pilosella	Sp^1
Ajuga orientalis	Sol
Plantago major	Sol
Scleranthus uncinatus	Sol
Myosotis alpestris	Sol
Poa alpine var. vivipera	Sol
Herniaria caucasica	Sol
Lotus caucasicus	Sol
Bellis perennis	Sol
Scrophularia olumpica	Unic
Helichrisum plicatum	Sol
Moss Layer	
Moss species has not been found	_

Plot 21. Degraded cereals and forbs meadow-pasture land

Plot 22. Spruce forest with yellow azalea

Type of Vegetation Cenosis	**Yellow Azalea (*Rhododendron luteum)* Spruc forest**
Conservation Value	**High**
Location	River Skhalta Valley
Site No	22
Assessed plot area, m^2	50
GPS coordinates	**X** 292450 **Y** 4608203
Datum, masl	1979
Exposure	South-East
Slope	$15\text{-}20^0$
Structure of cenosis	
Max. DBH (sm)	15
Medium DBH (sm)	10
Maximum Height of Trees (m)	12
Medium Height of Trees (m)	8
Number of Trees on Sample area	10
Coverage of Tree-tier (%)	70
Coverage of shrub layer, %	50
Height of shrubbery layer, cm	200
Coverage of grass layer, %	20
Height of grass layer, cm	40
Coverage of moss layer, %	20
Number of higher plant species	8
Species	**Abundance/thickness on the Drude Scale**
Tree-tier	
Picea orientalis	Cop^1
Shrub Layer	
Rhododendron luteum	Sp^3
Grass layer	
Sanicula europea	Sp^2
Fragaria vesca	Sp^2
Platanthera bifolia (CITES)	Sol
Athyrium filix-femina	Sol
Moss layer	
Moss	Sp^1

Plot 22. Spruce forest with yellow azalea

Plot 22. *Rhododendron luteum*

Plot 22. *Platanthera bifolia*

Plot 23. Spruce forest with fern

Type of Vegetation Cenosis	**Spruce forest with fern**
Conservation Value	**High**
Location	River Skhalta Valley
Site No	23
Assessed plot area, m^2	50
GPS coordinates - spherical//UTM	**X** 292549 **Y** 4608203
Datum, masl	1880
Exposure	South
Slope	$25\text{-}30^0$
Structure of cenosis	
Max. DBH (sm)	25
Medium DBH (sm)	20
Maximum Height of Trees (m)	14
Medium Height of Trees (m)	12
Number of Trees on Sample area	20
Coverage of Tree-tier (%)	70
Coverage of shrub layer, %	_
Height of shrubbery layer, cm	_
Coverage of grass layer, %	20
Height of grass layer, cm	60
Coverage of moss layer, %	_
Number of higher plant species	7
Species	**Abundance/thickness on the Drude Scale**
Tree-tier	
Picea orientalis	Cop^2
Shrub Layer	
No Shrub	_
Grass layer	
Driopteris filix mas	Cop^1
Pyrethrum macrophyllum	Sp^2
Geranium sylvaticum	Sp^2
Verbascum blattaria	Sol
Moss layer	
Moss	Sp^2

Plot 23. Spruce forest with fern

Plot 23. *Pyrethrum macrophyllum*

Plot 24. Wetland in spruce forest window

Type of Vegetation Cenosis	**Wetland in spruce forest window**
Conservation Value	**High**
Location	River Skhalta Valley
Site No	24
Assessed plot area, m^2	10
GPS coordinates	**X** 292306 **Y** 4608203
Datum, masl	1820
Exposure	_
Slope	0^0
Structure of cenosis	
Height of grass layer, cm	50
Coverage of grass layer, %	80
Coverage of moss layer, %	_
Number of higher plants' species	11
Number of moss species	_
Species	**Abundance/thickness on the Drude Scale**
Grass layer	
Eleocharis uniglumis	Cop^2
Bolboshoenus maritimus	Cop^1
Luzula sp.	Sp^3
Dactyllorhiza euxina (CITES)	Sp^1 (14-16 pieces grow on 10cm2)
Carum carvi	Cop^3
Rhynanthus major	Sp^3
Ranunculus sp.	Sp^3
Centaurea salicifolia	Sol
Trifolium canescens	Cop^2
Trifolium alpestre	Cop^2
Prunella vulgaris	Sol
Moss layer	
Moss species not found	_

Plot 24. Wetland in spruce forest window

Plot 24. *Dactyllorhiza euxina*

Plot 25. Oak and hornbeam forest

Type of Vegetation Cenosis	**Oak and hornbeam forest**
Conservation Value	**High**
Location	Village Rakvta and Village Pushrukauli
Site No	25
Assessed plot area, m^2	50
GPS coordinates - spherical//UTM	**X** 288504 **Y** 4608203
Datum, masl	1200
Exposure	East
Slope	70-80^0
Structure of cenosis	
Max. DBH (sm)	23
Medium DBH (sm)	17
Maximum Height of Trees (m)	10
Medium Height of Trees (m)	8
Number of Trees on Sample area	10
Coverage of Tree-tier (%)	80
Coverage of shrub layer, %	_
Height of shrubbery layer, cm	_
Coverage of grass layer, %	20
Height of grass layer, cm	20
Coverage of moss layer, %	_
Number of higher plant species	7
Species	**Abundance/thickness on the Drude Scale**
Tree-tier	
Carpinus caucasica	Cop^2
Quercus dschorochensis-Kaucasus sub-endemic	Cop^1
Picea orientalis	Sp^2
Sorbus torminalis	Sol
Pinus kochiana (small size)	Sp^1
Shrub layer	
No Shrub	_
Grass layer	
Fragaria vesca	Sp^2

Poa nemoralis	Sp3
Moss layer	
Moss species not found	_


Plot 25. Oak and hornbeam forest


Plot 25. *Sorbus torminalis*

Plot 26. Spruce forest with admixed Chorokhi oak

Type of Vegetation Cenosis	**Spruce forest with admixed Chorokhi oak**
Conservation Value	**High**
Location	Between Village Vernebi and Village Pushrukauli
Site No	26
Assessed plot area, m^2	50
GPS coordinates - spherical//UTM	**X** 286083 **Y** 4608203
Datum, masl	1053
Exposure	East
Slope	$35\text{-}40^0$
Structure of cenosis	
Max. DBH (sm)	30
Medium DBH (sm)	25
Maximum Height of Trees (m)	12
Medium Height of Trees (m)	10
Number of Trees on Sample area	20
Coverage of Tree-tier (%)	70-80
Coverage of shrub layer, %	60-70
Height of shrubbery layer, cm	200
Coverage of grass layer, %	20
Height of grass layer, cm	40
Coverage of moss layer, %	40
Number of higher plant species	9
Species	**Abundance/thickness on the Drude Scale**
Tree-tier	
Picea orientalis	Cop3
Quercus dschorochensis- kavkasiis subendemi	Cop2
Shrub layer	
Rhododendron luteum	Sp2
Rosa canina	Sp1

Grass layer	
Driopteris filix mas	Sp^3
Fragaria vesca	Sp^2
Oxalis acetosella	Sp^2
Moss layer	
Moss	Cop^2

Throughout the adjacent territories of the given section, on the both sides of the ravine, spruce forest with admixed oak is developed, in some places the villages are situated on both slopes (agro landscape). Inclination is rather considerable on both (eastern as well as western) slopes.

On the opposite side of the village Vernebi, along the edge of the road, *Rhus coriaria*, *Juglans regia* and *Robinia pseudoacacia* grow. *Quercus dschorochensis* follows the road side.

Plot 26. Spruce forest with admixed Chorokhi oak

Plot 26. Chorokhi oak (*Quercus dschorochensis*)

Plot 27. Mixed broad-leaved forest with admixed spruce

Type of Vegetation Cenosis	Mixed broad-leaved forest with admixed spruce
Conservation Value	**Medium**
Location	River Skhaltistskali Valley
Site No	27
Assessed plot area, m^2	50
GPS coordinates - spherical//UTM	**X** 280356 **Y** 4608203
Datum, masl	1040
Exposure	West
Slope	$20\text{-}25^0$
Structure of cenosis	
Max. DBH (sm)	30
Medium DBH (sm)	20
Maximum Height of Trees (m)	10
Medium Height of Trees (m)	8
Number of Trees on Sample area	20
Coverage of Tree-tier (%)	70-80
Coverage of shrub layer, %	50
Height of shrubbery layer, cm	200
Coverage of grass layer, %	30

Height of grass layer, cm	40
Coverage of moss layer, %	40
Number of higher plant species	11
Species	**Abundance/thickness on the Drude Scale**
Tree-tier	
Picea orientalis	Sp^3
Quercus dschorochensis-kavkasiis subendemi	Cop^2
Carpinus caucasica	Cop^1
Fraxinus excelsior	Sp^1
Shrub layer	
Rhododendron luteum	Sp^3
Rosa canina	Sp^1
Grass layer	
Driopteris filix mas	Sp^2
Fragaria vesca	Sp^1
Oxalis acetosella	Sp^1
Moss layer	
Moss	Sp^3

Throughout the western slope, mixed broad-leaved forest with admixed spruce trees is spread, and the eastern slope, across which spruce and pine forest is developed (*Picea orientalis, Pinus kochiana*), represents habitat of medium conservation value. Below, on the riverbank terraces, alder (*Alnus barbata*) is spread.

Plot 27. Mixed broad-leaved forest admixed with spruce

Plot 28. Alder forest with fern (*Pteridium tauricum*) understorey

Type of Vegetation Cenosis	**Alder forest with fern (*Pteridium tauricum*) understorey**
Conservation Value	**Low**
Location	At Purtio Bridge
Site No	28
Assessed plot area, m^2	50
GPS coordinates	**X** 272083 **Y** 4608203
Datum, masl	526
Exposure	South-West
Slope	15-20^0
Structure of cenosis	
Max. DBH (sm)	30

Medium DBH (sm)	20
Maximum Height of Trees (m)	14
Medium Height of Trees (m)	10
Number of Trees on Sample area	25
Coverage of Tree-tier (%)	80
Coverage of shrub layer, %	_
Height of shrubbery layer, cm	_
Coverage of grass layer, %	70-80
Height of grass layer, cm	50
Coverage of moss layer, %	_
Number of higher plant species	2
Species	**Abundance/thickness on the Drude Scale**
Tree-tier	
Alnus barbata	Cop^3
Shrub layer	
No Shrub	_
Grass layer	
Pteridium tauricum	Cop^3
Moss Layer	
Moss species has not been found	_

Plot 28. Alder forest with fern (*Pteridium tauricum*) understorey

Plot 28^a. Rock and wood complex

Type of Vegetation Cenosis	**Rock and wood complex**
Conservation Value	**High**
Location	At Purtio Bridge
Site No	28a
Assessed plot area, m^2	10
GPS coordinates	**X**273200.708284 **Y** 4608203.96988
Datum, masl	559
Exposure	West
Slope	35-400
Structure of cenosis	
Height of grass layer, cm	10
Coverage of grass layer, %	5-10

Coverage of moss layer, %	_
Number of higher plants' species	2
Number of moss species	_
Species	**Abundance/thickness on the Drude Scale**
Grass Layer	
Amaracus rotundifolius-samxreT-dasavleT amierkavkasiis subendemi	Sp[1]
Vincetoxicum amplifolium	Sol
Moss Layer	
Moss species has not been found	_

As it is noticeable from the description above, within the given section, the population of *Amaracus rotundifolius* is developed on the rocks; nearby grows *Vincetoxicum amplifolium*.

Plot 28ª. *Amaracus rotundifolius*

Plot 28ª. *Amaracus rotundifolius*

Plot 28ª. *Vincetoxicum amplifolium*

Plot 29. Rock and wood complex

Type of Vegetation Cenosis	**Rock and wood complex**
Conservation Value	**High**
Location	River Chvanisckali and Adjarackali confluence
Site No	29
Assessed plot area, m^2	25
GPS coordinates	**X** 261418 **Y** 4608203
Datum, masl	363
Exposure	South-East

Slope	70-800
Structure of cenosis	
Max. DBH (sm)	25
Medium DBH (sm)	18
Maximum Height of Trees (m)	10
Medium Height of Trees (m)	8
Number of Trees on Sample area	6
Coverage of Tree-tier (%)	30
Coverage of shrub layer, %	20
Height of shrubbery layer, cm	200
Coverage of grass layer, %	10
Height of grass layer, cm	30
Coverage of moss layer, %	_
Number of higher plant species	5
Species	**Abundance/thickness on the Drude Scale**
Tree-tier	
Pinus kochiana	Sp^2
Quercus dschorochensis-kavkasiis subendemi	Sp^1
Shrub layer	
Cistus salviifolius	Sol
Juniperus rufescens	Sol
Grass Layer	
Salvia nemorosa	Sp^1
Moss Layer	
Moss species has not been found	_


Plot 29. *Cistus salviifolius*


Plot 29. Rock and wood complex

Plot 30. Riverside alder forest with admixed willow

Type of Vegetation Cenosis	**Riverside alder forest with admixed willow**
Conservation Value	**Lowland**
Location	Viliage Ckhromisi
Site No	30
Assessed plot area, m^2	50
GPS coordinates	**X** 255809 **Y** 4608203
Datum, masl	313
Exposure	_
Slope	00

Structure of cenosis	
Max. DBH (sm)	15
Medium DBH (sm)	10
Maximum Height of Trees (m)	8
Medium Height of Trees (m)	6
Number of Trees on Sample area	25
Coverage of Tree-tier (%)	80
Coverage of shrub layer, %	_
Height of shrubbery layer, cm	_
Coverage of grass layer, %	30
Height of grass layer, cm	20
Coverage of moss layer, %	_
Number of higher plant species	3
Species	**Abundance/thickness on the Drude Scale**
Tree-tier	
Alnus barbata	Cop^3
Salix alba	Sp^3
Shrub layer	
No Shrub	_
Grass layer	
Equisetum arvense	Sp^3
Moss layer	
Moss species not found	_

Plot 30. Riverside alder forest with admixed willow

Plot 31. Roadside forests

Type of Vegetation Cenosis	Roadside forests
Conservation Value	**Hige**
Location	At Viliage Sirabidzeebi
Site No	31
Assessed plot area, m^2	50
GPS coordinates	**X** 749411 **Y** 4614057
Datum, masl	249
Exposure	West
Slope	$5\text{-}10^0$
Structure of cenosis	
Max. DBH (sm)	25

Medium DBH (sm)	20
Maximum Height of Trees (m)	10
Medium Height of Trees (m)	8
Number of Trees on Sample area	20
Coverage of Tree-tier (%)	70
Coverage of shrub layer, %	_
Height of shrubbery layer, cm	_
Coverage of grass layer, %	20
Height of grass layer, cm	60
Coverage of moss layer, %	_
Number of higher plant species	6
Species	**Abundance/thickness on the Drude Scale**
Tree-tier	
Robinia pseudoacacia	Cop^2
Alnus barbata	Cop^2
Quercus dschorochensis-kavkasiis subendemi	Sp^3
Diospyros lotus (erTeulad)	Sol
Ostrya carpinifolia (erTeulad)	Sol
Shrub layer	
No Shrub	_
Grass layer	
Digitalis schischkinii-kavkasiis endemi	Sol
Moss layer	
Moss species not found	_

Plot 31. *Ostrya carpinifolia*

Plot 31. *Ostrya carpinifolia*

Plot 31. *Digitalis schischkinii*

Plot 32. Roadside deciduous forests, rock and wood complex

Type of Vegetation Cenosis	**Roadside deciduous forests, rock and wood complex**
Conservation Value	**Lowlands**
Location	Valley of River Chorokhi at Village Erge area
Site No	32
Assessed plot area, m^2	50
GPS coordinates	**X** 725205 **Y** 4603466
Datum, masl	41
Exposure	South
Slope	$20-25^0$
Structure of cenosis	
Max. DBH (sm)	15
Medium DBH (sm)	10
Maximum Height of Trees (m)	10
Medium Height of Trees (m)	8
Number of Trees on Sample area	30
Coverage of Tree-tier (%)	80
Coverage of shrub layer, %	_
Height of shrubbery layer, cm	_
Coverage of grass layer, %	10
Height of grass layer, cm	10
Coverage of moss layer, %	_
Number of higher plant species	5
Species	**Abundance/thickness on the Drude Scale**
Tree-tier	
Alnus barbata	Cop^3
Salix alba	Sp^1
Castanea sativa (erTeulad)	Sol
Ficus carica	Sol
Shrub layer	
No Shrub	
Grass layer	
Fragaria vesca	Sp^1
Moss layer	
Moss species not found	_

Plot 32. Roadside deciduous forests

Plot 32. Rock and wood complex

Plot 33. Roadside deciduous forest with boxwood understory

Type of Vegetation Cenosis	**Roadside deciduous forest with boxwood understorey**
Conservation Value	**Medium**
Location	Village Qvemo Jocho
Site No	33
Assessed plot area, m^2	50
GPS coordinates	**X** 725256 **Y** 4605703
Datum, masl	204
Exposure	South-West
Slope	5-10^0
Structure of cenosis	
Max. DBH (sm)	20
Medium DBH (sm)	18
Maximum Height of Trees (m)	12
Medium Height of Trees (m)	10
Number of Trees on Sample area	20
Coverage of Tree-tier (%)	70
Coverage of shrub layer, %	50
Height of shrubbery layer, cm	300
Coverage of grass layer, %	60
Height of grass layer, cm	40
Coverage of moss layer, %	70
Number of higher plant species	9
Species	**Abundance/thickness on the Drude Scale**
Tree-tier	
Carya pekan	Sp^1
Ficus carica	Sp^1
Robinia pseudoacacia	Sp^3
Shrub layer	
Buxus colchica	Sp^3
Corylus avellana	Sp^2
Grass layer	
Pteridium tauricum	Cop^2
Pteris cretica	Cop^1
Moss layer	
Moss	Cop^2

Around the given section, on the slopes is developed agro landscape, where tangerine and orange gardens are cultivated.

Plot 33. Deciduous forest

Plot 33. Deciduous forest with boxwood understorey

Plot 33. *Pteris cretica*

Plot 34. Hornbeam forest with yellow azalea understory

Type of Vegetation Cenosis	Hornbeam forest with yellow azalea understorey
Conservation Value	**Medium**
Location	Area at Village Ergo
Site No	34
Assessed plot area, m^2	50
GPS coordinates -	**X** 722821 **Y** 4605504
Datum, masl	116
Exposure	South
Slope	30-35^0
Structure of cenosis	
Max. DBH (sm)	35
Medium DBH (sm)	25
Maximum Height of Trees (m)	10
Medium Height of Trees (m)	8
Number of Trees on Sample area	20
Coverage of Tree-tier (%)	70
Coverage of shrub layer, %	80
Height of shrubbery layer, cm	200
Coverage of grass layer, %	60-70

Height of grass layer, cm	50
Coverage of moss layer, %	30
Number of higher plant species	6
Species	**Abundance/thickness on the Drude Scale**
Tree-tier	
Carpinus caucasica	Cop^{1}
Aleurites cordata	Sp^{1}
Shrub layer	
Rhododendron luteum	Cop^{2}
Grass layer	
Pteridium tauricum	Sp^{3}
Moss layer	
Moss	Sp^{3}

Plot 34. Yellow azalea (*Rhododendron luteum*)

Plot 34. Hornbeam forest with yellow azalea understorey

Plot 34. Hornbeam forest with yellow azalea understorey

Plot 35. Chestnut forest with admixed young beech trees

Type of Vegetation Cenosis	**Chestnut forest with admixed young beech trees**
Conservation Value	**Medium**
Location	On top of Makho Bridge
Site No	35
Assessed plot area, m^2	50

GPS coordinates	**X** 722911 **Y** 4605898
Datum, masl	134
Exposure	West
Slope	$15\text{-}20^0$
Structure of cenosis	
Max. DBH (sm)	30
Medium DBH (sm)	25
Maximum Height of Trees (m)	10
Medium Height of Trees (m)	8
Number of Trees on Sample area	20
Coverage of Tree-tier (%)	70
Coverage of shrub layer, %	60
Height of shrubbery layer, cm	300
Coverage of grass layer, %	70
Height of grass layer, cm	50
Coverage of moss layer, %	60
Number of higher plant species	7
Species	**Abundance/thickness on the Drude Scale**
Tree-tier	
Castanea sativa	Cop^1
Fagus orientalis	Sp^3
Aleurites cordata	Sp^3
Shrub layer	
Laurocerasus officinalis	Sp^3
Grass layer	
Pteridium tauricum	Cop^1
Moss layer	
Moss	Sp^3

Around this section, agro landscape is developed, which represents low sensitive territory.

Plot 35. Chestnut forest with admixed young beech trees

Plot 35. *Laurocerasus officinalis*

Sensitive areas identified within the OHL corridor

After the completion of detailed botanical survey of the Project corridor, the detailed characteristic of sensitive areas have been analysed. Based on the information gained from literature review and field surveys the following moderate and high sensitive areas have been identified.

The **high sensitivity** in terms of flora was assigned to following plots:

Plot 8. Cereals and forbs mesophilic meadow developed in pine forest window. Near the Mt.Shavshitsveri. GPS coordinates are: T38, **X** 308595 **Y** 4608203 (N41^{0}37'07.4''/E42^{0}42'09.3''). Height from the sea level (m) - 2076, aspect – south-east, inclination - 0-5^0.

There are *Pinus kochiana*, *Acer tratvetteri* as representatives of tree plants, *Juniperus depressa* - introduce bush plants. The grass plants are represented by: *Festuca varia, Koeleria caucasica, Helictotrichon pratense, Phleum pratense, Plantago lanceolota, Rhinanthus major, Trifolium canescens, Betonica grandiflora, Orobus hirsutus, Trifolium pratense, Geranium bohemicum, Pyrethrum punctatum, Cynosurus cristatus, Tephroseris subfloccosa* – endemic of the Caucasus, *Aetheopappus pulcherrimus, Gladiolus dzavakheticu s-* endemic of the Caucasus, *Gymnadenia conopsea* (CITES), *Papaver orientale*.

Plot 15. Shallow bushland, Pyretum salicifoliae. In the vicinity of the village Giorgitsminda near Akhaltsikhe. GPS coordinates are: **X** 338009 **Y** 4608203 (N41^{0}41'36.6''/E43^{0}03'12.1''). Height from the sea level (m) 800, aspect – north-east, inclination - 5-10^0.

Tree plant representatives are as follows: *Pyrus salicifolia, Prunus divaricata,* among bushes there are: *Crataegus pentagyna, Berberis vulgaris, Juniperus rufescens, Arceutobium oxycedri, Elaeagnus angustifolia, Cytisus caucasicus, Cotoneaster meyeri, Quercus iberica* (thornbush), and from herbaceous plants the following species are spread: *Teucrium polium, Botriochloa ischaemum, Cerinthe minor, Salvinia nemorosa, Rhinanthus pectinatus, Inula germanica, Plantago lanceolata, Phlomis pungens, Echium vulgare, Teucrium chamaedrys*.

Plot 16. Pine forest with admixture of spruce and smoke tree understorey. In the vicinity of the village Giorgitsminda, adjacent to Akhaltsikhe. GPS coordinates are as follows: **X** 338009 **Y** 4608203 (N41^{0}41'36.6''/E43^{0}03'12.1''). Height from the sea level (m) 1000, aspect – north-east, inclination - 70-80^0.

Tree plants are represented by: *Pinus kochiana, Picea orientalis,* the following species are noticed from the bush species: *Ligustrum vulgare, Rosa canina, Cotinus coggygria, Cotoneaster meyeri, Swida australis,* and:*Oxalis acetosella, Fragaria vesca* grow from the herbaceous species.

Plot 22. Spruce forest with yellow azalea. The river Skhaltistskali ravine. GPS coordinates are: **X** 292450 **Y** 4608203 (N41^{0}34'52.6''/E42^{0}30'36.9''). Height from the sea level (m) 1979, aspect – south-east, inclination 15-20^0.

The tree plant species are represented by Picea orientalis; *Rhododendron luteum* is seen from the bush species, and the following hernaceous plants, such as: *Sanicula europea, Fragaria vesca, Platanthera bifolia* (CITES), *Athyrium filix-femina* grow here.

Plot 23. Spruce forest with fern. The river Skhaltistskali ravine. GPS coordinates are: **X** 292549 **Y** 4608203 (N41^{0}34'44.4''/E42^{0}30'41.5''). Height from the sea level (m) 1880, aspect – southern, inclination 25-30^0.

Among the tree plants there is *Picea orientali;* from the herbaceous vegetation: *Driopteris filix mas, Pyrethrum macrophyllum, Geranium sylvaticum, Verbascum blattaria* grow around the area.

Plot 24. Wetland in spruce forest window. The Skhaltistskali River Gorge. GPS coordinates: **X** 292306 **Y** 4608203 (N41^{0}34'38.5''/E42^{0}30'31.2''). Height from the sea level (m) 1820, inclination 0^0.

The following herbaceous species are represented here: *Eleocharis uniglumis, Bolboshoenus maritimus, Luzula sp., Dactyllorhiza euxina* (CITES); in particular, 14-16 specimens grow within the area of 10m^2, *Carum carvi, Rhinanthus major, Ranunculus sp., Centaurea salicifolia, Trifolium canescens, Trifolium alpestre, Prunella vulgaris*.

Plot 25. Oak and hornbeam forest. Between the villages of Ragvta and Pushrukauli. GPS coordinates are: **X** 288504 **Y** 4608203 (N41^{0}33'48.2''/E42^{0}27'49.0''). Height from the sea level (m) 1200, aspect – east, inclination 70-80^0.

Among tree plants there are: *Carpinus caucásica, Quercus dschorochensis* (sub-endemic of the Caucasus), *Picea orientalis, Sorbus torminalis, Pinus kochiana* (young specimens). On the opposite slope of the river broad-leaved forest with admixed spruce trees and Colkhic understorey can be seen.

Plot 26. Spruce forest with admixed dchorokhi oak. Between the villages of Pushrukauli and Veranebi. GPS coordinates are: **X** 286083 **Y** 4608203 (N41^{0}33'53.7''/E42^{0}26'04.3''). Height from the sea level (m) 1053, aspect - western, inclination - 35-40^0.

Among the tree plants there are: *Picea orientalis, Quercus dschorochensis* (subendemic of the Caucasus); the following bush species are growing here: *Rhododendron luteum, Rosa canina;* From the herbaceous plants are growing the following plants: *Driopteris filix mas, Fragaria vesca, Oxalis acetosella*. Within the adjacent territories of the given section, on the both sides of the gorge, spruce forests are developed with admixed oaks.

On both slopes (eastern as well as western) inclination is rather considerable. On the opposite side of the village Veranebi, along the roadside, *Rhus coriaria, Juglans regia* (The Georgian Red List Species) and *Robinia pseudoacacia* grow. *Quercus dschorochensis* follows the entire edge of the road.

Plot 28^a. Rock and wood complex. Near the Purtio bridge. GPS coordinates are as follows: **X** 273201 **Y** 4608203 (N41^{0}37'23.7''/E42^{0}15'99.3''). Height from the sea level (m) 559, aspect - west, inclination - 35-40^0.

The following herbaceous plants are growing here: *Amaracus rotundifolius* (sub-endemic to south-western Trans-Caucasia), *Vincetoxicum amplifolium*.

Plot 29. Rock and wood complex. At the confluence of the rivers Tchvanistskali and Adjaristskali. GPS coordinates are: **X** 261418 **Y** 4608203 (N41^{0}38'40.4''/E42^{0}08'06.8''). Height from the sea level (m) 363, aspect – south-east, inclination - 70-80^0.

Tree plants are represented by: *Picea orientalis, Quercus dschorochensis* (sub-endemic of the Caucasus), from the bush plants are represented: *Cistus salvifolius, Juniperus rufescens*.

Plot 31. Roadside forests. Nearby the village Sirabidzeebi. GPS coordinates are: **X** 725205 **Y** 4603466 (N41^{0}38'21.3''/E41^{0}59'40.4''). Height from the sea level (m) 249, aspect – west, inclination - 5-10^0.

From the tree species ar growing the following plants: *Robinia pseudoacacia, Alnus barbata, Quercus dschorochensis* (subendemic of the Caucasus), *Diospyros lotus* (in single specimens), *Ostrya carpinifolia* (in single specimens) (The Georgian Red List Species); the herbaceous plant *Digitalis schischkinii* - endemic to the Caucasus is growing in this section.

The **Moderately sensitive** areas**:**

Plot 4. Bushland with raspberry and blackberry. Beshumi, by Tago settlement (Shepherds' houses). GPS coordinates are: **X** 299590 **Y** 4607822 (N41^{0}35'49.1''/E42^{0}35'43.1''). Height from the sea level (m) 2118, aspect – north-west, inclination 0-5^0.

The following bush plants are growing here: *Rubus idaeus, Rubus* sp. From the herbaceous species the following plants are represented: *Cirsium caucasicum, Inula grandiflora, Senecio kolenatianus*-endemic of the Caucasus, *Hesperis matronalis, Rumex arifolius, Veratrum lobelianum, Driopteris filix mas, Stachys balansae, Galium verum Viola kupfferi, Onosma caucasica*.

Plot 5. Forb meadow with Festuca varia/Festucetum variae. Beshumi, near to Tago settlement (Shepherds' houses). GPS coordinates: **X** 300430 **Y** 4608203 (N41^{0}36'02.2''/E42^{0}36'18.9''), height from the sea level 2018, aspect – west, inclination - 5^0**.**

From herbaceous species are represented the following plants: *Festuca varia, Cynosurus cristatus, Carex* sp., *Festuca ovina, Phleum alpinum, Trifolium ambiguum, Alchemilla* sp., *Ranunculus* sp., *Lotus caucasicus, Tripleurospermum caucasicum, Trifolium canescens, Sibbaldia parviflora, Carum caucasicum, Polygala alpicola, Polygonum carneum, Dactyllorhiza urvilleana* (CITES).

Plot 7. Forb meadow. Near Mt. Shavshitsveri. GPS coordinates: **X** 308380 **Y** 4608203 (N41^{0}37'27.4''/ E42^{0}41'59.3''). Height from the sea level (m) - 2103, aspect – north-east, inclination - 0-5^0.

From the herbaceous plants the following species are represented: *Festuca sulcata, Agrostis planifolia, Trifolium alpestre, Alchemilla sp., Trifolium canescens, Lotus caucasicus, Sibbaldia parviflora, Veronica gentianoides, Centaurea cheiranthifolia, Ranunculus* sp., *Cirsium echinus, Stachys germanica, Nardus stricta, Koeleria caucasica, Festuca varia, Pedicularis eriantha, Erigeron alpinus, Gymnadenia conopsea* (CITES)*, Polygonum carneum, Viola kupfferi*.

Plot 9. Oakwood. Adigeni district. GPS coordinates: **X** 309579 **Y** 4608203 (N41^{0}37'13.5''/ E42^{0}42'51.6''). Height from the sea level (m) - 1894, aspect – south-east, inclination - 5-10^0.

From the tree plants are represented the following species: *Quercus iberica, Pinus kochiana, Acer pseudoplatanus, Fraxinus excelsior, Acer trautvetteri, Sorbus caucasigena*; from the bush species are growing: *Corylus avellana, Rosa canina*; and from the herbaceous species are growing the following plants: *Calamagrostis arundinacea, Geranium sylvaticum, Polygonum carneum, Verbascum blattaria, Betonica grandiflora, Rumex crispus, Cephalaria gigantean, Grossheimia macrocephala, Silene wallichiana, Astrantia maxima, Pimpinella rhodantha, Briza elatior*.

Plot 10. Pine forest. Adigeni district. GPS coordinates: **X** 309998 **Y** 4608203 (N41^{0}37'16.8''/E42^{0}43'09.6''). Height from the sea level (m) 1881, aspect - south, inclination - 5-10^0;

From the tree plantsthe following species are growing in this area: *Pinus kochiana, Fagus orientalis* (young), *Sorbus caucasigena* (young), bush plants are represented by the following species: *Corylus avellana, Rosa canina,* and from the herbaceous plantsare growing the following species: *Phleum pratense, Cephalaria gigantea, Coronilla varia, Pimpinella rhodantha, Thalictrum buschianum*-endemic of the Caucasus, *Dactylis glomerata, Linum usitatissimum*.

Plot 12. Oakwood. Adigeni district. GPS coordinates: **X** 310866 **Y** 4608203 (N41^{0}37'16.0''/ E42^{0}43'47.1''). Height from the sea level (m) 1685, aspect - east, inclination 10-20^0.

Tree plants are represented by the following species: *Quercus iberica, Acer campestre, Fraxinus excelsior, Ulmus glabra* (Georgian Red List Species), *Carpinus caucasica, Picea orientalis;* from the bush plants are growing the following species: *Corylus avellana, Philadelphus caucasicus, Rosa* *canina, Rubus* sp. and herbaceous plants *Linaria schelkovnikowii*- endemic of the Caucasusis growing on this section.

Plot 13. Astragalus scrubland. Surroundings of the village Ude. GPS coordinates: **X** 316097 **Y** 4608203 N41⁰37'31.9''/E42⁰47'32.6''. Height from the sea level (m) 1400, aspect - west, inclination - 25-30⁰.

From the bushes *Astragalus microcephalus* growshere, as for herbaceous plants, *Salvia verticillata, Achillea millefolium, Stachys atherocalyx, Salvia nemorosa, Teucrium polium, Polygala transcaucasica* are growing on this section.

Plot 19. Spruce, pine shallowly among bushland. Ghordze countryside. GPS coordinates: **X** 313489 **Y** 4608203 (N41⁰38'30.0''/E42⁰45'37.9''). Height from the sea level (m) 1346, aspect – north-west, inclination - 15-20⁰.

From the bush species are growing the following plants: *Crataegus orientalis, Berberis vulgaris, Juniperus rufescens, Rosa canina, Cotoneaster meyeri*; from herbaceous plants *Astragalus microcephalus* is growing in this area. Within the mentioned section *Picea orientalis* (PBH-70-80cm, height -8-10m) as well as *Pinus kochiana* (PBH-80cm, height -8m) is shallowly spread in bushland.

Plot 20. Degraded cereals and forbs meadow. Beshumi, nearby Tetrobi settlement (Shepherds' houses). GPS coordinates: **X** 293383 **Y** 4608203 (N41⁰34'47.3''/E42⁰31'17.4''). Height from the sea level (m) 2089, aspect – south-west, inclination 30-35⁰.

The following herbaceous species are distributed here: *Festuca varia, Sibbaldia parviflora, Trifolium ambiguum, Phleum alpinum, Trifolium canescens, Alchemilla* sp., *Plantago saxatilis, Prunella vulgaris, Sedum spurium, Hieracium pilosella, Ajuga orientalis, Plantago major, Scleranthus uncinatus, Myosotis alpestris, Poa alpine* var. *vivipera, Herniaria caucasica, Lotus caucasicus, Bellis perennis, Scrophularia olumpica, Nonea intermedia* (endemic of the Caucasus).

Plot 27. Mixed broad-leaved forest with admixed spruce. The river Skhaltistskali ravine. GPS coordinates: **X** 293383 **Y** 4608203 (N41⁰34'42.0''/ E42⁰21'55.1''). Height from the sea level (m) 1040, aspect – west, inclination - 20-25⁰.

From the tree plants there grow the following species: *Picea orientalis, Quercus dschorochensis* (subendemic of the Caucasus), *Carpinus caucasica, Fraxinus excelsior;* the following bush plants are growing in this area: *Rhododendron luteum, Rosa canina*; from the herbaceous specieas the following plants are spread in this section: *Driopteris filix mas, Fragaria vesca, Oxalis acetosella*. Throughout the west slope, mixed broad-leaved forest with admixed of spruce is spread; east slope is covered with fir and pine forest (*Picea orientalis, Pinus kochiana*). On the lower part, along the riverside terraces – alder forest (*Alnus barbata*) is developed.

Plot 33. Roadside deciduous forest with boxwood understorey. The village Kvemo Jocho. GPS coordinates: **X** 725256 **Y** 4605703 (N41⁰34'16.6''/E41⁰42'06.2''). Height from the sea level (m) 204, aspect - south-west, inclination - 5-10⁰.

Tree plants are represented by: *Carya pecan, Ficus carica, Robinia pseudoacacia;* from the bushes are growing the following species: *Buxus colchica* (Georgian Red List Species), *Corylus avellana,* and herbaceous plants: *Pteridium tauricum, Pteris cretica* are growing in this section.

Plot 34. Hornbeam forest with yellow azalea understorey. The surroundings of the village Erge. GPS coordinates: **X** 722821 **Y** 4605504 (N41⁰34'12.6''/E41⁰40'20.9''). Height from the sea level (m) 116, aspect – south, inclination - 30-35⁰.

Tree plants are represented by: *Carpinus caucasica, Aleurites cordata,* bush species *Rhododendron luteum,* and herbaceous plant *Pteridium tauricum* grow within the area.

Plot 35. Chestnut forest with admixed young beech trees. GPS coordinates: **X** 722911 **Y** 4605898 (N41^{0}34'25.3''/E41^{0}40'25.3''). Height from the sea level (m) - 134, aspect – west, inclination - 15-20^0.

From the tree species *Castanea sativa* (Georgian Red List Species), *Fagus orientalis, Aleurites cordata* are growing in this area; bush plant *Laurocerasus officinalis,* and herbaceous plant *Pteridium tauricum* are growing in the area.

Other sections of the project corridor are considered as low sensitivity areas, however even in low sensitivity areas, the protected species can be encountered.

Protected Species in the project corridor

As a result of detailed botanical investigation of project corridor, five plant species included in Georgia Red List were identified in the designed project corridor: *Juglans regia* L., ***Ostrya carpinifolia*** Scop., *Buxus colchica* Pojark., *Castanea sativa* Mill., *Ulmus glabra* Hudds. List and status of the plant species included in Georgia Red List are following:

№	Latin Name	English Name	Category of State and Protection Status
Herb species			
1	*Buxus colchica* Pojark.	Colchic boxwood	VU
2	*Castanea sativa* Mill.	Sweet chestnut	VU
3	*Juglans regia* L.	Persian walnut	VU
4	*Ostrya carpinifolia* Scop.	European hop hornbeam	EN
5	*Ulmus glabra* Hudds.	Elm	VU

In addition to the species included in Georgian Red list, there are populations of some rare, endangered and vulnerable species in the project corridor, including: *Laurocerasus officinalis, Digitalis schisckinii* (Endemic of the Caucasus), (threatened species), *Amaracus rotundifolius* (sub-endemic of the south-west Transcaucasia), *Quercus iberica, Diospyros lotus* (rare species), *Ficus carica* (endangered species);

Other endemic species of Caucasus region identified in the OHL corridor include: *Tephroseris subfloccosa, Gladiolus dzavakheticus, Senecio kolenatianus, Thalictrum buschianum, Linaria schelkovnikowii, Nonea intermedia*; Sub-endemic of the Caucasus región - *Quercus dschorochensis*.

Populations of species protected by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES 1975; universal) are: *Gymnadenia conopsea, Platanthera bifolia, Dactyllorhiza euxina, Dactyllorhiza urvilleana*.

Plant species protected by the Bern Convention have not been identified within the project corridor.

6.2.3 Fauna

This section describes fauna and fauna sensitivities for the whole corridor and identifies most important wildlife areas for the project. Survey methods used for collection of wildlife information are described in Section 5 "ESIA Methodology".

Survey Approach and Data Analysis

The literature review delivered certain data about the wildlife and habitats and species of concern in the project region. However, it should be stated, that the information available is limited for certain areas. The major part of reference materials is published in 1960-1990s, and rather limited fauna studies have been implemented science then (see Bibliography). Besides, information provided in reference materials is mostly related to wider areas and rather limited data could be obtained regarding specific features of the OHL corridor.

Still, there are some recent publications available (Verhelst et al, 2011, Abuladze, 2012, etc.) related to assessment of raptors in the South-West Georgia, in particular the westmost section of the project corridor. Besides, some recent wildlife assessment data are provided in the Adjaristskali HPP ESIA (Mott MacDonald, 2012), which covers major part of the project corridor.

The desk study showed that several sections of the OHL will be built in rather sensitive areas, which are high value wildlife habitats and/or important migration corridors. As such, according to WWF (2006), major part of the project corridor is within a priority conservation area (PCA) of the West Lesser Caucasus and Wildlife Corridor of Trialeti-West Lesser Caucasus, and is in the vicinity of Trialeti PAC.

The desk review showed also, that the most sensitive issue for the project corridor is avian fauna, including migratory and locally breeding species. Due to abundance of birds and high importance of some species three important bird areas (IBAs) (Shavsheti Ridge, Kintrishi and Batumi) (USAID, 2009) are identified in close proximity of the project corridor. Among these, the most sensitive area is so called Batumi bottleneck, which is important migratory flyway, especially for raptors, which migrate through this area in large numbers.

The birds' surveys were implemented by the Batumi Raptor Count (BRC) for the Mott MacDonald, which is the design engineer for the project. The Surveys comprised the proposed corridor of Akhaltsikhe Batumi 220 KV line inclusive northern alternative through Goderdzi pass. As described in the alternatives' section, difference between northern alternative and the preferred option is only the small section around the Goderdzi Pass. Respectively, their findings can provide rather good picture for the project corridor.

The Autumn Survey comprised the period of September 18 – October 4, 2012 and the Spring Survey the period of April 20 – May 25, 2013, covering migration time for majority of important migrant bird species recorded within the study area.

The Autumn Survey focused on 16 sites (Figure 6.2.4) along the project corridor and total observation time of 106.4 hours. The Spring Survey comprised 22 observation points (Figure 6.2.5) and 219.5 hours total observation time.

Count sites were selected in areas where the likelihood to encounter migratory and/or local birds is high. These were chosen based on the South-North and the North-South directions of the seasonal (spring, autumn) migrations, considering varying weather conditions and the different migration strategies of each species. Indicators used were: the occurrence of hotspots for the development of thermal updrafts (isolated bare rocks, strategically located ridges), river valleys orientated along the principal axis of migration, river crossings, mountain ridges and forests which might serve as night roosting sites. Different effort was devoted to different section of the route, considering their sensitivity in terms of birds. Birds were detected by eye, or by scanning the sky with binoculars or telescope. The following indicators were recorded during each count:

- **Bird species:** This was done as much as possible. However, identification by species was complicated when migration was strong, or then birds were flying too high or too far and identification was made to genus level in such cases.

  - **Flying height:** The recording of flying height enabled categorization of birds by flying height to enable prediction of potential impact of the planned OHL. In particular, all them were broken down into three categories: Category 1 was assigned to birds flying lower than 30m (0-30m height), Category 2 – to birds flying between 30m and 60m, and Category 3 – to birds flying over 60m height.

  - **Flying direction:** Flying direction of birds was recorded to help with categorization of avian species into migrant or local.

  - **Weather parameters** that can influence bird migration were recorded for each count. These included the visibility and cloud cover.

Birds were categorised as migratory or local, though such a categorization was based on the subjective judgement of the observer. A migrating bird was defined as birds on active migration at the observation moment that is birds that were flying straight to the south/the north using thermals. On the other hand, birds flying around were categorized as local birds. This characterization is not precise as some migrant species resting and foraging in the area could be also categorized as local.

Number of counts to observation sites varied from two to five, depending on importance of particular site; duration of count varied respectively. Time period between two visits to each observation point varied from one day minimum to one week. Counts on the same site were done at different times of the day to allow coverage of within-day variation in bird migration. More details about the survey methodology together with findings are available in the respective bird survey reports, provided in Annex 2.

Despite considerable efforts devoted to bird studies, they have not comprehensively covered all aspects. In particular, the Autumn Survey did not fully seized migration period of Montagu's Harrier (*Circus pygargus*) and Honey Buzzard (*Pernis apivorus*); however, autumn migration of these species in the Batumi bottleneck was quite well studied by Verhelst, et al (2011). Besides, the Spring Survey provided additional data on these species.

The Spring Survey poorly covered migrant species in the environs of the Goderdzi Pass, as only later counts could be done due to late snow cover. The Skhalta valley was covered only by a rapid survey in the frames of the Spring Survey as this alternative was not developed by the Survey time, and a rapid survey on June 30 – July 12, 2013 implemented by the DG Consulting. Though, as mentioned in the following section, these territories are not within migration area and are less important area in terms of local birds as well.

As mentioned, DG Consulting carried out the rapid wildlife assessment in the OHL route in summer 2013. It comprised entire project corridor, with the objectives to describe wildlife habitats along the OHL route, identify which sensitive fauna habitats reported/unreported in the literature could fall within the project ROW and determine territories disturbance of which should be avoided not to cause significant impact on wildlife. The "walkthrough" method was used to achieve these objectives. Animal species and signs of their vital activity (traces, droppings, dens, feather, etc.) encountered during the survey within or near the corridor were recorded.

The following sections provide general faunistic overview of the project region, as well as the comprehensive description of the wildlife for the project corridor. The information provided is a combination of the desk review and field survey findings. The results of the field surveys are organized in a way to create clear picture on the project-specific details. Sections giving a review of protected species for the project ROW and summarizing main findings are also provided. Wildlife sensitivity maps are prepared for the project corridor to highlight sensitive wildlife areas (Figure 6.2.32-Figure 6.2.34).

Figure 6.2.4 Birds' Autumn Survey Points marked with green dots, BRC, 2012

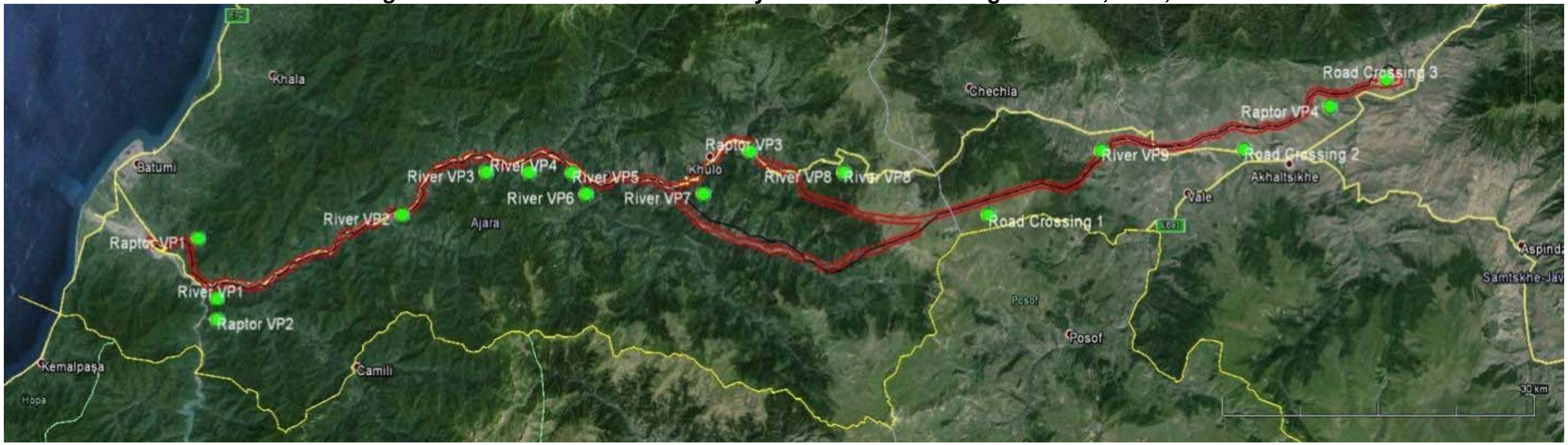


Figure 6.2.5 Birds' Spring Survey Points marked with yellow pins, BRC 2013

General Overview of Project Region

Wildlife habitats on different sections of the project corridor have distinct features due to varying geographic and landscape conditions and socio-economic activities. In overall, these habitats include semi-dry mountain steps in Akhaltsikhe area, larger rivers and floodplains covered by riparian forests, small size streams, deciduous, coniferous and mixed forests on various sections, sub-alpine and alpine meadows in surroundings of the Beshumi area, rock outcrops on the mountain slopes and ridges, etc. Some of habitats are heavily modified due to agriculture or other economic activities, whilst others are persevered in natural or near-natural state. This wide variety of habitats in the project area determines wildlife diversity there, where various species find suitable shelter, feeding, breeding and migration areas.

Major portion of the route falls within the priority conservation area (PCA) of the West Lesser Caucasus stretching from the Borjomi-Kharagauli National Park to the Altindere Valley in Turkey. In addition, the route crosses important wildlife corridor, called Trialeti-Western Lesser Caucasus Corridor, connecting the mentioned PCA with Trialeti PCA (comprising Borjomi-Kharagauli Park and its environs) (WWF, 2006). Figure 6.2.6 shows these PCAs and migration corridor, and layout of the project corridor.

The West Lesser Caucasus PAC is distinguished due to presence of endemic small mammals, amphibians, reptiles and invertebrates. Its section near Batumi is a well-known bottleneck for migratory birds, especially raptors. The Trialeti-Western Lesser Caucasus Corridor is important area for local migration of wildlife and gene flow between the above mentioned PACs.

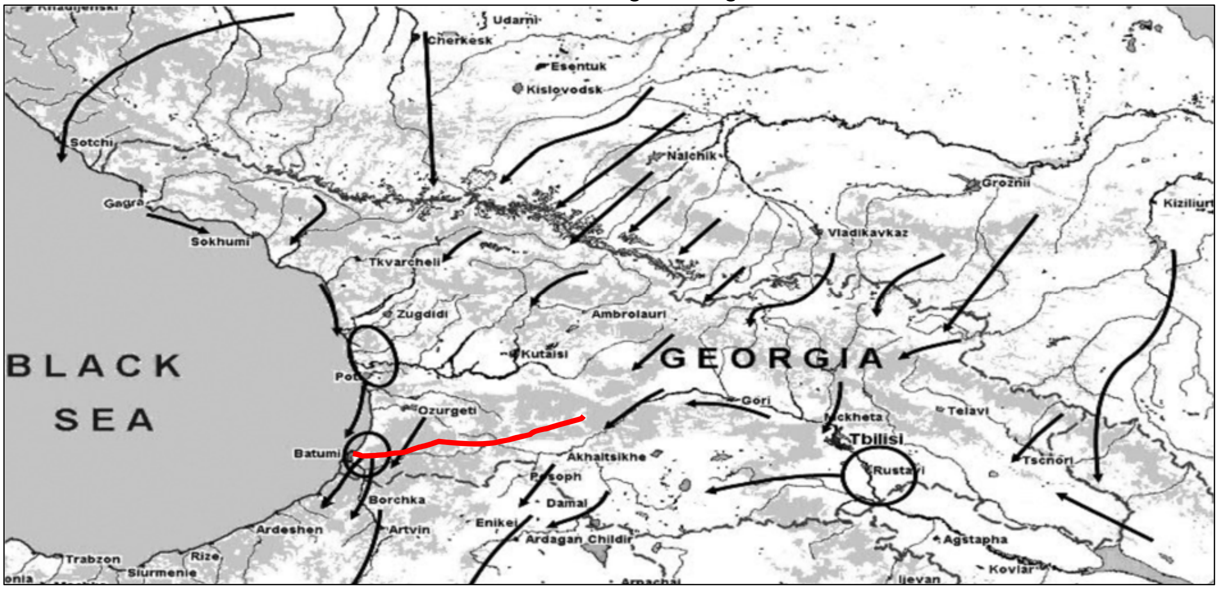
Among focal species of these PACs, which could be found in the project area, are: Brown Bear (*Ursus arctos*), Caucasian Black Grouse (*Tetrao mlokosiewiczi*), Caucasian Salamander (*Mertensiella caucasica*), Lesser Horseshoe Bat (*Rhinolophus hipposideros*), Eurasian Otter (*Lutra lutra*) and Eurasian Lynx (*Lynx lynx*). Though, some other important fauna species, including but not limited to migrant birds, are also recorded within these important wildlife areas, as well as in other project sections.

Sensitivity of the project corridor is also determined by presence of three important bird areas (IBAs) (Shavsheti Ridge, Kintrishi and Batumi IBAs (USAID, 2009)) along or in proximity of the route. Of these, Batumi IBA is a well-known bottleneck for migratory birds and especially migratory raptors, as previously mentioned (see Figure 6.2.7).

Figure 6.2.6 Important conservation areas and corridors in the Caucasus Ecoregion (the project corridor is shown with red line)

Source: WWF, 2006

Figure 6.2.7 Most important known flyways and bottlenecks of the raptors' autumn passage through Georgia



N.B. Flying directions are shown by arrows, encircled are stop-over sites, the red line shows the project corridor. Source: Abuladze, 2012

Over 800,000 birds and 34 species were recorded in this bottleneck in 2008 and 2009. Of these, the number of ten species - European Honey-buzzard (*Pernis apivorus)*, Steppe Buzzard (*Buteo buteo*), Black Kite (*Milvus migrans*), Levant Sparrowhawk (*Accipiter brevipes*), Montagu's Harrier (*Circus pygargus*), Pallid Harrier (*Circus macrourus*), Lesser Spotted Eagle (*Aquila pomarina*), Greater Spotted Eagle (*Aquila clanga*), Booted Eagle (*Hieraaetus pennatus*) and Steppe Eagle (*Aquila nipalensis*) - exceeded 1% of their estimated world population. Especially abundant were Honey Buzzard, average amount of which totalled 453,444, or 45%-130% of the world population (Verhelst et al. 2011); however those figures can be overestimated. In addition, among the listed species, Pallid Harrier (*Circus macrourus*) is protected in internationally (IUCN NT) and Greater Spotted Eagle (*Aquila clanga*) both locally (Georgian Red List, VU) and internationally (IUCN VU).

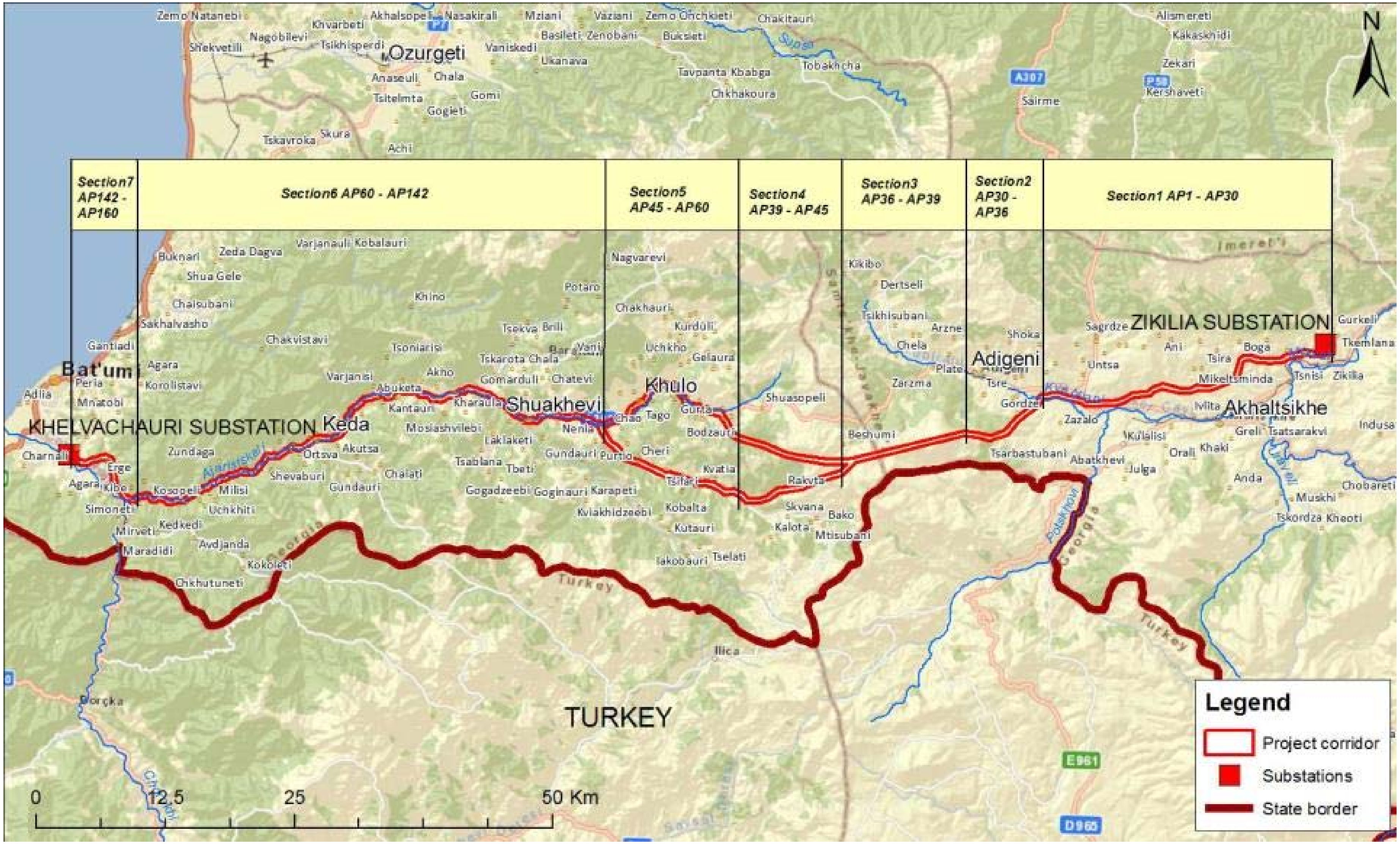
Description of Habitats and Wildlife for the Project Corridor

In order to reach good representation and better understanding of wildlife habitats and animal species through the project corridor, we have divided it into seven main sections (Figure 6.2.8). The division was based on landscape, vegetation characteristics and more or less homogenous habitats. The sections are following:

- Section 1: The OHL corridor between the Zikilia Village (sub-station site) and the crossing of the Kvabliani River (Ghordze Village) (AP1-AP30)
- Section 2: The OHL corridor from the crossing of the Kvabliani River to the northern slopes of the Shavshi-Tsveri Mountain, near Ghordze Village (AP31-AP36)
- Section 3: The OHL section from forest massif next to the Shavshi-Tsveri Mountain to so called Tetrobi summer farms located south to the Abanos-Keli Pass (AP36-AP39), 2100-2400 masl
- Section 4: The section between the Tetrobi summer farms to the midstream of the Skhalta River, near Pushrukauli Village (AP39-AP45).
- Section 5: The OHL section within the gorge of the Skhalta River, between the Pushrukauli Vllage to Purtio bridge (the river mouth) (AP45-AP60).
- Section 6: The gorge of Adjaristskali River from Purtio bridge to the mouth of the Chorokhi River (AP60-AP142), 550-50 masl.
- Section 7: The OHL section from the mouth of the Adjaristskali River to the Khelvachauri Sub-Station, surroundings of the villages of Erge and Jocho (AP142-Ap160), datum 20-400m.

These sections and animal species most characteristic to the area are described for each established section below.

Figure 6.2.8 Division of the Project Corridor by sections in accordance to characteristic habitats



Section 1: The OHL corridor between the Zikilia Village (sub-station site) and the crossing of the Kvabliani River (Ghordze Village) (AP1-AP30)

The OHL corridor runs in the Akhaltsikhe Depression, over the eastern part the Adjara-Imereti Ridge, in lower part of its southern slopes. Elevation of the corridor varies from 950 masl to 1200 masl. Most common landscapes for this part of the Akhaltsikhe Depression are forest steps and secondary steps which are formed under relatively dry climate (L.Maruahsvili, 1964). The OHL corridor itself majorly comprises orchards, croplands, pastures and grasslands (Figure 6.2.9, Figure 6.2.10). Small grove preserved by local population could be found on a steep slope at Giorgitsminda Village (Figure 6.2.11). Narrow strip of riparian forest encounters at crossings of the Potskhovi River and other small streams. Rock outcrops and open areas, which are raptors' breeding and feeding areas, are common for this section, especially in the area between the Zikilia Sub-Station and Akhaltsikhe City.

Figure 6.2.9 Meadows near Mugareti Village

Figure 6.2.10 Potato and maize croplands at the roadside leading to Tatanisi Village

Figure 6.2.11 Grassland and preserved grove near Giorgitsminda Village

From mammals, mostly small and medium size mammals are recorded on this section of the corridor. These include: Southern White-breasted Hedgehog (*Erinaceus concolor*), Lesser Shrew (*Crocidura gueldenstaedtii*), Common Vole (*Microtus arvalis*), Ground Vole (*Terricola majori*), Brown Rat (*Rattus norvegicus*), Steppe Field Mouse (*Apodemus fulvipectus*), European Hare (*Lepus europaeus*), Forest Dormouse (Dryomys nitedula), Least Weasel (*Mustela nivalis*), Stone Marten (*Martes foina*), Gray Wolf (*Canis lupus*), Red Fox (*Vulpes vulpes*).

Among small mammals separately should be noted bats including: Lesser Horseshoe Bat (*Rhinolophus hipposideros*), Lesser Mouse-eared Bat (*Myotis blythii*), Common Pipistrelle (*Pipistrellus pipistrellus*), protected under the by EUROBATS and Brandt's Hamster (*Mesocricetus brandti*), which has NT status in the IUCN Red List.

Amphibians recorded there include: European Tree Frog (*Hyla arborea*), Marsh Frog (*Rana ridibunda*) and European Green Toad (*Bufo viridis*). Reptiles are presented by: Slow-worm (*Anguis fragilis*), Caspian Green Lizard (*Lacerta strigata*), Three-lined Lizard (Lacerta media), Grass Snake (*Natrix natrix*), Dice Snake (*Natrix tessellata*) and Ring-Headed Dwarf Snake (*Eirenis modestus*). Some people also claim that encountered near the municipal landfill of Akhaltsikhe the Transcaucasian Long-nozed Viper (*Vipera transcaucasiana*), which is enlisted in IUCN Red List (NT) and Georgian Red List (EN).

Among birds most common are: Hoopoe (*Upupa epops*), White Wagtail (*Motacilla alba*), Eurasian blackbird (*Turdus merula*), Winter wren (*Troglodytes troglodytes*), Red-backed Shrike (*Lanius collurio*), great tit (*Parus maior*), coal tit (*Parus ater*), blue tit (*Parus caeruleus*), black-billed magpie (*Pica pica*), Hooded Crow (*Corvus cornix*), Common Raven (*Corvus corax*), house sparrow (*Passer domesticus*), Eurasian chaffinch (*Fringilla coelebs*), European Goldfinch (Carduelis caduelis), European Greenfinch (*Chloris chloris*) and Corn Bunting (*Miliaria calandra*).

Among rare species recorded on these section are the Egyptian Vulture (*Neophron percnopterus*), which both on Georgian Red List (VU) and IUCN Red List (EN), Imperial Eagle (*Aquila heliaca*) (IUCN & Georgian Red Lists, VU) and Golden Eagle (*Aquila chrysaetos*) (Georgian Red List, VU).

Nine observation points of Spring Bird Survey 2013 fall within section and its close proximity. Layout this count points (E4-3-E17) are given in Figure 6.2.12. During the Spring Survey highest number of birds (919 in total, or 92 birds/hr) were recorded at observation point E15, which is ca. 2.5 km south-east from Tatanisi Village, which is an open space with rocky outcrops. The Autumn Survey 2012 comprised this section with five observation points (River VP9, Road Crossing 2, Raptor VP4, Road Crossing 3) (Figure 6.2.13). Highest intensity of birds (birds per hour) was counted at River VP 9 for raptor species and at Road Crossing 2 for other species.

Figure 6.2.12 The 12 selected sites surveyed in spring 2013, East of the Goderzi pass

Source: BRC, 2013

Figure 6.2.13 The 5 selected sites surveyed in Autumn 2012 East of the Goderzi pass

Source: BRC, 2012

As the Spring Bird Survey (BRC, 2013) showed, this section of the OHL is distinguished with relatively higher number of the Lesser Spotted Eagle (*Aquila pomarina*), Booted Eagle (*Hieraaetus pennatus*), Golden Eagle (*Aquila chrysaetos*), Egyptian Vulture (*Neophron percnopterus*) and Harriers (Pallid and Montagu's), when in other sections of the route. The Egyptian Vulture, Golden Eagle and Booted Eagle are resident species for this section, what can be reason for their relative abundance. The Autumn Survey (BRC, 2012) also reported relative abundance of raptors on this section.

According to BRC (2013), birds on these section are mostly soaring or gliding (flying over 60 m height), with the exception of E8 point (the Potskhovi Crossing), where about 45% of birds flied at 0-30 m height and about 65% in the range of 0-60 m as many birds (gull, osprey, heron, etc) are associated with the river there. Still it should be accentuated that some bird species were found mostly low flying in all areas. Among them should be accentuated Pallid Harrier, Golden Eagle and Egyptian Vulture, which as mentioned above, were relatively abundant on this part of the OHL than in other areas and which are protected species.

Low fly height for this section was also proven by the Autumn Survey (BRC, 2012), according to which from 20% to 40% of birds were flying below 60 m on this section. Most low flying birds were recorded at the count point Road Crossing 3, near the Zikilia Sub-Station.

Spring Survey (BRC, 2013) recorded the endangered Egyptian Vulture (*Neophron percnopterus)* around sites E14, E15 and E16 (east of Akhaltsikhe) and sites E13 and E11 (west of Akhaltsikhe). One pair of this bird was also encountered during the rapid field survey in June-July 2013 in the environs of Atskuri Village (the east of Akhaltsikhe City), where the OHL crosses their preying habitats.

Figure 6.2.14 Eastern Imperial Eagle (*Aquila heliaca*) in meadows near Tatanisi Village

During the Rapid Survey 2013 were also recorded one specimen of the Imperial Eagle (*Aquila heliaca*) (Figure 6.2.14) in meadows near Tatanisi Village, which are its feeding habitat and one nestling pair of the Common Buzzard (*Buteo buteo*), in the preserved grove near Giorgitsminda Village. Usually relatively large number of the Common Buzzard is reported for these areas, where they enter mostly for hunting.

Section 2: The OHL corridor from the crossing of the Kvabliani River to the northern slopes of the Shavshi-Tsveri Mountain, near Ghordze Village (AP31-AP36).

Datum on this section changes from 1100 masl to 2100 masl. Climate changes from temperate semi-arid mountain climate on lower elevations to moderately cold mountain climate at higher datum. About half of the project corridor is occupied by croplands, most part of which is situated at lower datum. Woodlands and grassland also occupy rather vast areas in the range of 1500-2100 m elevation. Woodlands are mostly coniferous; though deciduous trees and shrubbery are also present in riparian zones. Juniper shrubbery is developed in open spaces. Forests are mostly notably modified due to intensive tree felling (Figure 6.2.15). Rock outcrops are dotted at places.

Figure 6.2.15 Logged grove near Ghordze Village

Starting from environs of the Ghordze Village to the west the entire project corridor belongs to the above mentioned West Lesser Caucasus PCA.

Wide variety of rodents is recorded on this section. These include: Erinaceus concolor (*Erinaceus concolor*), Lesser Shrew (*Crocidura gueldenstaedtii*), Eurasian Red Squirrel (*Sciurus vulgaris*), Forest Dormouse(Dryomys nitedula), Common Vole (*Microtus arvalis*), Least Weasel (*Mustela nivalis*), Ground Vole (*Terricola majori*), Steppe Field Mouse (*Apodemus fulvipectus*), European Hare (Lepus europaeus), Stone Marten (*Martes foina*), Brandt's Hamster (*Mesocricetus brandti*), the later having status NT on the IUCN Red List.

Among large mammals there can be encountered: Gray Wolf (*Canis lupus*), Red Fox (*Vulpes vulpes*), Brown Bear (*Ursus arctos*), Wild Cat (Felis silvestris), European Roe Deer (Capreolus capreolus). Of these, the Brown Bear is protected locally (GRL, VU). Local population claims that these numerous Wild Boar (*Sus scrofa*) lived in these areas in recent past.

From amphibians are the following species: European Tree Frog (*Hyla arborea*), Marsh Frog (*Rana ridibunda*), Green Toad (*Bufo viridis*) and Long-legged Wood Frog (*Rana macrocnemis*). During Rapid Survey 2013 we encountered on the Southern Crested Newt (*Trtiturus karelinii*), which came out of water after breeding season.

Reptiles characteristic to these area include: Slow-worm (*Anguis fragilis*), Caspian Green Lizard (*Lacerta strigata*), Three-lined Lizard (*Lacerta media*) and Grass Snake (*Natrix natrix*). Derjugin's Lizard (*Darevskia derjugini*), which is internationally protected (IUCN, NT), is also reported to be spread on this section.

Numerous widely spread bird species nestle in these areas. These include: Short-toed Snake-eagle (*Circaetus gallicus*), Common buzzard (*Buteo buteo*), Eurasian Sparrowhawk (*Accipiter nisus*), Booted Eagle (*Aquila pennatus*), Eurasian Hobby (*Falco subbuteo*). Eurasian Nightjar (Caprimulgus europaeus), Great Spotted Woodpecker (*Dendrocopos major*), Owl (*Strix aluco*), Tree Pipit (*Anthus trivialis*), Common Redstart (*Phoenicurus phoenicurus*), Hedge Accentor (*Prunela modularis*), Wood Nuthatch (*Sitta europaea*), European Robin (*Erithacus rubecula*), Song Thrush (*Turdus philomelos*), Mistle Thrush (*Turdus viscivorus*), Eurasian blackbird (*Turdus merula*), Winter wren (*Troglodytes troglodytes*), Blackcap (Sylvia atricapilla), Common Chiffchaff (Phylloscopus collybita), Greenish Warbler (Phylloscopus trochiloides), Red-backed Shrike (*Lanius collurio*), great tit (*Parus maior*), coal tit (*Parus ater*), blue tit (*Parus caeruleus*), Eurasian Bullfinch (*Pyrrchula pirrchula*), Eurasian Jay (*Garrulus glandarius*). In meadows we often heard noise of Quail during the Rapid Survey.

During the Spring Survey (BRC, 2013), this section was encompassed by three observation points (Figure 6.2.12). At E7, which is in woody area about 1 km south from Ghordze Village, was counted fewest number of birds (82 birds, or 8.2 birds/hr) compared to other count points in the Samtskhe-Javakheti section of the route. This site was also distinguished due to high proportion of resident birds and low proportion of soaring/gliding specimen. The Autumn Survey (BRC, 2012) established one count point near the Mt. Shavshi-Tsveri on this section (Figure 6.2.13). Birds number was found low there.

According to these both surveys, birds flying height was mostly over 60 m. Only 10 to 20 per cent of birds were detected on 0-30 m and portion of birds below 60 m comprised 30%-40%.

Section 3: The OHL section from forest massif next to the Shavshi-Tsveri Mountain to so called Tetrobi summer farms located south to the Abanos-Keli Pass (AP36-AP39), 2100-2400 masl.

This section comprises extremely rugged slopes in the upper zone of the Arsiani Ridge, descending towards the Skhalta River basin. Elevation of the section varies between 2100-2400 m datum. Landscapes are presented by sub-alpine and alpine meadows, with rhododendron shrubbery at places. Coniferous forests grow at places. The territory is mainly used as summer pastures. Mountain slopes are often eroded due to complex relief and overgrasing (Figure 6.2.16, Figure 6.2.17).

Figure 6.2.16 Eroded slopes near the Tetrobi summer farms

Figure 6.2.17 Overgrazed meadow on the slope of the Ghrmani Mountain

These sub-alpine and alpine meadows provide habitats to various rodents including: Caucasian Mole (*Talpa caucasica*), Radde's Shrew (*Sorex caucasicus*), Lesser Shrew (*Crocidura gueldenstaedtii*), Common Vole (*Microtus arvalis*), Ground Vole (*Terricola majori*), Daghestan Pine Vole (*Terricola daghestanicus*), Robert's Snow Vole (*Chionomys roberti*), Least Weasel (*Mustela nivalis*).

In surroundings of Beshumi, at the intersection of Alternatives 2.1 and Alternative 2.2 we encountered on mounds of Nehring's Blind Mole Rat (*Nannospalax nehringi*) during the Rapid Survey 2013 (Figure 6.2.18). Coordinates of the site are 295789/4608159. This rodent is put on GRD, status VU.

Besides, on the main route, on 2115 m datum (coordinates 300451/4608206) we found a colony of section Long-clawed Mole Vole (*Prometheomys schaposchnikowi*) (Figure 6.2.19), which is protected locally (GRL, VU) and internationally (IUCN, NT).

Location of the Nehring's Blind Mole Rat and Long-clawed Mole Vole colonies are showed in 0.

Figure 6.2.18 Mounds of Nehring's Blind Mole Rat (*Nannospalax nehringi*)

Figure 6.2.19 Colony of Long-clawed Mole Vole (*Prometheomys schaposchnikowi*)

Among large mammals common for these areas are Gray Wolf (*Canis lupus*) and Red Fox (*Vulpes vulpes*). Brown Bear (*Ursus arctos*) is reported to visit this terrain in search of food during spring.

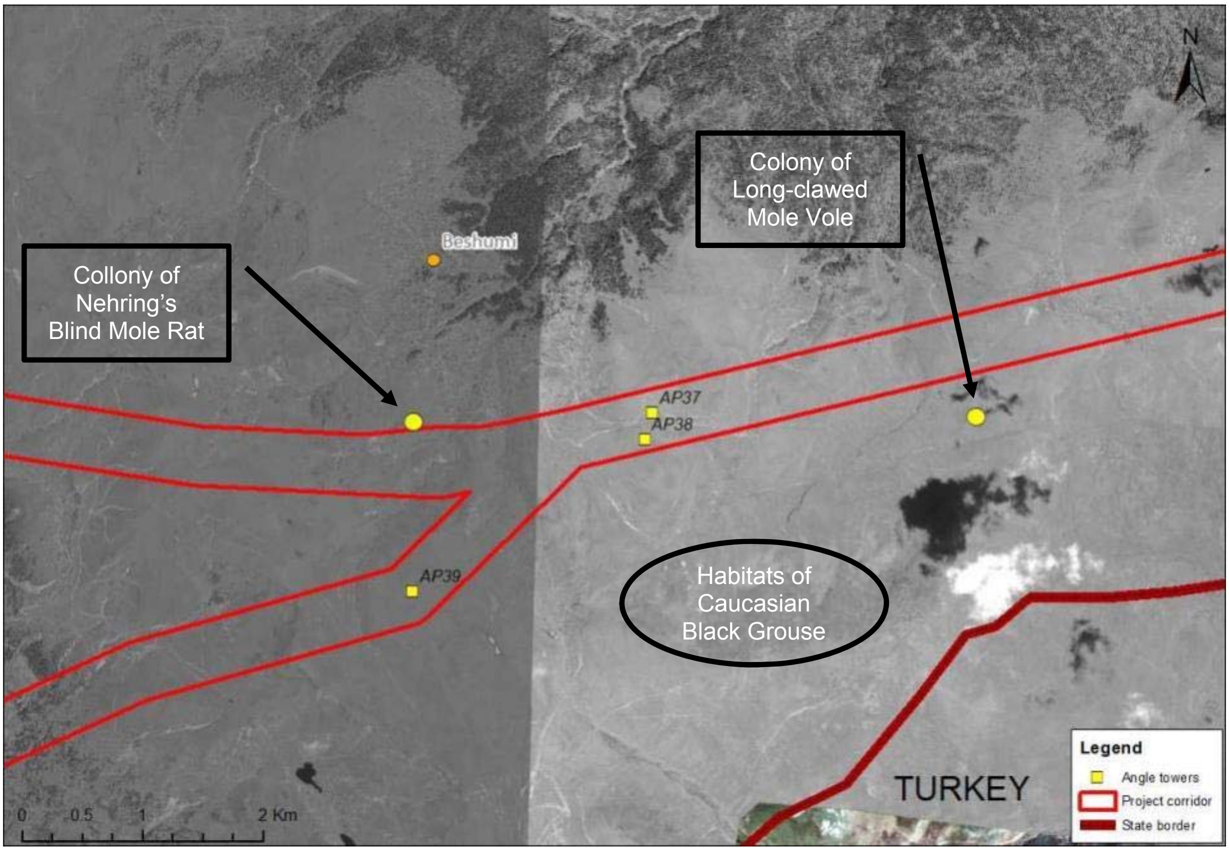
Reptiles are not so common for this section. However, during site visit we have encountered on lizard (Darevskia sp.), most probably Armenian Lizard (*Darevskia armeniaca*).

Among birds common are: Water Pipit (Anthus spinoletta), Eurasian Skylark (*Alauda arvensis*), Northern Wheatear (*Oenanthe oenanthe*) and Common Linnet (*Carduelis cannabina*). Of these most abundant are Water Pipit and Eurasian Skylark. Other bird species on this section see in Annex 2.

The north slopes of Mt. Grmani (Tlili), covered by rhododendron shrubbery, shelter Caucasian Black Grouse (*Tetrao mlocosiewiczi*), which is protected both locally (GRL, VU) and internationally (IUCN, NT). This habitat of the Grouse is in about 1-1.5 km south from the OHL route (0); however, during the seasonal migration this bird may also occur in the OHL corridor.

During the Rapid survey we often heard noises of Common Quail (*Coturnix corurnix*) from high grass meadows. Besides, we have detected one specimen of the Booted Eagle (*Aquila pennata*). The Spring and Autumn Surveys of birds did not encompass this section as it was not considered so important for migratory species.

Figure 6.2.20 Location of Nehring's blind mole rat's and Long-clawed mole vole's colonies near Beshumi



Section 4: The section between the Tetrobi summer farms to the midstream of the Skhalta River, near Pushrukauli Village (AP39-AP45).

This section spreads between 2300 masl and 950 masl. Climatic conditions change from cold mountain climate in upper zone to thermo-moderate and humid mountain climate in lower areas. Such a variation of physico-geographic conditions determines presence of several essentially different habitats. Sub-alpine and alpine meadows cover the beginning of the section in the range of 1900-2300 m datum. At lower elevations these are followed by coniferous forests alternating with rather waste mountain meadows presented by high grass habitats and small bogged patches (Figure 6.2.21). The lowest part of the section presents deep river gorge, which is covered by mixed forests. Among deciduous trees dominant are oak and hornbeam; other deciduous species include maple, lime tree, chestnut, etc. (Figure 6.2.22).

Figure 6.2.21 Meadow covered high grass at the edge of fir forest

Figure 6.2.22 Deciduous forest near Pushrukauli Village

Small mammals on these section are presented by: Southern White-breasted Hedgehog (*Erinaceus concolor*), Caucasian Mole (*Talpa caucasica*), Radde's Shrew (*Sorex raddei*), Caucasian Shrew (Sorex satunini), European Hare(*Lepus europaeus*), Eurasian Red Squirrel (*Sciurus vulgaris*), Forest Dormouse(*Driomys nitedula*), Common Vole (*Microtus arvalis*), Robert's Snow Vole (*Chionomys roberti*), Ground Vole (*Terricola majori*), Daghestan Pine Vole (*Terricola daghestanicus*), Steppe Field Mouse (*Sylvaemus fulvipectus*), European Pine Marten (*Martes martes*), Eurasian Badger (*Meles meles*), Wild Cat (*Felis silvestris*).

Besides, two bat species including Natterer's Bat (*Myotis nattereri*) and Common Pipistrelle (*Pipistrellus pipistrellus*) are recorded on this section. These are protected by EUROBATS.

From large mammals most common are Gray Wolf (*Canis lupus*) and Red Fox (*Vilpes vilpes*). European Roe Deer (*Capreolus capreolus*), Wild Boar (*Sus scrofa*) and Brown Bear (*Ursus arctos*) also could be found there, through more rarely.

Among amphibians could be found: Marsh Frog (*Rana ridibunda*), Long-legged Wood Frog (*Rana macrocnemys*), Green Toad (*Bufo viridis*) and Common Toad (*Bufo bufo verucosissima*), the later encounters at lower elevations.

Reptiles recorded on this section include: Smooth Snake (*Coronella austriaca*) and Grass Snake (*Natrix natrix*), Spiny-Tailed Lizard (*Darevscia rudis*), Red-Belied Lizard (*Darevskia parvula*) and Derjugin's Lizard (*Darevskia derjugini*), the later is internationally protected by IUCN Red List, under NT status.

Among birds there spread species characteristic to middle and upper mountain forest zones. These include: Booted Eagle (*Aquila pennatus*) (in upper zone of the forest), Common buzzard (*Buteo buteo*), Eurasian Sparrowhawk (*Accipiter nisus*), Northern Goshawk (*Accipiter gemtilis*), Tawny Owl (*Strix aluco*), Eurasian Nightjar (*Caprimulgus europaeus*), Common Cuckoo (*Cuculus canorus*), Black woodpecker (*Dryocopus martius*), Great Spotted Woodpecke (*Dendrocopos major*), Water Pipit (*Anthus spinoletta*), Tree Pipit (*Anthus trivialis*), Hedge Accentor (*Prunella modularis*), European Robin (*Erithacus rubecula*), Common Redstart (*Phoenicurus phoenicurus*), Mistle Thrush (*Turdus viscivorus*), Blackcap (*Silvia atricapilla*), Greenish Warbler (*Phylloscopus nitidus*), Winter wren (*Troglodytes troglodytes*), great tit (*Parus maior*), Goldcrest (*Regulus regulus*), Wood Nuthatch (*Sitta europaea*), Eurasian chaffinch (*Fringilla coelebs*), Eurasian Siskin(*Spinus spinus*), Eurasian Bullfinch (*Pyrrhula pyrrhula*).

Neither this section was comprised by the Spring or Autumn Bird Surveys in 2012 and 2013, as this OHL route option was developed later on. Besides, these territories were considered less important for migratory birds, like the pervious section.

Section 5: The OHL section within the gorge of the Skhalta River, between the Pushrukauli VIlage to Purtio bridge (the river mouth) (AP45-AP60).

This section of the Skhalta River is formed mostly by abrupt mountain slopes, which are covered with mixed forests (Figure 6.2.23). Small size agricultural lands encounter in floodplain zone of the river nearby settlements. The elevation of terrain is in the range of 550-950 masl. Climatic conditions vary from thermo moderate to humid mountain.

Southern White-breasted Hedgehog (*Erinaceus concolor*), Caucasian Mole (*Talpa caucasica*), Caucasian Shrew (Sorex satunini), European Hare (*Lepus europaeus*), Caucasian Squirrel (*Sciurus anomalus*), Eurasian Red Squirrel (*Sciurus vulgaris*), Edible Dormouse (Glis glis), Forest Dormouse(*Driomys nitedula*), Common Vole (*Microtus arvalis*), Robert's Snow Vole (*Chionomys roberti*), Ground Vole (*Terricola majori*), Daghestan Pine Vole(*Terricola daghestanicus*), Steppe Field Mouse (*Sylvaemus fulvipectus*), European Pine Marten (*Martes martes*), Stone Marten (*Martes foina*), Least Weasel (*Mustela nivalis*), Eurasian Badger (*Meles meles*), Wild Cat (*Felis silvestris*) are recorded there from small mammals.

From small mammals separately should be mentioned the Eurasian Otter (*Lutra lutra*), which founds helter on the river banks along this section. The Otter is protected in Georgia (VU) and internationally (IUCN, NT).

Presence of bat species in the forests on this section should be also highlighted. Bat species found there include the Lesser horseshoe (*Rhinolophus hipposideros*), Whiskered Bat (*Myotis mystacinus, M.aurascens),* Brandt's Bat (*M.brandti)* Common Pipistrelle (*Pipistrellus pipistrellus*) and Noctule (Nyctalus noctula), which are protected by EUROBATS.

Figure 6.2.23 The gorge of the Skhalta River near Tsipari Village

From large mammals there are found Jackal (*Canis aueus*), Gray Wolf (*Canis lupus*), Red Fox (*Vilpes vilpes*), Brown Bear (*Ursus arctos*), European Roe Deer (*Capreolus capreolus*) and Wild Boar (*Sus scrofa*).

Among amphibians there are spread: Marsh Frog (*Rana ridibunda*), Long-legged Wood Frog (Rana macrocnemys), Green Toad (*Bufo viridis*), Common Toad (*Bufo bufo verucosissima*) and European Tree Frog (*Hyla arborea*).

Reptiles are presented by five species including: Spiny-Tailed Lizard (*Darevskia rudis*), Red-Belied Lizard (*Darevskia parvula*), Smooth Snake (*Coronella austriaca*), Grass Snake (*Natrix natrix*), Derjugin's Lizard (*Darevskia derjugini*), the later of which is on the IUCN Red List (NT).

Bird species on this section include: Common buzzard (*Buteo buteo*), Eurasian Sparrowhawk (*Accipiter nisus*), Northern Goshawk (*Accipiter gemtilis*), Tawny Owl (*Strix aluco*), Boreal Owl (*Aegolius funereus*), Common Cuckoo (*Cuculus canorus*), Black woodpecker (*Dryocopus martius*), Great Spotted Woodpecker (*Dendrocopos major*), Middle Spotted Woodpecker (*Dendrocopos medius*), White-backed Woodpecker (Dendrocopos leucotos). Tree Pipit (*Anthus trivialis*), Hedge Accentor (*Prunella modularis*), European Robin (*Erithacus rubecula*), Common Redstart (*Phoenicurus phoenicurus*), Mistle Thrush (*Turdus viscivorus*), Song Thrush (*Turdus philomelos*), Eurasian blackbird (*Turdus merula*), Blackcap (*Silvia atricapilla*), Greenish Warbler (*Phylloscopus nitidus*), Winter wren(*Troglodytes troglodytes*), great tit (*Parus maior*), Coal Tit *(Parus ater*), Goldcrest (*Regulus regulus*), Wood Nuthatch (*Sitta europaea*), Eurasian chaffinch (*Fringilla coelebs*), Eurasian Siskin (*Spinus spinus*), Eurasian Bullfinch (*Pyrrhula pyrrhula*), Rock Bunting (*Emberiza cia*), Corn Bunting (*Miliaria calandra*). Similar to previous section, avian species are mostly adapted to forests. Diversity of avian fauna notably increases on migration season.

During the Spring Survey this section of the OHL route was assessed only rapidly. The given alternative was developed later on. Instead, Alternative 2.1 running little north to the preferred option was surveyed; though, only five observation points were selected in the central part of the route and limited observation time was devoted to them as it is considered less sensitive in terms of avian fauna. Location of the observation points is shown in Figure 6.2.24. Three points (C5, C6, C7) fall more or less close to this section. According to the Survey, number of birds on this section was lower than on other sections surveyed. Majority of birds were found flying at low heights, especially in C6 where number of low flying birds was over 90%. Bad weather conditions during the observation could be partly responsible for that. One count point of the Autumn Survey 2012 was established at the confluence of the Adjaristskali and Skhalta rivers, in the end part of this section (Figure 6.2.26). Intensity of birds was high during this survey; however, birds were found mostly flying over 60m.

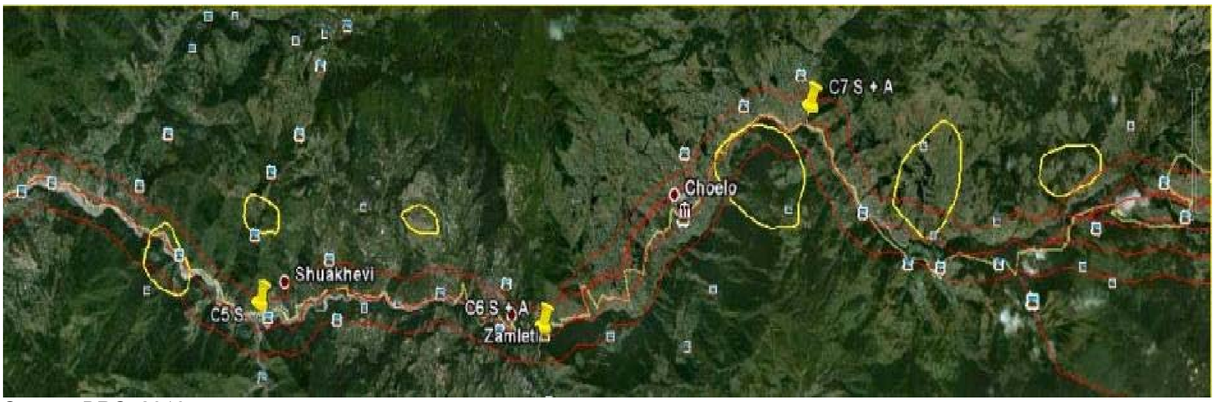
This section is presented by mostly local birds including raptors. Sites (cliffs) suitable for breeding of Griffon (*Gyps fulvus*), Egyptian Vulture (*Neophron percnopterus*), Golden Eagle (*Aquila chrysaetos*), Peregrine (*Falco peregrinus*) and Eagle Owl (*Bubo bubo*) and thus more sensitive were identified during the Spring Survey, through rapid examination of the area. They are shown in Figure 6.2.25. As the figure shows, these breeding areas are situated mostly north to the present route, in the

Adjaristskali valley. In contrast to this, large cliffs were not identified in Skhalta valley, where the OHL will be built.

Figure 6.2.24 The 5 selected sites surveyed in spring 2013 in the central section of the route

Source: BRC, 2013

Figure 6.2.25 Potential breeding cliffs in yellow marking



Source: BRC, 2013

Figure 6.2.26 The 8 selected sites surveyed in Autumn 2012 in the central section of the route

Section 6: The gorge of Adjaristskali River from Purtio bridge to the mouth of the Chorokhi River (AP60-AP142), 550-50 masl.

This is rather narrow gorge, surrounded by abrupt mountain slopes completely covered by dense forests (Figure 6.2.28). The mountain foothills, where the OHL corridor passes, are overgrown by deciduous forests with little admixture of coniferous trees. The OHL will mainly run in lower zone of the forested slopes. Relatively flat areas of the river gorge are occupied by settlements and their agricultural lands. The gorge is relatively wide at its end section and the river flows in branches.

Among small mammals there are recorded: Erinaceus concolor (*Erinaceus concolor*), Caucasian Mole(*Talpa caucasica*), Radde's Shrew (*Sorex raddei*), Caucasian Pygmy Shrew (*Sorex volnuchini*), Lesser Shrew (*Crocidura gueldenstaedti*), European Hare (*Lepus europaeus*), Caucasian Squirrel (Sciurus anomalus), Eurasian Red Squirrel (*Sciurus vulgaris*), Edible Dormouse (*Glis glis*), Forest Dormouse (*Driomys nitedula*), Common Vole (*Microtus arvalis*), Robert's Snow Vole (*Chionomys roberti*), Groun Vole (*Terricola majori*), Mouse (*Sylvaemus sp.*), House Rat (*Rattus rattus*), Stone Marten (*Martes foina*), Least Weasel (*Mustela nivalis*), European Pine Marten (*Martes martes*), Eurasian Badger (*Meles meles*). On this section is also recorded Eurasian Otter (*Lutra lutra*), which inhabits on river banks.

Bats on this section are even more diverse than in previous one. These include: Natterer's Bat (*Myotis nattereri*), Noctule (*Nyctalus noctula*), Lesser Noctule (*Nyctalus leisleri*), Serotine Bat (*Eptesicus serotinus*), Particoloured Bat (*Eptesicus serotinus*), Common Pipistrelle (*Pipistrellus pipistrellus*), Nathusius' Pipistrelle (*Pipistrellus nathusii*), Brown Big-eared Bat (*Plecotus auritus*), Burmese Whiskered Myotis (*Myotis mystacinus),* Brandt's Bat *(M.brandti), M.aurascens*), Lesser horseshoe (*Rhinolophus hipposideros*).

Among large mammals there spread: Jackal (*Canis aueus*), Gray Wolf(*Canis lupus*), Red Fox (*Vilpes vilpes*), Brown Bear (*Ursus arctos*), Wild Cat (*Felis silvestris*), Eurasian Lynx (Lynx lynx), European Roe Deer (*Capreolus capreolus*) and Wild Boar (*Sus scrofa*).

Amphibians are presented by: Marsh Frog (*Rana ridibunda*), Green Toad (*Bufo viridis*), Common Toad (*Bufo bufoverucosissima*) and European Tree Frog (*Hyla arborea*). Besides, Caucasian Salamander (*Mertensiella caucasica*) inhabits in small brooks.

Reptiles include: Derjugin's Lizard (*Darevskia derjugini*), Spiny-Tailed Lizard (*Darevscia rudis*), Red-Belied Lizard (*Darevskia parvula*), Smooth Snake (*Coronella austriaca*), Grass Snake (*Natrix natrix*), Tessellated Water Snake (*Natrix tessellata*), Dahl's Whip Snake (*Coluber najadum*) and Aesculapian Ratsnake (*Elaphe longissima*).

Among bird species commonly there could be found: Common buzzard (*Buteo buteo*), Eurasian Sparrowhawk (*Accipiter nisus*), Northern Goshawk (*Accipiter gemtilis*), Tawny Owl (*Strix aluco*), Boreal Owl (*Aegolius funereus*), Common Cuckoo (*Cuculus canorus*), Black woodpecker (*Dryocopus martius*), Great Spotted Woodpecker (*Dendrocopos major*), Middle Spotted Woodpecker (Dendrocopos medius), White-backed Woodpecker (Dendrocopos leucotos). Tree Pipit (*Anthus trivialis*), Hedge Accentor (*Prunella modularis*), European Robin (*Erithacus rubecula*), Common Redstart (*Phoenicurus phoenicurus*), Mistle Thrush (*Turdus viscivorus*), Song Thrush (*Turdus philomelos*), Eurasian blackbird (*Turdus merula*), Blackcap (*Silvia atricapilla*), Greenish Warbler (*Phylloscopus nitidus*), Winter wren (*Troglodytes troglodytes*), great tit (*Parus maior*), Coal Tit (*Parus ater*), Goldcrest (*Regulus regulus*), Wood Nuthatch (*Sitta europaea*), Eurasian chaffinch (*Fringilla coelebs*), Eurasian Siskin (*Spinus spinus*), Eurasian Bullfinch (*Pyrrhula pyrrhula*), Rock Bunting (*Emberiza cia*), Corn Bunting (*Miliaria calandra*).

The Bird Survey in 2013 comprised this section; however, as mentioned above, much effort was not made on its survey due to lower importance. In total five observation points (Figure 6.2.24) of the Survey, which were immediately on this section or its close proximity, could be used to for description of the situation. According to the Survey results, birds are fewer in the central part of the route than on other sections. Most birds (80 birds) were counted at C1, where their concentration comprised 20 birds/hr. Only about 15% of these were flying below 60m. Even fewer birds were detected at C2, where only 25 specimens were recorded, 6.25 birds/hr in average. Point C6 at the confluence of the Adjaristskali and Skhalta distinguished due to extremely high proportion of low flying birds: 70% of birds were recorded in 0-30 m range and 95% of birds below 60m. Total number of birds counted on this section was 231 specimen and their average concentration was 11.5 birds/hr. Their flying height was mostly lower and birds flying below 60 m comprised about 55%. In general, number of low flying birds was higher than on the eastern or western sections of the route. Observation in bad weather condition should be partly responsible for that.

During the Autumn Survey six count points were established on this route section (see Figure 6.2.26). Relatively high abundance of birds was recorded at the confluence of the Adjaristskali and Skhalta (count point River VP7) than during the Spring Study in this area. In addition, most birds (75%-95%) were flying over 60 m high, in contrast to the Spring Survey. On of reasons for such a divergence between these two studies on the given section could be different weather conditions: as mentioned, Spring Survey investigated this area only in bad weather conditions, when birds mostly fly low and their number could be lower as well.

Together with bird count, the Survey 2013 included identification of breeding habitats of local raptors. Several sites on mountain ridges were considered to be suitable for breeding of Griffon (*Gyps fulvus*), Egyptian Vulture (*Neophron percnopterus*), Golden Eagle (*Aquila chrysaetos*), Peregrine (*Falco peregrinus*) and Eagle Owl (*Bubo bubo*). These areas are shown in Figure 6.2.25 and Figure 6.2.27.

Figure 6.2.27 Potential breeding cliffs in yellow marking

Section 7: The OHL section from the mouth of the Adjaristskali River to the Khelvachauri Sub-Station, surroundings of the villages of Erge and Jocho (AP142-Ap160), datum 20-400m.

Partly terraced mountain slopes are used for growing of citruses and other sub-tropical plants. Therefore major part of wildlife habitats is modified to different level. Natural habitats comprising oak-hornbeam forests with admixture of chestnut and box trees are preserved over small areas along the Jocho River and its tributaries (Figure 6.2.14). This area is on a well-known migration route of birds.

Figure 6.2.28 Midstream of the Adjaristskali River

Figure 6.2.29 Panorama from Jocho Village towards Khelvachauri

Small mammals are presented by: Erinaceus concolor (*Erinaceus concolor*), Caucasian Mole (*Talpa caucasica*), Levantine Mole (*Talpa levantis*), Radde's Shrew (*Sorex raddei*), Transcaucasian Water Shrew (*Neomys teres*), Lesser Shrew (*Crocidura gueldenstaedti*), European Hare (*Lepus europaeus*), Caucasian Squirrel (Sciurus anomalus), Forest Dormouse (*Driomys nitedula*), European Water Vole (*Arvicola terrestris*), Robert's Snow Vole (*Chionomys roberti*), Ground Vole (*Terricola majori*), Mouse (*Sylvaemus sp.*), House Rat (*Rattus rattus*), Brown Rat (*Rattus norvegicus*), Eurasian Badger (*Meles*

meles), Least Weasel (*Mustela nivalis*). Presence of Eurasian Otter (*Lutra lutra*) makes sensitive river banks.

Large mammal species are rather few on this section, due to anthropogenic load. They are mostly presented by Jackal (*Canis aueus*) and Red Fox (*Vilpes vilpes*).

Natterer's Bat (*Myotis nattereri*), Greater Horseshoe Bat (*Rhinolophus ferrumequinum*), Lesser Horseshoe Bat (*Rhinolophus hipposideros*), Lesser Mouse-eared bat (*Myotis blythii*), Natterer's Bat (*Myotis nattereri*), Noctule (*Nyctalus noctula*), Lesser Noctule (*Nyctalus leisleri*), Common Pipistrelle (*Pipistrellus pipistrellus*), Nathusius' Pipistrelle (*Pipistrellus nathusii*), Particoloured Bat (*Vespertilio murinus*).

Among amphibians common are: Marsh Frog (*Rana ridibunda*), Green Toad (*Bufo viridis*), Common Toad (*Bufo bufoverucosissima*) and European Tree Frog (*Hyla arborea*). Besides, Caucasian Salamander (*Mertensiella caucasica*) is found in small tributaries of Jochostskali River.

Wide spread reptiles are presented by: Spiny-Tailed Lizard (*Darevscia rudis*), Red-Belied Lizard (*Darevskia parvula*), Smooth Snake (*Coronella austriaca*) and Grass Snake (*Natrix natrix*), Tessellated Water Snake (*Natrix tessellata*) and Dahl's Whip Snake (*Coluber najadum*). Besides, there is found Caucasian Viper (Vipera kaznakovi) (IUCN EN, GRL EN). There is high likelihood to encounter on Clarks' Lizard (*Darevskia clarkorum*) (IUCN EN, GRL EN), which is reported to be found on Mt. Mtirala and in surroundings of Charnali Village.

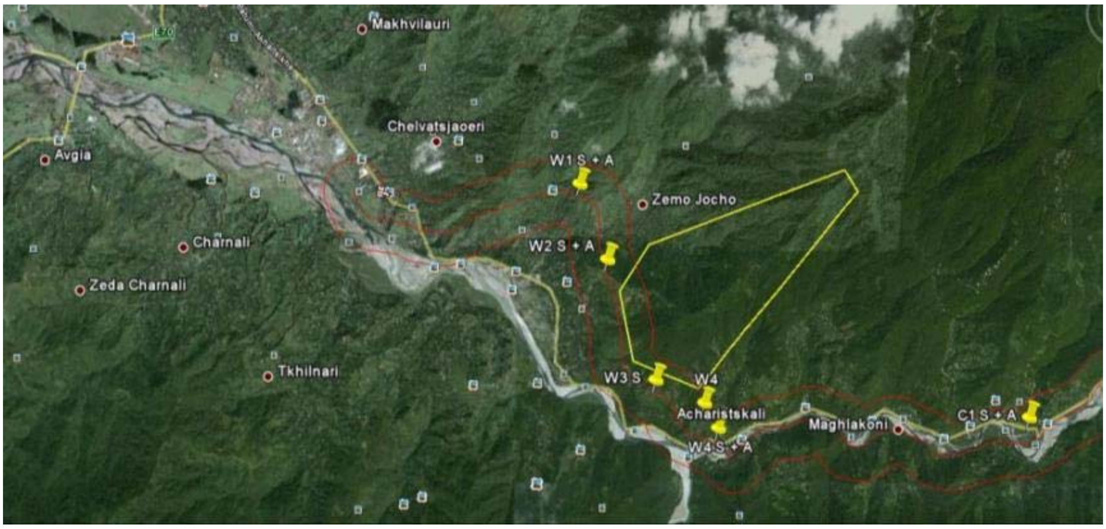
Among birds common are: Common buzzard (*Buteo buteo*), Eurasian Sparrowhawk (*Accipiter nisus*), Common Cuckoo (*Cuculus canorus*), Eurasian Green Woodpecker (Picus viridis), Great Spotted Woodpecker (*Dendrocopos major*). European Robin (*Erithacus rubecula*), Common Redstart (*Phoenicurus phoenicurus*), Song Thrush (*Turdus philomelos*), Eurasian blackbird (*Turdus merula*), Blackcap (*Silvia atricapilla*), Greenish Warbler (*Phylloscopus nitidus*), Spotted Flycatcher (*Muscicapa striata*) Red-breasted Flycatcher(Ficedula parva), Winter wren (*Troglodytes troglodytes*), great tit (*Parus maior*), Blue Tit (*Parus caeruleus*), Wood Nuthatch (*Sitta europaea*), Eurasian chaffinch (*Fringilla coelebs*), house sparrow (Passer domesticus).

The Spring Survey 2013 devoted particular attention to this section as it is a part of Batumi bottleneck. Four observation points were established for this only about 9 km long section of the route and total observation time comprised 80 hours. The observation points are given in Figure 6.2.30. Counts were made during various weather conditions.

In total around 15,000 birds were counted on this section, which is much higher than in other two sectors. Their average concentration comprised 186 birds/hr. The highest bird number was counted at W3 (4,617 birds, or 213 birds/hr); around 4,500 birds were counted in neighbouring W4. The observation point W4 also was distinguished due to low flying birds, where about 45% of birds flied below 60 m and about 40% in the range of 0-30 m. Figure 6.2.30 shows the ridge where birds fly at low elevation (yellow polygon).

Three observation point were established on this section during the Autumn Survey 2012; these are shown in Figure 6.2.31. This survey also found higher intensity of birds on this, despite the fact that migration periods of the Honey Buzzard (*Pernis apivoru*), which is the most abundant migrant species in the autumn in this area (Verhelst et al, 2011), was not comprised by the survey. Flight height of 45% birds was found below 60 m at Raptor VP2, though in other two points low flying birds did not exceed 10%. Still it could be said that environs at the confluence of the Adjaristskali and Skhalta are high risks areas in terms of avian fauna.

Figure 6.2.30 The 4 selected sites surveyed in spring 2013 near the Adjarstskali-Chorokhi confluence. The yellow polygon marks the ridge where birds fly at low elevation



Source: BRC, 2013

Figure 6.2.31 The 3 selected sites surveyed in Autumn 2013 near the Adjarstskali-Chorokhi confluence

6.2.4 Protected Animal Species in Project Corridor

Table 6.2.1gives complete list of animal species which are protected by the Georgian Red List and/or IUCN Red List. Their protection status is also provided. Occurrence of these species within the OHL corridor is provided throughout the text in the section above. Besides, these sensitive sites are summarized in the following section.

Table 6.2.1List of protected animal species and their conservation status

№	Name			Protection Status	
	Latin	Georgian	English	Georgian Red List	IUCN Red List
			Mammalia		
1	*Lutra lutra*	წავი	Common Otter	VU	NT
2	*Ursus arctos*	მურა დათვი	Brown Bear	VU	
3	*Lynx lynx*	ფოცხვერი	European Lynx	VU	
4	*Sciurus anomalus*	კავკასიური ციყვი	Caucasian squirrel	VU	
5	*Nannospalax nehringi*	ნერინგის ბრუცა	Nehring's Bland Mole Rat	VU	DD
6	*Prometheomys schaposchnikowi*	პრომეთეს მემინდვრია	Long-claved mole-vole	VU	NT
7	Mesocricetus brandti	ამიერკავკასიური მემინდვრია	Brandt's Hamster	VU	NT
			Avian		
8	*Neophron percnopterus*	ფასკუნჯი	Egyptian Vulture	VU	EN
9	*Aquila chrysaetus*	მთის არწივი	Golden Eagle	VU	
10	*Aquila heliaca*	ბეგობის არწივი	Imperial Eagle	VU	VU
11	*Aquila clanga*	მყივანი არწივი	Spotted Eagle	VU	VU
13	*Accipiter brevipes*	ქორცქვიტა	Levant Sparrow hawk	VU	
15	*Falco cherrug*	გავაზი	Saker Falcon	CR	
16	*Falco vespertinus*	თვალშავი	Red-footed Falcon	EN	
17	*Buteo rufinus*	ველის კაკაჩა	Long-legged Buzzard	VU	
18	*Aegolius funereus*	ბუკიოტი	Tengmalm's Owl	VU	
19	*Tadorna ferruginea*	წითელი იხვი	Ruddy Shelduck	EN	
20	*Circus macrourus*	ველის ძელქორი	Pallid Harrier		NT
21	*Tetrao mlocosiewiczi*	კავკასიური როჭო	Caucasian Black Grouse	VU	NT
			Reptiles		
22	*Darevskia clarkorum*	თურქული ხვლიკი	Clark's Lizard	EN	EN

23	*Vipera kaznakovi*	კავკასიური გველგესლა	Caucasian viper	EN	EN
24	*Darevskia derjugini*	დერიუგინის ხვლიკი	Derjugin's Lizard		NT
Amphibian					
25	*Mertensiella caucasica*	კავკასიური სალამანდრა	Caucasian salamander	VU	VU

In 2001 Georgia joined the Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA). The agreement protects all waterfowl in the country. Such birds are not abundant along the corridor, though still occur there. These are mostly migrant species, which exception of Little Ringed Plover (*Charadrius dubius),* Common Sandpiper *(Actitis hypoleucos),* Green Sandpiper (*Tringa ochropus*) and Gull (*Larus sp.*). Eurasian Marsh Harrier, which is native for most of Georgia, is visitor for the project area. Table 6.2.2 provides there list. Neither of these species is endangered in Georgia or worldwide.

Table 6.2.2List of AEWA species

№	Latin Name	Georgian Name	English Name
1	*Tachybaptus ruficollis*	მცირე მურტალა	Little Grebe
2	*Pelecanus crispus*	ხუჭუჭა ვარხვი	Dalmatian Pelican
3	*Nycticorax nycticorax*	ღამის ყანჩა	Black-crowned Night Heron
4	*Ardeola ralloides*	ყვითელი ყანჩა	Scuacco Heron
5	*Bubulcus ibis*	ეგვიპტური ყანჩა	Cattle Egret
6	*Casmerodius albus*	დიდი თეთრი ყანჩა	Great White Egret
7	*Egretta garzetta*	პატარა ოყარი	Little Egret
8	*Ardea purpurea*	წითური ყანჩა	Purple Heron
9	*Anser fabalis*	მეკალოე ბატი	Bean Goose
10	*Anser anser*	რუხი ბატი	Greylag Goose
11	*Tadorna ferruginea*	წითელი იხვი	Ruddy Shelduck
12	*Tadorna tadorna*	ამლაყი იხვი	Common Shelduck
13	*Anas penelope*	თეთრშუბლა იხვი	Eurasian Wigeon
14	*Anas strepera*	რუხი იხვი	Gadwall
15	*Anas platyrhinchos*	გარეული იხვი	Mallard
16	*Milvus migrans*	ძერა	Black Kite
17	*Circus aeruginosus*	ჭაობის ბოლობეჭედა	Eurasian Marsh Harrier
18	*Porzana porzana*	ქათამურა	Spotted Crake
19	*Crex crex*	ღალღა	Corncrake

20	*Charadrius dubius*	მცირე წინტალა	Little Ringed Plover
21	*Gallinago gallinago*	ჩიბუხა	Common Snipe
22	*Tringa ochropus*	შავი ჭოვილო	Green Sandpiper
23	*Actitis hypoleucos*	მებორნე	Common Sandpiper
24	*Larus ridibundus*	ჩვეულევრივი თოლია	Black-headed Gull
25	*Larus genei*	წვრილნისკარტა თოლია	Slender-billed Gull
26	*Larus armenicus*	სომხური თოლია	Armenian Gull
27	*Larus cacchinans*	ყვითელფეხა თოლია	Yellow-legged Gull

Georgia is also a party to the Agreement on the Conservation of European Bats (EUROBATS). Respectively, the country is liable to protect all bat species spread there. Table 6.2.3 provides the list of bats recorded within or in close proximity to the project corridor.

Table 6.2.3List of EUROPATS species

№	Latin Name	Georgian Name	English Name
1	*Rhinolophus ferrumequinum*	დიდი ცხვირნალა	Greater horseshoe
2	*Rhinolophus hipposideros*	მცირე ცხვირნალა	Lesser horseshoe
3	*Eptesicus serotinus*	მეგვიანე ღამურა	Serotine bat
4	*Myotis bechsteinii*	ბეხშტეინის მღამიობი	Bechsteinii's bat
5	*Myotis blythii*	წვეტყურა მღამიობი	Lesser mouse-eared bat
6	*Myotis mystacinus*	ულვაშა მღამიობი	Whiskered bat
7	*Myotis brandti*	ბრანდტის მღამორი	Brandt's bat
8	*Myotis emarginatus*	სამფერი მღამორი	Goffroy's bat
9	*Nyctalus noctula*	წითური მეღამურა	Common noctule
10	*Nyctalus leisleri*	მცირე მეღამურა	Lesser noctule
11	*Pipistrellus kuhlii*	ხმელთაშუაზღვისეული ღამურა	Kuhlii's pipistrelle
12	*Pipistrellus nathusii*	ნათუზისეული ღამურა	Nathusii's pipistrelle
13	*Pipistrellus pipistrellus*	ჯუჯა ღამორი	Common pipistrelle
14	*Barbastella barbastellus*	ევროპული მაჩქათელა	Barbastella's bat
15	*Plecotus auritus*	მურა ყურა	Common long-eared bat
16	*Vespertilio murinus*	ჩვ. ღამურა	Common bat

6.2.5 Summary of Wildlife Sensitivities

The desk study and field surveys implemented for the project showed that though major section of the project corridor has undergone anthropogenic impact, some sites are rather sensitive in terms of wildlife due to presence of protected species and/or due to abundance and high diversity of animal species. These sensitivities include:

For Section 1: The OHL corridor between the Zikilia Village (sub-station site) and the crossing of the Kvabliani River (Ghordze Village) (AP1-AP30)

- Cliffs and open spaces from the Akhaltsikhe Sub-Station up to Akhaltsikhe City are highly sensitive as relatively high number of some raptors (Lesser Spotted Eagle (*Aquila pomarina*), Booted Eagle (*Hieraaetus pennatus*), Golden Eagle (*Aquila chrysaetos*), Egyptian Vulture (*Neophron percnopterus*) and Harriers (Pallid and Montagu's)) were recorded during Spring Survey 2013 and Autumn Survey 2012, and flying height of birds was rather low on this section. Of these relatively abundant spices Egyptian Vulture, Pallid Harrier and Golden Eagle are protected nationally and/or internationally. Among protected raptors recorded on this territory is also Imperial Eagle (*Aquila heliaca*). Flying height of these birds were found mostly below 60 m on this site, what makes them vulnerable for the project.

For Section 2: The OHL corridor from the crossing of the Kvabliani River to the northern slopes of the Shavshi-Tsveri Mountain, near Ghordze Village (AP31-AP36)

- Crossing of the Potskhovi River is relatively sensitive as high number of low flying birds (mostly associated with river) was recorded at this site during Spring Survey 2013.
- End part of this section near Ghordze Village, which is presented by woodlands, is relatively sensitive as shelter higher number of animal species including Brown Bear (*Ursus arctos*), Georgian and IUCN red list species
- Environs of the Mt. Sjavshi-Tsveri are also relatively sensitive as high number of low flying birds was recorded there; though birds number itself was low.

For Section 3: The OHL section from forest massif next to the Shavshi-Tsveri Mountain to so called Tetrobi summer farms located south to the Abanos-Keli Pass (AP36-AP39), 2100-2400 masl.

- The OHL section close to Beshumi is highly sensitive as:
  - Colonies of the Nehring's Blind Mole Rat and Long-clawed Mole Vole were found within and or close proximity of the route.
  - Area ca. 1.5 south from AP37 is a habitat of the Caucasian Black Grouse, which may enter the project corridor during migration.
- The entire section is relatively sensitive as rocks and woods shelter abundant raptors (Golden Eagle (*Aquila chrysaetos*), Booted Eagle (*Aquila pennatus*), Steppe Buzzard (*Buteo buteo*)) and migrant raptors (Imperial Eagle (*Aquila heliaca*), Lesser Spotted Eagle (*Aquila pomarina*), Spotted Eagle (*Aquila clanga*)) also visit these territories. Besides, Brown Bear (Ursus arctos) visits this area in springs.

For Section 4: The section between the Tetrobi summer farms to the midstream of the Skhalta River, near Pushrukauli Village (AP39-AP45).

- This section is rather sensitive due to abundance of animal species. Among them are protected species including: Brown Bear (*Ursus arctos*), bats (Natterer's Bat (*Myotis nattereri*) and Common Pipistrelle (*Pipistrellus pipistrellus*)) and Derjugin's Lizard (*Darevskia derjugini*).

For Section 5: The OHL section within the gorge of the Skhalta River, between the Pushrukauli VIlage to Purtio bridge (the river mouth) (AP45-AP60).

- High diversity of animal species which find habitats in well-preserved forests make this section sensitive. Among protected species are recorded: Brown Bear (*Ursus arctos*), Eurasian Otter

(*Lutra lutra*) making sensitive river banks, Derjugin's Lizard (*Darevskia derjugini*) and various bats (Lesser horseshoe (*Rhinolophus hipposideros*), Whiskered Bat (*Myotis mystacinus, M.aurascens),* Brandt's Bat (*M.brandti)* Common Pipistrelle (*Pipistrellus pipistrellus*) and Noctule (Nyctalus noctula)).

- Relatively rare cliffs provide shelter to native raptors. Number of birds is relatively low on this section, however they were found flying low in most cases, what makes them vulnerable to the project.

For Section 6: The gorge of Adjaristskali River from Purtio bridge to the mouth of the Chorokhi River (AP60-AP142), 550-50 masl.

- Due to woody areas this section is characterized by high wildlife diversity. Among protected species there are recorded: Boreal Owl (Aegolius funereus), Brown Bear (*Ursus arctos*), numerous bats (Natterer's Bat (*Myotis nattereri*), Noctule (*Nyctalus noctula*), Lesser Noctule (*Nyctalus leisleri*), Serotine Bat (*Eptesicus serotinus*), Particoloured Bat (*Eptesicus serotinus*), Common Pipistrelle (*Pipistrellus pipistrellus*), Nathusius' Pipistrelle (*Pipistrellus nathusii*), etc), Derjugin's Lizard (*Darevskia derjugini*). Eurasian Otter (*Lutra lutra*) and Caucasian Salamander (*Mertensiella caucasica*) make sensitive river banks and small brooks.
- Forest in surroundings of Chvana River mouth and Chalakhmela Village are rather well preserved and should be considered as high sensitive.

For Section 7: The OHL section from the mouth of the Adjaristskali River to the Khelvachauri Sub-Station, surroundings of the villages of Erge and Jocho (AP142-Ap160), datum 20-400m.

- This section is a part of well-known Batumi bottleneck, which is important area for migrant raptors. High number of migratory raptors is recorded throughout the section.
- The confluence of Chorokhi and Adjaristskali Rivers is highly sensitive as very high number of birds is recorded there.
- The mountain ridge north to the confluence is also highly sensitive as many birds fly at low heights (<60m) there.
- Eurasian Otter (*Lutra lutra*) and Caucasian Salamander (*Mertensiella caucasica*) are recorded on this section, what makes river banks and brooks sensitive areas.
- This section is distinguee due to abundance of bat species.
- Among protected reptiles there are recorded Caucasian Viper (Vipera kaznakovi) and Clarks' Lizard (*Darevskia clarkorum).*

Figure 6.2.32-Figure 6.2.34 represents wildlife sensitivity maps for the project corridor, which show spatial distribution of the above listed sensitivities along the OHL ROW.

Figure 6.2.32 Wildlife sensitivity map for the OHL corridor

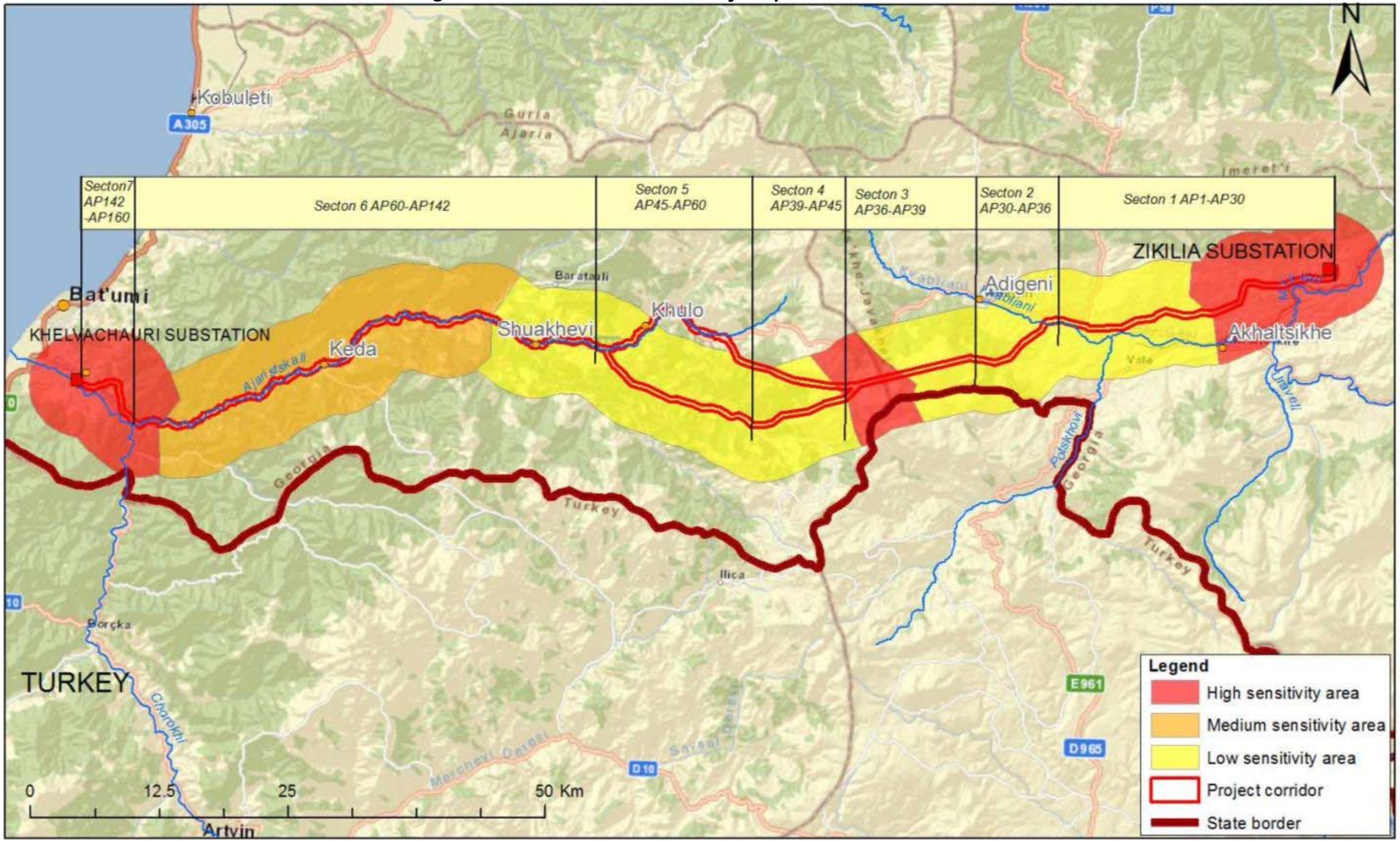


Figure 6.2.33 Wildlife sensitivity map and fauna sensitivities for the eastern section of the OHL corridor

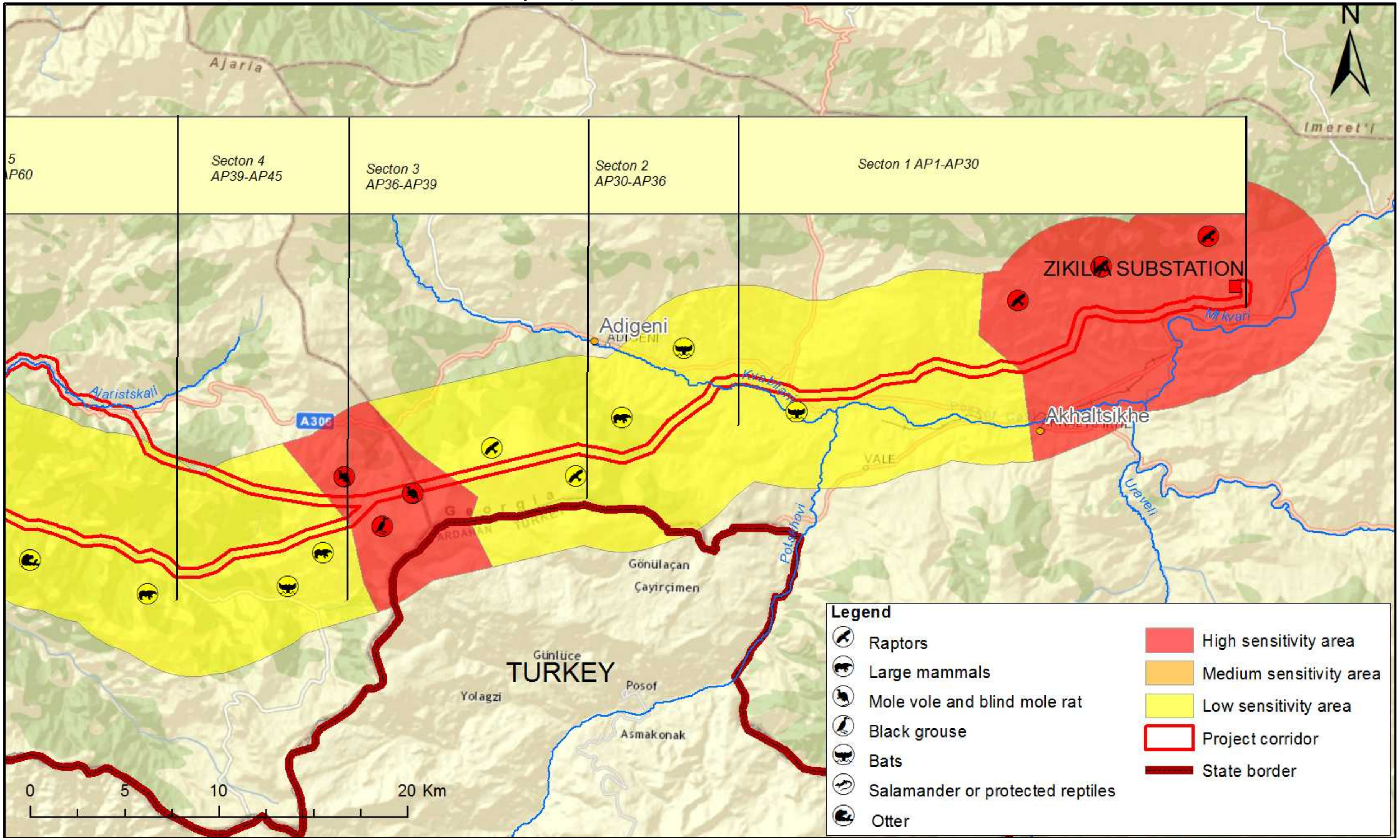
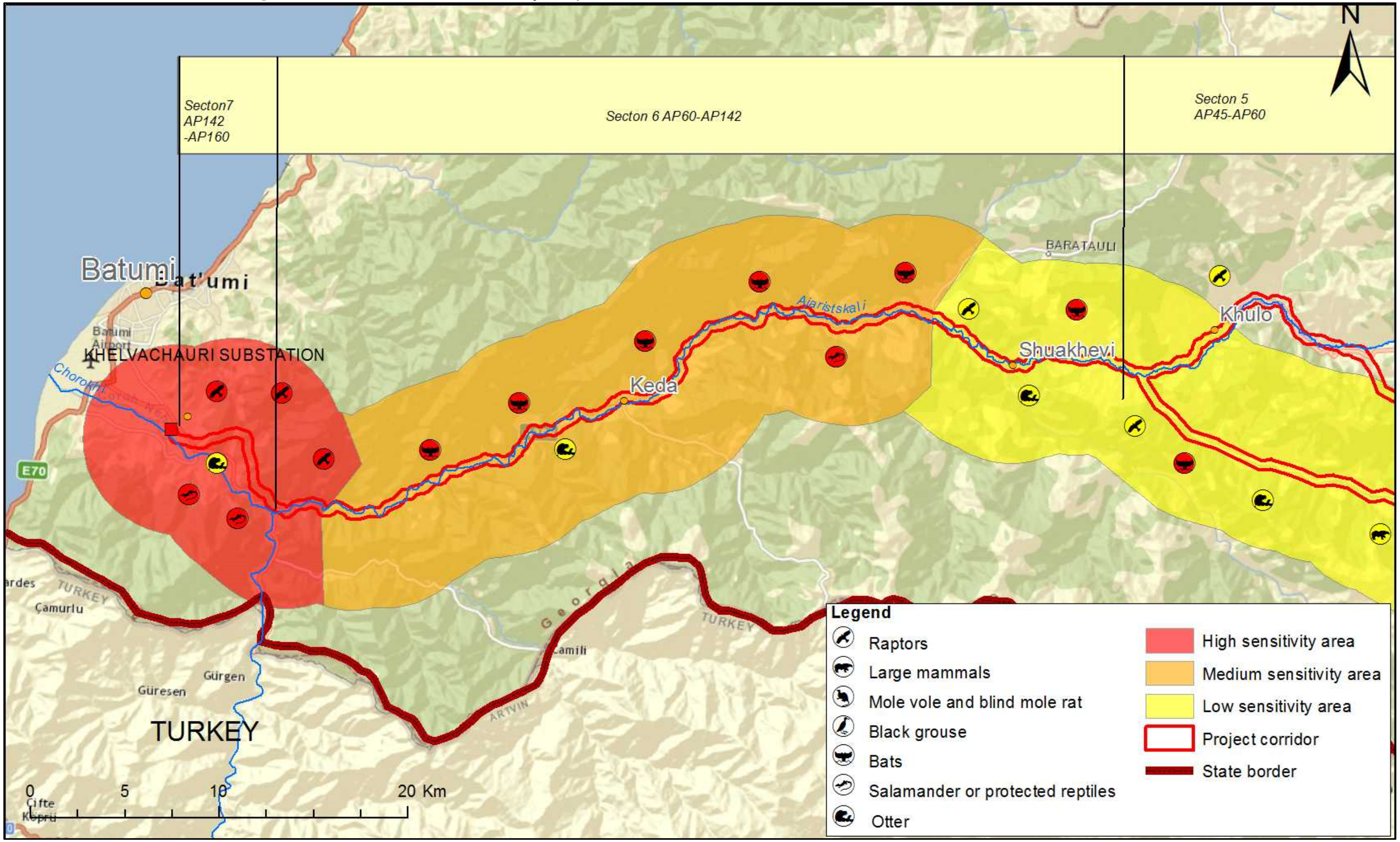


Figure 6.2.34 Wildlife sensitivity map and fauna sensitivities for the wester section of the OHL corridor



6.3 Socio-Economic Environment

6.3.1 Introduction

The present section describes socio-economic baseline for the Batumi-Akhaltsikhe 220kV Power Transmission Line Project. Major part of the baseline is based desk review of open source statistical data and various publications, though small scale survey of potentially affected communities (PAC) have been also conducted for the project to draw up their specific socio-economic profile. Besides, rather comprehensive field survey of cultural heritage was implemented for the entire project corridor.

Various socio-economic issues such as demography, economics, industry, agriculture, education, employment, social protection, health care, land use and ownership, cultural heritage and other features are described on various scales including regional, municipal and PAC level. Major data sources used for regional and municipal level information include:

1. General Census of Georgian Population 2002, voll. I-IV, State Department for Statistics of Georgia, Tbilisi, 2003;
2. Agriculture Census of Georgia 2004, Department for Statistics of the Ministry of Economic Development of Georgia, Tbilisi, 2005;
3. Description of rural infrastructure, foundation –Millennium Challenge Account Georgia, Geostat, 2011;
4. Statistical data provided on the official web-site of the National Statistics Office of Georgia (www.geostat.ge)
5. Samtskhe-Javakheti development strategy 2014-2021, Government of Georgia.

Data obtained from these sources are not always up-to-date; however, they are the most recent available for the moment of the report writing. The following sections provide detailed description of the project's social-economic baseline.

6.3.2 General Overview of Project Region

The OHL project covers two regions of Georgia: Samtskhe-Javakheti Region which is in the south-east Georgia and Adjara Region in the south-west part of the country. Major part of the OHL will be comprised on Adjara territory. Socio-economic features of these regions notably differ from each other in terms of and social structures, economic development, availability of public infrastructure, agricultural lands and other resources.

Samtskhe-Javakheti Region

The Samtskhe-Javakheti Region comprises six municipalities including Adigeni, Akhaltsikhe, Akhalkalaki, Aspindza, Borjomi and Ninotsminda, of which the project corridor crosses only Akhaltsikhe and Adigeni Municipalities. This is a mountainous region, with 6,400 km^2 total area, which is about 9.2% of the country area (69,700 km2). Total population of the region is around 213 thousand people and average population density is 32 people/km^2. Approximately 32-35% of population lives in cities. Akhaltsikhe City is the regional centre.

Akhaltsikhe Municipality, where the OHL will be connected to the Sub-Station, spreads over 1010 km2 and around 48,400 people live there. Average population density in the municipality is 48 people/km2, which is higher than average regional index, because terrain and climatic conditions are more favourable for living, and economic activities are more focused around the regional centre; however, this is still lower than average index of the country (64 people/km2).

Adigeni Municipality is smaller both in land area and population. Total area of the municipality is about 800 km2. Its population is 20.8 thousand people, or 26 people/km2 in average.

Adjara Region

Adjara Region (the autonomous republic) comprises the municipalities of Khulo, Keda, Kobuleti, Khelvachauri and Shuakhevi, and self-governing city of Batumi, which is the administrative centre of the autonomous republic. The total area of Adjara Region is 2,900 km^2 and population is 394 thousand people. Average population density for the region is 136 people/km2, which is twice higher when the country wide index (64 people/km2). However, population is extremely unevenly distributed in the region and about half of these people live in Batumi City.

The proposed transmission line will cross all municipalities of Adjara, excluding Kobuleti. Among these the largest territory (710 km2, or about 24% of the region) occupies Khulo Municipality and smallest area is under the Khelvachauri administration. However, highest number and concentration of people distinguishes Khelvachauri from other municipalities of interest.

The project regions and municipalities crossed by the OHL are presented in Figure 6.3.1 Figure 6.3.3and Figure 6.3.3.

Figure 6.3.1 Municipalities Samtskhe-Javakheti Region

Figure 6.3.2 Municipalities Adjara Region

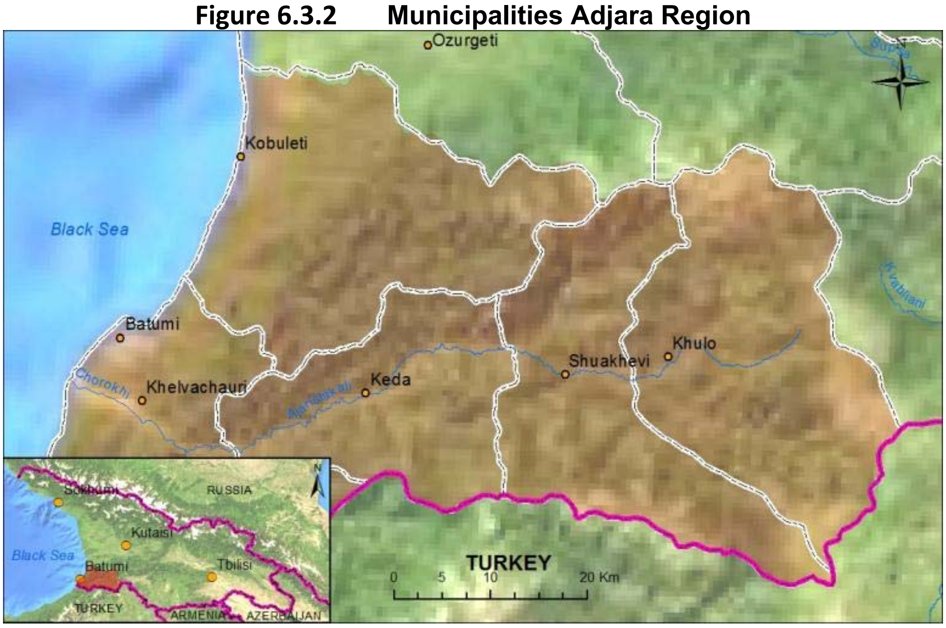


Figure 6.3.3 Project affected municipalities and RoW of transmission line

6.3.3 Demography

This section is mainly based on the statistical data gained from the National Statistics Office of Georgia (NSOG). Presented data are as resent as available.

The Project Affected areas are situated in the territory of 6 municipalities including Keda, Shuakhevi, Khelvachauri and Khulo in Adjara, and Akhaltsikhe and Adigeni in Samtskhe-Javakheti. The population distribution by the project regions and municipalities are presented in Table 6.3.1. According to these figures, 9% and 5% of Georgian population live in Adjara and Samtskhe-Javakheti regions respectively. One major difference between Adjara and Samtskhe-Javakheti Region is ethnic composition. Population in Adjara is mostly ethnic Georgian (98%), whilst Armenians create rather large community in Samtskhe-Javakheti, where they are concentrated in Akhaltsikhe, Ninotsminda and Akhalkalaki Municipalities.

Diagrams in Figure 6.3.4 and Figure 6.3.5 give visual representation of population distribution between municipalities in Adjara and Samtskhe-Javakheti Regions. Figure 6.3.4 clearly demonstrates concentration of major part of Adjara people (41%) in Batumi City, which is the regional centre and at the same time concentrates most economic activities.

It should be noted that living conditions in mountainous areas of Adjara are rather challenging and many people have migrated to Batumi in search of income. Besides, wide-spread natural disasters (mostly landslides) in Adjara uplands are often the reason for migration from Khulo and Keda Municipalities. In most cases ecomigrants moved either to Samtskhe-Javakheti region or within Adjara. However, the provided data do not show any significant re-distribution of population within the regions during the given period. Only exception is Batumi and Khelvachauri, where recent change of administrative borders significantly impacted the picture.

Table 6.3.1 Population of Adjara and Samtskhe-Javakheti for last decade

Territorial Unit	**Population by Municipalities**				**Growth Rate per Period**
	2003, thousand	**% of Regional**	**2013, thousand**	**% of Regional**	
GEORGIA	**4,342.6**		**4483.8**		3%
Adjara region	**373.3**		**394.2**		6%
Batumi City	121.0	32%	160.0[1]	41%	32%
Keda Municipality	19.6	5%	20.5	5%	5%
Kobuleti Municipality	87.4	23%	92.9	24%	6%
Shuakhevi Municipality	21.6	6%	22.8	6%	6%
Khelvachauri Municipality	90.2	24%	62.1[1]	16%	-31%
Khulo Municipality	33.2	9%	35.9	9%	8%
Samtskhe-Javakheti	**206.2**		**213.5**		4%
Adigeni Municipality	20.7	10%	20.8	10%	0%
Aspindza Municipality	12.9	6%	13.2	6%	2%
Akhalkalaki Municipality	60.5	29%	64.8	30%	7%

[1] Significant difference between 2012 and 2013 is conditioned by the changes of administrative borders of Batumi City and Khelvachauri Municipality

Territorial Unit	Population by Municipalities				Growth Rate per Period
	2003, thousand	% of Regional	2013, thousand	% of Regional	
Akhaltsikhe Municipality	45.8	22%	48.4	23%	6%
Borjomi Municipality	32.2	16%	31.5	15%	-2%
Ninotsminda Municipality	34.1	17%	34.8	16%	2%

Source: National Statistics Office of Georgia

Figure 6.3.4 Population distribution at Adjara autonomous republic

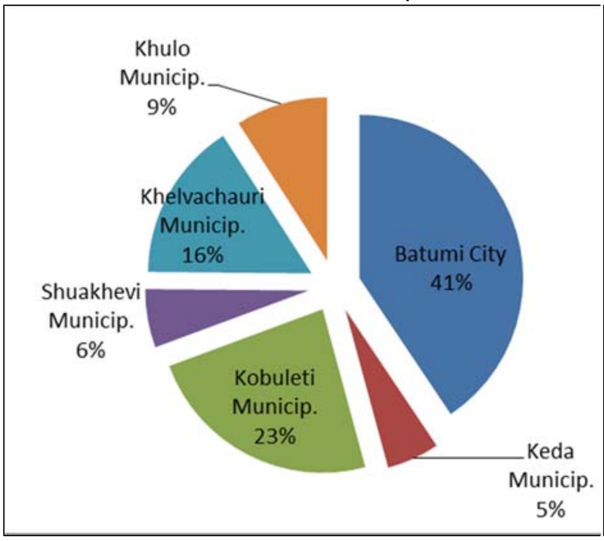
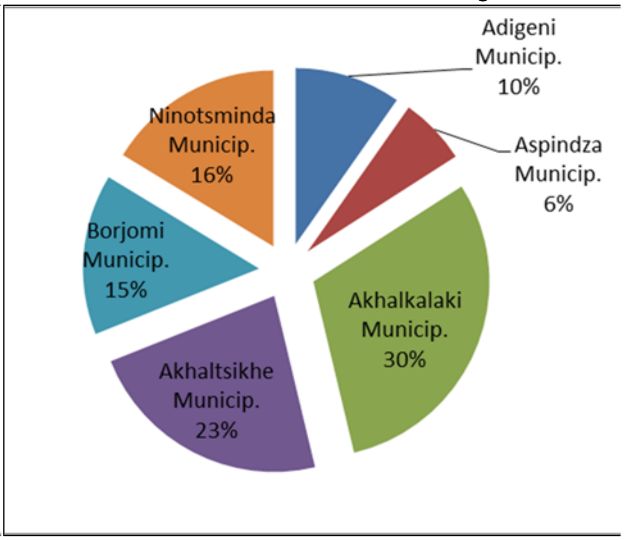


Figure 6.3.5 Population distribution in Samtskhe-Javakheti Region



As Table 6.3.1 shows, population has mainly increasing trend in all territorial units; though, growth rate was rather low (4-6%) for the last decade (2003-2013). One of major reasons for that should be emigration out of the country, which had rather high rate recently, as Census 2002 showed and internal migration to other regions in search of incomes. Unfortunately, recent migration data are not available for the regions and the studied municipalities. Though, common trend in the country is high migration rate from rural areas to large cities and aboard in search of jobs and income.

Another reason for low growth rate is low birth rate and increasing death rate. These are most likely to be impacted by high migration rate, as major portion of migrants are usually people of reproduction age.

Data on deaths, births and natural growth are presented in Table 6.3.2. According to them, number of births had notably increased during 2007-2010 in Adjara and Samtskhe-Javakheti; though, this index fell down in 2011-2012. Due to this and against the increasing death rate, natural growth rate in Adjara and Samtskhe-Javakheti decreased by 27% and 75% respectively compared to 2009, when the natural growth was maximum per 2007-2012 period; however, positive growth rate is still maintained.

Table 6.3.2 Basic Demographic Data of regions

Administrative Unit	2007	2008	2009	2010	2011	2012
Number of Deaths						
Georgia	41,178	43,011	46,625	47,864	49,818	49,348
Adjara	2,563	2,813	2,950	3,217	3,280	3,274

Administrative Unit	2007	2008	2009	2010	2011	2012
Samtskhe-Javakheti	1,574	1,647	1,884	2,184	2,167	2,162
Number of births						
Georgia	49,287	56,565	63,377	62,585	58,014	57,031
Adjara	4,687	5,391	6,322	6,293	5,709	5,733
Samtskhe-Javakheti	2,124	2,625	2,912	2,706	2,329	2,413
Natural growth						
Georgia	8,109	13,554	16,752	14,721	8,196	7,683
Adjara	2,124	2,578	3,372	3,076	2,429	2,459
Samtskhe-Javakheti	550	978	1,028	522	162	251

Source: National Statistics Office of Georgia

General trend in Georgia is population ageing due to low natural growth rate and high outmigration rate of younger of population. Though, population ageing indexes differs by regions. Usually, it is higher for high mountainous areas and in the regions with lower economic activities, which are left by younger people in search of jobs. Table 6.3.3gives the age structure of population in the project regions. As the data shows, population is younger in the regions of the concern compared to the country level, and Adjara has younger population among these two regions.

Table 6.3.3 Distribution of Adjara and Samtskhe-Javakheti population by age (2012)

Age Group	Portion of total population, %		
	Georgia	Adjara	Samtskhe-Javakheti
0-19	**24**	**35.2**	**30.6**
20-39	31	31.6	28
40-59	27	22.2	24.2
20-59	**58**	**53.8**	**52.2**
60<	**19**	**11**	**17.2**

Source: National Statistics Office of Georgia

Adjara and Samtskhe-Javakheti Regions differ in average household size as well. In general, families are larger in Adjara where average household size comprises 4.4 people against 3.7 people in Samtskhe-Javakheti Region. Table 6.3.4below shows break-down of households by size for the regions of interest. According to these data, families comprised of 5 people dominate in Adjara, whilst most common family size for Samtskhe-Javakheti is 4 people.

Table 6.3.4 Breakdown of households by size, % (2012)

	Number of people per household						
	1	2	3	4	5	5<	Average

Portion of house-hold of given size, %	Adjara	6.6	8.0	14.9	25.2	18.8	26.5	4.4
	Samtskhe-Javakheti	11.8	16.1	13.8	25.6	15.6	17.1	3.7

6.3.4 Economics

The study regions do not demonstrate high economic development level, especially Samtskhe-Javakheti Region. Share of Adjara and Samtskhe-Javakheti Regions in the national GDP was around 7% for 2006-2012 period; though Adjara solely contributed to the national GDP in average by 5.7% against 1.2% of Samtskhe-Javakheti. Share of these two regions in the country economy was more or less stable during the last seven-year period; though, absolute value of value added was increasing in average by 23% and 26% correspondingly in Adjara and Samtskhe-Javakheti (see Table 6.3.5).

Table 6.3.5 Value added of Georgia vs. Adjara AR and Samtskhe-Javakheti

Year	Georgia, mln. GEL	Adjara AR, mln. GEL	Annual Growth for Adjara, %	Share of Adjara AR in National Index, %	Samtskhe-Javakheti (SJ), mln. GEL	Annual Growth for SJ, %	Share of SJ in National Index, %	AJ &SJ, %
2006	3479	229		6.6	49		1.4	8.0
2007	4542	258	13%	5.7	52	6%	1.1	6.8
2008	5163	276	7%	5.3	61	17%	1.2	6.5
2009	5464	273	-1%	5.0	51	-16%	0.9	5.9
2010	6703	345	26%	5.1	98	92%	1.5	6.6
2011	9254	514	49%	5.6	100	2%	1.1	6.6
2012	11191	744	45%	6.7	152	52%	1.4	8.0

Source: National Statistics Office of Georgia

Economic development of the studied regions is determined by various sectors, such are agriculture, trade, service sector, industry, building, etc. In general, sectorial development in Adjara and Samtskhe-Javakheti Regions significantly differ from each other. Breakdown of value added by economic sectors for 2006-2011 for both regions is provided in Table 6.3.6 and Table 6.3.7.

The highest value added in Adjara Region in the given period was produced by public administration and service sectors (about 17-18% in average). Tourism should be responsible for such a high index of service sector. Contribution of industry, building sector and agriculture in value added was lower, though still tangible (8-9% in average). During 2006-2011 industry and building sectors were growing, absolute value of value added of these sectors almost doubled, and their share in the regional value added had growing trend. Opposite to this, agricultural production was falling down in this period was falling down (Table 6.3.7, Figure 6.3.6).

Different from Adjara, leading economic sector in Samtskhe-Javakheti Region was agriculture, which contributed to regional vale added by 32% in average and agricultural production almost doubled in this five-year period. Public administration sector was not leading, but its share was rather high (16% in average) in this region as well. Activity in industrial sector significantly reduced in this period, falling from 47 mln GEL in 2006 to 19 mln GEL in 2011 (Table 6.3.7, Figure 6.3.7).

Figure 6.3.6 Breakdown of value added by economic sectors for Adjara

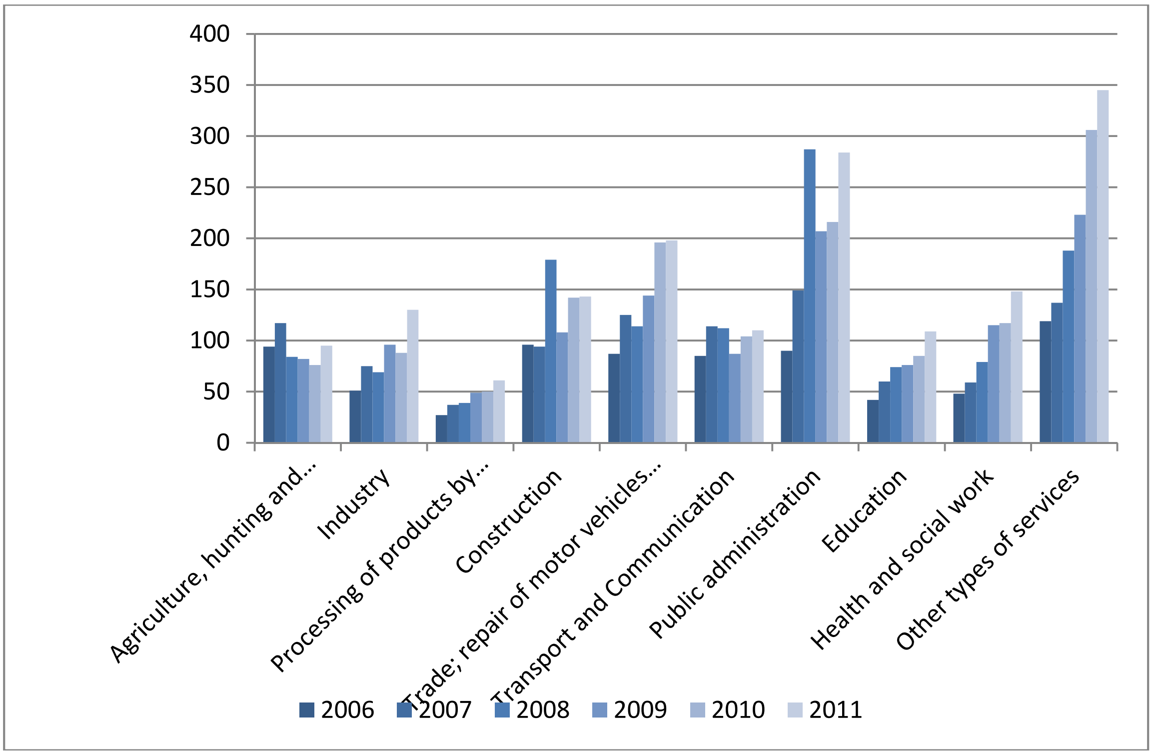


Figure 6.3.7 Break-down of value added by economic sectors for Samtskhe-Javakheti

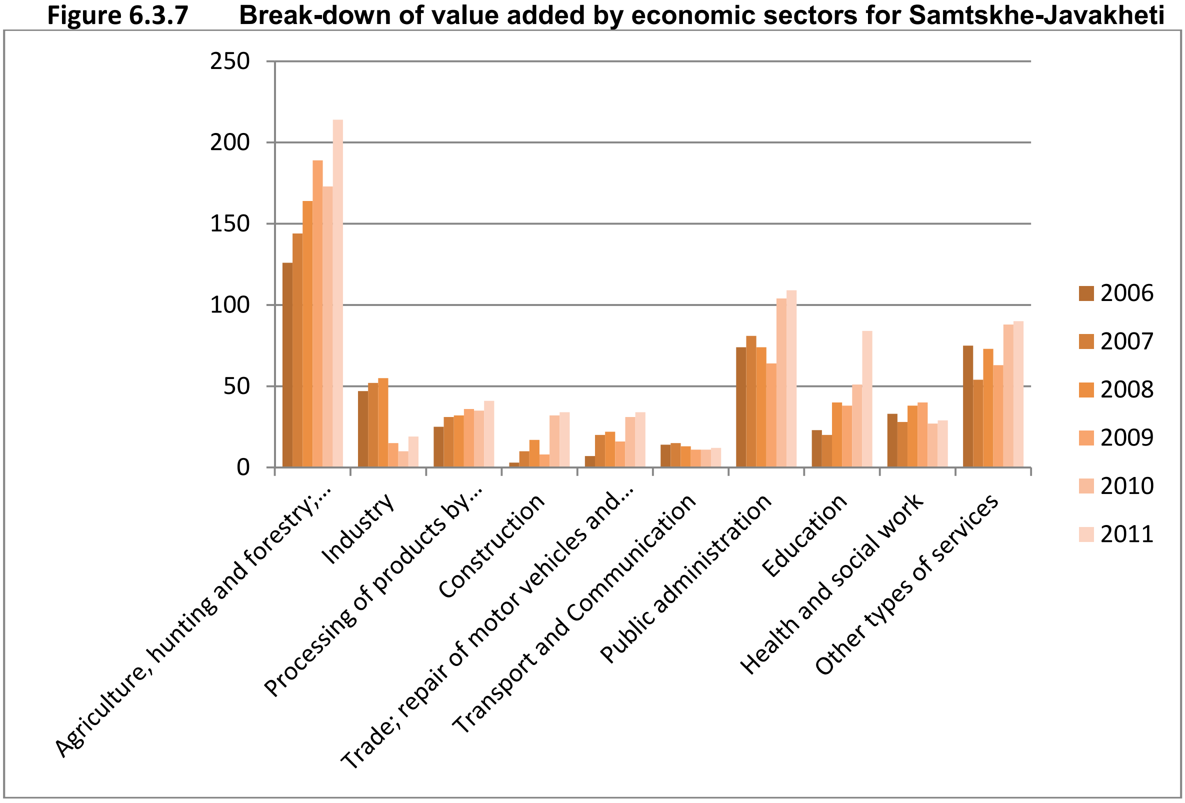


Table 6.3.6 Breakdown of value added by economic sectors for Adjara mln. GEL (in current prices)

	2006	2007	2008	2009	2010	2011	2006	2007	2008	2009	2010	2011
	mln. GEL						**% of total**					
Agriculture, hunting and forestry; fishing	94	117	84	82	76	95	13	12	7	7	5	6
Industry	51	75	69	96	88	130	7	8	6	8	6	8
Processing of products by households	27	37	39	49	50	61	4	4	3	4	4	4
Construction	96	94	179	108	142	143	13	10	15	9	10	9
Trade; repair of motor vehicles and goods	87	125	114	144	196	198	12	13	9	12	14	12
Transport and Communication	85	114	112	87	104	110	12	12	9	7	8	7
Public administration	90	149	287	207	216	284	12	15	23	17	16	18
Education	42	60	74	76	85	109	6	6	6	6	6	7
Health and social work	48	59	79	115	117	148	6	6	6	10	9	9
Other types of services	119	137	188	223	306	345	16	14	15	19	22	21
Gross Value Added, total	**739**	**967**	**1,224**	**1,185**	**1,379**	**1,622**	**100**	**100**	**100**	**100**	**100**	**100**

Table 6.3.7 Breakdown of value added by economic sectors for Samtskhe-Javakheti, mln. GEL (in current prices)

	2006	2007	2008	2009	2010	2011	2006	2007	2008	2009	2010	2011
	mln. GEL						**% of total**					
Agriculture, hunting and forestry; fishing	126	144	164	189	173	214	30	32	31	40	31	32
Industry	47	52	55	15	10	19	11	11	10	3	2	3
Processing of products by households	25	31	32	36	35	41	6	7	6	7	6	6
Construction	3	10	17	8	32	34	1	2	3	2	6	5
Trade; repair of motor vehicles and goods	7	20	22	16	31	34	2	4	4	3	6	5
Transport and Communication	14	15	13	11	11	12	3	3	2	2	2	2
Public administration	74	81	74	64	104	109	17	18	14	13	19	16
Education	23	20	40	38	51	84	5	4	8	8	9	13
Health and social work	33	28	38	40	27	29	8	6	7	8	5	4
Other types of services	75	54	73	63	88	90	18	12	14	13	16	13
Gross Value Added, total	**425**	**455**	**527**	**477**	**563**	**665**	**100**	**100**	**100**	**100**	**100**	**100**

6.3.5 Agriculture and land availability

As discussed in the previous section, leading economic sector in Samtskhe-Javakheti Region is agriculture, which is growing, though not so rapidly. Opposite to this, agriculture is relatively poorly developed and does not grow in Adjara. These two regions also differ in agricultural production types.

In general it could be said that agriculture in the both regions are mostly subsistent as rather limited land areas are hold by farmers. Agricultural land availability is higher in Samtskhe-Javakheti Region, what should be determining higher development level of agricultural sector in this region compared to Adjara. Still, mostly small scale farming activities (crop growing and cattle breeding) are spread in the both regions.

Adjara Region

Agricultural land resources are rather limited in Adjara region due to complex topographic conditions and comprise only 8% of the total territory. Arable lands are even more scant, comprising only about 35% of total agricultural lands. Availability of arable lands is very limited in middle and high mountainous municipalities of Khulo, Keda, Khelvachauri and Shuakhevi, where households may hold only 0.25-0.5 ha of land, hardly sufficient to sustain a family. On the other hand, complicated relief in mountainous area also hinders development of cattle breading. In this regards situation is more or less similar Shuakhevi and Khulo Municipalities crossed by the OHL.

Situation is different in Keda and Khelvachauri Municipalities which occupy lower areas in the region. Land plots in Keda are mostly arable (83% of agricultural), meantime when more than half of agricultural lands in Khelvachauri are occupied by citrus plantations and other perennials. Comprehensive data on agricultural lands and their type by Adjara municipalities are provided in Table 6.3.8.

Table 6.3.8 Data on agricultural lands for Adjara Region by target municipalities

Administrative Unit	Land	Agricultural land total	Arable land	Land under perennials	Pastures and meadows
Adjara	ha	26,064	9,212	7,770	9,082
	%	100	35	30	35
Keda Municipality	ha	2,434	2,028	107	299
	%	100	83	4	12
Shuakhevi Municipality	ha	6,483	1,620	54	4,809
	%	100	25	1	74
Khelvachauri Municipality	ha	4,540	1,518	2,978	44
	%	100	33	66	1
Khulo Municipality	ha	5,732	2,284	13	3,435
	%	100	40	0.2	60

Source: Agricultural Census 2004

Main plant grown in lower Adjara are citruses (lemon, mandarin, orange, Grape fruit and citron, which occupy 5200 ha (20% of agricultural lands) in the region. They are mainly grown in Khelvachauri

Municipality. During 2011-2012, about 72 000 tons of citruses were produced, out of which 80% was exported mainly to Azerbaijan, Ukraine and Armenia. Vegetable and tobacco are preferred one-year cultures in Adjara. Crop growing does not require irrigation in most cases due to rather high precipitation.

Another leading agricultural sector in Adjara is livestock breeding. There are approximately 115 thousand heads of cattle there. As mentioned, cattle breading is mainly spread in mountainous areas, including Khulo and Shuakhevi, where pastures are more available; though, complicated relief is a barrier for this sector. Due to this, cattle breeding farms are mainly small scale.

Adjara Region is known for aquaculture sector as well. Fish farms mainly breed trout and black sea salmon. Estimated number of fish farms is around 100, which produce about 600 ton of trout and employee about 200 people.

Samtskhe-Javakheti

Samtskhe-Javakheti Region provides rather favourable conditions for agricultural sector, which is relatively well developed in this region and is a leading economic sector contributing to the total regional value added by over 30% and employing major part of population in the region. Agricultural land resources there comprise 16% of the total territory, about half of which is arable lands and another part is pastures; though, small portion is also devoted to fruit growing (Table 6.3.9). Land plots owned by households (0.7-1.5 ha) in this region are larger compared to Adjara; though, they are rather small and only few large scale farms are established. As such, 90% agriculture products are produced by small farms, of which 73% is produced for self-consumption and the remaining 27% for market. In general it could be sailed that lower areas in the region are more focused around crops, whilst mountainous areas are more favourable for cattle breading.

Like the region, Akhaltsikhe and Adigeni Municipalities are favourable for agriculture. Both of them have arable lands and pastures for crop growing and cattle breeding. Though, Adigeni municipality, which is more mountainous, is more favourable for cattle breeding different from Akhaltsikhe, where more arable lands are available. Besides, Akhaltsikhe Municipality is also more favourable for fruit growing due to milder climate (Table 6.3.9).

Table 6.3.9 Data on agricultural lands for Samtskhe-Javakheti Region by target municipalities

Administrative Unit	Land	Agricultural land total	Arable land	Land under perennials	Pastures and meadows
Samtskhe-Javakheti Region	ha	105,811	45,940	1,540	58,331
	%	100	43	1	55
Adigeni Municipality	ha	24,282	3,673	413	20,196
	%	100	15	2	83
Akhaltsikhe Municipality	ha	7,339	5,417	616	1,306
	%	100	74	8	18

Priority annual crops in the region and among them in Adigeni and Akhaltsikhe Municipalities are potato, cereals, beans, maize, vegetable, which could be harvested factually throughout the region. Among these particularly should be noted potato and barley, as their production respectively comprised around 50% and 40% of these crops produced in the country recently. Almost all the families grow vegetables, however mainly for self-use and only a small portion of vegetables are sold on market. One of the major problem for crop growing sector is lack of irrigation.

An animal breeding is also relatively on large scale in the region. Cattle breeding comprised around 8-11% of the country production in 2000-2010 period and this sector demonstrates growing trend. Similar to Adjara, mostly small scale farms are established in the region; though, number of larger cattle farms is also growing there. Sheep breeding is at smaller scale in Samtskhe-Javakheti and is declining; though, its share is also rather high on the national level. It seems that bee keeping is becoming popular in the region, where number of hives kept doubled during 2000-2010. Detailed statistics of animal husbandry sector for Samtskhe-Javakheti Region is provided inTable 6.3.10. Major problem for animal growing in the region is degradation of pastures due to overgrazing.

Table 6.3.10 Data on animal husbandry sector for Samtskhe-Javakheti Region

Territorial Unit	2000	2005	2010
Number of cattle (thousand heads)			
Georgia	1,177	1,191	1,049
Samtskhe-Javakheti	99	93	111
Region's share	8%	8%	11%
Number of sheep (thousand heads)			
Georgia	547	720	597
Samtskhe-Javakheti	115	88	75
Region's share	21%	12%	13%
Bee hives (thousand hives)			
Georgia	98	150	312
Samtskhe-Javakheti	11	16	22
Region's share	11%	11%	7%

Source: National Statistics Office

6.3.6 Industry and Non-Agricultural sector

In general it could be said that non-agricultural sector is more developed in Adjara than in Samtskhe-Javakheti, where monetary turnover in non-agricultural sectors were on average three times lower for 2007-2012 period. Table 6.3.11 and Table 6.3.12 below provide statistics on turnover in non-agricultural sectors in the studied regions for this period. Based on these data it could be said that turnover in all sectors increased several times in both regions during 5 years. During 2007-2012, trade was the leading in Adjara, meantime when industrial production was dominant in Samtskhe-Javakheti, where trade was only second in range by turnover. Despite this, Samtskhe-Javakheti is not more industrial than Adjara, as turnover in industries in both regions is almost equal. As the Table 6.3.11 shows, building sector was rather active in Adjara in past 5-year period. This is most probably due to large scale construction projects initiated by the state and local government in the region.

Table 6.3.11 Turnover in non-agricultural sectors for Adjara Region for 2007-2012

Years	Turnover in industry		Turnover in construction		Turnover in trade, vehicles maintenance, household goods		Turnover in hotels and restaurants		Total
	Mln GEL	% of total	Mln GEL	% of total	Mln GEL	% of total	Mln GEL	% of total	Mln GEL
2007	120	17%	138	20%	425	60%	20	3%	703
2008	108	13%	239	29%	447	55%	21	3%	814
2009	172	20%	184	22%	456	54%	27	3%	838
2010	159	17%	208	22%	544	57%	38	4%	949
2011	260	16%	327	21%	939	59%	54	3%	1579
2012	280	15%	495	26%	1060	55%	95	5%	1930
Average per period	171	17%	241	22%	601	58%	38	3%	1051

Source: National Statistics Office

Table 6.3.12 Turnover in non-agricultural sectors for Samtskhe-Javakheti Region for 2007-2012

Years	Turnover in industry		Turnover in construction		Turnover in trade, vehicles maintenance, household goods		Turnover in hotels and restaurants		Total
	Mln GEL	% of total	Mln GEL	% of total	Mln GEL	% of total	Mln GEL	% of total	Mln GEL
2007	73	46%	13	8%	65	42%	6	4%	157
2008	92	53%	23.2	13%	48	28%	9	5%	172
2009	92	62%	7.6	5%	42	28%	7	4%	148
2010	119	49%	32	13%	83	34%	7	3%	241
2011	152	44%	57.4	17%	132	38%	7	2%	348
2012	205	46%	63.1	14%	163	37%	15	3%	446
Average per period	115	51%	30	12%	81	33%	8	4%	235

Source: National Statistics Office

6.3.7 Labour Force and Employment

Information on labour force and their employment status is not available for municipality level. Therefore, these issues are discussed on regional level. According to 2012 data (GeoStat), economically active population comprised 208 thousand people in Adjara 227 thousand people in Samtskhe-Javakheti (Table 6.3.13). Information about employment opportunities in various sectors is not readily available for the studied region. However, certain analysis could be made based on the above-provided description of various economic sectors, as well as considering data in Table 6.3.13.

As described above, the leading sectors in Adjara are public administration, trade and service sector (including tourism). Respectively, most people should be engaged in these activities. Different from Adjara, agriculture should be responsible for the most of employment in Samtskhe-Javakheti; though, service and public administration sectors should also significantly contribute to employment. It should be mentioned that hired labour mostly present in urban areas, whilst people are mostly self-employed in rural areas, or commute to nearest cities for paid employment.

As Table 6.3.13 shows, major portion of employment in both regions is determined by self-employment in various sectors. Factually, this is reflection of the countrywide situation; though, self-employment rate is much higher in Samtskhe-Javakheti, when in Georgia or Adjara. This is likely to be majorly on account of people engaged in subsistent agriculture, which according to UNDP classification (2010), could be taken for ‘vulnerable’. On the other hand, employment rate in Samtskhe-Javakheti is higher than in Adjara or Georgia. In general, over 62% of employment in Georgia, including unpaid family workers or self-employed, is ranked as ‘vulnerable’, 17.4% of which live on less than 1.25US$/day (UNDP, 2010).

Table 6.3.13 Labour force and employment status for Adjara and Samtskhe-Javakheti Regions (2012)

Description	Adjara		Samtskhe-Javakheti		Georgia	
	Thousand people	**% of total employed**	**Thousand people**	**% of total employed**	**Thousand people**	**% of total employed**
Active population (labour force), total	208		227		2029	
Employed	174		209		1724	
Hired	60	34%	35	17%	663	38%
Self-employed	113	65%	157	75%	1054	61%
Not-identified worker	34	20%	17	8%	305	18%
Unemployment rate (%)	16		7		15	
Activity rate (%)	71		73		67	
Employment rate (%)	59		67		57	

Source: National Statistics Office

6.3.8 Structure of Incomes and Expenses of Population

Household incomes are generated from different sources include hired labour, self-employment, selling of agricultural products from own farms, financial assistance from the state and relatives, etc. As statistical data show, population in the target regions depend on monetary and in-kind incomes from various sources. In this regards, the situation in Samtskhe-Javakheti and Adjara is notably different. Major portion of family incomes (63%) in Adjara is monetary, contrary to Samtskhe-Javakheti, where monetary income comprises only half of family income. The reason for this most probably is more wide engagement in agricultural sector in Samtskhe-Javakheti, which together with

higher self-employment rate should provide higher in-kind incomes for families in this region. On the other hand, as described in the section above, Adjara has higher index for hired labour, which are receive monetary payment (Table 6.3.14). It should be mentioned that usually income structure significantly differs in rural and urban areas. In general incomes of families in urban areas mostly get monetary income, whilst rural residents significantly depend on in-kind incomes.
It should be mentioned that portion of various financial assistance (e.g. state assistance, support of relatives) is more or less in the same range in the both municipalities.

Table 6.3.14 Structure of Household Income (%, 2012)

Description	**Adjara, %**	**Samtskhe-Javakheti, %**
Cash income and transfers, from	**63.4**	**49.0**
Hired labor	26.9	15.4
Self-employment	20.6	9
Selling of agricultural products	10.0	17.2
From property	0.1	0.1
Pensions, scholarships, allowances	3.1	3.7
Transfers from abroad	0.5	1.6
Financial assistance of relatives	2.2	2.0
Non-cash income	**17.6**	**42.0**
Total income	**81.0**	**91.0**
Other funds	**19**	**9.0**
Estate Sale	7.4	1.2
Borrowing, savings	11.6	7.8
Total cash	**82.4**	**58**
Monetary and non-monetary incomes	**100**	**100**

Source: National Statistics Office

The structure of a typical household's expenditures in the project influence area is given in Table 6.3.15. The Table shows that about 90% of total household expenses is of consumer type in both studied regions, and very small portion is saved or invested in agriculture, the main economic activity in rural areas. In both regions around 50% of cash is spent on food and utilities (fuel, electricity); though, share of food in this is notably lower in Samtskhe-Javakheti, most probably due to higher rate of agricultural production for self-consumption. It should be mentioned that portion of money spent on health care, education and recreation is rather low in both regions.

The described structure of household incomes and expenditures show that poverty level in the studied regions should be high. Based on these data it could be assumed that poverty level is around 25-30% for 60% median consumption, and 10-15% for 40% median consumption. GINI index of total incomes is 0.40-0.45, which indicates on fairly high unequal distribution of incomes.

Table 6.3.15 Structure of Household Expenses (%, 2012)

Description	Adjara	Samtskhe-Javakheti
Consumer expenditure in cash	**80.8**	**64.0**
Food, beverages and tobacco	45.4	28.6
Cloths and Footwear	5.6	3.8
Household goods	8.5	8.3
Health Care	1.9	1.9
Fuel and electricity	5.3	14.3
Transport	7.9	2.6
Education, Culture, Recreation	2.4	1.7
Other consumer cash spending	3.8	2.8
Consumer non-cash expenses	**10.7**	**26.8**
Total consumer expenditure	**91.5**	**90.8**
Non-consumer expenses	**8.5**	**9.2**
Agricultural inputs	0.6	2.4
Transfers	1.2	1.2
Savings, lending etc	6.7	5.6
Total cash expenditure	**89.3**	**73.2**
Total expenditure	**100**	**100**

Source: National Statistics Office

6.3.9 Socio-Economic Profile of Project Corridor

In order to draw up socio-economic profile of potentially affected communities (PAC) by the project. As around 150 settlements fall quite close to the OHL ROW, only 25 communities and 120 households (HH) were surveyed for this purpose. Among them 60 HHs were studied from 10 settlements on Samtskhe-Javakheti section, and 60 HHs from 15 settlements in Adjara. Sample size in each of municipality crossed by the OHL was determined by number of settlements within 2 km radius from the OHL and settlements to be studied were selected using random selection method. Number of HH in each studied settlement was determined based on population size and proximity to the project corridor; households for interview were selected randomly by interviewers. The list of the surveyed communities together with surveyed household number is given in Table 6.3.16. Location of these communities is given in Figure 6.3.8.

Table 6.3.16 The list of communities surveyed for the OHL project

Region	Municipality	Settlement	Number of Surveyed HHs	Total HHs Surveyed
Adjara	Khelvachauri	Kvemo Jocho	4	12
		Adjaristskali	4	
		Maghlakoni	4	
	Keda	Keda	4	20
		Dologani	4	
		Kolatauri	4	
		Kveta Makhuntseti	4	
		Koromkheti	4	
	Shuakhevi	Khichauri	4	12
		Beselashvilebi	4	
		Kldisubani	4	
	Khulo	Oqtomberi	4	16
		Rakvta	4	
		Pushrukauli	4	
		Vernebi	4	
Samtskhe-Javakheti	Adigeni	Adigeni	6	30
		Benara	6	
		Shoraveli	6	
		Ghordze	6	
		Ude	6	
	Akhaltsikhe	Mugareti	6	30
		Giorgitsminda	6	
		Tskruti	6	
		Tsira	6	
		Mikeltsminda	6	

Figure 6.3.8 Location of settlements surveyed for the project

6.3.10 Demography

Demographic data of households surveyed in the project corridor is similar for Adjara and Samtskhe-Javakheti part and only little divergences could be identified. Summary of averaged and regional level demographic data is provided in Table 6.3.17. As the table shows, average family size for the project corridor is 5.37 people; family size is little smaller on Samtskhe-Javakheti section and comprises 5.07 people, against 5.66 people in Adjara. Average family along the OHL comprises 3.5 adults, 1.2 children and 0.6 elderly people. Average number of males among surveyed HHs is little higher than females.

Table 6.3.17 Age-sex structure of surveyed HHs

	Household Structure		
	Male	**Female**	**Total**
Age group	**Samtskhe-Javakheti**		
Children (<15 years)	0.68	0.41	1.09
Adults (15-65 years)	1.86	1.57	3.43
Elderly (>65 years)	0.32	0.23	0.55
Total	2.86	2.21	5.07
Age group	**Adjara**		
Children (<15 years)	0.59	0.70	1.29
Adults (15-65 years)	2.09	1.70	3.79
Elderly (>65 years)	0.22	0.36	0.58
Total	2.90	2.76	5.66
Age group	**Average per Survey**		
Children (<15 years)	0.65	0.58	1.23
Adults (15-65 years)	1.91	1.61	3.52
Elderly (>65 years)	0.29	0.33	0.62
Total	2.85	2.52	5.37

The survey showed that 85% of families in PAC are male-headed (89% in Adjara, 82% in Samtskhe-Javakheti). Average age of family head is 52.9 in Adjara (51 years for men and 70 years for women), and 53.5 in Samtskhe-Javakheti (53 years for men and 54 years for women).

Great majority of HHs (98%) on Adjara part are leaded by Georgian; this index for Samtskhe-Javakheti section is 73%. Religion belonging of HHs is dominated by Orthodox Christians (40% on average) and Muslims (42% on average); Orthodox is dominant group in Samtskhe-Javakheti, and Muslim – in Adjara. Follower of other confessions (Catholic and Gregorian Christians mainly) are also present in the project corridor. The distribution of family leaders by confession is given in the Table 6.3.18.

Table 6.3.18 Confession of the head of family

Region	Orthodox Christian	Catholic Christian	Gregorian Christian	Muslim	other
Samtskhe-Javakheti	57%	15%	17%	10%	2%
Adjara	25%	0%	0%	72%	3%
Average	40%	7%	8%	42%	2%

6.3.11 Education

Around 28-29% of surveyed family members are in pre-school or primary school age. The half of adults in PAC has accomplished secondary school only, whilst around fifth of them has high education. Distribution of population affected by the project according to the education is introduces in the Table 6.3.19.

Table 6.3.19 Distribution of Population According to Education Level
Table 6.3.20

Level of Education	Male	Female	Average
Samtskhe-Javakheti			
Preschool	16%	13%	15%
Primary school	12%	13%	13%
Secondary school	50%	52%	51%
High school	23%	21%	22%
Total for Region	100%	100%	100%
Adjara			
Preschool	10%	16%	13%
Primary school	19%	14%	16%
Secondary school	51%	51%	51%
Higher school	20%	19%	19%
Total for Region	100%	100%	100%

6.3.12 Economic activity and Employment

Approximately 67% of HHs surveyed in PACs is of working age (15-65 years old). About 13% of HH members older than 15 reported that they are hired employees, 56% - self-employed, 19% percept themselves as unemployed and 13% consider themselves economically inactive (the later group size is in good collation with portion of elderly people (>65) comprising 11% of surveyed people).

As the survey showed, about 63% of economically active people in the OHL corridor is engaged in agriculture, either in own farms (59%) or helping others farmers (3%). This index is up to 70% for Samtskhe-Javakheti Region versus 56% in Adjara communities.

Employment in public administration offices or other state funding jobs is the second in the range comprising 22% of working people on average for the OHL corridor. Again, significant difference is between Samtskhe-Javakheti and Adjara, where this index is respectively 15% and 29%.

The rest 15% of working people are engaged in various sectors such is own small business, employment in small enterprises or commercial sector, other. The above provided discussion is summarized in Table 6.3.21

Table 6.3.21 Distribution of Employed People by Economic Activities

Administra-tive Unit	Own Farms	Other Farms	Own Small Business	Budgetary Organiza-tions	Business and Comme-rcial Sector	Hourly Paid Job	Other
Samtskhe-Javakheti	64%	6%	1%	15%	4%	4%	5%
Adjara	56%	1%	3%	29%	4%	5%	4%
Total	59%	3%	2%	22%	4%	4%	4%

6.3.13 Incomes and Expenses

The average income of families in the OHL corridor is estimated at 692 GEL per month, corresponding to 129 GEL per month per person. This average income per HH is higher than living wage established in Georgia for a family consisting of 5 people 291 GEL as of August 2013; however, income per person is equal to substance minimum per average consumer for the same period (129 GEL).

Household incomes are little higher in Samtskhe-Javakheti, where average income per household per month comprised 849 GEL, or 167 GEL per person per month versus to 545 GEL per household per month, or 96 GEL per person per month in Adjara.

According to the survey data, main income sources of population along OHL are paid jobs (37% of income), selling of agricultural products (39%) and social assistance of the state (17%). Though, ratio of incomes from these sources varies between the studied regions: as such, incomes from selling of agricultural products is higher in Samtskhe-Javakheti, where agricultural sector is more developed compared to Adjara, and opposite to this, share of paid labour is higher in Adjara. Table 6.3.22 provides some more details on structure of HH incomes in OHL PACs. It should be mentioned that data of this table significantly differ from data based on average figures indicated by Department of Statistics.

Table 6.3.22 Structure of HH incomes in PACs

Income Source	Samtskhe-Javakheti	Adjara	OHL Corridor
Hired labour wage	32.7%	43.3%	37.0%
Sales of agricultural products	47.5%	29.9%	39.6%
Income from non-agricultural businesses	6.1%	2.1%	4.4%
Pensions and other social assistance	12.1%	23.8%	16.9%
Cash assistance from relatives	1.5%	2.9%	1.1%

As the survey showed, major portion of incomes (42%) of PAC HHs is spent on food, which is followed by health care expenses (13%) and transportation costs (12%). Again, there is a certain difference between Adjara and Samtskhe-Javakheti region. In particular, ratio of expenses on food is higher in Adjara and share of household appliances is lower there. Most probably this could be explained by lower incomes of families in Adjara. Table 6.3.23 below provides detailed statistics of various HH expenses.

Table 6.3.23 Structure of household expenses in the PACs

Category of Expences	Samtskhe-Javakheti	Adjara	OHL Corridor
Food/Beverage / Tobacco	39%	45%	42%
Cloths and footwear	9%	10%	9%
Household appliances	4%	0.5%	3%
Health care	12%	14%	13%
Education	1%	4%	2%
Communication	5%	4%	4%
Electricity bills	2%	3%	3%
Transport	13%	11%	12%
Fuel for heating	7%	6%	7%
Recreation	0.2%	0.2%	0.2%
Agricultural inputs	7%	1%	5%
Other	1%	0%	0.3%

6.3.14 Household assets

Houses

As the HH survey showed, houses of families in OHL PACs are built in average about 45 years ago. The majority of houses are two-storey brick or stone buildings (the average number of floors is 1.8). Average land plot under houses is 112 м2, and average number of rooms per house is 6. All of houses are supplied with electricity; though, other utilities such are natural gas or water is not provided through centralized systems. Population in PACs mainly use springs and wells for water supply. Sanitary facilities presented in PACs are mainly a cesspool toilet. All HHs use wood for heating. According to respondents' assessment, an average price of houses is 351 GEL per м2.

Durable goods and domestic animals

The HH survey showed that virtually all households in the PACs have TVs. Other household appliances such are cookers, refrigerators, washing machines, air conditioners are not affordable for all families, but majority of them have a refrigerator (79%), cooker (74%) and washing machine (58%); air conditioners are seldom: only 1% of HHs own it. Availability of these durables except but cookers is more or less equally distributed among the target regions.

Among studied families 40% owns a car, 7% have a motorcycle and 16% have a bicycle. Ratio of family with car or motorcycle is higher in Samtskhe-Javakheti. More details on ownership of durable goods are provided in the Table 6.3.24 below.

Table 6.3.24 Ownership of durable goods among HHs

Description	Samtskhe-Javakheti	Adjara	OHL Corridor
TV	97%	98%	98%
Radio	20%	8%	14%
Cooker	85%	64%	74%
Refrigerator	78%	80%	79%
Washing machine	57%	59%	58%
Air conditioner	2%	0%	1%
Computer	35%	34%	35%
Car	47%	34%	40%
Motorcycle	15%	0%	7%
Bicycle	27%	6%	16%

Table 6.3.25 provides data on domestic animals owned by HHs in PACs. As the table shows, families in Samtskhe-Javakheti villages keep more animals when in Adjara. Cattle growing in PACs is more or less similar in Adjara and Samtskhe-Javakheti, where respectively 80% and 90% of households keep cattle and average number of bovine head per household in these regions only slightly differs (4.5 heads in SJ vs. 3.1 heads in Adjara). Sheep and pig breeding is found only in Samtskhe-Javakheti, which also has much higher index of poultry growing (see Table 1.8.9).

Table 6.3.25 Ownership of domestic animals among HHs

Description	Samtskhe-Javakheti		Adjara		OHL Corridor	
	%	Average per HH	%	Average per HH	%	Average per family
Cattle	90%	4.5	80%	3.1	85%	3.8
Sheep / goats	10%	0.4	0%	0.0	5%	0.2
Pig	62%	1.0	0%	0.0	30%	0.5
Poultry	88%	14.0	55%	3.8	71%	8.8
Other	7%	0.1	0%	0.0	3%	0.03

Land Ownership

According to the survey data, the OHL PAC households on average own about 1.21 ha lands, of thise about 0.98 ha is agricultural and 0.23 ha is non-agricultural, manly under house buildings and yards. About 90% of PACs HHs own agricultural land parcel, and about 95% of them are owners of non-agricultural land (mainly parcel under the house and yard). Among agricultural lands major portion is arable, which comprises 0.78 ha per OHL HH per on average; other 0.20 ha is presented by perennials and pastures, with domination of the later.

As the survey showed, there is significant difference in land ownership pattern between Adjara and Samtskhe-Javakheti. In particular, average land size in ownership of HHs is larger in Samtskhe-Javakheti, where it comprises 1.63 ha vs. 0.83 ha in Adjara. Difference is considerable between agricultural lands in these two regions – 1.43 ha in Samtskhe-Javakheti vs. 0.55 ha in Adjara. Besides, virtually all HHs own agricultural land parcel and among them arable land in Samtskhe-Javakheti, while only 80% of HHs in Adjara have any agricultural land and only 48% have arable land. More details on land ownership in the study regions are provided in Table 6.3.26 below.

Table 6.3.26 Land ownership among HHs

Land Ownership			Samtskhe-Javakheti		Adjara		OHL Corridor	
			Per HH, ha	% of HHs	Per HH, ha	% of HHs	Per HH, ha	% of HHs
Agricultural Land	Arable	Irrigated	0.10	20%	0.07	20%	0.1	20%
		Non-irrigated	1.18	97%	0.26	38%	0.71	82%
		Total Arable	**1.26**	**100%**	**0.32**	**48%**	**0.78**	**80%**
	Perennials		0.08	24%	0.04	9%	0.06	16%
	Pasture/ Hayland		0.07	8%	0.18	39%	0.12	24%
	Total agricultural		**1.43**	**100%**	**0.55**	**80%**	**0.98**	**90%**
Non-Agricultural Land	House&Yard		0.19	95%	0.27	95%	0.23	95%
	Commercial		0.003	1.7%	0.003	1.60%	0.006	1.60%
	Other		0.001	1.7%	0.004	1.60%	0.005	1.60%
	Total non-agricultural		**0.19**	**95%**	**0.28**	**95%**	**0.23**	**95%**
Average land size per HH			**1.63**	**-**	**0.83**	**-**	**1.21**	**-**

6.3.15 Vulnerable groups of population and poverty self-perception

According to the collected data, 31% of people in PACs have different statuses of vulnerability, among them 15% are pensioners, 4% - disabled and 12% are registered as people living below poverty line.

Respondents were asked to characterise economic situation of their families. About 84% of HHs claim that they have irregular income, 43% have insufficient food, 14% does not have sufficient money for heating, 26% - insufficient money for children's education, and 56% insufficient money for cloths.

Table 6.3.27 provides data on self-perception of HHs economic status for the OHL corridor and the regions of interest. As the table shows, self-perception of economic situation is mostly different between the region. In general, equal portion of HHs in the both region claim of having irregular incomes; though, percentage of HHs which believes that do not have sufficient money for food, education and cloth is significantly higher in Adjara. Such a difference between self-perception of HHs the study regions is good reflection of pronounced difference between income levels of HHs there.

Table 6.3.27 Economic situation of project affected families according to self-perception

Description	Samtskhe-Javakheti	Adjara	OHL Corridor
Irregular income	83%	84%	84%
Insufficient food	32%	53%	43%
Insufficient money for heating	13%	14%	14%
Insufficient funds for children's education	17%	34%	26%
Insufficient money for cloths	42%	69%	56%

6.3.16 Attitude towards Project

According to the survey results, 10% of respondents perceive the project negatively, 20% have neutral attitude, 52% gave positive perception, and 18% do not/cannot express their attitude.

About 12% of respondents think that the project will negatively impact socio-economic situation in their community, 7% think that such impact will be neutral, 53% believes that the project will improve socio-economic characterises and 28% do not/cannot express their opinion.

6.4 Cultural heritage

This section provides general historical overview of the project regions, describes known and potential cultural heritage objects including archaeological sites in approximately 5-6 km distance from the OHL and gives information about historical value of these cultural heritage.

6.4.1 Methodology used for the current study

Information on archaeological and cultural heritage sites have been collected from scholarly publications, various field-works including the site reconnaissance field surveys conducted within the framework of the current ESIA project, legislative acts of the Georgian Ministry of Culture and Monument Protection, various Internet resources and interviews with local population. Based on thise information, the sites have been mapped and listed, indicating names, categories, location and dates of the sites. Identified sites have been mapped within approximately 5-6 km corridor along the projected Akhaltsikhe-Batumi 220 kV transmission line. The numbers on the map marked with asterisks (…*) correspond to the sites, which are of immovable national importance monuments according to the decree (#3/133) of the Minister of Culture and Monument Protection of 30/3/2006.

6.4.2 History Overview of the Project Affected Regions

Akhaltsikhe-Batumi 220 kV Transmission Line Project runs through Akhaltsikhe and Adigeni municipalities (two of six districts of historical province of Georgia - Samtskhe-Javakheti), and five municipalities of the Autonomous Republic of Adjara (Khulo, Shuakhevi, Keda Khelvachauri, Batumi). Although, currently, Samtskhe-Javakheti province is among the most ethnically non-homogeneous regions of Georgia, the majority of the autochthonous population of Akhaltsikhe and Adigeni districts, as well as mainly mountainous population of Adjara ethnically are Meskhetians (eastern Georgian speaking people) and therefore, during the certain periods, share common history. Other main autochthonous people of Adjara, who predominantly occupy coastal part of the republic and north-east provinces of Turkey are called Lazi who speak on a language of western Georgian language group - Megrelo-Chan.

Samtskhe (resp. Meskheti) is considered by many historians as a birthplace of the Georgian nation. Some scholars believe that Meskhetians are the descendents of Mushki, Iron Age Anatolean people known from the Assyrian written sources of 12th -9th centuries BCE, who later moved from Anatolia to South-Western Georgia. Greek authors of 6th-5th centuries BCE, like Hecateus of Miletus and Herodotus, identify the tribe of Moschoi with Colchians (western Georgian speaking tribes), whereas, Roman-Jewish scholar of 1st century CE, Titus Josephus Flavius, in his Genealogy of Nations, descend the tribe of Moschoi from Biblical ethnarch Meshech.

According to archaeological data, project affected regions (Meskheti and Adjara) have been populated at least from the Neolithic Age onwards. During the Early Bronze Age (first half of 3rd millennium BCE) archaeological sites of the Kura-Araxes Culture can be found both in Samtskhe-Javakheti and mountainous part of Adjara. However, so-called Early Kurgan Cultures of 3rd-2nd millennia BCE, which are common for Samtskhe-Javakheti, dose not spread farther west of Beshumi (Goderdzi pass). Most of the Bronze Age sites in Adjara represent the so-called Colchian Bronze Age Culture presented predominantly with hoards containing specific type of bronze tools and weapons - as Colchian axes, segmentlike tools etc.

During the Classical Period Adjara is one of the major provinces of the kingdom of “Colchis”. The costal part of Adjara in 5th and 4th centuries BCE was colonized by Greek merchants who peacefully coexist with local population (Colchians). This is vividly demonstrated by comparatively recent excavations of the Greek-Colchian common cemetery in Pichvnari, near Kobuleti. Samtskhe-Javakheti (resp. Akhaltsikhe and Adigeni) since 4th century BCE is one of the key provinces of the eastern Georgian kingdom of “Kartli” (Greek – “Iberia”) and part of Adjara was also incorporated in this kingdom. The coastal Adjara later came under Roman rule. Bathus, the present day Batumi, and Apsaros, modern Gonio, were the key cities and fortresses during the Roman rule.

From early dissemination of Christianity Adjara and Meskheti are linked with Christian Saints. The church tradition of Georgia regards St. Andrew as the first preacher of Christianity in Georgia and as the founder of the Georgian church, who, together with Simon Cananeus, came to Georgia via Adjara and Meskheti. Also, according to Greek sources, the remains of the apostle Sent Matthias are buried in the castle of Apsaros in gonio.

In 2nd century CE coastal provinces of Adjara was incorporated into the kingdom of Lazica-Egrisi (the strategic vassal kingdom of Byzantine), whereas the mountainous part of it, including Acharistskali gorge, together with Meskheti remained in Kartli (Ibera) kingdom. Petra in modern Tsikhisdziri became a key fortified settlement that during the Lazic war between Byzantunes and Persians in 542-562 served as a main battlefield.

Adjara and Meskheti also share common history in dissemination of Catholicism and Islam.

From the 8th c. onwards, with the decline of Arabian rule, when the region got under Byzantium, grows of the political importance of Meskheti takes its way. In the 10th c. Meskheti, that comprised Turkish part of Tao-Klarjeti, was the most powerful Georgian feudal states. later in the 11th c. when Georgia got united under Bagrationis, Adjara was governed by rulers of Samtskhe-Saatabago (resp. Meskheti).

In the 13th c. because of good relations of Queen Rusudan of Georgia with Rome, Catholicism becomes popular in the region. However, this ended with Jalal ad-Dyn Rumi and then Mongols invading Georgia in the 13th c. Since then, disintegration of Georgia took place, with the exception of being briefly reunited under Giorgi Brtskinvale (Brilliant). Country was finally divided in 15th-16th cc. into smaller principalities. After the fall of Constantinople, and invasions of Ottomans at the end of the 16th c. Meskheti turned into the Childir Vilayet of the Turkish Empire and Adjara was divided into two sandjaks and submitted to the Pasha of this Vilaet, with the residence in Akhaltsikhe.

Significant part of the population was forced to convert to Islam, and until the beginning of the 19th c. the territory was ruled by Muslim Georgian nobility. However, in 1828, as a result of the Russian-Turkish war, the citadel of Akhaltsikhe was conquered by the army of General Paskevich, and as a result, significant part of Meskheti together with Adjara became the part of the Russian empire.

6.4.3 Main Results of the Study of Cultural Heritage

Statistical overview

The literature review, field surveys, archaeological reconnaissance, interviews with local population and the data from various internet recourses have reviled 129 cultural heritage sites within approximately 5-6 km corridor along the projected Akhaltsikhe-Batumi 220 kV transmission line. Among these sites, 63 are of immovable national importance monuments marked on the Google Earth and shown on the maps prepared for the project with asterisks. None of these 63 sites are archaeological. They can be categorized as follows:

- cult and religious – churches and monasteries (18), mosques (17), medrese (1), ornamented stone stele (1);
- fortified structures – castles and towers (18);
- infrastructural – bridges (5);
- ethnographic – winepress (1).

  38 archaeological sites ranging from the Stone Age to the Middle Ages have been identified during the current study. Among them are:

- settlements (13);
- cemeteries (6);
- hoards (10);
- kurgan graves (2);

- aqueduct (1);
- cult sites (2);
- other archaeological site remains (4)

The locations of identified are shown on the figures Figure 6.4.6 - Figure 6.4.8. The complete list of identified cultural heritage sites is given in Table 6.4.1.

Archaeological Sensitive Areas

There are no cultural heritage (including archaeological) sites that, according to this study, match the exact locations of the projected electric tower spots. However, there are some archaeologically sensitive areas that need attention. These archaeological sites are located between AP26 and AP27, between AP29 and AP30, and next to AP30 of the proposed project. These sites are assigned #27, #35 and #36 on Figure 6.4.6 - Figure 6.4.8 and Figure 7.3.3 (the later is given in impact assessment section). More details on these archaeological sites are provided below.

The Late Classical-Early Medieval settlement of Benara (CH site #27 on the map) is located between projected AP26 and AP27 of the OHL. The photo of the site is provided in Figure 6.4.1. This site is in about 300 meters from these towers. However, Benara Settlement falls within 25 meter corridor of the transmission line; besides, exact boundaries of the archaeological site are not known and it is not excluded that the settlement of Benara extends towards AP26 and/or AP27, where excavation and earth works will be implemented.

Figure 6.4.1 Benara Settlement Hill, Late Classical-Early Medieval (#27)

Another sensitive area, which is between AP29 and AP30 of the OHL, is another Settlement Hill of the Bronze Age-Iron Age (Figure 6.4.2). This site is situated the north of Ude (CH site #35 on the map), just next to the road going to Ude. The road had already cut western and south-western slopes of the settlement. This road is only transportation route in these area and project machinery are likely to use it. There is a risk for big machinery driving over the road to harm the site.

The third Settlement Hill (CH site #36 on the map) of Classical Period, that is south of Bolajuri, is located in less than 50 meters west from AP30 of the OHL. The site is shown in Figure 6.4.3 and Figure 6.4.4. It is highly possible that the earthworks for tower AP30 reveal archaeological remains.

Figure 6.4.2 Settlement Hill north of Ude, Bronze Age-Early Iron Age (#35)

Figure 6.4.3 Settlement Hill South of Bolajuri, Classical Period (#36)

Figure 6.4.4 Stone structure on the top of the Settlement Hill south of Bolajuri, Modern and Classical Period (?), (#36)

One more site in the same area is the ruined Medieval Church south of Bolajuri, that although is located in about 350 meters north-west from AP30 of the OHL, may indicate the existence of a Medieval settlement in the vicinity of this site. Photo of this site is given in Figure 6.4.5.

Figure 6.4.5 Church ruins south of Bolajuri, Middle Ages

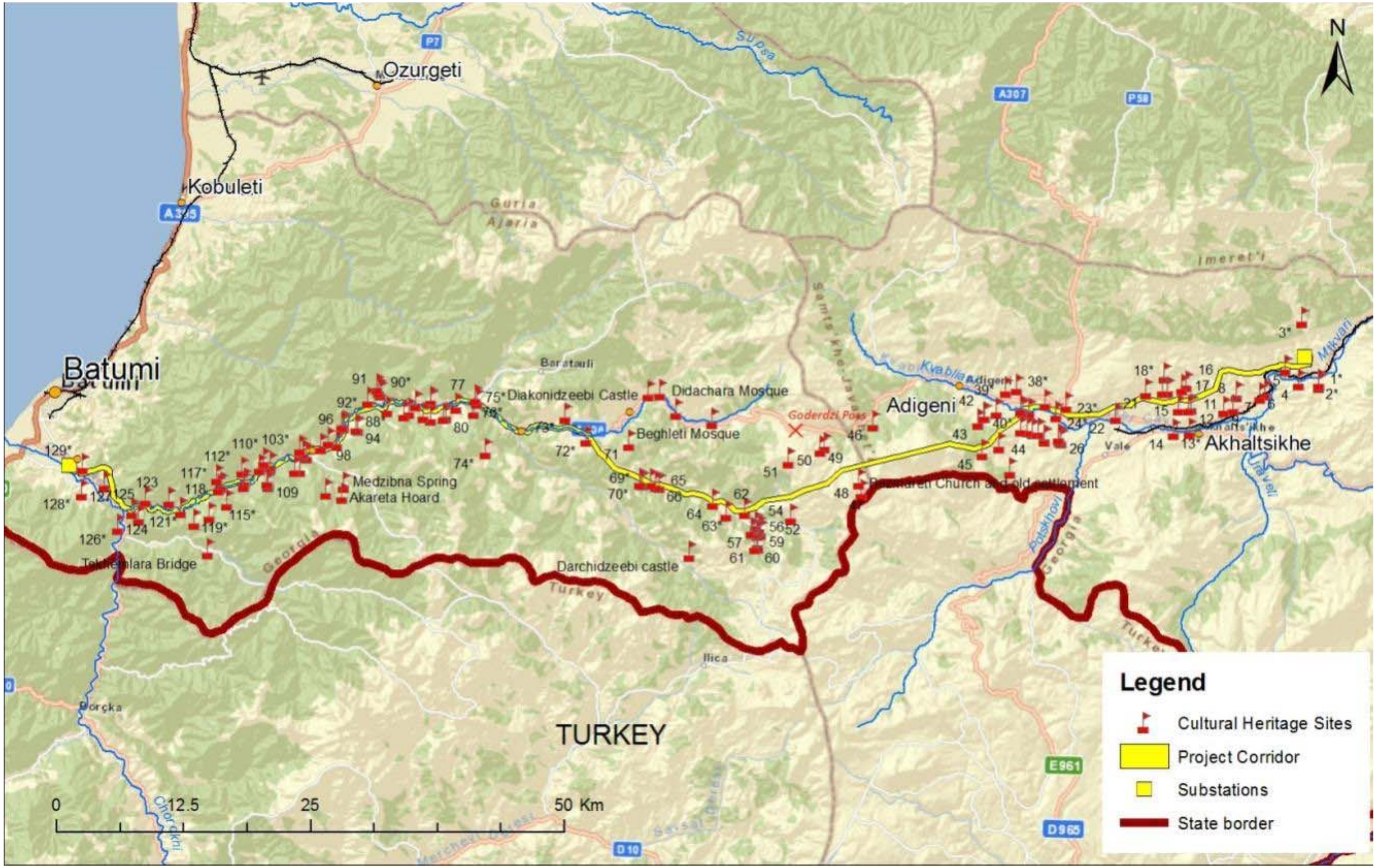


Figure 6.4.6 Cultural Heritage sites along the OHL Corridor, Sheet 1

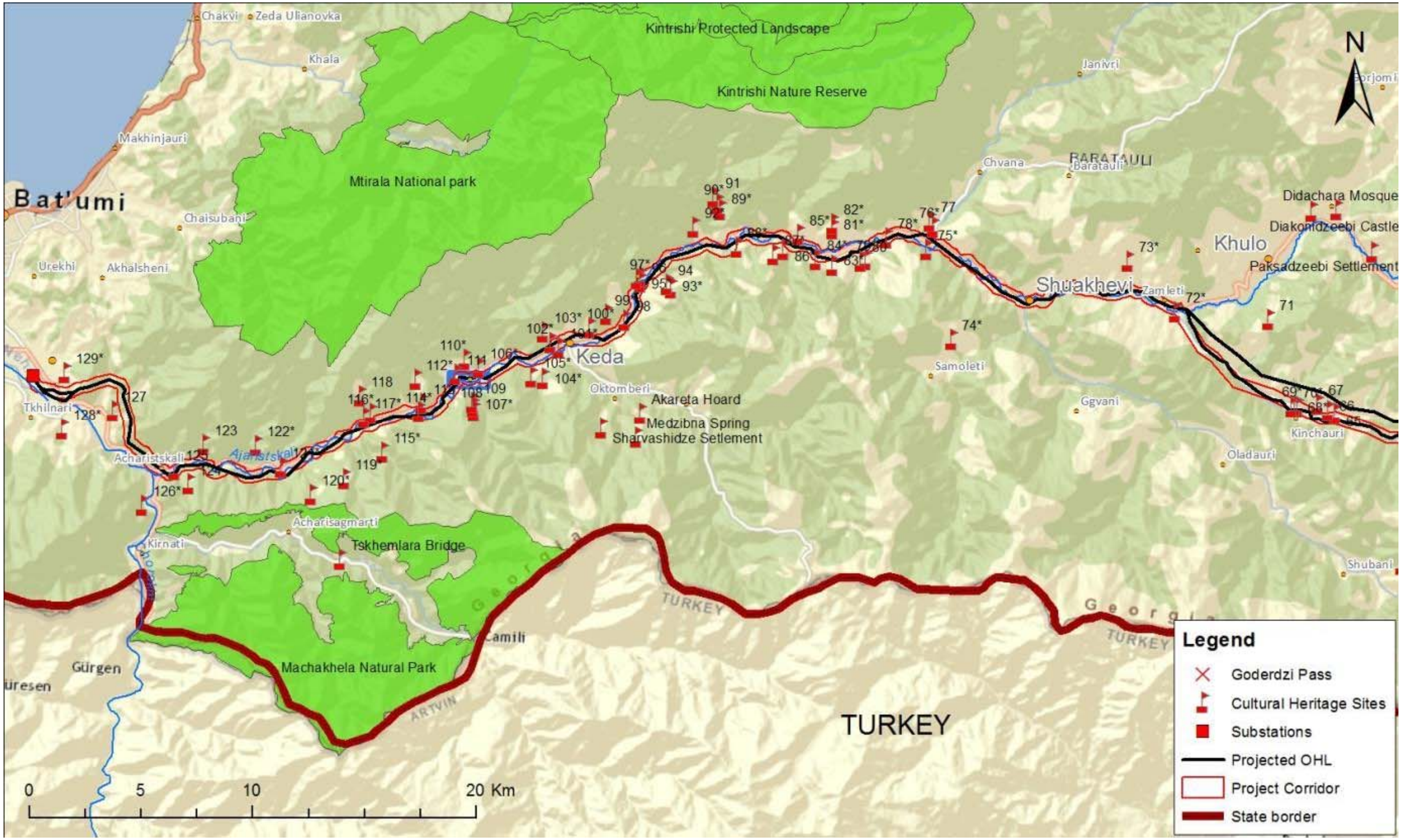


Figure 6.4.7 Cultural Heritage sites along the OHL Corridor, Sheet 2

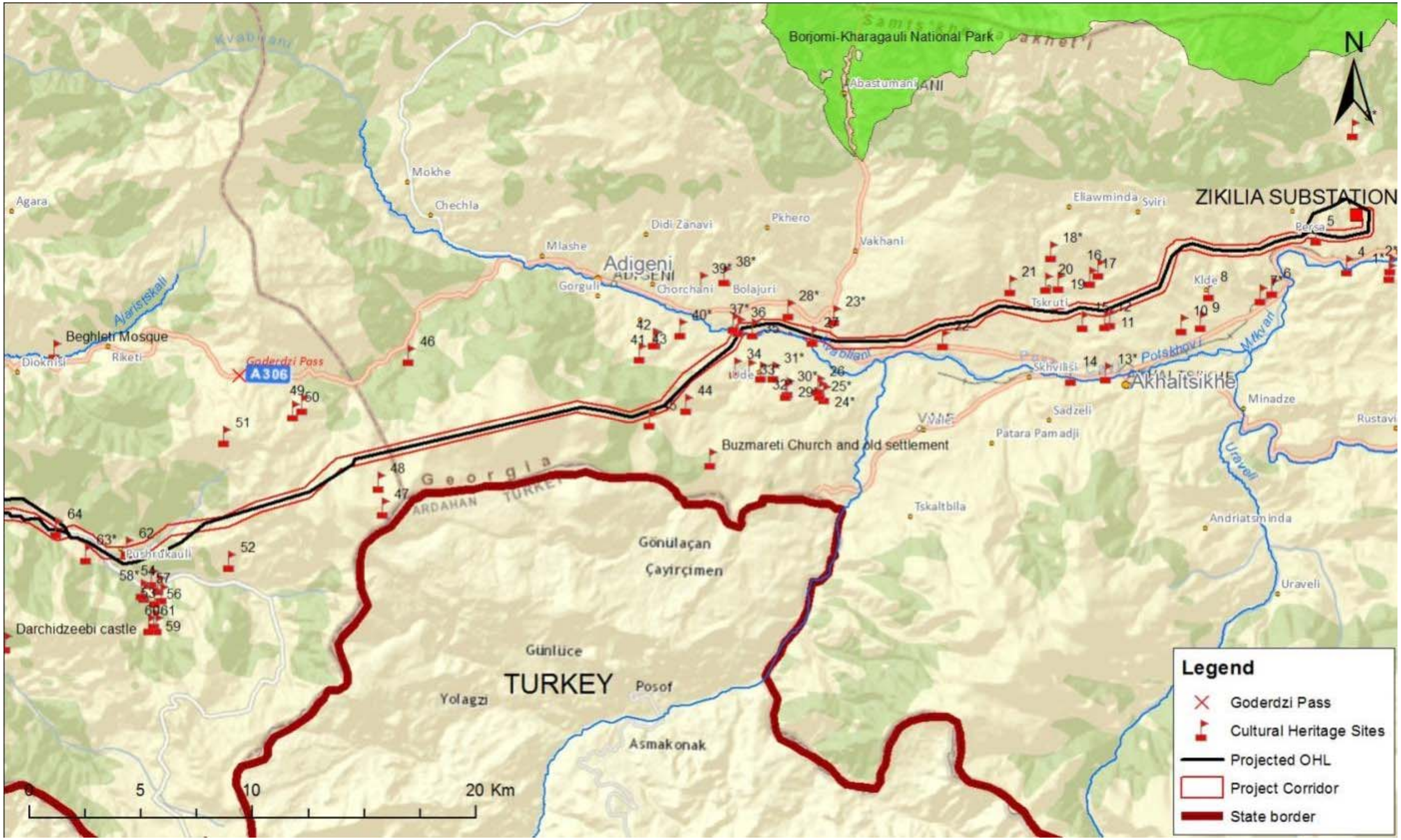


Figure 6.4.8 Cultural Heritage sites along the OHL Corridor, Sheet 3

Table 6.4.1 List of the Cultural Heritage Sites within 5-6 km Corridor of the Akhaltsikhe-Batumi 220 kV Transmission Line Project

N.B. Cultural heritage sites of national importance are marked with asterisks (*)

#	Name of the Site	Location	Age/Date	In Potential Impact Zone
1*	St. George Church	Sakuneti	XV-XVI c.	no
2*	St. George Church	Sakuneti	Middle Ages	no
3*	Monastery	Bieti	Domed Church (XIV c.), Shrine (1493), Bell Tower and Bridge (developed Middle Ages)	no
4	Church ruins	South-West of Zikilia	Middle Ages	no
5	Church ruins	Mugareti	Middle Ages	no
6	Cemetery	Tsnisi	Classical	no
7*	Tower ruins	Tsnisi	Developed Middle Ages	no
8	St. Nino Church	Klde	2007	no
9	Cult site	South-West of Klde	Early Bronze Age	no
10	Settlement	South-West of Klde	Early Bronze Age	no
11	Settlement	North of Akhaltsikhe	Early Bronze Age	no
12	Aqueduct	North of Akhaltsikhe	Middle Ages	no
13*	Rabati Complex	Akhaltsikhe	XIV c., XVII c., 1865, 1912	no
14	St. Ivlita and Kvirike Church	Ivlita	Late Middle Ages	no
15	Archaeological remains	North of Akhaltsikhe	Chalcolithic	no
16	Church ruins	East of Mikeltsminda	Middle Ages	no
17	Church ruins	South of Mikeltsminda	Middle Ages	no
18*	Church ruins	Noth East of Tskruti	Developed Middle Ages	no

19	Church ruins	Tskruti	Middle Ages	no
20	Church	Tskruti cemetery	Middle Ages	no
21	Church ruins	East of Tskruti	Middle Ages	no
22	Parekha Gora	East of Parekha	Early Bronze Age, Kura-Araxes Culture	no
23*	Cyclopic structures	Benara	Bronze Age	no
24*	Catholic Church	Arali	XIX c.	no
25*	Ornamented Stele	Arali	Early Middle Ages	no
26	Church ruins	Arali	Middle Ages	no
27	Settlement Hill	West of Benara	Late Classical-Early Medieval	This archaeological site is located between AP26 and AP27 of the OHL, in about 300 meters from the tower sites.
28*	Church	Shoraveli	Developed Middle Ages	no
29*	Shushan Kali Church	Between Ude and Arali	Late Middle Ages	no
30*	Virgin Mary Church	Between Ude and Arali	XIV-XVI c.	no
31*	Zurgiani Tower	Ude	Late Middle Ages	no
32*	Ascension of Virgin Mary Church	Ude	1904-1912	no
33*	Tower	Ude	Late Middle Ages	no
34	Ude Hoard	Ude	XIV-XII BC	no
35	Settlement Hill	North of Ude, at the right bank terrace of the river Kvabliani, next to the road going from Ude to Adigeni	Bronze Age – Early Iron Age	The road crossing the archaeological site will be used by the project machinery.

36	Settlement Hill	North-West of Ude, at the right bank terrace of the river Kvabliani	Classical (Roman ?)	This site is in about 50 meter west of AP30, within 25m corridor transmission line. Extension of archaeological remains of this site towards AP30 is highly possible.
37*	Church ruins	South of Bolajuri	Developed Middle Ages	no
38*	Church	Bolajuri	XIII c	no
39*	Church	Patara Smada	1467	no
40*	Mosque	Kakhareti	XIX c	no
41	Church ruins	North-West of Ghordze	Middle Ages	no
42	Kurgan grave	North-West of Ghordze	Bronze Age (?)	no
43	Church ruins	Amkheri	Middle Ages	no
44	Church ruins	Zazalo	Middle Ages	no
45	Irimchala Castle	West of Zazalo, in about 1.5 km	Middle Ages	no
46	Mezolughebi Big Settlement	South of Utkisubani	Early Middle Ages	no
47	Beshumi I, Settlement	6 km south-east of Goderdzi pass	Early Middle Ages	no
48	Leknari Settlement	5 km south-east of Goderdzi pass	Middle Ages	no
49	Shkernali	Next to Beshumi	Stone Age site	no
50	Beshumi Kurgan grave	Next to Beshumi	Bronze Age	no
51	Janjghnari Settlement	3 km south-west of Goderdzi pass, at summer pastures	Chalcolithic, V-IV mill. BC	no
52	Church ruins and the cemetery XIII c. and the Cemetery from XI-XIII cc	Tkhilvana	Church - XIII c. Cemetery - XI-XIII cc	no

53	Khikhadziri Neolithic site	Khikhadziri	Neolithic	no
54	Church ruins	Khikhadziri	Middle Ages	no
55*	Khikhadziri Castle	Khikhadziri	Middle Ages	no
56	Ibodede Hoard	Khikhadziri	VIII-VII BC	no
57	Tsikhiskeli Castle	West of Khikhadziri	XI-XIII c	no
58*	Khikhadziri Castle	At the junction of the rivers Kolota and Khikhanistskali	XI-XIII c	no
59	Kalota Pagan Sanctuary	Kalota	X-VIII BC	no
60	Kalota Hoard	Kalota	VIII-VII BC	no
61	Church	Kalota	XI-XIII c	no
62	Khizanaant Ghele Hoard	East of Oshanakhevi	VIII-VII BC	no
63*	Church	Vernebi	XI c. There are also old graves around the church	no
64	Pushrukauli Cemetery	At the right bank of the river Acharistskali, north-east of Makhalakuri	Late Bronze Age – Earli Iron Age	no
65	Neolithic site	Tsablana	Neolithic tools	no
66	Church	Tsablana	Middle Ages	no
67	Stone Age site	Tsablana	Stone Age tools	no
68*	Various Structures	Skhalta	Middle Ages	no
69*	Monastery and Cemetery	Skhalta	Middle Ages	no
70*	Minor Church	Skhalta	IX-XI	no
71	Tago Hoard	Tago	Bronze Age. Bronze ingots	no

72	Purtio Arched bridge	South of Zamleti	XI-XII cc	no
73*	Castle	Nigazeuli	Late Middle Ages	no
74	Castle	Tsinareti	Middle Ages	no
75*	Kaviani Castle	Dandalo, “Kalivake”	XII-XIII c.	no
76*	Castle	Takidzeebi	Middle Ages and cultural layers of Hellenistic Period	no
77	Cemetery and Hoard	Takidzeebi	Late Bronze Age	no
78*	Dandalo Bridge	Dandalo	XI-XII cc	This bridge falls within 25 m corridor of the project. OHL AP85 is located in about 100 m west of the bridge, at the right bank of the river. The discovery of archaeological remains is highly possible.
79	Castle	Takidzeebi	Middle Ages and Hellenistic layers	no
80	Hoard	Takidzeebi	Late Bronze Age	no
81*	Mosque	Gegelidzeebi	XIX	no
82*	Tower ruins	Gegelidzeebi	Middle Ages	no
83*	Winepress	Kokotauri	Late Middle Ages	no
84*	Mosque	Kokotauri	XIX	no
85*	Mosque	Akho	Late Middle Ages	no
86*	Tskhmorisi bridge	Tskhmorisi	Late Middle Ages	no
87*	Mosque	Tskhmorisi	XIX c.	no
88*	Mosque	Abuketa	XIX c.	no
89*	Tsoniarisi bridge	Tsoniarisi	Late Middle Ages	no
90*	Mosque	Tskhmorisi	XIX c.	no

91	Cemetery	Tskhmorisi	VIII-VII BC	no
92*	Mosque	Varjanisi	XIX c.	no
93*	Mosque	Kvashta	XIX c.	no
94	Settlement	Kvashta	V-IV BC	no
95*	Tower	Zvare	Late Middle Ages	no
96	Church	Modern		no
97*	Mosque	Zvare	1834	no
98	Castle	Akusta	Middle Ages	no
99*	Tower	Zesopeli	Middle Ages	no
100*	Mosque	Gulebi	XIX c.	no
101*	Church	Zendidi	Developed Middle Ages	no
102*	Castle	Zendidi	Late Middle Ages	no
103*	Castle ruins	Zendidi	Developed Middle Ages	no
104*	Castle	Dzentsmani	Middle Ages	no
105*	Mosque	Dzetsmani	XIX c.	no
106*	Tsivasula Castle	East of Pirveli Maisi	Middle Ages	no
107*	Mosque	Kolotauri	XIX c.	no
108	Cemetery	Kolotauri	Earli Bronze Age, Kura-Araxes Culture	no
109	Cemetery	Kolotauri	Earli Iron Age	no
110	Mitsis Khidi bridge	North-east of Pirveli Maisi	Middle Ages	no
111	Saghoreti hoard	South of Pirveli Maisi	XIII-XII BC	no
112*	Tower	Zeda Makhuntseti	Middle Ages	no

113	Makhuntseti hoard	Makhuntseti	XVIII-XVI BC	no
114*	Makhuntseti bridge	Makhuntseti	XI-XII c.	no
115*	Mosque	Zeda Bzubzu	XIX c.	no
116*	Kveda Makhuntseti bridge	Kveda Makhuntseti	Late Middle Ages	no
117*	Mosque	Kveda Makhuntseti	XIX c.	no
118	Zundagi hoard	Zundagi	XII-XI BC	no
119*	Medrese	Milisa	XIX c.	no
120*	Mosque	Uchkhiti	XIX c.	no
121*	Mosque	Dologani	XIX c.	no
122*	Mosque	Chinkadzeebi	XIX c.	no
123	Settlement	Kapnistavi	Classical	no
124	Winepress	Khertvisi (Zedubani)	Late Middle Ages	no
125	Khertvisi (Acharistskali) bridge	Khertvisi	XX c.	no
126*	Castle	Mirveti	Late Middle Ages	no
127	Castle	Zeda Erge	Developed Middle Ages	no
128*	Castle	Makho	Late Middle Ages	no
129*	Castle	Khichauri	Late Middle Ages	n/a

7. Sensitive Receptors and Potential Impacts

This section of the ESIA identifies and, to the extent possible, quantifies the project's en and socio-economic impacts anticipated at construction and operations stages. The a follows the methodology discussed in Section 5. In order to identify potential environmen the project activities are applied to the existing environment and sensitive receptors d Section 6. Each subsection contains description and comparison of likely impacts for all considered on the project planning and ESIA stages. The assessment of significance, as a the sensitivity of the receptor and magnitude of the impact, is presented for each impact Where significant adverse impacts are predicted to arise, measures to avoid, reduce, these impacts have been identified, and these are presented throughout Section 8 Environmental and Social Management and Monitoring Plan in Section 9. For each ma impacts are considered at both construction and operation phase. Decommissioning pl project has not been assessed in details, due to lack of information about the pro subsequently, the magnitude of the impact) and timing of decommissioning, at whic sensitivity of receptors may have changed. However, environmental and social imp decommissioning phase usually are similar to those of project construction.

7.1 Potential Impacts on Physical Environment

7.1.1 Potential impacts on surface water and groundwater

This section describes direct and indirect impacts of the project on surface water and g resources. GIS-based maps were evaluated to identify and assess surface water drainag floodplains, wetlands and groundwater resources in the study area. Each project a evaluated with respect to its direct and indirect impacts on hydrologic features, and these measured considering potentially affected area, sensitivity of receptor, likelihood of duration, severity of outcomes, etc., in accordance to the methodology proposed in Se impact assessment.

Direct impacts to groundwater are likely to be minimum due to the nature of the projec there may have place indirect impacts that are assessed. Impacts to surface waterways, and wetlands are identified and quantified with respect to the relative importance of eac resource, resource area impacted (for example area of impacted wetlands/total area of anticipated outcomes (e.g. higher surface runoff, increased flooding risk, water quality d etc.) and level of such changes.

Activities with potential to affect surface water or groundwater

The main project activities with the greatest potential to impact surface water and groundw building of access roads, excavations for tower foundations, and clearing and grubbing of for the transmission line right-of-way and access roads. These activities can affect water hydrology of local water bodies, and are briefly described below.

- *Access roads.* Road construction, operation and maintenance activities, with management and mitigation, may cause significant soil disturbance followed by washing away of soil by surface runoffs and consequently, resulting in increased t sediment deposition in receiving water bodies, at least temporarily. Vegetation l surfaces may allow storm water to flow without restriction, resulting in accelera erosion, channelling and increased sediment loads in water bodies. Removal of and compaction of road surface will reduce ground infiltration capacity, leading t surface runoffs, what is additional factor increasing soil erosion and can incre receiving water bodies. Earth cutting and filling activities during road construction subsurface hydrologic flow and bring water to the surface in new areas; besides clearing for roads is likely to change surface infiltration capacity and r groundwater recharge rate.

- *Excavations for tower foundations*. Excavation for transmission tower will remove vegetation, making exposed soil temporarily prone to erosion from wind and rain. Temporary stockpile of excavated ground could be washed down by storm water. As mentioned above, these factors can cause increased surface runoffs and sediment load in runoffs, resulting in increased turbidity and higher flow in receiving water bodies. At locations of shallow groundwater conditions, dewatering operations may be required in order to temporarily lower groundwater levels in order to install foundations. Towers placed in floodplains can disrupt water flow and trap debris which could further impede floodwater flow and raise flooding risk.
- *Clearing of transmission corridor*. Clearing and grubbing of vegetation including trees and shrubs in forested areas may make the soil more susceptible to erosion, temporarily increasing the amount of suspended solids and turbidity in receiving waters, which on its turn can cause sedimentation of water courses and increase the risk of flooding. As discued above, another impact factor will be changed (reduced) infiltration capacity and respectively, increasing of stormwater runoffs and increasing of flows in receiving water bodies.

Besides to the impact factors discussed above, there is a risk for accidental spills of oils/fuels and other chemicals used during construction and maintenance activities, what can eventually cause contamination of water resources. Water pollution could be also resulted from concrete works, if inappropriately managed.

Consumptive use of water is not a significant issue for the project, as the construction, maintenance or operation works will require small amount of water.

Project specific details on the impacts, including magnitude of changes, scale, etc. for construction and operation phases are discussed below and summarized in Table 7.1.2, at the end of this chapter.

Sensitivity of surface water and groundwater bodies, which is required for predicting of impact magnitude, is assessed considering their present condition including water quality, level of anthropogenic pressure, aquatic habitats, fish species and population, water use type, etc, which are described in the baseline section. Three sensitivity levels have been introduced based on these criteria, and these are listed in Table 7.1.1.

Table 7.1.1 Sensitivity Criteria for Water Environment

Sensitivity	**Criteria**
High	- River supporting fish with conservation status or providing major fishery resources. - River with good water quality (no pollution sources). - Surface or groundwater used for drinking. - Large floodplain.
Medium	- River supporting diversity of common fish species and providing resource for small-scale fishing. - River with fair water quality (occasional pollution sources) - Surface or groundwater used for industry or agriculture. - Small floodplain.
Low	- River which does not support fish resources, or supports very scant fish diversity and population. - River with poor water quality (pollution discharge sources). - Intermittent or no use of surface or groundwater by humans. - No floodplain.

Potential impacts on water bodies at construction phase

As described above, construction phase impact on surface water quality can be caused by erosion of exposed or disturbed soil, as well as sediment laden runoffs from excavation stockpiles. Sources of erosion and increased sediment transport include earthmoving activities, for example, excavation, vegetation clearing, grading and grubbing for site preparation and heavy equipment hauling over unpaved ground, which disturb soil being consequently easily washed by storm waters into nearby surface waters and increasing turbidity and sedimentation.

It is unlikely that soil disturbances from small work areas (tower sites) could be carried more than 100 meters from construction site. Respectively, receptors of the impact could be only streams within this distance from tower locations. In total there are about 40 towers located within 100 meters of major streams. The impact on minor streams, which are plenty in Adjara Region due to high precipitation level, should not be considered significant, because increased turbidity will disappear (due to settling and/or dilution) before stream reaches main water bodies. This impact on surface water should be short term, and should eliminate soon after completion of construction activities.

Forest clearing is another significant factor, which can cause increased erosion and sediment load. Tree felling is required for about 40-50 km of the entire corridor. Forested sections of the RoW are concentrated in the municipalities of Adigeni, Khulo, Shuakhevi and Keda. Where clearing occurs near streams, additional sediment and water quality degradation can occur. It should be mentioned, within forest clearance sections all project alternatives cross perennial streams that are tributaries of the Adjaristskali and Skhalta Rivers. Where line does not cross any perennial streams it would have minimal impact on water quality as a result of forest or vegetation clearing. Duration of the impact due to RoW clearance will be permanent as plant control will be required on operation phase as well.

As the above provided discussion shows, surface water resources in Adjara Region are more susceptible to the described impact, as relatively larger number of streams is concentrated along the RoW there. Other factors, which make water resources in Adjara more vulnerable to this impact, are local geological conditions and topography, which are very complex. In particular, likelihood of erosion is very high in Adjara due to erosion prone soils and steep hillsides (see Geology and Geohazards section); besides, many towers (40 units) will be installed close to major water bodies in this region. Respectively, implementation of proposed mitigations (see Section 8) and other relevant best practices is required to control the impact within acceptable level.

There will also be some potential for water pollution with hazardous material or fuel/oil spills during construction, operations and maintenance activities. In case of large spills surface water and groundwater can transport contaminants on large distances. Due to complex topography along the route, all transportation routes are in close proximity to streams, especially in Adjara Region, where the main and practically only road (except village roads to access remote agricultural lands) follows the Adjaristskali and Skhalta Rivers. Therefore, most probably major part of construction activities will be concentrated near to water bodies. However, spill risk could be easily controlled within acceptable level through appropriate management measures.

Increased stormwater runoff and the resulting disruption (increase) of surface flow can occur as a result of altering vegetation cover and topography on a site. This together with increased sedimentation potential can raise flooding risk for some river reaches. Such phenomena are of particular concern in areas that exhibit steep topography, such as hillsides, ravines and mountain slopes.

Potential impacts on water bodies at operation phase

The main impact on surface water hydrology during operation and maintenance of the project will be due to the increased vulnerability to erosion and subsequent impacts to water quality resulted from altered ground cover due to vegetation control, concrete tower foundations installed and permanent access roads. Effect of these factors on water bodies and sensitivity of the water bodies will be similar to the construction phase. In particular, these may include increased surface runoffs, increased sedimentation of stream channels, reduced groundwater recharge and increased turbidity in streams and rivers. More specifically, adverse impacts on water bodies on the operation phase will be as follows:

- Tower foundations will create impervious conditions, which will hinder infiltration and increase surface runoffs, accelerating erosion and sediment transport. However, towers will be scattered over large area and total paved area will be negligible compared to the total area of the project region and the right-of-way. Respectively, impact of tower's foundation on groundwater recharge rate, surface runoff and in-stream/river flow will be negligible.
- The operation of machinery during maintenance works, what can disturb soil and cause increased transport of inert material by stormwater to streams, entailing increase of turbidity and silting there. Need of machinery operations for maintenance will be rather limited, besides only access roads will be used for this purpose to avoid impact in undisturbed areas.
- Periodic clearing and control of vegetation within the right-of-way and along permanent access roads, what makes the soil more susceptible to erosion, increases stormwater runoffs and decreases ground infiltration capacity. This will be a long-term or permanent impact along the right-of-way sections presently covered by shrub land and forests, as these areas will not be allowed to fully revert to these habitats. As mentioned above, OHL sections where this impact will have place comprise in total 40-50 km.
- Direct water contamination, or secondary contamination of water as a result of soil pollution can occur from the use, improper handling and spills of hazardous materials, such as insulating oils, wood preservatives, paints and other toxic substances, which could be used during the operation and maintenance of the project. Vegetation control techniques that use herbicides is not planned for the project. Water contaminatin with chemicals (if any) will be a short-term and small scale impact with a potential to become a long-term and large scale impact without mitigation measures.

Impact summary and significance

The significance of the project impacts to surface and groundwater resources is practically of the same scale for all the alternatives discussed, except than no action alternative; these are summarized in Table 7.1.2.

Rivers in the project impact zone in Akhaltsikhe and Adigeni Municipalities are Mtkvari and Kvabliani. The expected impact on this surface water objects will be very limited, because the ROW is mostly sufficiently distanced from these water bodies. However, the Kvabliani River will be once crossed be the line. Despite this, impact on the river will be negligible, The infrastructure to be used by construction machinery (roads and bridges) in mentioned zone is well developed and placing of a tower in the river floodplain is not anticipated.

Situation in Adjara is different. As mentioned before, practically all access roads are located close to the major rivers of Skhalta and Adjaristskali. It is anticipated that construction activities for some poles will be conducted very close to these water bodies, or even at the edge of floodplains. There is possibility that river crossing by machinery will be also required for installation of some towers, because access to some tower sites is very limited. In such cases impact level can be high, but mostly very short-term, what makes impact of low significance.

The sensitivity for rivers and streams in the project region is assigned Medium level, currently they are in natural state or pollution is negligible. The water quality, especially in upper streams is very good, high oxygen content and low concentrations of biogenic compounds indicate low pollution level. There are no industrial sources of pollution and household wastewater is practically the main, though limited pollution source because mostly small scale population is present in the area. Rivers support some fish species, including protected one. The floodplain size in upstream sections is rather limited due to topographic characteristics. Main water use types are domestic water supply, drinking and agriculture.

The expected impacts on water resources are above 0 but, less than 5 per cent of the overall receptor area, indicating a very low magnitude of change. As a result, the significance of the described project impacts on water bodies is classified as “Negligible” for all alternatives of the project. Table 7.1.2 provides summary on main impact types for water resources and characteristics of these impacts.

Table 7.1.2 Significance of Environmental Impact: Surface Water and Groundwater

Receptor	*Sensitivity of Receptor*	*Potential Impact*	*Extent* *Intensity* Probability	Comments
Streams and Rivers	Medium	Sedimentation caused by sediment laden runoffs due to soil excavation and disturbance by project vehicle and other construction equipment along access roads and right-of-way.	Local Medium Definite	The amount of earth works required for the project is not significant, and will be limited to tower sites. Accordingly the expected impact will be very low, localized and scattered over large area.
Streams and Rivers	Medium	Placement of towers in floodplains can impede flood flows and produce flooding in upstream areas.	Local Low Possible	The evaluation of the project corridor showed that the absolute majority of towers are located away from main streams. Accordingly, the number of towers to be placed in the floodplain is very low. Mainly this considers middle section of Adjaristskali River, where the RoW runs close to the river. However, during the project planning towers have been spotted on naturally elevated areas, away from the floodplain (high bank, rocky hill). Respectively, possibility to cause flooding upstream is very low.
Streams and Rivers	Medium	Sedimentation and increase of turbidity due to transportation of soil eroded as a result of clearing of trees and shrubs in the corridor and along the access roads.	Local Low Definite	The increase of turbidity in surface runoff is expected because of vegetation clearance works in the corridor. Tree felling along the section from Village Zikilia to Village Ghordze is practically not required; accordingly the impact here will be negligible. From Ghordze to Rakvta (Skhalta River gorge) the OHL crosses forested areas and alpine meadows, where vegetation clearance and soil disturbance can cause significant erosion. However, water bodies are mostly distanced from the OHL, and washed sediments most probably will settle down before surface runoffs will reaches main streams. West to Rakvta the OHL runs close to rivers. Accordingly the impact can be noticeable there, but for short-term as vegetation (grass&shrub) will recover rather quickly due to subtropical climate and fertile soils. The main issue will be rapid reinstatement of all areas/sections after the works are finalized. Vehicles and equipment will travel across unprepared ground, with no preparation or road construction, unless efforts are needed to control erosion or excess land disturbance.
Streams and Rivers	Medium	Contamination caused as a result of in channel spill or transportation of pollutants spilled on ground by surface runoff.	Local low Possible	The amount of pollutants and hazardous materials required for construction and maintenance activities of the OHL is very limited, since the need for large number of trucks or special equipment is not required. The impact is most probable during the clearance and stringing works, when most part of machinery operations is required. However, the risk could be controlled via proper handling and operation of machinery and chemicals.

Receptor	*Sensitivity of Receptor*	*Potential Impact*	*Extent* *Intensity* Probability	Comments
Streams and Rivers	Medium	Vegetation control techniques that use herbicides can introduce environmental contaminants into the soil, surface water and groundwater	Local Low Possible	The use of chemicals for vegetation growth control can cause pollution with herbicides. This issue is important because the most part of the line is located in zone with high rainfalls and humidity. The herbicide use not expected during the construction activities, however can be applied during the exploitation of OHL. Avoidance of the herbicide use is recommended.
Streams and Rivers	Medium	Impact caused by the machinery operation in streams and at stream crossings	Local Low Probable	The impact on water bodies caused by the machinery operation within/near streams is expected to be low, because only around 10 poles will require stream crossings. Works requiring operation of machinery in the riverbed is not planned, and number of poles within the floodplain is also very low. Probability of stream crossing is higher for stringing activities, when machinery should pull conductors through right-of-way. In such cases use of alternative technique for stringing is recommended to avoid machinery working in a stream.

7.1.2 Potential impacts on air quality

This section examines potential changes in air quality due to the proposed project. In general, in the areas, where ambient air is already degraded due to existing emissions, the air quality is likely to be of higher sensitivity to additional impacts than where air quality is good. This is because in polluted areas smaller quotas are available, which could be used without violation of air quality thresholds and standards (for example, national or WHO, 2000), established to protect human health, vegetation and wildlife.

The national law requires implementation of air quality modelling, inventory of air emission sources and setting of maximum emission limits for all projects subject to ESIA. The air emission modelling report in required format is prepared for the project as a standalone document, which will be submitted to the authorities as a part of the ESIA package to obtain environmental permitting. To meet this requirement of the national law and quantify the impact on ambient air, air emission modelling has been implemented for the project (see Annex 4) and the modelling outcomes are used for impact assessment.

This section also examines climatic factors, in particular potential impact on greenhouse gases that contribute to global warming. The sensitivity of the global climate is assigned high level.

Potential impacts arising from the proposed project and respective emission sources are discussed in detail below.

Activities with potential to impact air quality

Primary air quality impacts associated with transmission lines occur during construction due to the release of fugitive dust emissions during earth works and transportation/machinery movement and pollutant (exhaust gas) emissions from vehicles and equipment.

On the operation phase, transmission line facilities do not include stationary combustion sources that are characteristic to many other industrial facilities. Pollutant and dust emissions can also occur during maintenance activities due to vehicular traffic on access roads and the operation of equipment (for example, gas-powered grass trimmers, lawn mowers, vehicles, etc.).

Other type and minor source of air pollution for OHLs on operation phase could be the leakage of sulfur hexafluoride (SF_6), which is a greenhouse gas with high global warming potential. SF_6 is typically used as a gas insulator for electrical switching equipment and in cables, tubular transmission lines and transformers at the transformers substations, which are not the subject of this ESIA.
Respectively, only fugitive dust and exhaust gas emissions will be discussed when assessing the project's impact on air quality on the construction and operation phases. Methodology described in Section 5 is used for the impact assessment. Anticipated deterioration of air quality is estimated in terms of timing, duration, severity. Criteria have been developed as well to assess sensitivity of impact recipients. The main parameter used for sensitivity assessment is the baseline air quality, which shows to what extent the ambient air quality could be further affected without jeopardizing human and environmental health. The criteria proposed for ambient air sensitivity are described in Table 7.1.3 below.

Table 7.1.3 Sensitivity Criteria for Ambient Air

Sensitivity	Criteria
High	Poor air quality in large urban and industrial areas, where existing emissions (SO_2, CO_2, PM_{10}, etc) exceed/ are likely to exceed international/ national thresholds
Medium	Acceptable air quality near within/near small settlements, where limited sources of emissions are present, and exceedance of international/national standards is not likely
Low	Good air quality, mostly in remote areas and open countryside, where few permanent emission sources do exist.

Potential impacts on air quality at construction phase

As described above, the air quality deterioration during the construction phase can be related to fugitive dust emission due to earth works and operation of vehicle and building machinery. Stationary emission sources (e.g. concrete batching plant, diesel generator, etc.) will not be used for the construction phase, because only small scale works are concentrated at each construction site. Works entailing air emissions and factors determining emission intensity are described below.

Sources of Fugitive Dust. Construction activities, including material moving, site preparation and vehicle traffic, if not properly monitored and controlled, have the potential to generate large amounts of fugitive dust. The dust-generating construction activities for the transmission line could be broken into the following three types:

- *Removal of Debris*. Debris removal consists of removing any man-made or natural obstructions (e.g., structures, trees and brushes) from the transmission line corridor. Under certain circumstances blasting could be required for site clearing; though this will be rather limited, if any. Loading/unloading of removed debris, disturbance of small areas and vehicular travel on unpaved surfaces are likely to be associated with debris removal and usually present fugitive dust sources.
- *Site preparation*. Site preparation for OHL includes grading and soil stabilization works to prepare the site for subsequent foundation construction and tower installation. Preparation activities typically include cut-and-fill operations, arrangement of access roads, aggregate surfacing, etc. Typical fugitive dust emission sources in these operations include movement of earthmoving equipment (for example, scrapers and dozers) over disturbed surfaces, material/aggregate loading and unloading, and vehicular travel on unpaved surfaces.

- *General construction*. The construction works include foundation work, structural steel erection, conductor deployment, electrical work and final landscaping. Again, machinery operations and material handling are dust emission sources.

Fugitive dust emissions sources resulting from these construction activities typically include disturbed surface areas, open storage piles, earthmoving operations and vehicular traffic. These dust emission sources could be described as follows:

- *Disturbed surface areas.* Many construction activities will result in temporary disturbed surface areas within the transmission line corridor, particularly at tower locations. Disturbed surfaces are more subject to wind and water erosion, and become emission sources during windy weathers and/or machinery movement. Emission intensity depends on soil humidity, and velocity of wind and machinery.
- *Storage piles.* Soil/aggregate stockpiles temporarily arranged during cut-and-fill operations and foundation works are typically left uncovered and represent fugitive dust emission source. Fugitive dust emissions may occur during material handling, and dust entrainment from piles by wind currents. Emission intensity depends on moisture content of piled material, as well as wind velocity.
- *Earthmoving.* Earthmoving refers to a broad range of construction activities using heavy equipment to clear land. The activities may directly expose soil material to wind erosion through excavation, hauling, loading, transferring, and other material moving activities. Emission intensity is dependent on work conditions and technique used, including humidity, wind rate, loading/unloading height, etc.
- *Vehicular traffic.* Vehicular traffic associated with the construction activities will likely include worker vehicles, equipment deliveries and heavy machinery traffic. These will mostly travel over unpaved surfaces, causing fugitive dust emissions in dry conditions. Machinery speed is another factor determining intensity of dust emission.

It should be mentioned that neither of dust generating activities will be large scale at individual construction site. However, mitigation measures will be required to avoid community and environmental nuisance. Mitigation measures suggested (see Section 8) will enable reduction of noxious factor to minimum level possible.

Vehicle Emissions. Transmission line construction typically involves the use of gasoline- or diesel-fuelled vehicles and equipment to transport workers, remove debris from the work area, conduct earthwork, erect structures, deploy conductor, etc. The operation of such vehicles and equipment result in emissions of flue gases including carbon monoxide, NOx, SO2, hydrocarbons and particulate matter. Intensity of emission depends on several parameters, including number of vehicles/machinery used, their capacity, operational hours, technical condition, etc.

Air quality modelling has been fulfilled for the construction phase to assess anticipated impact level. The modelling was implemented for small OHL section comprised running through the Khelvachauri City, considering machinery/vehicles most likely to be used during planned works. The construction activities for each pole, vegetation clearing and stringing operations are estimated based on type of machinery to be used and impact duration. Air emission loads are defined considering machinery requirement, excavation volume, quantity of compaction material to be delivered to site, conductoring works, volume of reinstatement works, etc. The purpose was assessment of potential impact on local population.

The computations showed that maximum concentration of flue gases at residential houses in 150-200 m from machinery operations will be in the range of 0.01-0.32 parts of maximum permissible concentrations established for them in Georgia. The situation will be similar for all OHL sections. Respectively, impact on air quality due to vehicle (flue gas) emissions is negligible.

Potential impacts on air quality at operations phase

Impact factors which could influence quality of ambient air on the operation phase are even more limited than on the construction phase. Works with such potential will mainly include vehicle emissions as part of regular maintenance and emergency response activities, as well as vegetation control activities with use of mechanical equipment. These will be gas- or diesel powered trucks, lawn mowers, grass trimmers, etc. The operation of such vehicles and equipment result in emissions of carbon monoxide, NOx, SO2, hydrocarbons, and particulate matter. Certain fugitive dust emission is also likely due to machinery movement. However, all these impacts will be short-term and temporary. Vegetation control along the ROW will occur once every 5 to 8 years. Ongoing maintenance of towers and conductors will be in response to tower and conductor/insulator damage and would be expected to be very limited in frequency and duration. Due to this and considering low to medium sensitivity of ambient air in the project RoW, air quality deterioration is considered to be negligible on the operation phase.

As mentioned above, sulfur hexafluoride (SF6) emission, which is GHG, is not relevant to the project, as gas insulated cables will not be used. However, the project still could be assessed in climate change context. In particular, the project will make hydropower generated electricity more available to local population, thus reducing reliance on combustion generation and firewood. Besides, the project will allow electricity generated from hydropower to be delivered to the Trans-Caucasus regional marketplace, what will enable reducing greenhouse gas emissions associated with coal/gas powered generating facilities. However, this beneficiary effect is not likely to be significant on the regional scale.

Impact summary and significance on air quality

As described, the OHL corridor will cross several small and medium size communities, with limited number of stationary emission sources and limited capacity of existing emission sources. Industrial emission sources factually do not exist along the RoW. Air quality in the project area is generally good as the project is not located in urban centres. Respectively, the sensitivity of ambient air in these areas is assigned medium to low level, depending on population size. In sections, where OHL will cross remote areas and open countryside, ambient air could be assigned low sensitivity level, as air pollution sources factually do not present there.

Volume and duration of construction works at each construction site will be rather limited. Air emission sources will be also few, and not intensive. The air emission during the operation phase will be even less. Respectively, air emission will be short term, most probably lasting from several days to several weeks. Background air quality will recover immediately after finalizing of project activities. Due to the above mentioned, impact on air quality is assigned very low level for the construction phase and negligible for the operation phase.

The significance of the impact to air quality associated with this OHL project are the same for all alternatives (except the no action alternative) and is summarized in Table 7.1.4.

Table 7.1.4 Summary of Significance of Potential Impacts to Air Quality

Receptor	Sensitivity of Receptor	Impact on Air quality	Extent Intensity Probability	Comments
Residents	Medium	Fugitive dust generation during construction	Spot Medium Definite	The amount of soil works required for the project is not significant. They will have spot character and will be scattered over vast area. Accordingly, the expected dust generation in specific locations will be very low. The construction traffic will not be significant and accordingly the impact will be low. For the sections where construction traffic has to pass small villages with dirty roads, the disturbance of population with dust will have short term character and will last only few days. The construction crew will move to the next location. The traffic management tools should be employed to minimise such input.

Receptor	Sensitivity of Receptor	Impact on Air quality	Extent Intensity Probability	Comments
Residents	Low	Fugitive dust generation during maintenance	Spot Medium Probable	The maintenance activities will not require large number of vehicles and equipment. The extent mostly will be on one or maximum few poles altogether, accordingly the disturbance will be negligible.
Residents	Low	Vehicle (flue gas) emissions during and maintenance	Local Very Low Definite	The quantity of vehicles is very low, as described. Accordingly flue gas emissions will be also very low. Air quality in the area is mostly good and of low sensitivity, so noticeable air quality deterioration is not expected even for short periods of time.
Residents	Low	Increased availability of hydropower generated electricity and reduced reliance on combustion generation and firewood	Local Low Possible	This type of impact is definitely positive. However, the impact will be negligible on the regional level.
Biodiversity	Low	Impact on biodiversity due to degradation of air quality during the construction (dust, smell disturbance)	Regional Low Possible	The construction and maintenance machinery can impact biodiversity. However air quality modelling has shown that noticeable air quality degradation is not expected even in 50 m distance from active operation works. Accordingly impact on biodiversity because of air quality degradation will be negligible.

7.1.3 Potential impacts on geology, soils and geohazards

This section describes direct and indirect impacts of the project on geologic conditions and soils. GIS-based maps, as well as the Routing Study (Mott MacDonald, 2012) were evaluated to identify geologic issues and assess soil types along the study area for each alternative. The geologic description for the project region is given in Section 6.1.3 and the soil characteristics are described in Section 6.1.4. The geological and soil cover maps were prepared for the entire transmission line corridor from east to west (see Figure 6.1.19 - Figure 6.1.25) and used for the assessment of potential impacts on soils and geologic conditions, which are likely to arise during various site preparation and construction activities to be implemented for the proposed project.

Activities with Potential to Impact Geology, Soils and Geohazards

Project activities with greatest potential to impact geology and soils include clearing, grubbing and control of vegetation for transmission line ROW and access roads, excavation for tower foundations, machinery operations and movement, increased load on rocks due to installation of heavy structures (towers), routine maintenance works, etc. More specifically, these activities can have the below described effects on the geologic and soil conditions:

- *Vegetation clearing, grubbing and control.* Clearing of trees and shrubs make the soil more susceptible to erosion, as vegetation cover protect soils against wind and precipitation. ROW and access road clearing also can increase stormwater runoff, which on its hand can add to erosion potential. As a result, these areas may also become susceptible to landslides and mudslides over time. Vegetation control to maintain OHL ROW and access roads in safe and operable condition restricts re-vegetation of these areas, that is makes the described soil erosion potential permanent.

- *Excavation*. Excavation for tower foundations removes grass and vegetation, exposes soil and makes it prone to erosion from wind and rain. Blasting may be required to set tower foundation in rocky terrain. Blasting activities produce seismic waves which could locally produce rockslides, landslides or mudslides in geologically unstable areas. Blasting in mountainous terrain during the late winter and early spring could also set off avalanches in areas of a heavy snow pack.
- *Installation of towers.* Installation of heavy towers increases overburden on rocks, and can lead to mass movement of soil (landslide), if bedrock's bearing capacity is not sufficient to withstand increased load.
- *Machinery operations*. There is a potential for soil disturbance and compaction from construction and maintenance vehicles over the ROW during the construction and operation phases. These can entail increased erosion of loosen soil and restricted re-vegetation capacity. Additionally, there is a potential for soil contamination during this activities associated with leaks of fuel and oil spills from building and maintenance vehicles.

As the description of generic impacts on soil and geology shows, three major types of impacts including soil erosion, soil pollution and increased geohazards (landslides, mudflows) may have place in this regards.

The following paragraphs provide more details regarding these impacts. General overview of impacts on soil, geology and geohazards, inherent to OHL project is followed by the discussion of the potential impact factors and resultant project specific impacts for the proposed OHL for the construction and operation phases. Like other impact types, the impact assessment for soil, geology and geohazards is based on the methodological approach adopted for the present ESIA, and considering extent, duration, likelihood and other relevant characteristics of potential impacts. The sensitivity of local soil and geological conditions, which largely determines magnitude of the impact, is estimated based on the criteria introduced. Largely, these include susceptibility of soil to erosion, vegetation condition, presence/potential of landslides, etc. Specific sensitivity criteria are given in Table 7.1.5.

Table 7.1.5 Sensitivity Criteria for Geology, Soils and Geohazards

Sensitivity	**Criteria**
High	- Steep slopes, where tree/shrub clearing is anticipated - Large size landslide areas, which not be comprised in the span between two towers - Deep landslide areas, where stable bedrock is factually unreachable - Sites covered with dense forest and/or shrubbery - Alpine meadows covered with fragile soils, which are extremely sensitive to any disturbance
Medium	- Moderate slopes, where tree/shrub clearing is anticipated - Medium size landslide areas, which could be comprised in the span between two towers - Moderately deep landslide areas, where stable bedrock are rather deep laing - Sites covered with forest and/or shrubbery
Low	- Slight slops or flat areas, where tree/shrub clearing is anticipated - Small size/shallow landslide areas, which could be easily avoided, or where landslide risk is readily controllable - Areas, where vegetation clearing is not required, or could be restored post construction

Soil Erosion Impacts

As indicated above, earthmoving activities, such as vegetation clearing, grading and grubbing for site preparation and heavy equipment hauling over unpaved ground may loosen soils. Loss of vegetation and soil disturbance increases the vulnerability of soils to erosion. Besides, soil compaction due to machinery operations makes difficult re-vegetation, The soil is particularly vulnerable to these impact factors during wet weather or after snowmelt, when vehicle traffic can cause the greatest damage.

The potential risk for erosion is increased by siting project components in areas with steep slopes, unstable soils such as peat, humus and alluvial soils, and clays which are fine-grained and susceptible to erosion in dry conditions. The vulnerability of soils is highest in alpine meadows, where soils are sensitive to any disturbance and poorly protected by vegetation.

Soil Contamination Impacts

Soil contamination can occur from the use, improper handling and spills of hazardous materials, such as oils and fuel, wood preservatives, paints, herbicides and other toxic substances which could be used during the construction, operation or maintenance activities.

Liquid petroleum fuels and lubricants for vehicles and other equipment pose a risk of soil contamination if spilled/leaked during construction, operation and maintenance activities.
Vegetation control along the right-of-way can cause soil pollution, if herbicides are used for this purpose. Respectively, pollution prevention/ mitigation measures are required whenever this method is used for vegetation control.
Steel towers and aluminium conductors do not cause soil contamination, composite elements naturally occur in the soil, and the leaching potential for these elements from these structures is extremely low.

Paint, if used on towers, could also cause soil contamination, if spilled or applied improperly; however, after drying this risk practically disappears.

Geohazard Impacts

The potential risk of geohazard impacts are related to siting of OHL towers in areas with unstable geological features, where catastrophic geological events such as landslides and mudslides can be developed. Such mass movement of rock or soil can jeopardize OHL towers' stability, as well as threaten down gradient lands and residents. Factors that can cause landslides/mudslides can be natural, or project related, and may include:

- Project related factors:
  - Increased overburden from structures
  - Reduction of roots holding the soil to bedrock
  - Undercutting of the slope by excavation or erosion
- Natural factors:
  - Increased soil moisture from rainfall/snowmelt (can cause mudslides)
  - Seismic shaking
  - Weathering by frost heave
  - Bioturbation (displacement of soil and sediment by plants and animals).

All these factors should be carefully considered during project planning and implementation to minimize potential risks to planned activities, population and other receptors.

Potential impacts on geology, soils and geohazards at construction phase

In case of the given project, the following types of construction activity could lead to soil erosion, landslide activation and soil contamination:

- Vehicle and other construction equipment traffic along access roads and ROW may cause soil compaction and rutting. This will be a short-term impact with a potential to become a long-term impact without mitigation measures. However, without proper management of traffic and machinery, the resultant impact could be high, especially in areas where soil, topographic and weather conditions can aggravate the outcomes.

  In case of the present OHL, such sensitive areas include sub-alpine and alpine meadows, as well as steep mountain slopes between Ghordze to Rakvta. Fragile mountainous soils, complex topography and high precipitation level together with overgrazing make this section extremely susceptible to erosion. The anticipated outcome of this impact could be assessed considering already impacted terrain within the project ROW, where population seems to drive off-road vehicle over grassland to avoid unpleasant drive on bumpy roads. Resulted soil damage and erosion is shown in Figure 7.1.1, which was captured during the site visit in July 2013. As the figure shows, damage to soil and resultant erosion could be significant, if the movement of the project machinery and vehicles will be uncontrolled.

- Vegetation clearing and especially tree/shrubbery removal from ROW, construction camps, tower foundations and supporting work areas, and access roads can make the soil susceptible to erosion and mass movement. Besides, it will increases stormwater runoff, as the infiltration capacity of the bear soil will be lower.

  This will be a permanent impact for towers, ROW and permanent access roads, as vegetation will not be restored there after construction. Impacts from construction camps will be short-term, as these areas will only be used during construction activities and reinstatement will be ensured post construction. Besides, sites requiring minimum vegetation clearing will be selected for camps.

  In this regards sensitive issue will be vegetation clearing in erosion/ landslide prone areas. Such are forested terrain and shrubland over steep slopes. As Figure 6.1.16 and Figure 6.1.18 show, Skhalta and Adjaristskali River gorges, where major part of tree felling is anticipated, are considered to have high risk of landslides. Some large-scale landslides are detected on this section. As Figure 6.1.17 shows, Akhaltsikhe and Adigeni Municipalities face lesser geohazards risk than the Adjara Region.

  Mudflow potential is relatively low for the whole corridor due to the very strong vegetation in the corridor, but the risk can be significantly increased after vegetation clearance. Further details regarding geohazards in the project region are given in detail in Section 6.

- The installation of tower foundations in rocky terrain (bedrock, hard volcanic rocks) may require blasting activities. Blasting in high slope areas could generate sound and seismic waves that could trigger mass movement of soils, or avalanches in areas of high snow. Blasting could also fracture supporting bedrock and produce mass movement of overlying soil in high sensitivity areas.

  It should be noted, that very limited blasting (if any) is expected to be required for the project. In case of such need, geohazards risks and blast charges will be adequately assessed to avoid development of mass movement of soil/rocks. The sensitivity of the OHL corridor to this factor is described in the paragraph above.

- Soil contamination can occur from the use, improper handling and spills of hazardous materials, paints and other toxic substances which could be used during the construction works. This will be a short-term impact with a potential to become a long-term impact without mitigation measures.

It should be mentioned, that some of potential impacts on soil, geological conditions and geohazards significantly differ between the project alternatives. This is due to varying conditions in terms of forest clearing needs and existing/potential landslides. These factors have been evaluated during the routing study and analysis of the proposed alternative, so that to identify options with lowest geohazards risks. This helped to select from the route alternatives developed the one where vegetation clearing will make less vulnerable exposed soils, and high landslide risk areas could be avoided to prevent damage to the project or environment.

Figure 7.1.1 Area showing affected soil from off-road traffic

Potential impacts on geology, soils and geohazards at operations phase

The main impact on soils and geohazard sites during operation and maintenance of the project will be the increase in vulnerability of soils erosion and potential for soil contamination. The following operation and maintenance activity could lead to potential soil erosion and contamination:

- Vehicle traffic along access roads and ROW during maintenance, what may cause soil compaction and rutting. Most probably this will be required for the project once per five years. Respectively, the impact should be short-term. However, as access roads close to populated areas could be used by local population, the impact is likely to have permanent character in such areas. It should be mentioned that if available, exiting roads are used for access to avoid additional environmental impact.
- Periodic clearing of vegetation as part of routine right-of-way and access road maintenance activities will make the soil more susceptible to erosion and increase stormwater runoff, which on its hand add to soil erosion process. These will be a permanent impact along right-of-way areas and permanent access roads, that are presently shrubland and forest as these areas will not be allowed to fully revert to these habitats. As mentioned above, need for vegetation clearing in highly sensitive areas is avoided through routing alternatives.
- Installation of heavy towers increases overburden on rocks, and can lead to mass movement of soil (landslide), if bedrock's bearing capacity is not sufficient to withstand increased load. This will be avoided through comprehensive assessment of geologic conditions and proper siting of towers.
- Soil contamination can occur from the use, improper handling and spills of hazardous materials, such as oils, paints and other toxic substances required for operation and maintenance of the OHL. It is planned to use mechanical vegetation control techniques for the OHL. However, if herbicides still are used for this purpose, environmental contaminants will be introduced into the soil and adjacent habitats. Soil pollution will be a short-term impact with a potential to become a long-term impact without mitigation measures.

Together with the above described geohazards risks, earthquake sensitivity is an issue for the project on the operation phase. The highest earthquake risk areas are located in Khulo and Shuakhevi

Municipalities. This should be considering during the design of towers and foundations so that they could be able to withstand these potential seismic shakes.

Impact summary and significance

The significance of the environmental impacts to soils, geology and geohazards associated with this project is summarized in Table 7.1.6. It should be mentioned, that the impact on geologic conditions is very important due to the high number of landslides and mudflows in the Adjara Region, which is a high geology risk area. In particular, the entire Skhalta River valley is considered as a high sensitivity area in terms of landslides. Geohazards risk is less in Adigeni and Akhaltsikhe Municipalities, and installation of towers in high risk areas could be easily avoided in these territorial units. Most of the project area has from medium to high sensitivity for earthquakes.

It is important to mention, that the preferred route has significantly less impact on geologic features, because amongst the selection criteria high importance was given to avoidance of high risk areas in terms of landslides.

Table 7.1.6 below summarizes main factors which can cause impact on soil, geologic conditions and geohazards; environmental sensitivities, which can increase the impact potential, are highlighted.

Table 7.1.6 Significance of Potential Impacts on Soils

Receptor	Sensitivity of receptor	Impact on Soils, Geohazards and Geology	Extent Intensity Probability	Comments
Soils	High	Soil compaction and rutting by vehicle and other construction equipment along access roads and ROW	Local, Low, Definite	The traffic movement during the construction activities will have local and temporary character. Only small scale construction activities are required at each tower site. Respectively, the impact on soils will also have short term character at specific locations, if appropriate preventive/mitigation measures are used during and post construction activities. Areas particularly sensitive to these impacts comprise alpine meadows and steep slopes, where soils are extremely susceptible to erosion if disturbed.
Soils	High	Clearing of trees and shrubs make the soil more susceptible to erosion and mass movement.	Local, Medium, Definite	After clearing activities the soil will be exposed to rains and wind action. Accordingly, soil degradation is unavoidable. It is expected, that will not have significant effect for most part of the ROW. The natural growth of vegetation in target areas is very fast, and grass cover will be quickly covered with vegetation. However, growth of trees should be controlled along the ROW and permanent access roads. Respectively, erosion and landslide development risk will be notably increased in some areas.
Soils	High	Blasting for tower foundations may trigger mass movement of soil, or avalanches in high snow areas.	Spot, Low, Possible	It is not likely that much blasting will be required. Even in such cases the expected impact will have local character. Besides, blasting charges will not be large, since the volume of required excavation under the towers is very small.
Soils	High	Soil contamination from the use, improper handling and spills of hazardous materials (fuels and lubricants,	Local, Low, Possible	There is always risk of soil pollution due to improper use and management of hazardous materials. The extent of such pollution depends on quantity of hazardous materials spilled, soil characteristics and spill response. The proper management of

Receptor	Sensitivity of receptor	Impact on Soils, Geohazards and Geology	Extent Intensity Probability	Comments
		paints, etc.), which could be used during the construction and maintenance works.		hazardous materials will be required to mitigate or avoid such risks.
Soils	High	Vegetation control techniques that use herbicides can contaminate the soil.	Local, Low, Improbable	Mechanical vegetation control is planned for the project. It should be ensured that contractors or vegetation control team do not use herbicides for this purpose.
Soils	High	Soils excavated for foundations may be exposed to wind and water impact for long periods	Spot, Medium, Probable	Soil excavations will have spot character, because the tower foundation will scattered with 300-400 meters interval along the ROW. Site reinstatement planned will ensure that spoil material is properly compacted and reinstated.
Soils	Very High	Damage to soil structure in the Alpine meadows area	Spot, Medium, Possible	The alpine meadows in the section from Ghordze village to Skhalta gorge (village Rakvta) inclusive Beshumi area are very sensitive, accordingly the impact is possible and intensity should be accounted as medium, however the impact will be during short time.
Geo-hazards	High	The placement of poles on unstable areas, or areas with geohazard activation risk can cause landslides	Local, High, Probable	The geohazard risk is high for the ROW, especially in Khulo and Shuakhevi Municipalities. This risk is minimized through comprehensive routing study and identification of alternative, safer routes, where installation of towers in high risk areas is avoided. However, the project can contribute to geohazards development processes.

7.1.4 Potential impacts on land use

This section describes potential impacts of the project on the existing land uses. The existing land use categories for the ROW are described in Section 6. Approximate extent of each category affected by the project is estimated using Google Earth images, and these estimates are used for prediction of magnitude of change for each land use type. Land use sensitivity criteria have been also introduced in this section, which together with other characteristics of potential impacts (e.g. magnitude of change, duration, reversibility, etc.) described in the impact assessment methodology adopted, is used for assessment of the significance of potential impacts.

Activities with the potential to affect land use

Land use impact of OHL projects can be caused due to need to allocate and maintain corridor for installation of the transmission line, as well as to construct temporary and permanent access roads. Land use impact may imply:

- *Permanent loss of the existing land use*: Such impact can have place at sites under OHL towers and areas, where permanent access roads are arranged, as they are permanently lost for other uses. Land use type could be permanently impacted for ROW sections which were formerly occupied by forests or orchards, as tree removal could be required for OHL safety and recovery of forests and tree planting is usually restricted. High voltage lines (≥330 kV) can also cause residential land loss, if OHL could not be sufficiently distanced from living houses and physical displacement is required.

- *Temporary restriction of the existing land use*: Such restrictions may have place during construction operations, when land parcels are required for implementation of planned works. Lands used for temporary roads can also be temporarily lost for former land use. Usually, former land use type could be restored for temporary sites. Major part of ROW can also be used as previously, with the exception of the above described cases; however, certain limitation could be imposed. This may include limitation of time, which could be spent by land users/local population in close proximity to high voltage OHLs, prohibition of installation of high structures within certain distance from the OHL, tree planting, etc.
- *Temporary or permanent restriction of access to lands and/or other resources*: Access to some areas and resources (e.g. forests, pastures, etc.) could be temporarily limited due to construction/maintenance activities to prevent safety risks to users and avoid injury of cattle from construction operations and machinery used. For OHL projects this is usually short-term impact, as duration of construction works is rather short for individual site and section. Other impacts in this category may include reduced availability of certain recourses (e.g. wood, medical plants, pastures, etc.), which could be impacted by the project (e.g. due to vegetation clearing, erosion, etc.). Such impacts could be temporary or permanent, depending on impact factor and location.

Together with the above listed direct impact factors, some indirect impacts from OHL projects can also influence land use. In particular, as discussed in respective sections, vegetation clearance, potential erosion, sedimentation and landslides, soil and water pollution, etc, are factors which can also influence existing land uses.

The discussion and assessment of project specific impacts for construction and operation phases is provided in the following paragraphs. For assessment of impact on land use using the project's methodological approach, land use sensitivities have been determined. Criteria used for grading of land use sensitivity include land use types and relative value of current land use for the environment and socio-economics. Specific land use sensitivity criteria adopted for the present ESIA are provided in Table 7.1.7 below.

Table 7.1.7 Land Use Sensitivity Criteria

Sensitivity	Criteria
High	- Protected area of national or regional importance and its surroundings - Massive pristine forests - Alpine meadows and riparian forests - Residential areas
Medium	- Regionally and economically important land uses - Modified and/or fragmented forests, scrublands - Pasturelands, croplands and agricultural lands.
Low	- Abandoned brownfield areas and degraded landscapes - Areas of urban intrusion or uncontrolled development in the open countryside

Potential impacts on land use at construction phase

As described above, vegetation clearance, OHL construction and arrangement of access roads are activities of OHL projects, which can impact on land use on the construction phase.

Major land use categories which can be impacted by the planned OHL include agricultural (crop growing and cattle breeding), residential and forestry. Proportion of these land uses and their sensitivity is different for the OHL ROW. Rough estimate of the affected land use by the major categories is provided in Table 7.1.8. This table does not concern to the entire ROW, but only ROW sections, which could be affected by vegetation clearance and/or construction works. As the table shows, that roughly 425 ha area will be affected by the OHL construction. Out of this 320 ha (80%) will be forests, including ca. 80 ha (20%) fragmented forests and 240 ha (60%) massive forests. In total, these forests grow over about 40 km long section out of 150 km of the OHL ROW. It should be mentioned, that most part of potentially impacted massive forests are already modified due to commercial and social logging, and only small portion is preserved pristine.

Coupling the above mentioned with Table 7.1.8 and the sensitivity criteria in Table 7.1.7, most land use impacted by vegetation clearance and construction works could be assigned medium sensitivity level. Though, some highly sensitive lands (e.g. pristine massive forests, riparian forests, alpine meadows, residential areas) are also likely to be affected. It should be mentioned, that impact on highly sensitive land use is minimized to the level practicable during the OHL routing.

As discussed, one of impact factors for the land use will be vegetation clearance to ensure safety of the OHL corridor. The need for vegetation clearance and respectively, the width of the OHL corridor varies between OHL sections, and depends on vegetation cover (height) and topographic conditions. In particular, this is determined by the need to ensure at least 12 m vertical clearance between line conductors and vegetation. Due to this and according to the respective clearance assessment, about 65 meters wide clearance corridors will be required in some massive forest sections, whilst in other places this will be much narrower. Vegetation clearance for tower installation will be much smaller, as only 200 m^2. is required for each tower. Approximately 6 m wide corridor is considered for new access roads. However, considering that the project will seek to use existing roads, or cut new roads through relatively bear areas, tree/shrubbery removal for this purpose will be relatively limited as well.

As the above mentioned shows, land use impact will be most significant in forested areas, where trees and understory species will need to be cleared for 65 m width. In sections, where due to topography the lines will be at 20-35 m height from the ground surface, the tree cutting of whole width is not considered, and only narrow paths will be cleared for pulling of conductors during the stringing and OHL safety. As provided in Table 7.1.8, forest clearance for the OHL construction and safety is required in total over 320 ha roughly. The impact on forests will be mainly permanent, as vegetation control on operation phase will be necessary to ensure OHL safety. After finishing of construction works, solely small deforested areas cleared conductor pulling only could be allowed to restore tree cover.

The areas cleared for access road construction is 50 ha, from this area, approximately 30% is woodland, 25% is grassland and meadows and 20% will be on agricultural land and other will be on floodplain, river channel. The additional access roads will not be constructed within population areas, because those already have the road network, which will be used by the project. Not significant amount of work will be required for widening those roads.

As Table 7.1.8 shows, forest cutting and sensitivity of affected forests, and respectively, impact on this land use category will be unevenly distributed between the affected municipalities. Most forests will be cut in Khulo and Keda Municipalities, were around 200 ha will be fall down together. Among them, some forest sections could be assigned high sensitivity, as they have not undergone anthropogenic pressure and are well preserved; however, area of such forests is rather limited. Considering the sensitivity of the land use, scale and duration of impact, impact on forestry could be assigned high significance for Khulo and Keda Municipalities, medium significance for Adigeni, Shuakhevi and Khelvachauri, and very low significance for Akhaltsikhe.

The land use on open grasslands, shrublands, meadows and agricultural parcels (croplands or pastures) will be mostly temporarily restricted by construction works. However, former land use could be mostly immediately restored after the OHL is installed; though, in some cases impact will last over operation phase as well, as recover of former conditions (e.g. recovery of soil and grass) requires time.

Though, in some cases these land use categories will also undergo permanent impact. This will include: sites where towers are installed or permanent access roads are maintained; orchards, or industrial sites, as tree planting and construction of high structures will be prohibited; narrow strip under the transmission line, where certain restriction on time spent could be imposed for population to prevent health risks.

According to the sensitivity criteria, these land use types are assigned mostly medium sensitivity; impacted area of high sensitive alpine meadows will be rather small. Considering the impact scale (see Table 7.1.8), duration, socio-economic value of these land use types and expected outcomes, the resultant impact significance could be given low level largely. Impact scale will be comparable for all municipalities.

Separately should be discussed construction phase impact on residential land use. Impact anticipated for residential areas include physical displacement, if a residential house is not sufficiently distanced from the OHL to ensure health and safety of a household. This impact will have permanent character. Though, this is not expected to be large scale (see Table 7.1.8) and as the ROW survey shows, only around dozen households (if any) could be affected by the project, The land use sensitivity is high; however, considering the impact scale and planned compensation/mitigation measures, the impact significance could be assigned low level.

Table 7.1.8 Land use affected by the transmission line route

Municipality	Agricultural Lands, ha		Residential House/ Yard, ha	Forests, ha		Riparian/ River Bank Forests, ha	Total, ha
	Grassland	Cropland		Fragmented	Massive		
Akhaltsikhe	10.4	3.1	0.1	6.9	0.0	0.0	20.4
Adigeni	8.8	1.1	1.1	9.0	26.0	0.0	46.1
Khulo	4.9	0.0	0.8	16.4	99.4	1.3	122.6
Shuakhevi	1.3	0.0	0.2	13.9	22.7	10.1	51.6
Keda	1.7	1.1	0.5	27.3	72.3	25.4	150.7
Khelvachauri	1.9	0.8	0.6	11.1	15.3	2.0	32.3
Total, ha	**28.9**	**6.1**	**3.2**	**81.6**	**238.7**	**38.7**	**423.7**
% of total land impacted	**7%**	**2%**	**1%**	**21%**	**60%**	**10%**	**100%**

Potential impacts on land use at operations phase

Impacts on land use due to routine operation and maintenance of the OHL include the impacts of permanent character, discussed for the construction phase. In particular, these will be:

- Forestry areas within the ROW where vegetation control is required to prevent the re-establishment of tall trees in the cleared areas.
- Agricultural land use (crop growing, cattle breading) for sites occupied by towers and permanent access roads, and respectively, could not be used for former purposes.
- Former orchards or industrial sites within ROW, where tree planting or erecting of high facilities will be prohibited.
- Agricultural lands (croplands, pastures) under the OHL, where presence of people could be restricted in time to avoid health effects

- Residential areas, which were subjected to physical resettlement on the construction phase.

Detailed discussion of these impacts and respective significance level is provided in the paragraphs devoted to the construction phase.

Impact summary and significance

As discussed above, the project impacted land use will mostly include agriculture and forestry; though, some residential areas could be also affected. According to the rough assessment of the OHL ROW, most impact on the current land use will be imposed on the forestry, as forested lands comprises around 80% of all potentially impacted territories. Besides, different from other land uses, most impact on forestry will be permanent due to need to ensure sufficient clearance between trees and the OHL.

Impact level on forestry and other land uses is assessed considering the sensitivity criteria given in Table 7.1.7, impact scale and magnitude of change. According to these criteria, forested areas, grasslands, shrublands and agricultural areas (croplands, pastures) are considered to be of medium or high sensitivity due to their socio-economic value; residential areas are considered to be highly sensitive. Impact scale for each land use category was roughly estimated using Google Earth imaginary. Magnitude of change was determined taking into account total area impacted for each land use category, as well as duration of impacts and anticipated changes. As estimated, the magnitude of change should be greater than 0 but less than 1 per cent of the overall land use for each category. As a result, the significance of land use impacts is classified as low, with exception of impact on the forestry. In case of forestry, considering the sensitivity of forests and the scale and duration of the impact (clearance), impact on forestry is assigned high significance for Khulo and Keda Municipalities, medium significance for Adigeni, Shuakhevi and Khelvachauri, and very low significance for Akhaltsikhe.

Main findings of the impact assessment on the land use including impact factors, potential impacts and their characteristics, receptors of the impacts, expected outcomes, etc., are summarized in Table 7.1.9.

Table 7.1.9 Summary of Significance of Potential Impacts to Land Use

Receptors	Sensitivity of receptor	Impact on Land Use	Extent Intensity Probability	Comments
Residentia l Houses	High	Physical displacement of households	Local, Low, Probable	The need for physical displacement will be determined after preparing the detailed OHL design. However, such a need should not be large scale and displacement only doze households could be required. Displacement (if any) will mainly have place in Adjara Region, where such impact could be unavoidable due to complex topographic and geologic conditions. Restoration of at least current living standards will be ensured for all displaced households.
Agriculture	Medium	Permanent or temporary loss of croplands and grasslands	Local, Low, Definite	According to the estimates, rather limited area of agricultural lands will be impacted. This will be mainly temporary impact on grasslands due to conductoring. Permanent impact will be caused on small sites allocated for towers. Impact on this land use category is assigned a low level.
Forestry	Medium to High	Forest clearing for construction and conducting works, and OHL safety	Regional, Low, Definite	Forestry will be the most impacted land use category, as quite volumetric forest clearing will be required mostly to provide passage along the OHL for machinery during condactoring and to provide sufficient clearance between OHL and trees. On some

Receptors	Sensitivity of receptor	Impact on Land Use	Extent Intensity Probability	Comments
				forest sections clearance need will be minimum (only 6 m wide corridor) due to favourable topographic conditions. However, mostly 65 m wide corridor should be cleared in forested areas to ensure OHL safety. Forestry sector will be most impacted in Khulo and Keda Municipalities, where clearance need is higher and forests are of higher value. Most part of forest sites will be permanently impacted, as recover of tree cover will not be allowed within OHL clearance zone.
Alpine meadows	High	Temporary degradation of alpine meadows within the ROW due to construction and conductoring works, and permanent loss of small sites used for tower installation	Local, Low, Definite	Apline meadows are assigned high sensitivity level due to fragile soil cover, which could be easily destroyed and sever climatic conditions, which may restrict re-vegetation. Only 15 km of the ROW crosses sub-alpine/alpine meadows in the Adigeni and Khulo Municipalities. Impact on these sensitive meadows will be limited, as only max. 6 m wide corridor will be temporarily impacted along the OHL due to conductor stringing. This corridor together with individual sites damaged during construction works will be reinstated immediately post construction. Permanently impact will have place only at tower sites.
Riparian / riverbank forests	High	Clearing of riparian forests for construction and conductoring works, and OHL safety	Local, Low, Possible	Impact on riparian /riverbank forests will be rather limited as the project will seek to avoid disturbance of such areas in order to avoid associated impacts. This impact will be mainly concentrated in Shuakhevi and Keda Municipalities, where the OHL will be built in the gorges of the Skhalta and Adjaristskali River.

7.1.5 Potential effects on landscapes and views

This section examines effects of the project on landscapes and visual receptors. The ROW landscapes are described in Section 6. The sensitivity of the landscape and visual receptors has been assessed as part of the impact assessment methodology described in Section 5.

Visual impacts to the landscape were evaluated using a viewshed analysis. Line-of-sight impact maps were developed for sensitive sections of the project corridor using a digital elevation model, land cover mapping, and project information in a GIS system to identify areas along the project routes that are visible to the public travelling on the road or tourists at important tourist areas.

Given the lattice structure, the thickness of wires, relative height compared to other features (trees and buildings), and the sensitivity of the human eye, it is unlikely that most viewers would be able to discern the project features at distances greater than five kilometres. Therefore, this was the limit placed on the viewshed model.

The actual sensitivity of visual receptors and views over the transmission line will depend on the location and context of the viewpoint and the occupation and activity of the visual receptor. Potential visual landscape receptors in the region include local residents, travellers, and tourists.

Landscape character is derived from the intervention of human activity with the natural physical land surface. At its root is the solid geology and subsequent physical processes of weathering and deposition that have modified the topography of the land surface. This in turn influences the human activities of land use, leading to a landscape character that reflects both human and other influences. Landscape impact assessment is concerned with:

- Effects on landscape elements or the overall pattern of elements that give rise to landscape character and regional and local distinctiveness.
- Impacts upon acknowledged special interests or values such as designated landscapes, conservation sites, and cultural heritage sites.

Table 7.1.10 Visual Receptors and their Sensitivity to Change

Visual receptor type	Sensitivity to Change	Receptors/areas of concern
Residents	**Moderate –**Residents are likely to be highly sensitive receptors due to permanent disruption or obstruction of views.	Disruption of views – residential population centres. Obstruction of views – local residents.
Tourists	**High –** Many tourists visiting this region of Georgia would be doing so to enjoy the natural landscape and recreational opportunities of the region.	National Parks, Managed Preserves, resorts.
Travellers	**Low –** Travellers are of low sensitivity as visual disruption is for a short period of time.	Main highway where the project would be visible

Visual impacts introduce a human element to a landscape assessment by changing how humans perceive the landscape. The degree of impact will be subjective and thus will vary between individuals. However, general predictions of impact significance can still be made. Therefore, visual impact is concerned with:

- The direct impacts of the development upon views of the landscape through intrusion or obstruction.
- The reactions of viewers who may be affected.
- The overall impact on visual amenity, which can range from degradation through enhancement.

The landscape over the transmission line route alternatives includes grasslands with relatively few trees and shrubs mainly in Akhaltsikhe and Adigeni municipalities, forests and alpine meadows in Adigeni and Khulo municipalities, forested mountain slopes in Shuakhevi, Keda and Khelvachauri municipalities. Due to human development in the region, many of these areas already are traversed by transmission and power distribution lines.

Activities with the potential to affect landscapes and views

New 220 kV conductor lines will be installed along the entire project route. The project will include clearing and maintaining a 65 meter-wide wide right-of-way through forested areas where they presently occur. Constructing and maintaining 150 kilometres of new transmission line towers approximately 32 meters in height. Construction activities will affect the visual landscape due to the size and scale of the project, and the principal potential impacts would be: a) the disturbance of natural views for residents and tourists by the presence of transmission line towers, conductor lines, and right-of-way clearing; and b) the obstruction of views by transmission line towers.

Potential impacts on landscape from OHL construction

The impact to local residents would be generally permanent because the line will be maintained in operation for the foreseeable future and the disturbance of views by towers, conductors and the results of forest clearing will remain. Local residents are present near most areas along the transmission line corridor; however, the impacts will be greatest in villages and towns within the viewshed. Although towers may be within the views of residents, travellers, and tourists, they would be unlikely to obstruct views. The towers proposed are lattice towers that do not completely obstruct the landscape. The towers will be centred in the 65-meter-wide right-of-way and will be no closer than 30 meters to the nearest residents, a distance too far to obstruct views of the landscape. (As noted previously, although lines could theoretically be seen from farther away from five kilometers, their lattice structure and the thin wires are very unlikely to be seen from farther away. In addition, the view is unlikely to be obtrusive from farther than one or a very few kilometres.)

Tourists and tourism may be adversely affected by the landscape changes associated with the project. The presence of transmission lines and towers does change the visual character of the landscape and removes some of the appeal as a natural landscape. Especially this is true for Adjara region, where is touristic route along Adjaristskali River, near to Beshumi, where skiing resort was recently developed as well as Akhaltsikhe Town with its pretty views. The proposed OHL does not cross any of protected areas legally established by Georgian legislation. However, these effects may be apparent from places where tourist activities may occur and where the transmission line can be seen. The modified viewshed will be permanent, although tourist exposure to the viewshed would be temporary, only as long as they were in the area.

Potential impacts on landscape from OHL operations

Potential impacts to landscape views during operation and maintenance of the project are largely the same as those for construction since the ROW and structures will be maintained in place for the foreseeable future. However, there are some additional activities unique to operation and maintenance that could impact the landscape:

- Vehicle and worker activities in the right-of-way for routine tower and substation inspection and maintenance once every few years.
- Vehicle and worker activities in the right-of-way for vegetation control activities once every 5 to 8 years.
- Vehicle and worker activities in the right-of-way for line re-conductoring every 30 to 40 years.

In all these cases the impacts are the same: short-term and temporary view of workers in the right-of-way by local residents, tourists, and travellers. The views of cleared corridor will be less noticeable, due to the grass and shrubs growing in the corridor, however the visual impact will be significant in forested areas.

The existing OHL lines near to Akhaltsikhe, as described in baseline section of present report is concentrated near to Zikilia Substation. Three existing main lines: Gardabani Akhaltsikhe, Zestaphoni Akhaltsikhe (500KV) and Akhaltsikhe –Turkish border (400KV) are already disturbing views. In Adigeni section there is Akhaltsikhe –Beshumi 110 KV power line and 400 KV Akhaltsikhe –Turkish border lines are located. In most of Adjara region there is only one 35 KV line along the Goderdzi pass – Batumi motor road.

The viewshed modelling was conducted in order to enable quantitative and semi-quantitative evaluation of impacts from placement and operation of Akhaltsikhe-Batumi 200 kV Power transmission line. In order to support visualisation, the Google earth images were used as terrian pictures, and poles and wires were placed on these landscape images. It should be mentioned, that the modelling of views from whole length of motor road is very difficult, and viewshed models are created only for specific points, which were considered as more sensitive for visual impact. The results of visual modelling is presented below.

The closest section, where the distance from Akhaltsikhe-Batumi Road to proposed OHL line is minimum and the visual impact could be significant, is at Benara Settlement, where the OHL line crosses road and river channel. The AP27-AP 29 are located in the area. The visual model for this was prepared to assess significance of impact. The Figure 7.1.2 shows view from the motor road, when distance to the pole is about 500m. The Figure 7.1.3 shows the same pole from closer distance (300m). The picture also indicates that the next 3 poles will be also visible from the viewpoint selected. According to the images, the visibility of line should be high; however, the view should not unpleasant.

The same section of OHL line between AP27 and AP29 is also visible from outcrops of village Ude. The line will be visible for local population from practically whole length of the main road to Ude Village. The visibility increases close to the village, however distance to the OHL is significant (more than 3km), and visual disturbance should be small Figure 7.1.4.

The important section for visibility impact is around the Skiing resort of Beshumi. The project corridor was moved away from this resort zone; however, the OHL will be visible from certain zones adjacent to the skiing track. The visual modelling shows that the impact on tourists visiting skiing resort should not be significant (see Figure 7.1.5, Figure 7.1.9).

The landscape alteration in the section where OHL corridor is descending to Skhalta Village was also assessed. The modelled view covers section up to the Beshumi resort from Skhalta. There is picturous gorge for a visitor standing in Skhalta valley and looking towards sub-alpine and alpine zone in Beshumi direction. The visual impact from placement of poles will alter the existing pictureous view. However, the line is positioned in such a way to minimize visual disturbance.

The next sensitive area is considered to be environs of AP44 - AP45. The viewshed analysis has indicated, that the line will be partially visible from Khikhadziri cultural heritage site; however, the visibility is limited: the line is visible from south part of cultural heritage site and partially visible from most area. The alternative to move the line corridor to the north direction was rejected. In this case the impact on forested area is increased and there will be more impact in terms of visibility as well, because the line would be visible from longer section of Batumi-Akhaltsikhe road. The image on Figure 7.1.9 shows expected changes in the views.

The Skhalta monastery is one of the most visited sites in project area. The viewshed modelling was carried out in order to assess significance of powerline impact in this area. The monastery was considered as sensitive receptor in terms of landscape and view loss. The recommendations provided at early stage of project developer were considered during the route selection process. The angle poles 52-54 will be partially visible from monastery site, other poles and wires are not visible. So construction of the OHL will not cause significant loss in landscapes there. The location can be considered as the best option in this area (Figure 7.1.7).

The last area, sensitive from landscape point of view, is section near to the Adjaristskali and Skhalta river confluence. The powerline from AP59 to AP60 will be definitely visible from the road and settlement. The lines should be constructed in the way to avoid wide corridor clearance of vegetation, which can be ensured by placing the wires at high altitude from ground surface. The loss of views if corridor is narrow will be much less than in case of 65m wide clearance. The vegetation here should be reinstated, with low growing plants (bushes) and grass. The species should be selected in a way to ensure, that newly planted bushes have the same colour as forest. The position for angle pole 59 is selected to minimize visual impact for tourists and travellers. From the road, the angle pole will be visible only from 1 km long road section. From other part of the road within visual zone range this pole will be hidden.

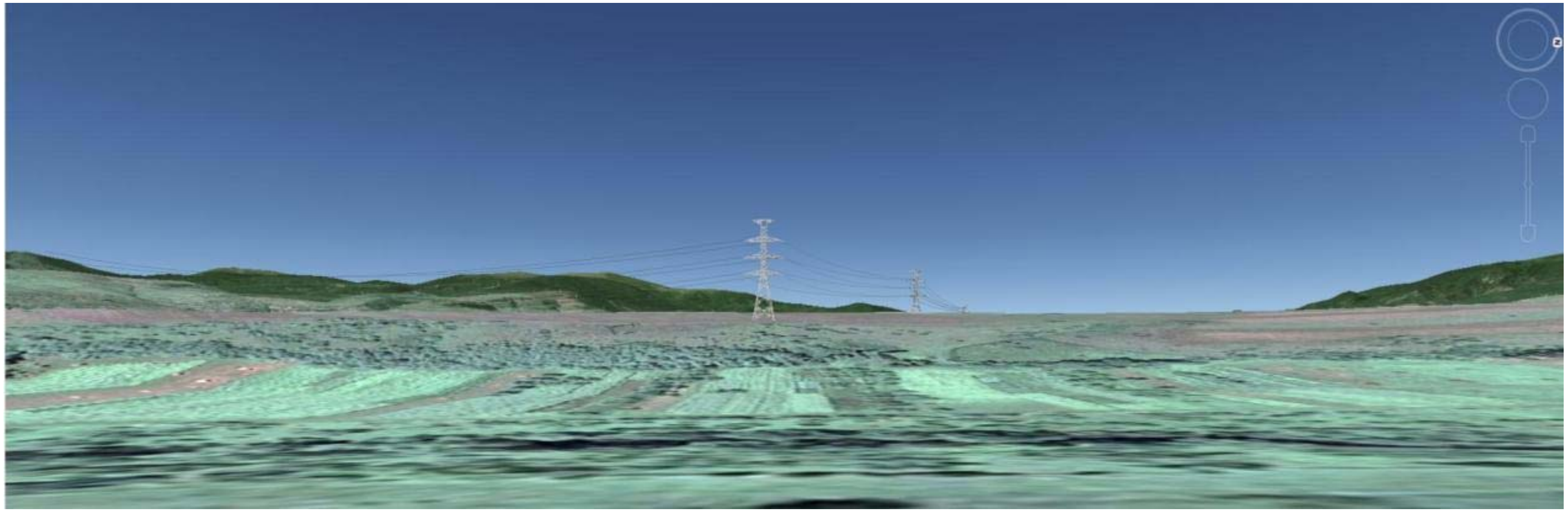


Figure 7.1.2 The view of poles AP27 - AP29 from the Akhaltsikhe Batumi Motor road (distance to closest pole 500m)

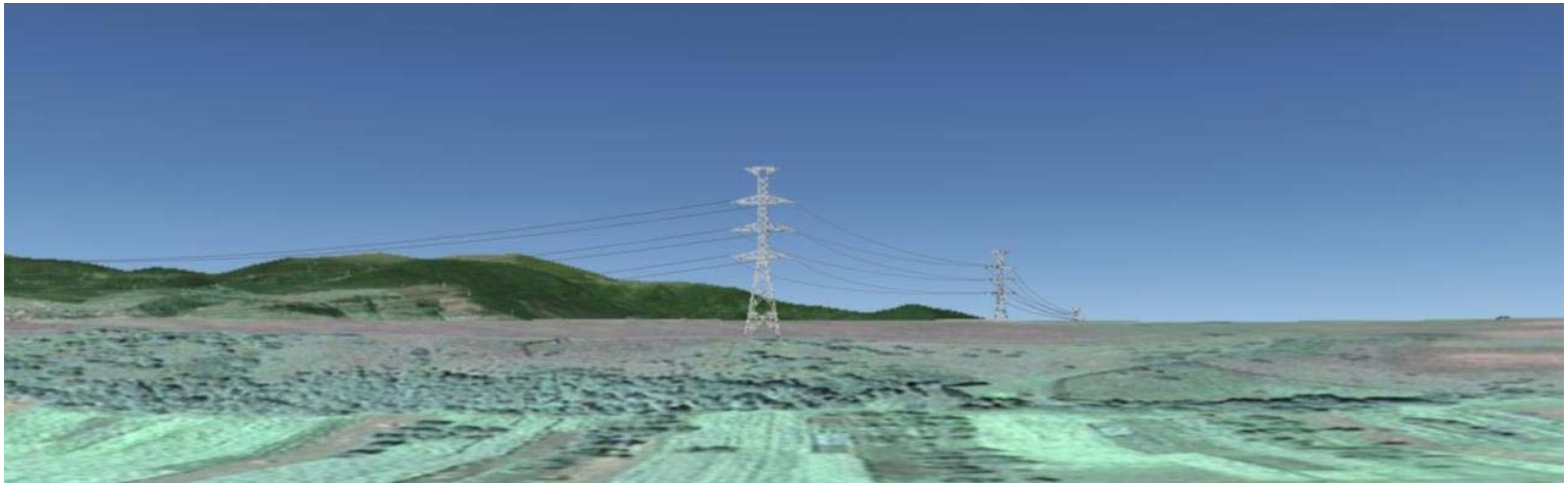


Figure 7.1.3 The view of poles AP27 - AP29 from 300 m distance

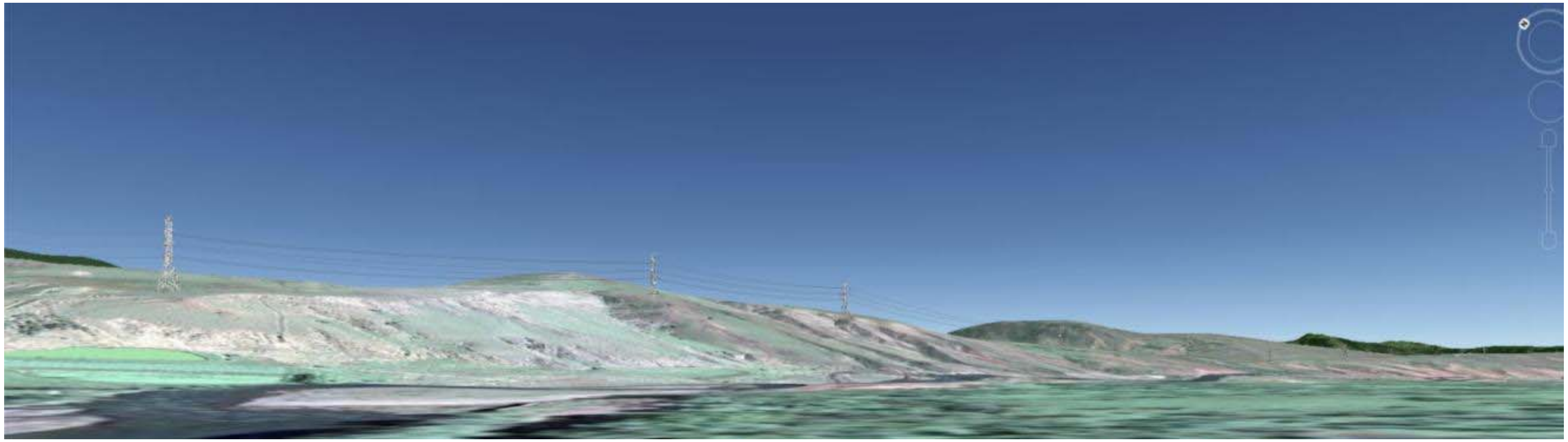


Figure 7.1.4 The view of poles AP27 - AP29 from 1 km distance towards north east from Ude village

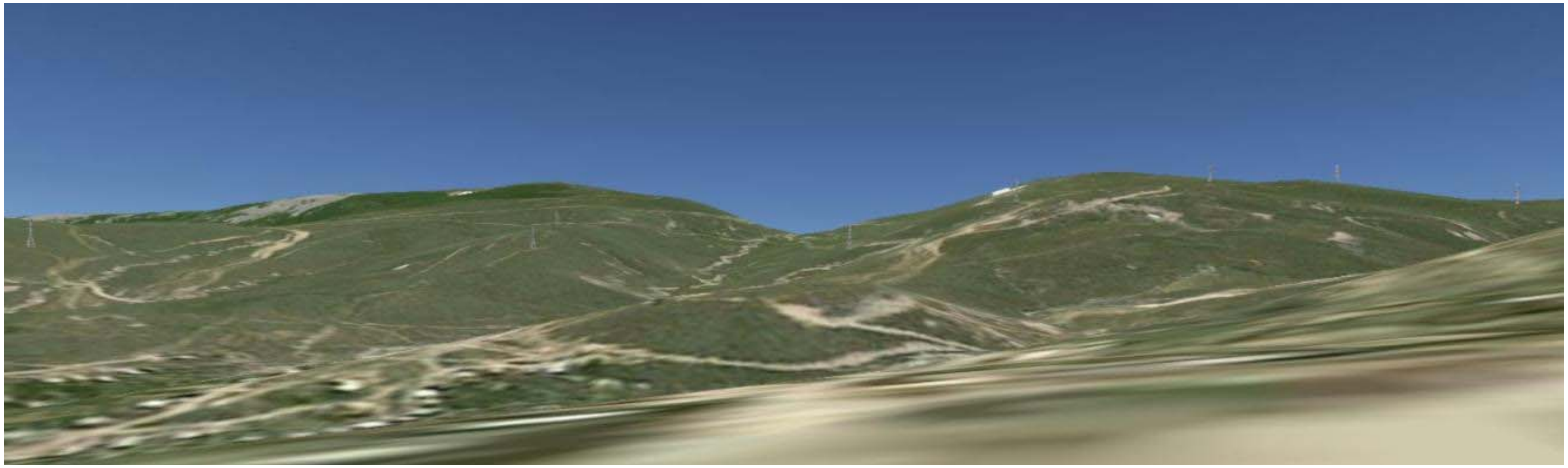


Figure 7.1.5 The view of power line near to the Beshumi resort area AP38

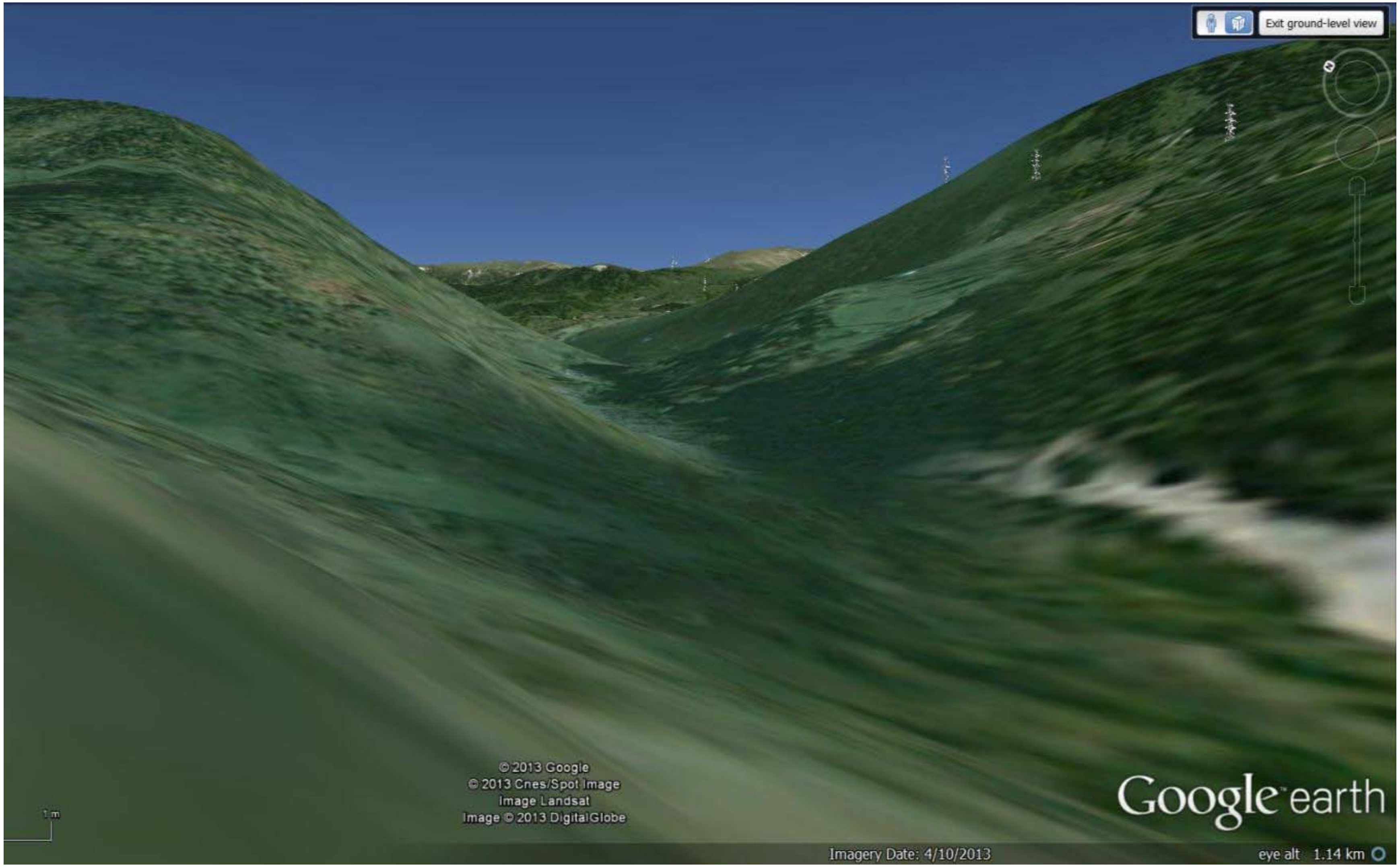


Figure 7.1.6 View from Rakvrta Village towards Beshumi, The line located on the slope (AP40-AP 39)

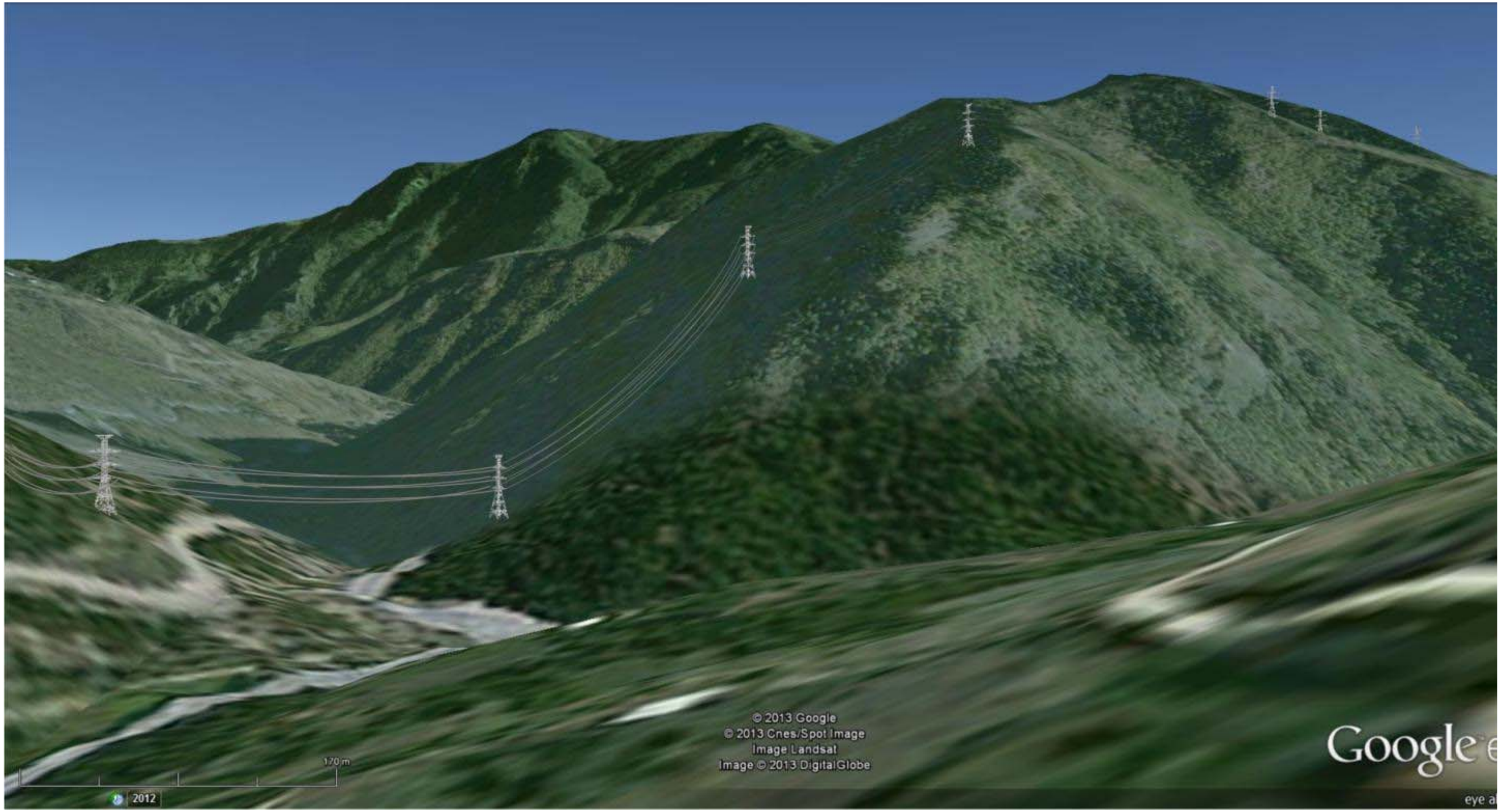


Figure 7.1.7 View from Furtio, AP 60 - AP56 section. The direction north-east

Figure 7.1.8 View from Dandalo to Kokotauri, AP85-AP86. The direction to South-West

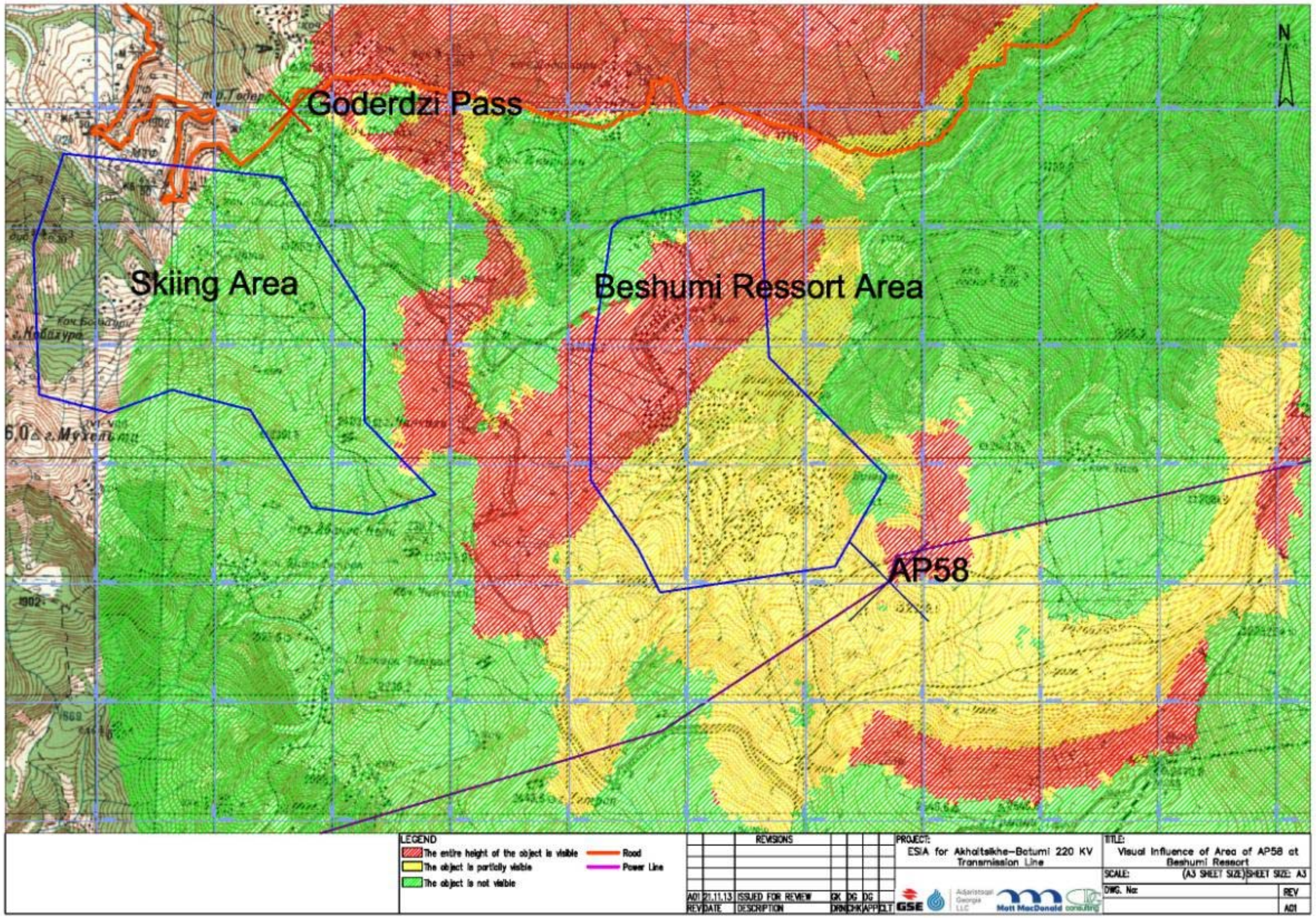


Figure 7.1.9 Viewshed analysis image for Ap44, Beshumi Area

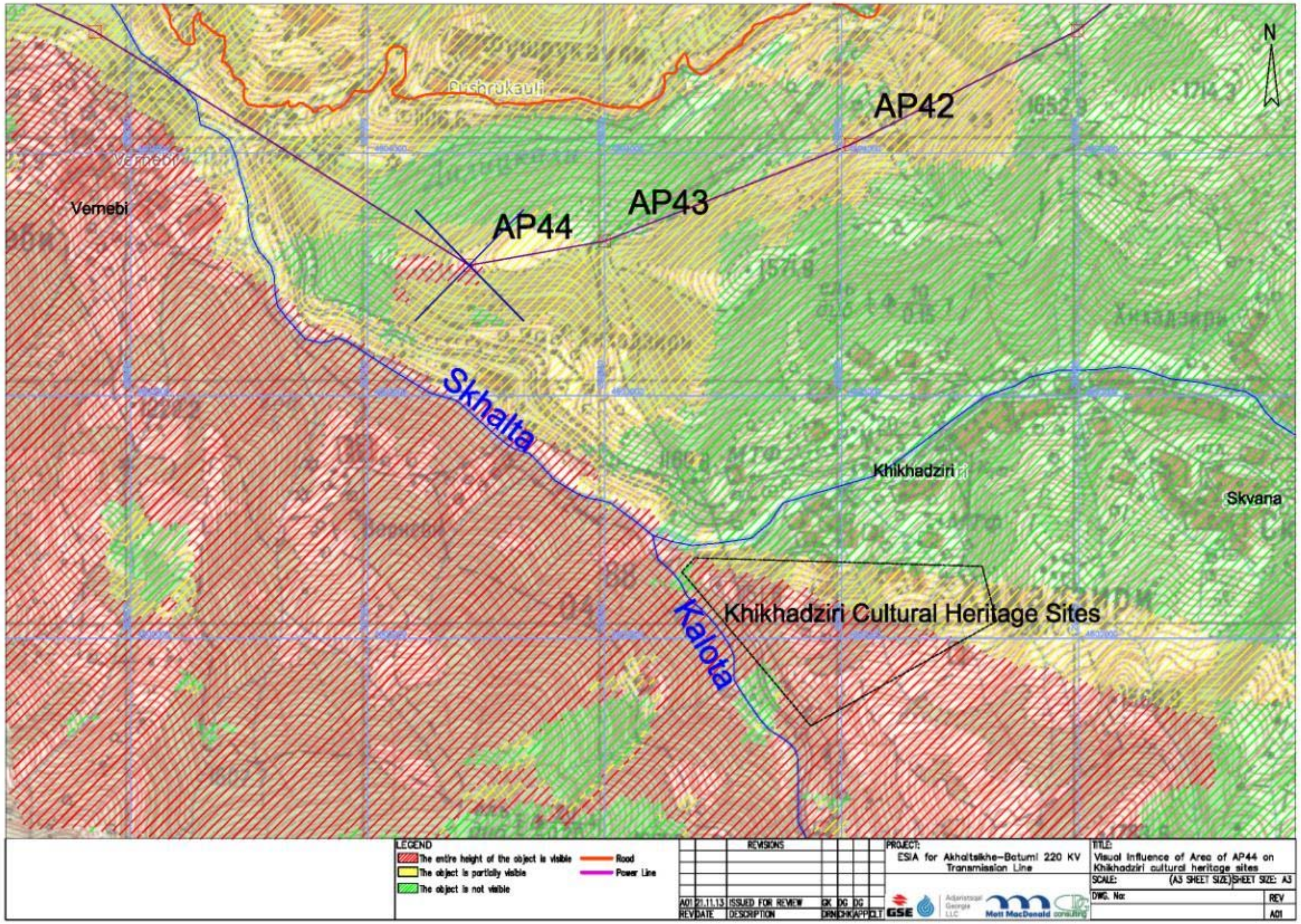


Figure 7.1.10 The visibility of OHL section from Khikhadziri cultural heritage site, AP44

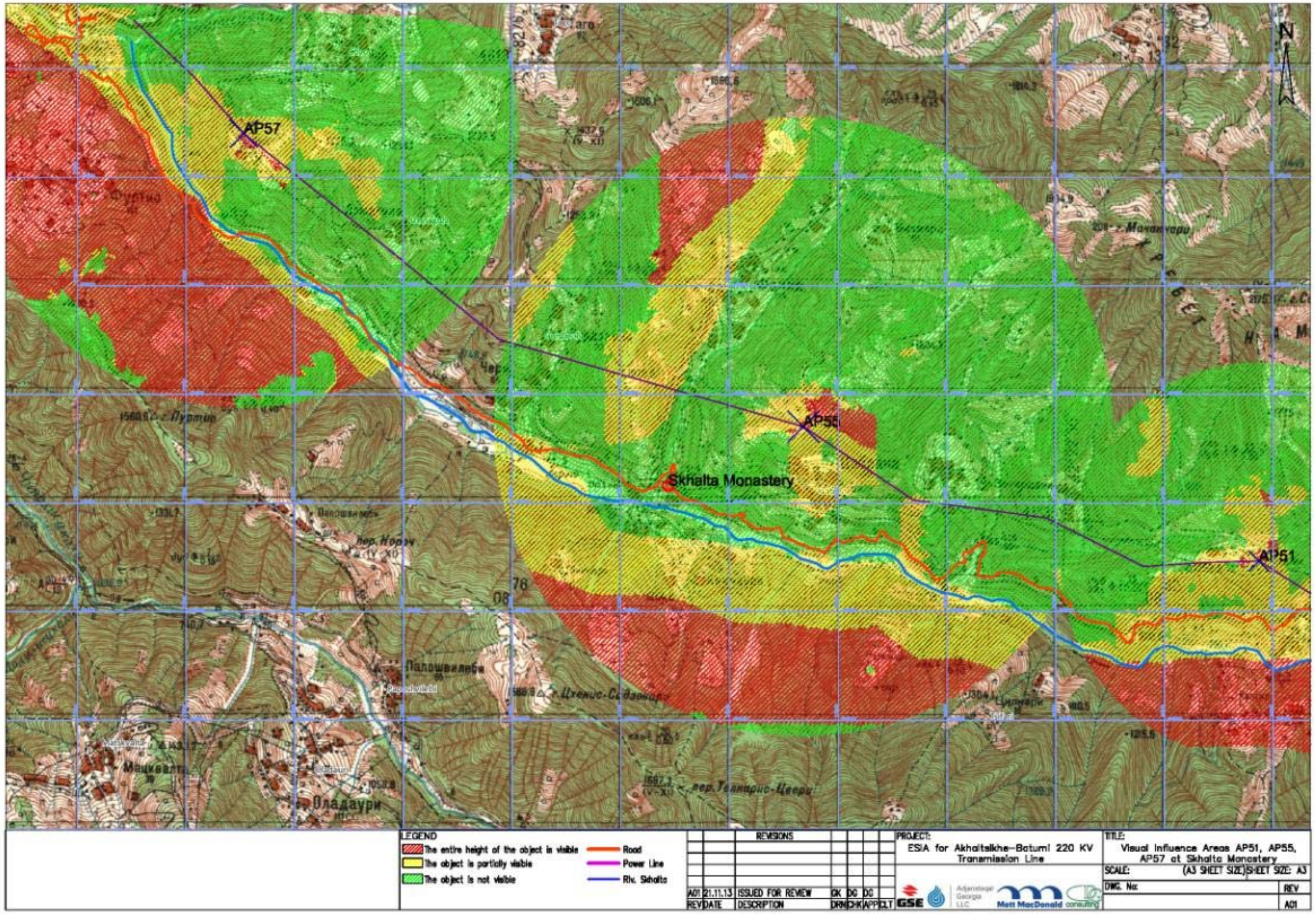


Figure 7.1.11 The line visibility analysis for section AP51 AP57

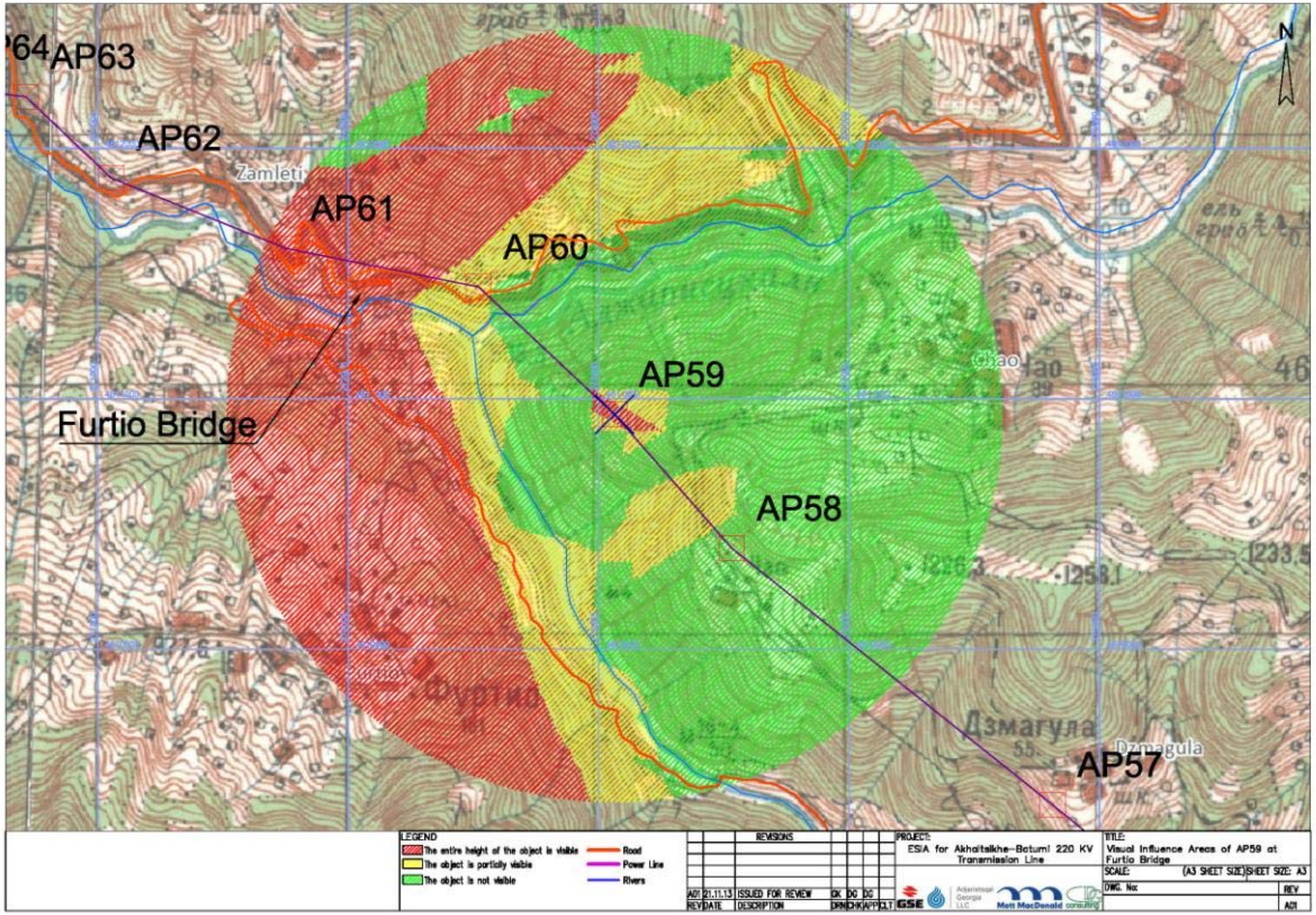


Figure 7.1.12 The Viewshed analysis for AP 59 (Furtio area)

Impact summary and significance

In summary, potential impacts to landscape views will occur during construction, operation, and maintenance activities. There will be permanent adverse impacts to residents associated with disruption of natural views by the transmission lines, towers, and right-of-way clearing. There will be permanent impacts to tourists (but temporary for any particular tourist) associated with disruption of natural views by the transmission lines, towers, and right-of-way clearing in protected areas. There will be temporary impacts to travellers as they travel in areas where the project is visible.

For residents living within the viewshed of the transmission line, the change in landscape would be most significant for those living within two kilometres of new sections of the transmission line. For these residents, there could be a visible change in the landscape in 10 to 25 per cent of their views while indoors or outdoors. Therefore, in accordance with ranking criteria discussed in section 5, the magnitude of change is characterized as low and the significance of the impact to these residents is minor adverse.

Travellers passing through the region would only be able to view the project features while travelling on main road connecting major towns through the project affected region (Akhaltsikhe to Batumi). From the perspective of the traveller, these would be temporary effects, occurring only when passing through areas within the viewshed of the project, however the viewshed covers practically most part of route from Zamleti to Batumi (almost half of entire route). Some sections will be visible for travellers travelling from Borjomi to Akhaltsikhe, however this sections are very short.

Based on above mentioned the magnitude of change is characterized as “high” and the significance of the impact to these residents is medium negative. In terms of viewshed, the main two alternative routes considered are comparable, in one case the visual impacts will be more for travellers through Goderdzi pass. The line visibility area will remain practically on whole length of 40 km section. For preferred route, the line will have limited visibility for tourists in Beshumi skiing resort and tourists coming for rest in Beshumi area during summer, however the visual impact in this case is less.

7.2 Biological Environment

This section describes the impacts to ecosystems, flora and fauna from construction, operation and maintenance of the proposed project and alternatives. Impacts to dominant flora, known fauna and potential species of special concern (for example, from the IUCN and Georgian Red Lists) are assessed for each ecosystem and a description of the specific habitat requirements for each protected species is provided. The direct and indirect impacts associated with the project and all alternatives on these ecosystems and species are discussed.

The direct and indirect impacts of the project are described with respect to habitat alteration, increased risk of forest fires (an impact to habitats/ecosystems), and avian collision/electrocution (an impact to fauna) consistent with *Environmental, Health, and Safety Guidelines for Electric Power Transmission and Distribution (*WBG, 2007). Mitigation measures and best management practices to address potential impacts to these resources are provided in Section 8 of this report.

The ecological sensitivity of areas along the transmission line is described in Section 6 devoted to baseline study. The baseline information is used for assessment of potential impacts on each type of habitat within the RoW and identification of areas, habitats and species which may become sensitive receptors of expected impacts.

Activities with the potential to affect biological environment

Main project activities with the greatest potential to impact ecosystems, flora and fauna include construction/clearance of transmission line right-of-way, access roads, installation of conductors and maintenance activities along the OHL corridor. More detailed description of impacts inherent to these activities is described below.

- *Clearing and Construction*. Clearance of transmission line right-of-way, as well as construction of towers and access roads may transform habitats, depending on the characteristics of existing vegetation, topographic features and installed height of the transmission line. Examples of habitat alteration from these activities include full or partial fragmentation of forests, loss of wildlife, loss of endemic or rare flora species, habitats including nesting, roosting, breeding and foraging areas for various animal species, and establishment of non-native/ invasive plant species. In addition, animals and plants could be injured or crushed, and animals could be disturbed by noise visual and auditory disturbance due to the presence of machinery, construction workers, transmission towers and associated equipment. Indirect impact on wildlife habitats and animal species could result from deterioration of water quality in water bodies, what could be result of increased erosion caused by vehicular/machinery movement, and soil and clearance works. This will mainly impact aquatic and riparian species; though, terrestrial species could be also affected. Some impacts would be permanent (for example, tree removal on the right-of-way, use of land for towers) and some temporary (for example, vegetation removal/crushing in the laydown area, human activities).
- *Conductor Installation*. Vehicular traffic to pull the conductor and unloading activities at laydown areas can cause physical impacts, such as injuring or crushing animals and plants. Installation of conductor over the entire length of the transmission corridor will cause noise and visual disturbance that could temporarily disturb and displace various animal species; disturbance/destruction of animal's nestling, breeding and foraging areas which encounter along the pulling route can also have place during conductoring works. Impacts from installation activities of transmission conductors are very short-term and temporary since the wire pulling will happen only once (except than replacement of particular damaged sections in case of emergency repairs) and will not last more than one week on particular section. On the operation phase conductors usually pose threat to birds and bats as they could be killed/electrocuted due to collision with lines, if touch two live wires at a time, or can be impacted by EMF influence (bats)

- *Maintenance Activities*. Maintenance activities along the transmission corridor may cause erosion and adversely affect water quality. Disturbance/damage from noise and physical presence of machinery and workers will occur during activities such as tree trimming, inspections, tower and foundation repairs and maintenance of damaged/downed transmission wires. Impacts on flora and fauna during the maintenance period will be related to transport movement on existing roads, some minor repairs of access roads, which does not include construction of additional roads or widening of existing ones. The vegetation clearance activities will be limited to "sanitary clearance" which includes only trimming or partial removal of high trees to ensure safe clearance distances to wires. In addition sanitary clearance will be required only on the dedicated sections of RoW corridor, where wires are close to the ground surface and where the vegetation growth is active due to the wet climate and fertility of soils. The impacts area and scale is usually lower during the maintenance since small volume of works is required at operation stage.

The discussion of these potential impacts with respect to the Akhaltsikhe-Batumi 220 kV OHL project is provided in the following paragraphs. The discussion highlights the project specific details which determine the scale, magnitude, duration and other characteristics of each potential impact for construction and operation phases. The sensitivity of ecological receptors is assigned based on ecological baseline of the project, including relative ecological value, protection status, endemism, abundance, etc and capacity of receptors to restore after potential impacts. These sensitivity criteria are provided in Table 7.1.1 below:

Table 7.2.1 Sensitivity Criteria for Biological Environment

Sensitivity	Criteria
High	- Critical habitats as of WBG's definition and criteria, that is (i) habitats of significant importance to critically endangered and/or endangered species, (ii) habitats of significant importance to endemic and/or restricted range species, (iii) habitats supporting globally significant concentrations of migratory species and/or congregatory species, (iv) highly threatened and/or unique ecosystems, and/or (v) areas associated with key evolutionary processes - Protected areas of national, regional or international importance - Planned protected areas and areas supporting particularly high biodiversity and/or large number of endemic and protected species - Species of flora and fauna, which are protected nationally and/or internationally
Medium	- Fragile habitats with lower capacity of recovery/restoration after disturbance (e.g. sub-alpine and alpine meadows, sub-alpine forests) - Habitats and ecosystems supporting high biodiversity, though not critical for biodiversity preservation
Low	- Widespread habitats and abundant species of flora and fauna which cannot be classified as unique (endemic, rare) and are of low concern in terms of biodiversity preservation

7.2.2 Potential impacts on terrestrial habitats

Adequate terrestrial habitat is critical for the survival of plant species, and must provide suitable food resources, territory, loafing areas, nesting sites and reproduction dens for birds and animals which depend on the ecosystem. Major impacts of the project are expected to be loss of wildlife habitat including fragmentation of forest, potential for forest fires and establishment of non-native invasive species due to site development and the presence of construction workers, vehicles and machinery, disturbance of soil and vegetation, and trimming and removal of trees. These are described in more details below.

Terrestrial habitat alteration

Impacts inherent to the construction, operation and maintenance of transmission line and its right-of-way, especially for sections that pass through forested areas, result in alteration and disruption to terrestrial habitats. Activities which usually result in modification of habitats include:

- Vegetation clearance, which can lead to: destruction and/or fragmentation of habitats, especially in forested areas and over scrublands; invasion of non-native species, or alternation of former balance between local species; erosion and associated loss of topsoil.
- Excavation, grading and earthmoving activities, which physically disturb and remove topsoil. The topsoil contains plant seeds and invertebrates which are critical to maintain a healthy ecosystem.
- Movement of project vehicles / machinery to access construction sites, which can physically disturb soil and thus threaten the ecosystem health
- Installation of OHL (towers and conductors), which will be the source of various disturbance factors and threats (e.g. visual disturbance, noise, EFM, bird collision risk, etc).

Vegetation clearance works will include vegetation grabbing at tower sites and tower/material laydown areas, cutting of trees/shrubbery along the RoW to enable machinery passage for conductoring works and cutting of trees for entire RoW width to meet technical standards and ensure OHL safety on operation phase. Sites impacted for tower foundations and material laydown will be rather limited. It is expected that maximum area under each tower will be 200 m2. Opposite to this, conductoring and RoW clearance works will affect large areas. Presence of OHL facilities can alter habitats for some animal species (e.g. birds). Main types of terrestrial habitats which are likely to be impacted by the project include:

- Grasslands and meadows at lower datum, which are mostly overgrazed
- Alpine/sub-alpine meadows, which are at places partly modified due to grazing
- Coniferous, deciduous and mixed forests
- Riparian forests

As per OHL RoW survey and criteria of Table 7.1.1, - the project will not cross critical and high sensitivity habitats such are existing/planned protected areas or areas supporting particularly high biodiversity. At the same time habitats of some protected flora/fauna species may be impacted; however, neither of these habitats are critical for endangered or restricted-range species. In this regards major part of wildlife habitats along the corridor could be assigned low or medium sensitivity.

Most prominent and actually the only high sensitive wildlife habitat for the OHL corridor is the Batumi bottleneck, which gives passage to numerous raptors. The flyway is especially important for European Honey Buzzard (*Penis apivorus*), as about 45-130% of its world population is reported to use this route during autumn migration; to be mentioned, this bird is of least concern and not protected locally or worldwide. The most important impact type on this wildlife area will be caused from presence of the OHL, which will present hazard to birds. Total cross-section of the flyway is around 15 km, out of which only about 5 km section comprised between AP142 and AP 150 (between the mouth of Adjarisqali River and the Zemo Jocho Village) is likely to be exposed to OHL impact. The development of re-routing alternative to avoid this sensitive area is impossible, as the final connection point - the Khelvachauri Sub-station - is already built and operating there for decades. Therefore, the only option is to design the OHL towers and conductors applying best practice features to reduce the likelihood of bird collisions and electrocutions. This will include placing of conductors within the distance established to avoid electrocutions while perching, and equipping the cables with bird reflectors to increase their visibility and rescue collisions.

In order to evaluate the impact areas, the detailed assessment of project corridor was carried out, in order to investigate each section of the entire route and to define, which type of habitat is impacted at what extent. The longitudinal profile of whole corridor was prepared, in order to define the sections, where the conductors will be placed at significant height from ground surface. Taking into account vegetation characteristics, the need for initial and sanitary clearances has been assessed. Later, depending on type of corridor, required for construction, the impact area was defined for each particular section of entire RoW.

The detailed information regarding the type of impacted habitat and extent of impact is presented in table below. The habitats were classified as pasture, cropland, garden, hay land, farm, non fragmented and fragmented forests, riparian forest, the forested area included into state forest fund, areas in river channels and etc. The summary table of impact on forests is presented in Table 7.2.2 below, the detailed information is provided in Excel workbook – annex 5, and drawing Figure 7.2.1 - Figure 7.2.4.

Table 7.2.2 Summary of impacted forested areas by municipality

Municipality	Unit	Impacted non-fragmented forests	Impacted fragmented forested areas	Impacted Riparian Forests
Akhaltsikhe	m^2	38510	29900	0
	ha	3.851	2.99	0
Adigeni	m^2	90450	260480	0
	ha	9.045	26.048	0
Khulo	m^2	163800	993530	13000
	ha	16.38	99.353	1.3
Shuakhevi	m^2	139100	243560	101230
	ha	13.91	24.356	10.1
Keda	m^2	273100	769105	277658
	ha	27.31	76.9105	27.7
Khelvachauri	m^2	111150	152750	19500
	ha	11.115	15.275	1.9
Total	m^2	816110	2449325	411388
	ha	*81.611*	*244.9325*	*41.1*

The forested areas will be also impacted due to the construction of access roads. The detailed information is provided in annex.

In addition to above mentioned classification, it is also important to evaluate the type of impacted forest and extent of each type forest. This part can be evaluated section by section, taking into account the grade of forest value and the level of anthropogenic impact on forest to date, at particular section.

The types of forest and its sensitivity is assessed in baseline section of present report. The OHL corridor does not impact the protected areas, accordingly does not impact the forested areas of very high conservation value. All forests crossed by the OHL (except than alternative 2.1 which was rejected due to potential impact on high conservation value forest and terrestrial rodent mammals) are either included in national forest fund or are grown on public land, accordingly the anthropogenic impact on such forests is similar in whole Adjara. Exceptions are forests located in remote areas, where the road access is very limited, however, these forests are not crossed by project corridor.

The different situation is in Adigeni municipality, the forested zone here is even more impacted due to the extensive (sometimes illegal) logging for a long period of time. In addition, the project corridor goes next to existing cleared corridor for the active110 KV Akhaltsikhe-Beshumi transmission line, as it was recommended in route selection study.

The important activity requiring vegetation clearance is arrangement of access roads to the poles. Detailed evaluation of access to each pole has been undertaken in order to identify potential corridors for new access roads. For each pole, the closest location which can be reached using existing village roads and dirty tracks, was identified. It was assumed, that the construction machinery traffic load will be very low and will have temporary character (not more than 10 vehicles per day during few days and 2-5 vehicles during two weeks period). The length of section from established point to the pole, taking into account the constructability and landscape, has been estimated. The area of impact was calculated with assumption that road width doesn’t exceed 6 meters, whereas in reality width of access road will be 3.5 meters. The clearance areas were calculated using GIS model for the access roads taking into account type of vegetation cover. The established boundaries of affected land were overplayed with maps of boundaries of forested areas in order to define exact boundaries of required clearance for arrangement of access roads. The quantitative information regarding required clearances in forests related to access road construction is summarized in Table 7.2.3.

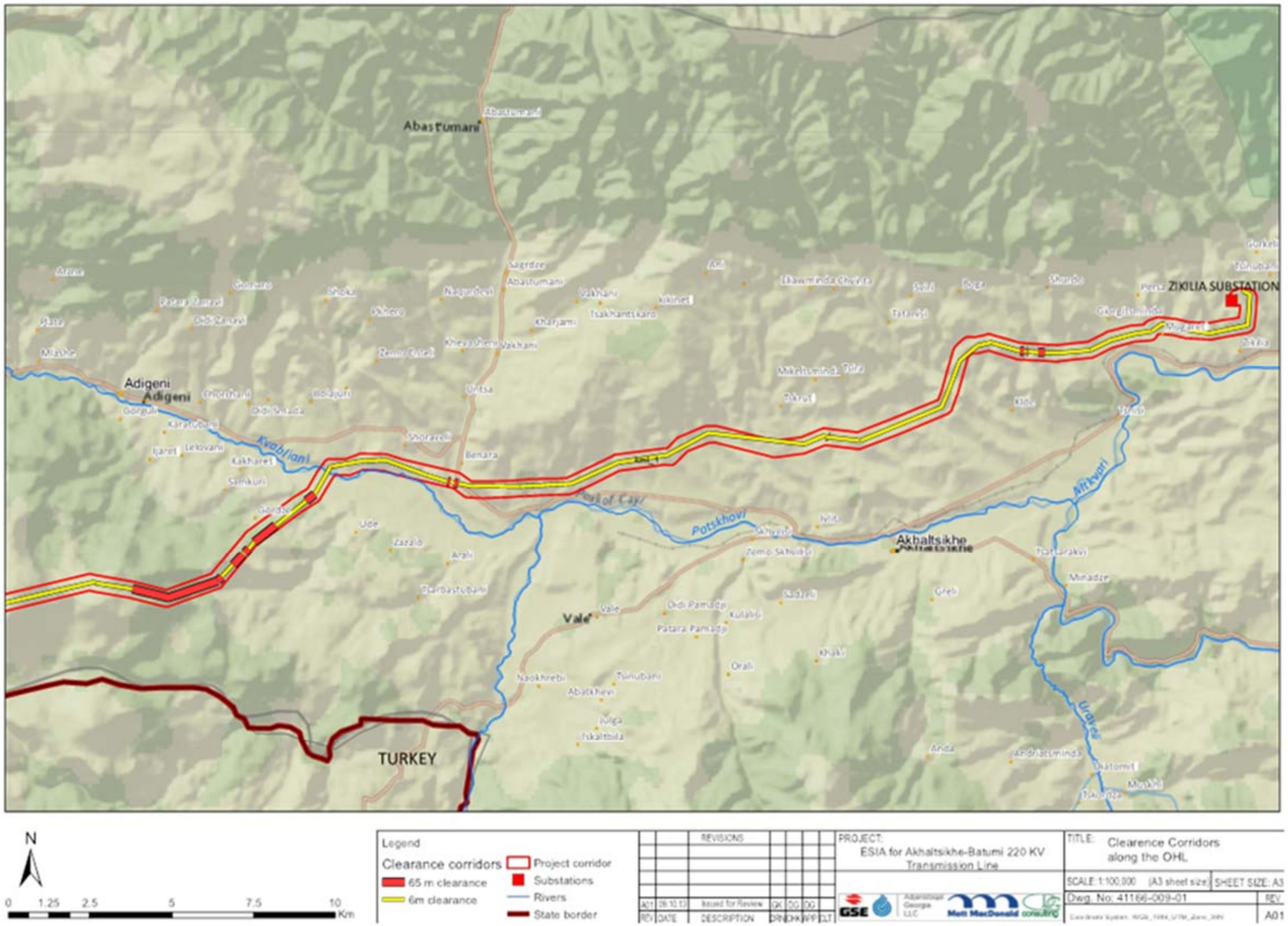


Figure 7.2.1 The clearance corridors within forested areas – Sheet 1

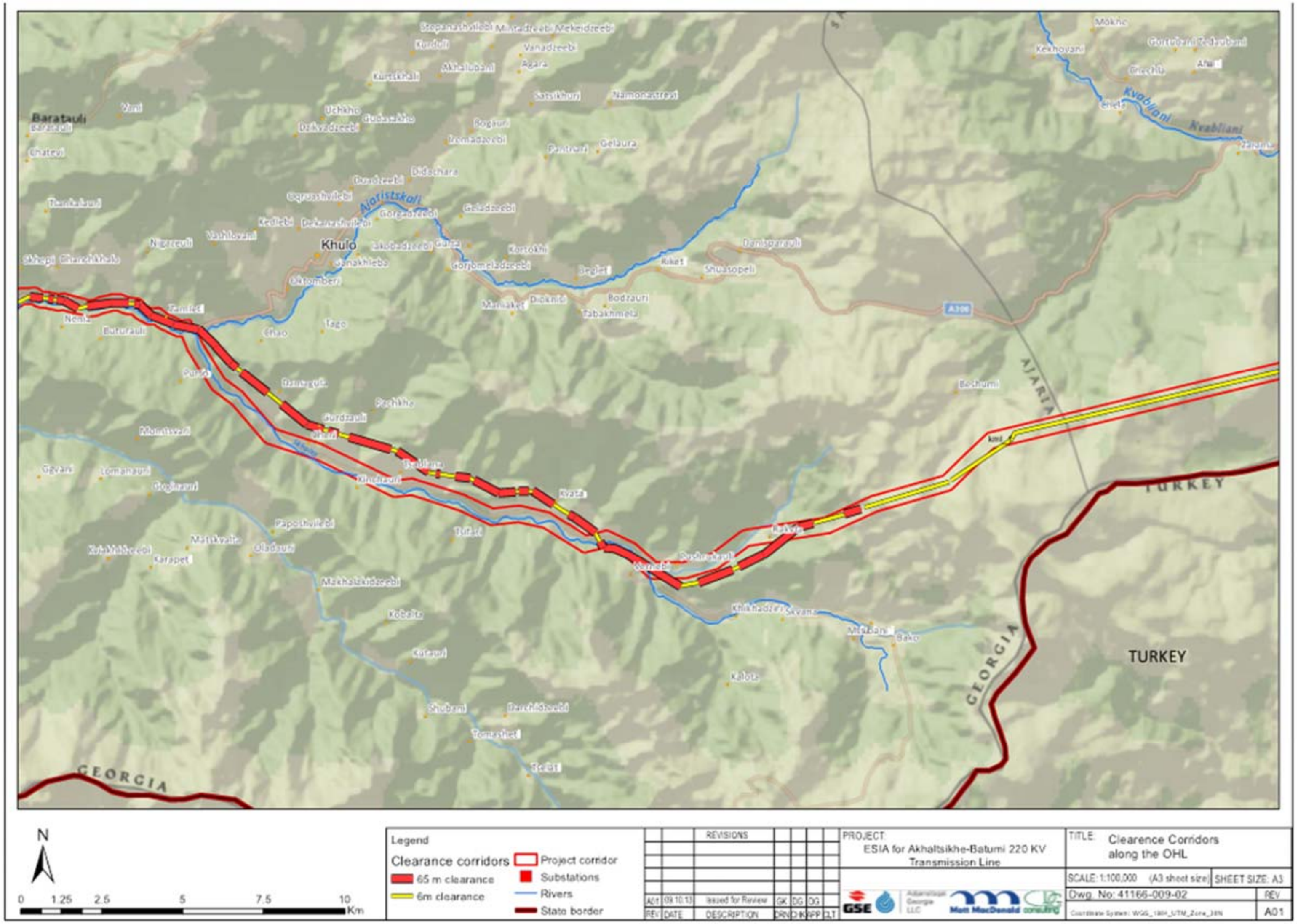


Figure 7.2.2 The clearance corridors within forested areas – Sheet 2

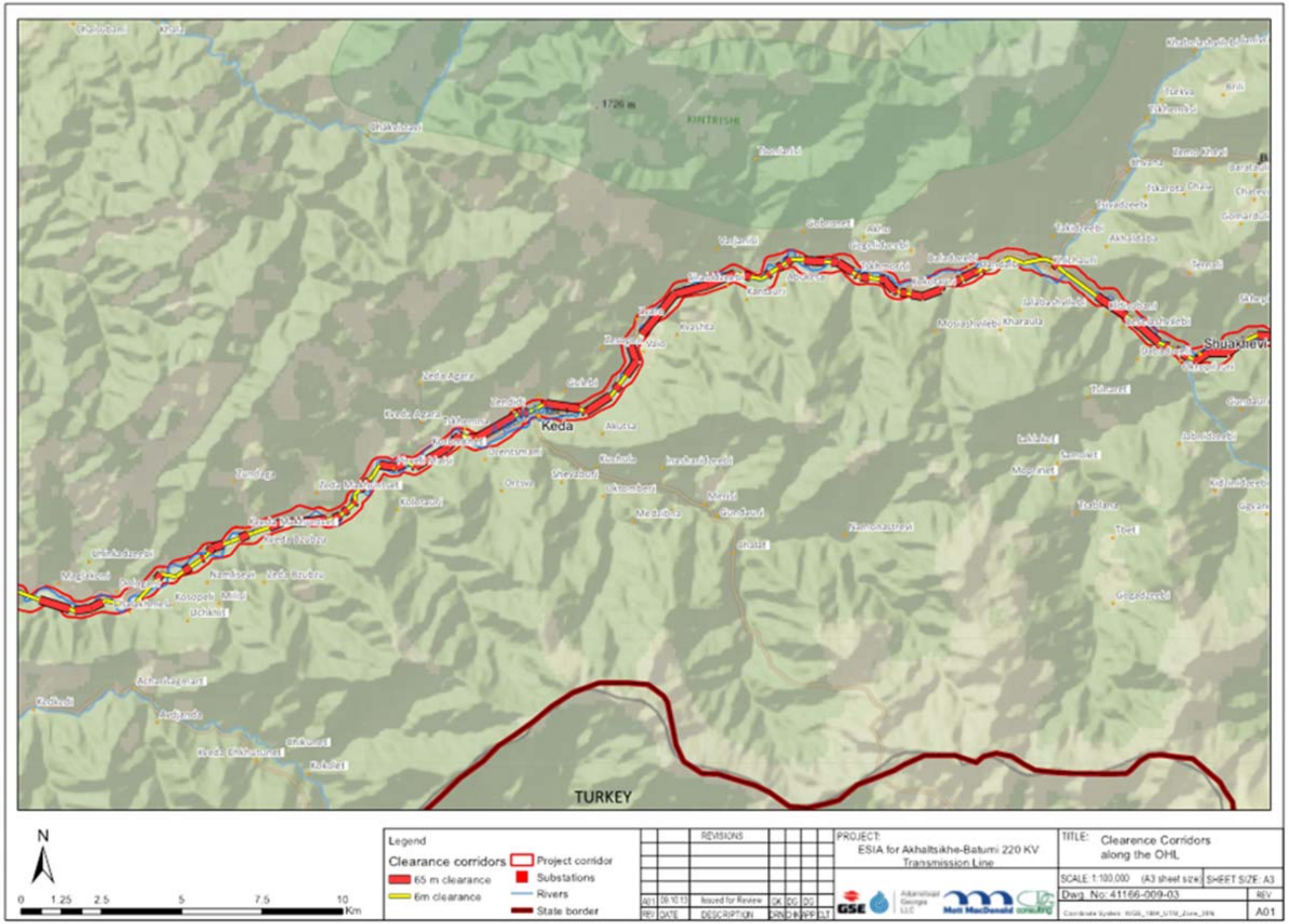


Figure 7.2.3 The clearance corridors within forested areas – Sheet 3

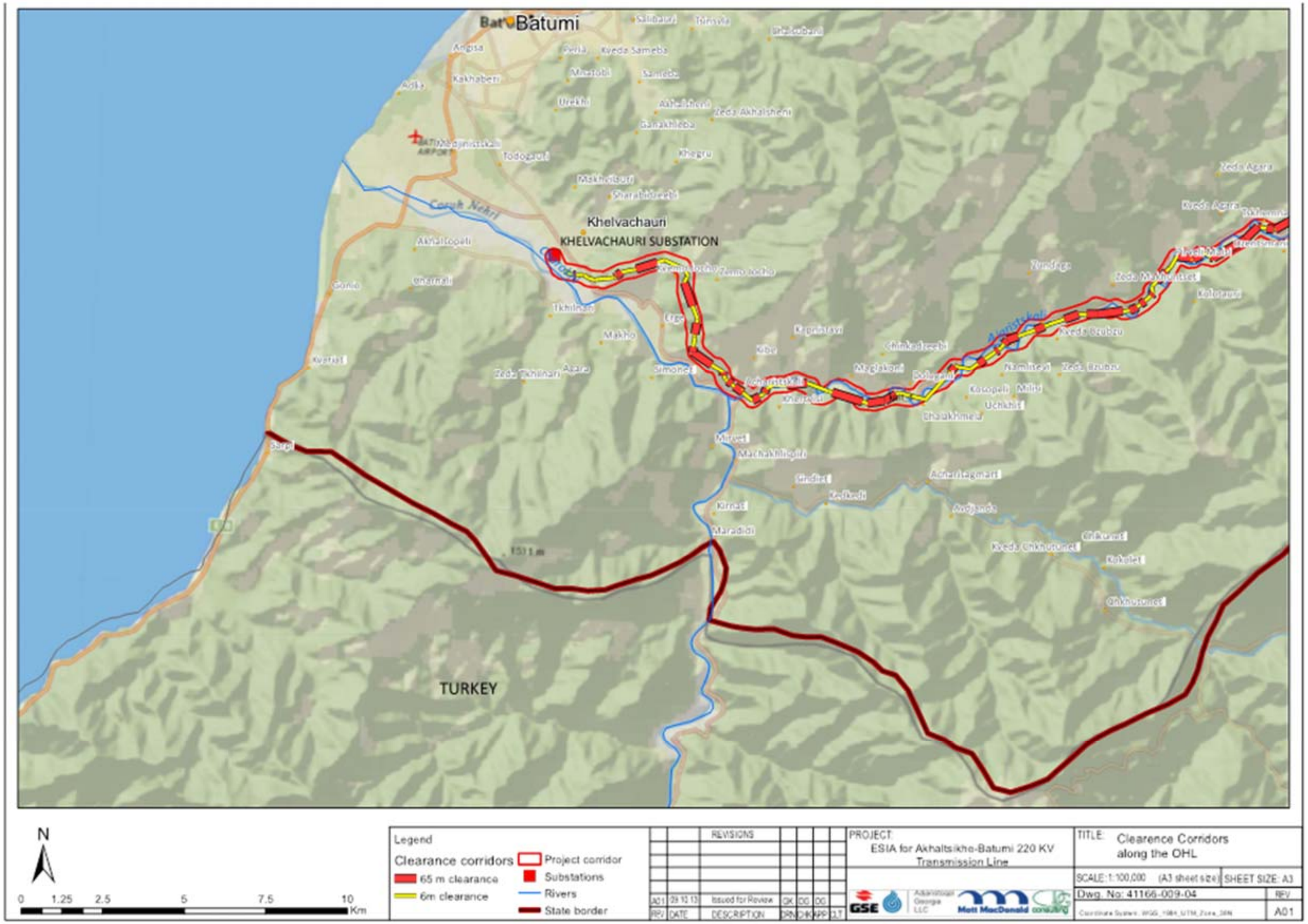


Figure 7.2.4 The clearance corridors within forested areas – Sheet 4

Table 7.2.3 Forested areas clearance related to arrangement of access roads

Municipality	Area in non fragmented forest, m^2	Area in fragmented forest, m^2	Total, m^2	Total impacted forested area, ha	Ratio of impact area from total forested areas in the muni-cipality, %
Akhaltsikhe	0	0	0	0	0
Adigeni	0	0	0	0	0
Khulo	12300	30960	43260	4.326	0.012%
Shuakhevi	17400	9000	26400	2.64	0.007%
Keda	31200	38100	69300	6.93	0.018%
Khelvachauri	9000	10800	19800	1.98	0.008%

The analysis of data has indicated that clearance required in forested areas is very low in comparison to forest fund in each municipality. In Akhaltsikhe and Adigeni municipalities the construction of access roads to poles is not required, because the access is already available to tower locations and no forest clearing required. In lower section of proposed power line, the impact on forests due to the arrangement of access roads are also very small and can be considered as negligible comparably to the impact caused by the clearing of OHL RoW.

The analysis of geographic data and quantitative evaluation of the OHL impacts on forested areas, indicated that maximum impact in terms of area is in Shuakhevi municipality, where the most forest clearing works are required. Although the largest clearing activities are required in Shuakhevi municipality, the percentage of cleared area in comparison with entire forested area in this municipality does not exceed 0.2%. Accordingly, the significant impact on forest habitats in terms of forest clearing is not expected. The baseline study has indicated that forests within the corridor in Khelvachauri and Shuakhevi municipalities are less sensitive.

The impacts on forest habitats crossed by the OHL can be summarized as follows: in total around 40 km of the OHL (out of total 150) will be built in forested areas. The selected corridor passes through lower value forests, major of which are exposed to anthropogenic pressure/impact. Considering the national technical safety standards, RoW clearance width in forested areas will vary approximately from 6 m to 65 m, depending on topographic conditions of the forests. It is anticipated that mostly 65 m wide clearance would be required to ensure the OHL safety. In overall, the area of impacted forest land will make about 350 ha, that is less than 0.2% of the total forest ecosystems (200 000 ha) in project affected municipalities.

In addition to quantitative/area analysis, it is important to analyse types of impacted forests, in order to evaluate the sensitivity of particular zones and identify, if any of these zones should be considered as area of critical habitat.

Higher sensitivity forested section of the OHL corridor is comprised between Beshumi and Zamleti Village, that is the Skhalta River gorge, where major part of 65 m wide clearance corridor should be arranged. According to the project baseline, forests on this section support relatively higher diversity of animal and plant species.

Sub-alpine forests, which are spotted between the Mt. Shavshitsveri and Beshumi should be considered also relatively sensitive, as usually their capacity to restore after impact is lower due to severer climate conditions. Around 30-40 ha of impacted forests will be riparian/river bank. This type of habitats mainly could be encountered as narrow strips along the Skhalta and Adjarisqali Rivers.

Impacted forests support various plants and animals, including some protected species; however, they do not represent a critical habitat for wildlife. None of plant or animal populations in the project area is significantly dependant on the forest stands falling within the OHL RoW. As mentioned, the impact on higher value forests is avoided through the OHL re-routing. Furthermore,, the need for forest cutting was reduced to minimum practicable level during the routing, when efforts were made to use favorable topographic features (e.g. mountain ridges) to reduce tree felling within full corridor width (65 m), and shift OHL to open and sparser areas whenever possible. Implementation of such design measures is important not only in terms of preservation of wildlife habitats and biodiversity, but also for prevention of natural hazards (erosion, landslides, floods, mudflows) what is ensured by these ecosystems. Micro-siting options for towers will be used to further allow for reduction of impact, when effort will be made to avoid adverse effects on species of concern.

The impact on forests is expected to be permanent, because high tree growth should be prevented within RoW by sanitary cutting, to maintain technical conditions for safe operation of the OHL; only low shrubs and grass will be allowed to regenerate post-construction. It should be mentioned that the mild and humid climate in Adjara are favorable for rapid natural re-vegetation, and the recovery of sub-forest is expected soon after the completion of construction.

As summary of discussion it can be concluded that the project corridor does not cross the forest habitats of critical or very high value, and the RoW clearance in these particular types of forests will not cause partial of full loss of critical habitats.

Next type of relatively sensitive habitat for the OHL is alpine/sub-alpine meadows, as their capacity to recover after impact is limited due to sever climate and poorly developed topsoil. Therefore, there is high erosion potential in such areas, if vegetation is disturbed. Alpine/sub-alpine meadows mainly spread between the Mt. Shavshitsveri and Beshumi. It should be mentioned that the vegetation cover is already significantly impacted (as described in baseline study) by overgrazing and off-road driving. The project impact will comprise damage of alpine vegetation due to earth works, conductoring and traffic. Preventive/mitigation measures are required to reduce potential impacts on these habitats to acceptable level.

Forest fires

Forested ecosystems represent majority along the project route and are particularly sensitive to fires. The project has potential to promote forest fires if:

- Regular vegetation control is not ensured. Unchecked growth of tall trees may result in forest fires if trees are in contact with live conductors. Regular maintenance of vegetation (every six to eight years) within the RoW is necessary to avoid such risks. Usually, vegetation grow is well controlled as they can cause damage to overhead power lines and transmission towers, leading to power outages, corrosion of steel equipment, and interference with critical grounding equipment.
- Slash (tree limbs, tops, etc) from initial construction or routine maintenance is left to accumulate within the right-of-way boundaries, sufficient fuel may be available to promote forest fires. GSE will ensure removal of vegetation slash after vegetation control activities so that not to increase fire risks.
- Project workers do not follow precaution measures during construction and maintenance activities when handling flammable materials and fuels.

Invasive, Exotic Species

Intentional or accidental introduction of alien or non-native species of flora into areas where they are not normally found can be a significant threat to biodiversity, since some alien species can become invasive, spreading rapidly and out-competing native species.

Clearing of forested habitats along the project route, where forests will be permanently converted into grassland or shrubbery, will be the only significant change in habitat type. Once the vegetation has been cleared away, the ground will naturally re-vegetate with native (sub-forest) species and non-native species from adjacent areas. Due to the potential risk of introducing invasive exotic species in the forested habitats of the project, mitigation measures will be employed to minimize invasive colonization and propagation. Especially this is important issue in areas, where the special re-vegetation or regrassing will be required due to engineering geology conditions. It is expected, that the proper topsoil storage procedures, and short period of topsoil storage will allow the project team to plan their works in a way that allows maximum reuse of topsoil and avoidance of seed loss.

7.2.3 Potential impacts on aquatic habitat

The OHL construction and maintenance activities may negatively impact aquatic habitats as a result of water quality degradation due to:

- Sediment laden runoffs from construction sites, which on its turn is likely to be caused by vegetation clearance, earth moving works and machinery movement. As described in respective section, construction works for about 40 towers will be in close proximity to major rivers. Number of small streams in close proximity to construction works is not known. It is anticipated that erosion prevention and surface runoff management methods (e.g. silt barriers, halting of soil works during heavy rains, etc) will be ensured for the project to avoid significant impact on receiving water bodies.
- Direct impact due to river crossing by machinery to access the tower locations where other access is not available. This will increase the level of suspended solids. The detailed evaluation of pole locations and access roads was conducted and it was estimated, that river crossing will be required only in 10 instances, where there are no bridges, and other access does not exist. The works in riverbeds is not expected, because there are no poles in the channel itself, and only few poles are located on the floodplain. Machinery management measures and maybe use of temporary flume-pipes will be ensured to minimize the impact.
- Accidental spills of chemicals (e.g. fuels, solvents, etc). Such a risk will be minimal as material and machinery handling and management procedures will be implemented. Besides, limited volume of chemicals will be available at work sites.

Considering duration of the construction/maintenance works, as well as planned pollution prevention, erosion control and other environmental management measures, water quality deterioration should not be significant and should be short term.

Another type of impact on aquatic habitat is likely to be direct damage of river courses, banks and floodplains due to installation of towers and machinery movement. As mentioned, none of the OHL towers is likely to be installed in floodplains. Number of large river crossings will be around 10. This will be used only in cases when no other access roads could be arranged; however, the number of small streams disturbed seems to be higher. Management measures will be used to reduce direct damage and disruption of aquatic habitats to the level practicable. Any damage to stream banks or streambeds will be repaired when work is concluded.

Furthermore, vegetation control in riparian/riverbank forests has potential to alter balance of organic matter in river water; however, such impact should be negligible as disturbance of floodplain areas will be maintained as low as possible so that to maintain its ecological functions. The project activities and/or facilities should not cause notable alteration of river discharge regime; lateral and longitudinal connectivity of water courses will not be affected as well.

Impact level on aquatic habitats will be of lower level on the operation phase, as in comparison with construction stage, volume of maintenance works, number of machinery and quantity of potential pollutants required for operation of maintenance crews will be significantly less. However proper management and good environmental performance will be required to avoid significant pollution and/or keep other potential impacts at low level.

Special attention should be given to the small streams in alpine zone, which is crossed by the OHL. Usually such streams are more vulnerable to pollution, as their self-purification capacity is lower and pollutants are more readily transported to lower streams. The maximum attention should be devoted to protection of such stream during the construction works, as during the operation/maintenance the usage of fuels, chemicals and transport will not be significant.

Introduction of alien or non-native species of flora and fauna into aquatic areas is not likely to have place as alteration of habitats will be mostly very short-term and changes in hydrologic conditions and habitats which could foster invasion and establishment of alien species will not have place.

7.2.4 Potential impacts on fauna

OHL projects have potential to have direct and indirect impacts on fauna as a result of construction/ maintenance activities and presence of OHL structures. In particular, construction and maintenance works involving the clearing of vegetation, excavation of soils, movement of vehicles or equipment over roads, terrain or streams, loading and unloading of materials, deployment of conductor and other activities can result in:

- Injury or mortality of animals. Crushing, suffocation, removal from protective habitat, destruction of nests and eggs and other conditions usually result in the immediate or eventual death of affected organisms. Such impacts can be significant if they involve large numbers of organisms, occur on a regular basis, or affect animal populations/species that are particularly sensitive, unable to reasonably compensate for losses, or already low in numbers.
- Destruction/ damage of nesting/ den, foraging, breeding areas for animals, or otherwise alteration of their habitats (see previous sections).
- Disturbance and temporary migration of fauna from the project impact areas due to noise, dust, traffic and vehicles/machinery operating onsite, and project workers. Usually, disturbance factors for OHL projects are short term and do not have large impact area, and animals migration is to short distance and for limited time. After completion of work, when all sources of disturbance are removed, animals return to traditional habitats.
- Habitat fragmentation, which is majorly related to vegetation clearance. This potential impact is discussed in the previous sections.

In addition, presence of OHL infrastructure on the operation phase alters habitats mostly for birds and bats, as towers and conductors represent barriers which can interfere with their flying, cause injury/killing of birds/bats as a result of collision and/or electrocution. In addition, electromagnetic field emitted by OHLs has a potential to interfere with echolocation of bats.

The baseline study of fauna has been conducted taking into account the potential impacts on fauna described and fauna sensitive areas identified. According to the established baseline and considering the project character, main fauna sensitivities for the proposed OHL are birds and particularly raptors, as the OHL corridor crosses important migration flyway and other potentially sensitive bird/bat areas. Due to high sensitivity of this issue, a separate subsection is devoted to discussion of potential impacts on birds and bats (see below).

Other fauna sensitivities for the project include protected species (see baseline), which may undergo the above described impacts. However, neither of habitats or population of protected species in the project area is reported to be critical on national, regional or international level. Among protected species (except for birds and bat) should be accented:

- Nehring's Blind Mole Rat (*Nannospalax nehringi*) and Long-clawed Mole Vole (*Prometheomys schaposchnikowi*): colonies of these species are found close to the OHL corridor near to Beshumi. Based on current information about OHL corridor, these colonies are sufficiently distanced from the corridor to be impacted (see Figure 6.1.17); however, if preventive measures (demarcation of working/transportation areas) are not taken, earth moving works and machinery movement can adversely impact these areas.
- Otter (*Lutra lutra)*, which is recorded in the Skhalta and Adjaristsqali River gorges. River banks and floodplains are habitat of the Otter and it can be impacted as a result of river crossing by heavy machinery, vegetation clearance in floodplain areas, deterioration of water quality in the rivers and reduction of fish population as a result of project activities (e.g. water pollution). As mentioned, only around 10 river crossings could be required in areas, where other passage is not available. Otherwise disturbance of river banks and courses will be maintained at minimum level through appropriate management of works and machinery.
- Caucasian Salamander (*Mertensiella caucasica*), which is recorded in small streams in the lower part of Adjaristsqali River and could be impacted if water turbidity will increase, streams are crossed by machinery or otherwise impacted.

Most serious project impact on animals (except birds) will result from vegetation clearance and earth moving works. However, as described above, fragmentation of habitats and major alteration to the surrounding ecosystems or to the viability and composition of wildlife communities are not anticipated.

Avian and Bat Collisions and Electrocutions

OHL towers and conductors can pose potentially fatal risk to birds and bats through collisions and electrocutions. Avian collisions with power lines and transmission structures can occur in large numbers if located within daily flyways or migration corridors. Collision risk increases if birds groups are traveling at night or during poor weather conditions (e.g. dense fog, cloudy weather), when visibility and birds' flying height are lower. If conductors are not spaced far enough apart to prevent birds from touching two wires at once, or if "bird-proofing" measures are not implemented to keep birds away, large perching birds (particularly raptors) can be electrocuted. Bat collision risk with OHL structure is usually low as they use sonar system to navigate; however, such a risk still could be high if OHL crosses bat migration corridor and high number of bats occur near OHL, especially considering that sometimes bats stop echolocation to avoid signal interference from other bats. Besides, OHL EMF has potential to interfere with bat's echolocation and interfere with their foraging ability.

Due to crossing of well-known bird migratory flyway by proposed OHL, the comprehensive bird study was implemented to identify impact significance. Based on desk review of various publications and field surveys undertaken, the following relatively or high sensitivity areas are identified for the project:

- Surroundings of Akhaltsikhe (Zikilia) sub-station: this is sensitive area for raptors, as they find there their nesting and hunting habitats. Relatively higher concentration of some raptor species - Lesser Spotted Eagle, Booted Eagle, Golden Eagle, Egyptian Vulture and Harriers - are recorded there during bird surveys; besides, flying height of these birds was mostly below 60 m. Among raptors recorded on this section Egyptian Vulture, Imperial Eagle and Golden Eagle are protected in Georgia and/or internationally. The power line corridor is at significant distance from raptor nests detected in this area and the nesting areas will not be directly impacted. The impact expected on this habitat may be high, especially if consider cumulative effect of nearby OHLs.

Avoidance of this area is not possible as the sub-station is already built. Mitigation measures including sufficient spacing between conductors and minimization of their vertical distribution.

- OHL section between AP36 – AP37, which is near Beshumi: rhododendron shrubbery ca. 1.5 km south to the corridor is the Caucasian Grouse's nesting and foraging habitat. This bird migrates towards the north during the spring and returns back during the Autumn. Construction activities are planned in a way to stop operation on this section during the Grouse migration to avoid impact. Operation phase impact, in particular collision with OHL, may have place, however will not be significant. The Grouse is protected nationally and worldwide, however, Beshumi population of this bird is not recognized to be a key population.
- OHL section downstream of Skhalta and Adjaristskali confluence: this is a daily migration and hunting area for local raptors. Some potential nestling areas for local raptors are found there. Skhalta river gorge is also used for hunting. Bird concentration on this section is found to be low. As birds on this section mostly fly within river gorges and in parallel to rivers, two main considerations have been respected during the OHL routing to mitigate potential impact on avian fauna: minimization of river crossings and moving the power line close to mountain ridges.

  It should be mentioned that this section of OHL is distinguished also due to relative abundance of bats; however, bat migration routes, or bat congestion areas, are not crossed by the OHL. Usually bat populations could be found along river, close to food base, where they live in tree hollows. The OHL is placed on ridges, where possible. Due to the mentioned routing and considering bats' navigation using echolocation, the risk of bat collision with OHL, should be negligible. The EMF zone for 220 kV line is rather limited and it rapidly weakening with increase of distance. The cumulative EMF effect is not an issue, as there are no high voltage lines in the project area sensitive to bats. Accordingly, EMF interference with their sonar system should be negligible.
- OHL section starting from confluence of the Chorokhi and Adjaristskali Rivers down to the Khelvachauri Sub-Station: this 10 km long section of the OHL crosses well-known migratory flyway of Batumi, where high concentration of migratory raptors is recorded during autumn migration. The flyway is especially important for European Honey Buzzard (*Pernis apivorus*): this bird is not protected, though as estimated 45-130% of its world population is recorded in Batumi bottleneck during autumn migration. Some Georgian and IUCN red list species are also recorded there, though in lower concentrations. The total cross-section of the flyway is around 15 km, out of which only about 5 km section comprised between AP142 and AP 150 (between the mouth of Adjarisqali River and the Zemo Jocho Village) is likely to exposed to higher impact of the OHL, as birds are found flying at lower heights there (see Figure 7.2.5).

  As already mentioned, the development of re-routing alternative to avoid this sensitive area is impossible, as the final connection point - the Khelvachauri Sub-station - is already built and operating there for decades. However, re-routing was used to reduce the impact. In particular, Alternative 4.1 was developed, which is away from the Chorokhi River gorge (distance approx. 3-4 km), coinciding with the main migration area. Installation of OHL on the mountain ridge little east to the Zemo Jocho Village was avoided, as according to field surveys most birds fly at low heights there. The final section of the OHL (after the Makho bridge to the sub-station) follows existing lines in parallel.

  To demonstrate effectiveness of such re-routing option the cross-section of the terrain, indicating birds' likely flyway in this area, is shown on Figure 7.2.5. The cross section also demonstrates the locations of towers in this area and the zone where birds fly low. As the figure shows, the described re-routing should be quite effective, as topographic features enable to keep towers well-below the birds' flyway.

  Furthermore, the OHL towers and conductors will be designed considering best practices to reduce the likelihood of bird collisions and electrocutions. This will include placing of conductors within the distance established to avoid electrocutions while perching, and equipping the cables with bird reflectors to increase their visibility and rescue collisions.

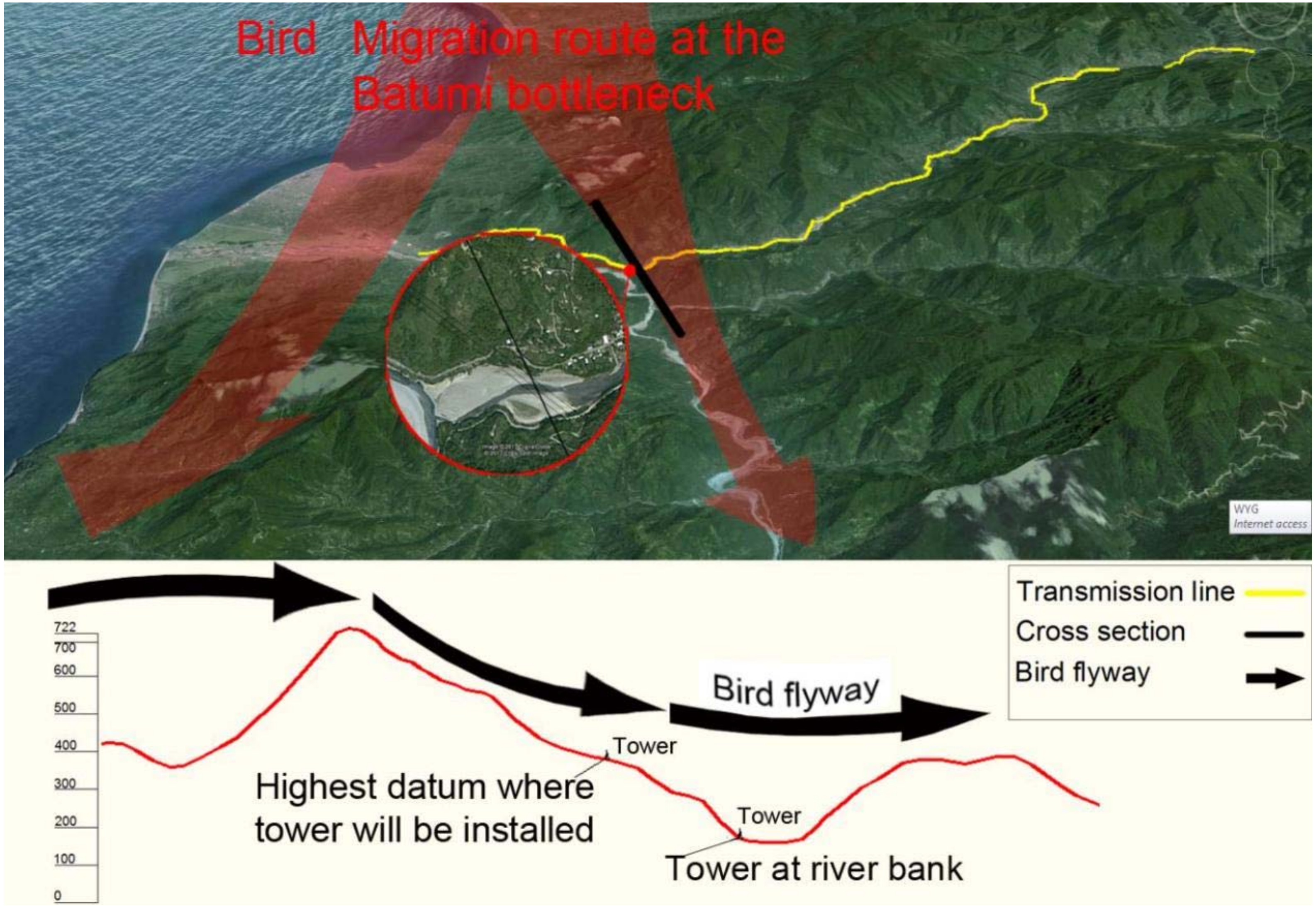


Figure 7.2.5 Layout of Batumi bottleneck and the proposed OHL

7.2.5 Potential impacts on flora

RoW clearing, installation of foundations, installation of towers, arrangement of access roads, and driving over areas of the right of way could destroy or damage individual plants or communities of significant concern. The present section is focusing on assessment of potential impacts on endangered and protected species.

The detailed description of flora is given in the section dedicated to baseline conditions of flora species within the corridor. The detailed information regarding the sensitive areas within the corridor is given in Section 6. The baseline study has indicated areas with higher likelihood to encounter protected and endangered species of plants. The sensitive areas, where the protected flora species were identified, have been included in constrains maps prepared by the environmental specialists prior to second stage of routing study. Later the flora sensitivity maps were prepared based on data collected during the field works and included in baseline section of present report.

The overall evaluation of potential impact on flora is estimated on sensitivity of section in terms of plants and expected extent and time scale of impact.

The flora baseline study has identified several sections of the project corridor, which are sensitive in terms of impact on flora. The paragraphs below describe mentioned sections and evaluation of potential impacts on specific communities of flora species.

Mesophilic meadows developed in pine forests – In the area located between AP08 and AP09 the sensitive zone with presence of endemic and protected herbs was identified (Tephroseris subfloccosa – endemic of the Caucasus, Aetheopappus pulcherrimus, Gladiolus dzavakheticu s-endemic of the Caucasus, Gymnadenia conopsea (CITES)). In order to minimize the potential impact, the OHL corridor was designed in a way to avoid mentioned complex; the vegetation clearance is not required in the area and the pole should be placed in a way to minimize the impact. The risk of impacting plant community which can cause loss of species is considered as very low.

Shallow bush land (sensitive plot #15) located in vicinity of Giorgitsminda village close to the AP08 was considered as sensitive. The AP 08 was located in a way to avoid the area of high sensitivity, however if such plant community is identified during the preconstruction survey and demarcation of project area, the micro relocation of tower will be required.

The Pine forest with admixture of spruce and smoke tree understorey (sensitive plot 16) is identified as area of high flora sensitivity, in the vicinity of the village Giorgitsminda, adjacent to Akhaltsikhe The area where such plant community is developed is much wider than project impact zone, so the construction will not cause loss of the species.

Spruce forest with yellow azalea, Spruce forest with fern and wetlands in spruce forest windows were identified in the Skhalta river valley as high sensitivity zones. The AP 39 and AP 40 were located in a way to minimize the impact on mentioned areas; however the micro spotting of tower will be required, to minimize impact on mentioned protected species. The corridor clearance is not required here, and the track for conductor pulling should be cleared in a way to avoid impact on this sensitive area.

The Oak and hornbeam forests and broad-leaved forest with admixed spruce trees and Colkhic undersorey between the villages of Rakvta and Pushrukauli were considered as sensitive (representative plot description #25). AP41- AP43 were relocated for minimization of impact on forest. The extent of such plant community is much wider, so estimated impact from corridor clearance and placement of poles will not cause loss of sensitive plant community, however the careful micro-spotting of towers is required during the construction works.

Spruce forest with admixed Chorokhi oak is identified between the villages of Pushrukauli and Veranebi and is considered as high sensitive area (AP 45-47, representative plot 26).The following tree plants are identified in this area Picea orientalis, Quercus dschorochensis (subendemic of the Caucasus); the bush species growing in understorey are: Rhododendron luteum, Rosa canina; herbaceous plants are following: Driopteris filix mas, Fragaria vesca, Oxalis acetosella. Within the adjacent territories of the given section, on the both sides of the gorge, spruce forests are developed with admixed oaks; several villages are located adjacent to forested plots. The Georgian red list species Rhus coriaria, Juglans regia are identified near to village Vernebi. The OHL corridor was selected in a way to avoid most of these sensitive areas and is placed mostly on agricultural land, however the clearance is required. The extent of plant communities is much wider than the clearance corridor and covers mountain slopes around, so the impact will cover only very small part of sensitive area.

The Rock and forest complex near the Furtio bridge is also considered as highly sensitive, however this area was considered for alternative 2.1 which was not selected as preferred alternative.

The Rock and forest complex near the confluence of the rivers Tchvanistskali and Atcharistskali was also considered as high flora sensitivity area, however the tower spotting allowed to avoid the complex, and impact is not expected. The sensitivity of area should be considered during the preconstruction stage.

The sensitive forests are located near the village Sirabidzeebi (Representative plot #31). Robinia pseudoacacia, Alnus barbata, Quercus dschorochensis (subendemic of the Caucasus), Diospyros lotus (in single specimens), Ostrya carpinifolia (in single specimens) (The Georgian Red List Species) are identified in the zone. The replanting may be required depending on results of preconstruction survey.

The other sections of OHL corridor are considered as low and medium sensitivity sections. The analysis of data has indicated, that the construction of OHL inclusive corridor clearance and construction of access roads will not cause loss or significant alteration of specific plant communities, however, the microspotting of towers is required at later stages of the project in order to avoid significant impact on flora species. In order to reduce the impact, the attention has been paid during selection of corridor to maximize the usage of natural landscapes and minimize the length of corridor which requires clearance at full width.

As a result of detailed botanical study it should be stated, that the impact on particular endangered and protected species of flora will not cause full or significant loss of these species.

After the corridor is clearly demarcated, the detailed forestry/botanical study is necessary within the framework of Forest Development Permit, in order to fulfil requirements of Georgian legislation. The study can be conducted by the project developer or construction contractor as a part of preconstruction survey, when the high qualified botanist and forestry specialists will be required. Botanist will identify protected and rear species and the forestry specialists will mark all trees to be cut and evaluate the volume of timber in accordance to species. The inventory records should be submitted to the forestry department of the ministry of natural resources of Georgia.

The Table 7.2.4 below evaluates the impacts on biological environment. In this table the extent, intensity and probability of impacts are indicated with consideration of mitigation measures applied at design, construction and operation phases of the Project (presented in the last column of the table and taken from the Sectionn 8 “Mitigation Measures’). This is done to avoid duplications and inadvisable comparison of say “bad route/alternative” and “good route/alternative” i.e. comparison of cases “with mitigation measures” against cases “without mitigation measures”.

Table 7.2.4 Significance of Impact on Biological Environment

Receptor	Sensitivity of Receptor	Potential Impact	Extent Intensity Probability	Comments
Forest ecosystems	Low to Medium	Permanent loss of forest habitats for wildlife due to RoW clearance, tower installation, conductoring and construction of access roads	Regional Low Definite	According to rough estimates, tree felling will be required along ca. 40 km length section out of 150 km RoW. Total area of impacted forests will be ca. 350 ha, what is around 0.2% of total forest ecosystems in the project affected municipalities. None of these forest ecosystems are critical habitat, or otherwise highly sensitive (as of sensitivity criteria) and none of plant or animal species/ populations in the project area are significantly dependant on the forest stands to be cut down. Relatively sensitive forest sections due to higher biodiversity are comprised in the Skhalta gorge, between Beshumi and Zamleti and sub-alpine forests between Mt.Shavshitsveri and Beshumi. The impact on higher value forests is avoided through the OHL re-routing. The need for forest cutting was reduced to minimum practicable level through use of favourable topographic features and shifting OHL to open/sparse forest areas wherever possible. Implementation of such design measures is important not only in terms of preservation of wildlife habitats and biodiversity, but also for prevention of natural hazards (erosion, landslides, floods, mudflows) what is ensured by these ecosystems.
Forest ecosystems	Low to Medium	Fragmentation of forest habitats due to RoW clearance, tower installation, conductoring and construction of access roads	Regional Low Improbable	65 m wide forest clearance and OHL facility are not likely to restrict passage of animals or population of plants across the corridor, as plant/animal species particularly sensitive to anticipated changes are not recorded in the project area.
Forest ecosystems	Medium	Increased risk of forest fires due to residual forest slash, improper vegetation control within RoW, or carelessness of project workers when handling flammable materials	Regional Low Possible	GSE will ensure implementation of precaution measures such are removal of vegetation slash after vegetation clearance and safe handling procedures of farmable materials. On the other hand, the OHL corridor can serve as a firebreak and prevent fast spread of fires, if properly maintained.
Forest ecosystems	Low to Medium	Introduction of invasive species into forested ecosystems	Regional Low Possible	This impact can have place in forest clearance areas, which will be permanently converted into grassland or shrubbery. Once the vegetation has been cleared away, the ground will naturally re-vegetate with native (sub-forest) species and non-native species from adjacent areas. Mitigation measures will be employed to minimize colonization and propagation of

Receptor	Sensitivity of Receptor	Potential Impact	Extent Intensity Probability	Comments
				invasive species, especially in areas, where artificial re-vegetation is required.
Sub-alpine and alpine meadows	Medium	Temporary loss of habitat	Local Low Definite	This kind of impact will have place during construction/maintenance works. These habitats will be impacted within ca. 6 m wide corridor. Damaged sites will naturally re-vegetated post construction. Reinstatement measures will be ensured if required.
Aquatic ecosystems	Low	Water quality deterioration as a result of sediment laden or chemically polluted surface runoffs from construction sites due to vegetation clearance, earth moving works and machinery movement.	Local Low Definite	About 40 towers will be in close proximity to major rivers; exact number of small streams in close proximity to construction works is not known. It is anticipated that erosion prevention and surface runoff management methods (e.g. silt barriers, halting of soil works during heavy rains) will be ensured to avoid significant impact on water bodies. The risk of pollution with chemicals (e.g. fuels, solvents, etc.) will be minimized through proper management of materials and machinery.
Aquatic ecosystems	Low	Direct impact/ damage due to river crossing by machinery to access tower locations where other access is not available.	Local Medium Definite	The detailed evaluation of pole locations and access roads showed that river crossing will be required only in 10 instances, where bridges or other access is not available. Works in riverbeds are not expected as poles in river channels will not be installed, and only few poles will be located in the floodplain. Machinery management measures will be ensured to minimize the impact.
Aquatic ecosystems	Low	Direct impact/ damage to riparian forests due to machinery movement and vegetation clearance	Local Low Definite	Riparian forests are very limited in the RoW and they are mostly fragmented due to human activities. Impact on these ecosystems is reduced through minimization of river crossings by the OHL and shifting the line away of the river banks (e.g. to the mountain ridges in the Skhalta gorge). Implementation of best management practices during construction works will enable controlling of the impact at the exactable level.
Aquatic ecosystems	Low	Introduction of invasive species	Local Low Improbable	Introduction of alien/ non-native species of flora and fauna into aquatic ecosystems is not likely as changes in hydrologic conditions and habitats which could foster invasion and establishment of alien species will not have place.
Fauna in sensitive areas	Medium to High	Destruction of dens/ nest, injury/mortality of animals during construction and maintenance activities	Local Low Definite	Sensitive fauna areas for the RoW include environs of Akhaltsikhe Sub-Station, Beshumi, Skhalta and Adjaristskali gorges and environs of Khelvachauri Sub-Station. None of these areas are critical habitats. According to the available information, the RoW avoids direct impact on sensitive fauna sites. Implementation of

Receptor	Sensitivity of Receptor	Potential Impact	Extent Intensity Probability	Comments
				Pre-construction Survey and Biodiversity Management Plan are required to avoid potential impacts on sensitive fauna areas or to minimize the impact.
Fauna in sensitive areas	Medium to High	Avian and bat collisions/ electrocution from contact with power lines.	Local Low-to-Medium Definite	Sensitive areas in terms of avian fauna are environs of Akhaltsikhe and Khelvachauri sub-stations. The later is comprised within Batumi bird migration flyway and is particularly sensitive. Lower streams of Skhalta gorge and middle streams of Adjaristsqali gorge are relatively sensitive in terms of bats. Design measures were ensured to minimize avian/bat collision with OHL. These include re-routing of the OHL to locations less sensitive for birds/ bats, and designing of conductors/towers up to best practices. Bird reflectors will be used to increase OHL visibility. Bird monitoring program will be implemented on the operation phase to check effectiveness of existing mitigation measures and identify if further mitigation is required.
Fauna in non-sensitive areas	Low	Destruction of dens/ nest, injury/mortality of animals during construction and maintenance activities	Regional Low-to-Medium Definite	The impact on wildlife will be minimized through pre-construction survey of the project RoW, when dens/nests and other important wildlife areas will be identified to avoid their disturbance to the level practicable. This will be achieved through micro-siting of towers and proper routing of new access roads. Implementation of biodiversity management plan will enable minimization of impact on wildlife.
Fauna in non-sensitive areas	Low	Avian and bat collisions/electrocution from contact with power lines.	Local Low Definite	OHL will be designed considering best design practices to minimize the risk for avian/bat collision and electrocution.
Flora in sensitive areas	Medium to High	Damage/removal of vegetation due to RoW clearance, construction works and machinery operation	Local Low-to-Medium Definite	Sensitive flora areas have been identified during the baseline survey. Findings were considered for development of re-routing alternatives and selection of preferred alternative. Pre-construction survey is advisable after preparation of the final OHL design to determine whether high flora sensitivity areas are impacted and ensure micro-siting of towers in a way to avoid/minimize impact. Further mitigation of impact should be ensured through Biodiversity Management Plan. Reinstatement activities should be ensured in sensitive areas, if natural re-vegetation in such areas is ineffective.
Flora in non-sensitive areas	Low	Damage/removal of vegetation due to RoW clearance, construction works and machinery operation	Regional Low-to-Medium Definite	Implementation of best management practices and Biodiversity Management Plan is deemed to minimize impact on flora. Natural vegetation of the RoW (except trees) will be allowed during the entire post construction period.

7.3 Potential Impacts on Socio-Economic Environment

This section identifies potential socio-economic impacts of the proposed project and describes their nature, magnitude, extent and location, timing and duration. Social and economic impacts of energy transmission projects can take place during construction and/or operation phases, and can be both positive and negative. These impacts usually vary by location, size, duration, manpower requirements, etc. of construction works, operational parameters of the project, distance to neighbouring communities, socio-economic characteristics of these communities, etc.

Negative impacts and causing impact factors common to most OHL projects may include:

- On the construction phase:
  - Health and safety issues as a result of dust, noise and vibration from construction vehicle transit and operations, vegetation clearance, and earthmoving, construction and conductoring operations, communicable diseases associated with the influx of construction labour.
  - Decrease of households' incomes and deterioration of living standards as a result of restriction of existing land use and physical displacement.
  - Deterioration of visual amenities and cultural heritage sites, and respective impact on tourism sector
  - Impact on public infrastructure, including public roads, railway, pipeline, etc. from project vehicle and machinery
  - Demographic changes in local communities as a result of introduced workforce and/or physical displacement of households
- On the operation phase:
  - Health and safety issues for public as a result of propagation of electric and magnetic fields (EMF), noise and ozone emission amd electrocution from OHLs, nuisance factors (air emissions, noise, traffic, etc.) from OHL maintenance activities, aircraft navigation safety, etc.
  - Occupational health and safety issues for OHL operational and maintenance teams due to working with high voltage installations, working at heights, EMF emissions, other work related hazards
  - Impact on public infrastructure, including air navigation (aircraft navigation safety due to towers and EFM), electromagnetic interference from EMF with radio and TV broadcasting
  - Visual interference of the OHL and resulted deterioration of visual amenities and cultural heritage sites
  - Deterioration of living standards as a result of restricted access to lands and resources

Positive impacts of transmission line project can include:

- On the construction phase: increased incomes among local population and business sector, including direct and indirect employment by the project, increased demand on local purchases and other services; increased tax base;
- On the operation phase: increased incomes among local population and business sector, including direct and indirect employment by the project, increased demand on local purchases and other services); increased tax base; cheaper and more reliable electric power.

As mentioned, the level of these potential impacts of OHLs depends on various project parameters and local settings, and should be assessed based on multi-criteria approach. The general impact rating criteria and approach adopted for impact assessment for the given ESIA is described in

Section 5. These criteria are specified for the project in the following sections, whilst description of project specific conditions and impacts. Besides, criteria are established to determine sensitivity level of impact receptors. The sensitivity criteria adopted for socio-economic receptors are provided in Table 7.3.1. The sensitivity criteria are established bearing in mind potential impacts and likely spatial extent of factors, which affect receptors.

The discussion and characterization of the above listed generic impacts for the given OHL is provided in the following sections, considering the project's socio-economic background and the results of public consultations. Both beneficial and adverse impacts identified are assessed using the adopted approach, and suitable mitigation measures to enhance positive effects and minimize negative ones are proposed for the projects; mitigation measures are discussed in Section 8.

Table 7.3.1 Sensitivity Criteria for Socio-Economic Receptors

Sensitivity	Criteria
High	For construction phase - Residential areas, schools, kindergartens, hospitals and other public facilities, cultural heritage sites and public infrastructure within 0-200 m distance from the OHL corridor and/or access road - Households subjects to physical displacement - Households losing access to lands/resources on which they greatly depend - Project labour For operation phase - Residential areas, schools, kindergartens, hospitals and other public facilities, within 30-50 m distance from the centreline of the OHL corridor - Public infrastructure and cultural heritage sites within 0-100 m from the OHL centreline - Airports in immediate proximity to OHL corridor - Project labour
Medium	For construction phase - Residential areas, schools, kindergartens, hospitals and other public facilities, cultural heritage sites and public infrastructure within 200-500 m distance from the OHL corridor and/or access road For operation phase - Residential areas, schools, kindergartens, hospitals and other public facilities in 50- 100 m distance from the OHL corridor's centreline - Public infrastructure and cultural heritage sites in 100-500 m from the OHL centreline - Airports in several kilometres from the OHL corridor - Local community members
Low	For construction phase - Residential areas, schools, kindergartens, hospitals and other public facilities, cultural heritage sites and public infrastructure over 500 m distance from the OHL corridor and/or access road - Communities in over 1 km distance from the OHL and access roads For operation phase - Residential areas, schools, kindergartens, hospitals and other public facilities in

Sensitivity	Criteria
	over 100 m distance from the OHL corridor's centreline - Public infrastructure and cultural heritage sites in over 500 m from the OHL centreline - Airports in over 10 kilometres from the OHL corridor - Communities in over 1 km distance from the OHL and access roads

7.3.2 Impacts on Local Population and General Public

As identified above, OHLs can either adversely or beneficiary influence local communities and public in general, and can expose them to the following impacts:

- Demographic changes
- Health and safety issues
- Physical and/or economic displacement
- Restriction of access to land and resources
- Decreased incomes and deterioration of living standards
- Deterioration or enhancement of public infrastructure
- Visual interference
- Creation of employment opportunities
- Cheaper and more reliable electric power

Usually, the level of these impacts is higher for local population, which can be directly imposed to the project. However, degree of exposure to impact factors may vary depending on local settings and project design. To enable proper assessment of the listed potential impacts, the socio-economic survey of communities falling within 1 km radius from the OHL has been implemented in the frames of the ESIA. Members of the ESIA team visited most of communities crossed by the OHL to conduct scoping, collect socio-economic information and determine the status of some of buildings within the corridor.

As the mapping of affected communities showed, their majority are rural. The OHL corridor practically avoids all large settlements, except of Khelvachauri, where the line has to be connected with the existing substation. Crossing of densely populated areas within each community is also avoided to the extent possible so that to reduce number of people exposed to potentially high impacts.

It should be mentioned that sanitary zone for protection of public health and safety area not established for OHLs by Georgian regulations, and only clearance standards are determined to ensure technical safety of lines. Review of regulations from various countries showed, that sanitary zones are not practiced for 220 kV OHLs, as related HS risks are not considered significant to protect residents against them and such zones are established only for 330 kV and higher voltage lines. Minimum sanitary zone for 330 kV lines are set at 20 m from the conductor, or around 50 m considering the conductor's deflection. This value is used as one of sensitivity measures for residential receptors for the given project. Therefore, residential houses and other buildings in 50 m and 100 m from the OHL centreline were identified, as they are considered to be highly or moderately sensitive receptors. The identification was made using GPS coordinates of angle towers of the OHL, high-resolution aerial photographs and Google Earth imagery.

Approximately 200 residential houses were identified within 100 meters of the line, with approximately 80 houses within 50 meters of the line. A total of around 350 structures including residential houses, auxiliary and household facilities were detected within 100 meters of the corridor centreline using the above described methods. The number of such buildings by municipalities is provided in Table 7.3.2.

However, according to the project design, the conductor lines are at a distance of 15-20 meters from the centreline of the three-tower arrangements used for turns and high-stress areas, and about 8-12 meters from the centreline of other towers, which comprise great majority for the OHL. As a result, the distance to houses and other buildings from the nearest conductor wire (that is the distance used by Georgian norms) depends on the type of tower(s) used, and cannot be exactly measured until the detailed OHL design is available. In general, any distance shown as being 50 meters or less could be within the corridor, but this will have to be verified at further stages of project development.

The above listed potential impacts, causing impact factors, receptors and their sensitivity, and assessment of impact significance are discussed in details in the following sections.

Table 7.3.2 Buildings within 50 m and 100 m of the transmission line

#	Municipality	Settlement	Residential Buildings		All structures (including residential)	
			50 m	100 m	50 m	100 m
Samtskhe-Javakheti						
1	Akhaltsikhe	Mugareti	2	6	2	6
2		Persa	7	11	7	11
3		Giorgitsminda	-	-	-	1
4		Tskruti	-	5	-	7
5		Benara	-	1	2	9
6	Adigeni	Kakhareti summer huts	-	-	13	30
7		Arali summer huts	14	34	14	34
Total for Samtskhe Javakheti			***23***	***57***	***38***	***98***
Adjara						
8	Khulo	Kvatia	5	8	9	13
9		Zagardani		3	3	8
10		Tsablana	-	-	-	1
11		Gurdzauli	2	4	2	4
12		Dzmagula	-	2	-	4
13	Shuakhevi	Shuakhevi	-	5	7	17
14		Khichauri	2	6	5	11
15	Keda	Dandalo	-	3	3	6
16		Takidzeebi	2	4	2	5
17		Gogiashvilebi	2	5	2	11
18		Kokotauri	2	11	3	21
19		Akho	4	6	4	7
20		Keda	11	30	12	35
21		Tskhemna	-	2	-	3
22		Koromkheti	2	4	2	4
23		Pirveli maisi	-	5	1	13
24		Kveda Bzubzu	-	3	-	3
25		Makhuntseti	-	1	-	3

26	Khelvachauri	Acharistskali	2	5	1	7
27		Kvemo Jocho	3	14	3	17
28		Khelvachauri	17	24	30	50
Total for Adjara			***54***	***145***	***89***	***243***
Total for OHL			**77**	**202**	**127**	**341**

Public health and safety issues at construction phase

Communities in immediate neighbourhood of the project will be directly impacted during the vegetation clearance, construction and conductoring works. Main disruption factors and their effect on local population will be as follows:

- *Noise, dust, flue gases and vibration from project activities and machinery:* As discussion in respective sections showed, these emissions, which have potential to affect human health, will be rather limited for individual areas, as planned works at each affected site will be small scale and short-term. Out of these, flue gas emissions will be negligible and there is no risk to influence surrounding community members. Noise and dust emissions are likely to be of higher level; though, planned mitigation (dust control measures, work timing, etc.) can reduce them to acceptable level. Besides, these factors rapidly reduce with the distance, and only people living or working in immediate neighbourhood 0-200 m from the project activities could be considered as receptors. Their sensitivity to noise and dust disturbance is likely to be moderate to high, however very short lasting for several days only. Still, the number of high and medium sensitivity receptors will be rather limited, as the OHL avoids densely populated areas.
- *Temporarily increased traffic*: The project will increase traffic related HS risks along the entire OHL. Again, scale of project traffic at each section should not be high, and duration will be also rather limited. However, adoption and implementation of traffic management plan is deemed, so that to reduce such risks to minimum level.
- *Propagation of communicable disease due to introduced workforce*: Number of introduced workers will be rather limited in each construction area due to limited volume of works to be implemented on each section. As anticipated, local workers will be employed for the project, whenever possible. Respectively, the risk for communication of disease will be negligible for all communities along the OHL corridor.

Public health and safety issues at operation phase

Public health and safety issues on the OHL's operation phase could be related to:

- *Noise, dust, flue gases and vibration from maintenance activities:* As discussed above, maintenance activities and related nuisance factors will be of considerably lower volume, than construction activities and their impacts. Spatial extent and duration of these impacts will be also limited. Maintenance works is likely to have place only once per year.
- *OHL noise:* During operation, a low buzzing, crackling or hissing sounds could be audible directly under the line and perhaps a few meters. These sounds are produced as a result of corona discharge when ambient air contacts with conductors, from damaged or dirty insulators, or due to wind blowing through conductors and tower lattice. The noise is usually louder during wet weather, when the relative humidity of ambient air is over 80%, or in windy conditions. Besides, the noise level also increases by OHL voltage. According to various fact sheets, during relatively dry and calm conditions noise level is usually in the range of 40-50 dBA at the edge of the ROW, what could increase to the range of 50-60 dBA in wet weather and windy conditions. Review of the noise level modelling for rainy conditions for various 220 kV OHL projects showed, that expected noise level for 220 kV lines is around 45 dBA in the ROW centreline and it decreases to around 40 dBA in 30 m from the centreline. Considering the national and WHO noise standards, the OHL noise disturbance could be

considered low or negligible for people living or working in close proximity to the proposed OHL.

- *Electric and magnetic fields (EMF) of the OHL:* All transmission lines are source of electromagnetic field, strength of which is determined by the line voltage and amperage. Separate paragraph below is devoted for detailed discussion of the health risks due EMF and respective risk assessment, due to sensitivity of the issue.
- *Electrocution:* Electrocution hazards can occur as a result of direct contact with live cables, or from contact with tools, vehicles, ladders, or other devices that are in contact with cables. Direct contact with live cables may happen if cables fall down (e.g. due to heavy snow or high wind). Indirect contact is most probably when high machinery is driven or operated under the OHL.

  Climbing on transmission towers are often seen as a challenge for playing children, who do not understand the extreme danger connected to this activity. This risk is relevant to all places where the transmission line is found close to inhabited areas. On the other hand, it would take a major effort to climb up the towers near the conductors.

  The described risk of electrocution is a long term, though of low probability. GSE will provide information on such risks and precaution measures to potentially affected communities so that to prevent such accidents. In particular, each tower will have appropriate signs (in Georgian and in the language of nearby residents), that warns trespassers of the risk of electrocution, falls and other dangers. The sign will also have the 24-hour telephone number to which emergency calls can be made.
- *Failure/falling of towers and/or cables:* People or their property could be harmed by towers and live lines in case of their falling, for example from earthquakes, heavy snow or high winds.

  GSE will provide information on security measures local communities should take in such cases. This will include information about related dangers, and steps that community members should take to avoid accidents. Residents will be instructed clearly when it is especially dangerous to be under or around the lines (e.g. during extreme winds and electrical storms) and measures to take to ensure that they will be protected. GSE will establish a 24-hour emergency telephone number for reporting problems or damage to the line.
- *Aircraft navigation safety:* Power transmission towers, if located near an airport, can impact aircraft safety directly through collision or indirectly through radar interference.

Batumi International Airport is located in proximity to Khelvachauri Substation (about 3-4 km) and it caters to large aircrafts and smaller planes. The proposed transmission line will be located sufficiently far from Batumi airport to not affect normal operations. The placement of visual markers on transmission line is not required; however, this can be installed, if the Aero navigation authority will require such measures. As the above provided discussion shows, health and safety risks are mainly related to local population, and in particular people which live or work in close proximity to the OHL. Overall, health and safety risks will normally be low or negligible, but could be major adverse in case of serious accidents. As mentioned above, GSE will inform local population what actions should be taken in such cases. Other relevant mitigation measures are described in section 8.

Potential impact of electric and magnetic fields (EMF)

Electromagnetic field (EMF) is emitted by any electrical devices, including power lines. The electric field (EF) is produced due to the difference of potential between two points, i.e. voltage. Its strength is proportional to voltage, and is measured in volts per meter (V/m). Electric fields could be readily shielded using conductors, or trees and buildings. Magnetic fields (MF) result from the electric current, and increases in strength proportional to the current. The MF is measured in Gauss (G) or Tesla (T) (1T=10,000G). Different from EF, magnetic fields pass through most materials and are difficult to shield. Both electric and magnetic fields decrease rapidly with distance.

In most homes, magnetic field from various household appliances, wiring and nearby power lines average about 1 mG. The intensity of magnetic fields diminishes quickly with distance from the source, and few homes are close enough to transmission lines to be impacted by their magnetic field. Respectively, the magnetic field in residential houses is majorly determined by electrical appliances within the home.

Although there is public and scientific concern over potential health effects associated with exposure to EMF, there is limited empirical data demonstrating adverse health effects from exposure to typical EMF levels from power transmission lines.

Power frequency EMF in the 50 to 60 Hz range carries very little energy, has no ionizing effects, and usually has no thermal effects. Because EMF in the range of power line frequencies is far too weak to damage molecules or break up DNA, they cannot lead to mutational changes or cancer. EMF can cause very weak electric currents to flow in the body. In animal studies, scientists exposed rat and mice test subjects to electric or magnetic fields, some as high as 50,000 mG, and compared the amount of disease they observed to the amount of disease observed in animals that had not been exposed.

Research on EMF in residential settings and health was prompted by a 1979 epidemiology study of children exposed to EMF, mostly from neighbourhood transmission lines. A weak statistical association has been reported in some studies between childhood leukaemia and average exposure to magnetic fields greater than 3 - 4 mG. Hundreds of studies have subsequently addressed almost all issues that have been raised about EMF and health. These later studies did not find convincing or consistent evidence to suggest that EMF exposure was higher or more frequent in children with leukemia, thus supporting the idea that EMF is not a cause of cancer. Since there is very little support in other areas important for evaluating causation (for example, similar findings in animal studies and a plausible biological mechanism), the overwhelming scientific consensus is that these findings are insufficient to establish a cause-and-effect relationship between residential EMF exposure and childhood leukemia. Rather, most researchers agree that where associations exist in epidemiology studies, they are likely the result of study design issues such as bias or confounding.

Using a weight-of-evidence approach to evaluate this large body of research, the scientific consensus of numerous organizations is that no cause-and-effect relationship between EMF from any source and ill health has been established at the levels typically found in residential environments. As a result, no scientific organizations have recommended standards to prevent long-term health effects (such as cancer), nor are there any standards in the U.S. or most other countries for limiting exposure to the levels of EMF typically encountered in people's everyday lives.

According to the latest review of EMF research by the World Health Organization (WHO), EMF do not cause any long-term adverse health effects (WHO, 2007). As reported in the WHO review, no consistent adverse health effects, including cancer, are reported in animals even after exposure to high levels of electric and magnetic fields, and there is no evidence that EMF exposure causes or contributes to any disease.

The International Commission on Non-Ionizing Radiation Protection (ICNIRP) recommends a residential exposure limit of 833 mG and an occupational exposure limit of 4,200 mG for magnetic field (ICNIRP, 1998). The International Committee on Electromagnetic Safety (ICES) recommends that exposures of the general public be limited to 9,040 mG (ICES, 2002). Both standards are designed to provide a very large margin of safety.

Based on EMF exposure levels cited in the National Institute of Environmental Health Sciences report "EMF, Electric and Magnetic Fields Associated with the Use of Electric Power" (NIEHS, 2002), an electrical worker has an average EMF exposure of 9.6 mG, and typical EMF levels 15 meters from a 220 kV power transmission line is 19.5 mG, decreasing to 7.1 mG at 30 meters.

Russia and some former soviet states have established safety or hygienic protection zones (SPZs or HPZs) that limit exposure to EMF. Georgia's *Rules of Installation of Electric Equipment*-ПУЭ (Ministry of Energy, undated-2) establish a 30 m buffer zone (measured from the outermost line), within which there can be no residents.

As the above provided data show, the EMF field levels within and at the edge of the 100-meter wide corridor of the proposed project, and at the edge of the 30-meter buffer zone, should be well below the safe levels recommended by the ICNIRP and the ICES. Respectively, 30 m buffer zone can protect neighbouring residents against potential adverse impacts of EMF.

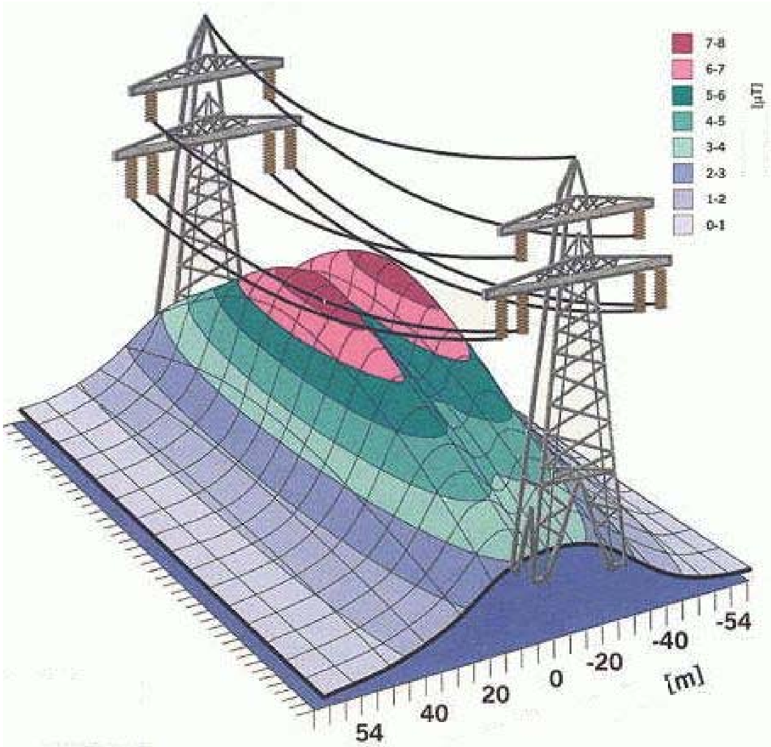


Figure 7.3.1 The Typical strengs contours of EMF

As already mentioned, the project corridor is defined in a way to avoid passing within 30 meters of dwelling areas, or when this is not possible ensure physical displacement of such households. These properties will be registered in RAP, and resettlement will be implemented in accordance to the procedures described in action plan documents. .

Occupational health and safety issues at construction phase

On the construction phase, the occupational health and safety risks for the project labour will be related to:

- *Emission of noise, dust, flue gases and vibration from project activities and machinery:* As discussed in respective section, flue gas emissions will be negligible and there is no risk to cause any health effect for the project labour.

  Noise and dust emissions are likely to reach nuisance level for workers at construction sites despite dust and noise control measures.

- *Hazardous works* including working at heights, handling and application of hazardous materials, working near heavy machinery, hazards from falling objects, etc. High hazard works may cause injury of labour, or other damage to their health, if special precaution measures are not fulfilled during such works. It is deemed that GSE, or its contractor will identify all hazardous works related to the project and develop appropriate HS procedures to prevent incidents and accidents during construction phase.

Occupational health and safety issues at operation phase

Labour health and safety issues for occupational phase are related to OHL maintenance works, including vegetation control, repairing of damaged towers and cables, replacing of cables and insulators, etc. In particular, on the operation phase transmission line workers will be subject to injury or death from falls, falling objects, electrocution, heavy equipment use, vehicle accidents, handling of hazardous materials.

Physical and/or economic displacement

For the given project, the need for physical displacement may raise if any residential houses occur within 30 m buffer zone of the 220 kV OHL. Though the project corridor is already identified, detailed engineering design of the OHL is not prepared yet and only rough estimate on the physical displacement need could be made. As given in Table 7.3.2, around 80 residential houses are in 50 m distance from the corridor centreline. Definitely, fewer houses will be in 30 m buffer zone; however, the estimates are not made for the buffer zone, as around 10-15 m divergence is anticipated due to departure of conductors and this departure will differ by tower types, as it described in the beginning of this section. Besides, the number of people to be displaced could be reduced through micro-siting of towers. In general, certain physical displacement is probable, though it will be small scale if any.

The need for economic displacement mainly due to loss of lands and crops due to installation of towers and conductoring works is definite; though, precise estimate of land acquisition is not possible on this stage as detailed OHL design is not available. At present, GSE is in the process of determining the status of land ownership where towers to be located; that is, whether a right-of-way was retained when the land was privatized. In general, as figures in Table 7.1.8 show, the need for economic displacement should be rather small, as only around 35 ha of agricultural lands could be impacted by the project. However, impact on individual landlords/lessee will be dependent on a land plot area to be acquired for the project and dependence rate of a particular family on this land. To ensure that impact due to land and/or crop loss is appropriately managed, landlords/lessee will be properly compensated for any related losses, in compliance with Georgian Law and lender's policies. In addition, except in cases of emergency, GSE will notify farmers and landowners' at least 30 days in advance of any activities on their land so they can make appropriate arrangements for farm workers, herds, etc. on the land.

In order to get prepared for physical and economic displacement and ensure their implementation in compliance with national and international standards, Resettlement Policy Framework document has been prepared for the project. The framework document identifies categories of affected assets and the groups of affected people, with indicative valuation of costs of compensation per unit of affected livelihood or other assets – up to the level of entitlement framework. This does not cover the preparation of the final entitlement matrix with exact names of PAPs, precise number and size of affected land plots, title status, volume/inventory of affected assets and entitled compensations. These tasks will be accomplished only after detailed cadastral survey, delineation and registration of affected non-registered property and preparation of cadastral maps.

In summary, the adverse impact on physically and/or economically displace people could be moderate to significant without mitigation, but should be negligible to minor if planned restoration of living conditions and compensation for all damages or losses is ensured.

Impact on Incomes of local population and their access to resources

The project can have the both beneficiary and adverse effects on income sources and incomes of local population. In particular, these impacts may include:

- *Loss of income from agricultural land:* this impact will be minor even without mitigation or compensation, because the area of agricultural land permanently affected by the project will be very small. Considering planned compensation for economic losses the effect becomes negligible.
- *Loss of income due to restricted access to resources:* Considering potential impacts on various resources, as described above, forest will be the resource which will be most intensively impacted. However, considering that only below 1% of the forestry resources will

be impacted in each municipality and regionally, this should not reflect on availability of forestry resources for the local population.

- *Incomes from the employment on the construction and operation phases:* The construction of the transmission line will require workforce; the number will not be known until the contractor is hired to do the work, but it will likely be at least 100 workers. GSE (or its successor) will encourage its contractors to recruit labour from neighbouring communities. For the maintenance of the line, GSE will hire local labourers and technicians whenever possible and appropriate. All labourers will be paid a standard fair wage and will receive full benefits while employed for the project. Considering the project scale, the new employment opportunities will have low beneficial effect.

Potential impact on demography

Demographic changes of development projects could be related to the need for:

- The physical displacement of local population, and/or
- Introduction of non-local workers for project implementation

Potential demographic changes depend on the scale of physical displacement, and number of non-local workers. The impact recipients are communities subject to the displacement, host communities and communities in the neighbourhood of construction works and construction camps.

As mentioned above, the need for the physical displacement caused by proposed OHL project will be negligible (around 10 households) if any. Respectively, this cannot cause any notable demographic changes in population subject to displacement, or host communities, moreover that in case of such need households will be offered residential areas in the same or neighbouring community whenever possible. The number of project labour will not be large. In total around 100 workers will be required for construction of the OHL. Besides, the project corridor is distinguished due to large spatial extension and only small size construction works requiring even fewer labourers will be required at particular OHL section. Planned requirement among locals whenever possible will decrease the influx of workers from other areas.

As the discussion shows, demographic changes due to the planned development are not anticipated. However, should demographic shifts occur, GSE will be responsible for implementing respective resettlement plans/activities.

Impact summary and significance

As the discussion of the potential impacts on local population showed, most prominent for the OHL project will be health and safety risks related to the construction and operation phases of the transmission line. Among construction phase main impacts are nuisance factors due to traffic, as well as noise and noxious matter emissions from the project machinery and earth moving operations. As estimated, these impacts should be negligible for majority of local residents; for highly sensitive receptors, that is people in immediate proximity (0-200 m) of the construction works these nuisance factors could be disturbing; however, overall impact level even these sensitive receptors is assigned low level, as impacts will be very short term.

During the OHL operations main public concerns are usually related to noise and especially EMF emissions from transmission line. However, as the review of various reference materials showed, these impact factors are of low concern for the planned 220 kV line. In particular, noise emission in adverse weather conditions is likely to be in the range of 40-45 dBA in 30 m from the OHL centreline, and no in-door or out-door noise disturbance is likely to have place.

The strength of magnetic field, which is usually of concern in terms of EMF radiation, is anticipated to be around 19.5 mG and 7.1 mG in 15 m and 30 m from the 220 kV line's centreline. These values are far below the thresholds established by International Commission on Non-Ionizing Radiation Protection and International Committee on Electromagnetic Safety for public or occupational exposure. In its publications the WHO have not acknowledge evidences of any adverse health effects due to exposure of even very high EMF. Respectively, health risks for public due to EMF are considered negligible.

Occupational health and safety risks of the project due to heavy machinery operations, or other hazardous works and work related risks usually are well-manageable, and could be kept within acceptable level.

The need for physical displacement of people is not clearly determined at the moment, because the detailed OHL design is not available yet. Though, rough estimates have shown that this should be very low scale, if any. The need for economic displacement is definite as the acquisition of private lands is required for the project. Precise area of lands to be acquired is not known, though this will be of low scale, as the rough estimates show. RPF document is developed for the project to properly guide resettlement issues for the project.

Table 7.3.3 provides summary of potential impacts on local population, project workers and public in general by receptors. Overall characterization of each impact and major findings are also given.

Table 7.3.3 Summary of Significance of Potential Impacts to Local Population, Project Workers and General Public

Receptors	Sensitivity of receptor	Potential Impact	Extent Intensity Probability	Comments
Construction phase				
Residents in 0-500 m from the OHL centreline	Medium to High	Potential health risks due to noxious factors (noise, flue gasses, dust)	Local Low Definite	Noxious factors produced from the planned construction works will be rather limited at each work site due to small volume of activities to be implemented at each site. Mitigation measures introduced will reduce potential impacts to minimum level. Duration of impact will be very short, lasting for several days only. Number of people exposed to the impact will be small, as impact level will rapidly reduce with the distance and will be mainly concentrated within 500 m radius from works.
Residents in 0-500 m from the OHL centreline	Medium to High	Potential safety risks from project machinery movement	Regional Low Possible	Intensity of project traffic will be low and short-term for each section. Traffic management plan will be put in place to manage project vehicles and avoid road related incidents.
Communiti es along OHL	Low	Propagation of communicable disease from introduced workers	Regional Low Improbable	Such health risk for local population will be negligible, as requirement for workforce is rather limited for the project. In total only around 100 workers will be required for OHL construction. Number of workers at each OHL section will be even fewer. Part of them will be hired from locally.
Project workers	High	Potential health risks due to noxious factors (noise, flue gasses, dust)	Local Low Definite	These noxious factors will be of higher intensity for project labour; however, mostly of sufficiently low level to cause health effects. Protection against noise could be required for some workers.
Residents in 30 m from the OHL	High	Resettlement of households from 30 m buffer zone	Local Low Possible	The need for the resettlement is possible, though not evident. It will be determined after preparation of OHL design. Rough estimates show that this should be of low

Receptors	Sensitivity of receptor	Potential Impact	Extent Intensity Probability	Comments
centreline				scale (if any), comprising around dozen households. RPF is developed for the project to guide with resettlement issues, if such need will rise.
Landlords within OHL corridor	High	Economic displacement due to land acquisition to install towers and crop losses occurred as a result of construction works	Local Low Definite	This type of impact is definite. Exact number of affected people or affected property is not known yet; though, according to rough estimates, the scale of economic displacement should be low. RPF is developed for the project to provide guidance about economic displacement.
Communities along OHL	Low	Demographic changes due to resettlement or introduced workers	Local Low Improbable	Such impact is not likely to have place, as resettlement scale will be negligible (if any), and number of introduced project workers will be too low to cause any notable demographic changes.
Operation Phase				
Residents in 0-500 m from the OHL centreline	Medium to High	Potential health risks due to noxious factors (noise, flue gasses, dust)	Local Low Definite	These noxious factors will be related to maintenance works. Their intensity will be much lower than on construction phase. Impact duration will be also several days.
Residents in 30-50 m from the OHL centreline	High	Nuisance due to OHL noise	Local Low Improbable	OHL noise is likely to be in the range of 40-45 dBA in 30-50 m distance from the centreline. Such noise will be below background in-door or out-door noise, and cannot cause any disturbance.
Residents in 30-50 m from the OHL centreline	High	Health risks due to EMF radiation	Local Low Improbable	Strength of magnetic field in 30 m from the OHL is likely to be 7.1 mG, what is much below than threshold values established internationally for residential exposure.
People living or working in proximity of towers and lines	High	Safety risks due to falling of towers or live cables	Local High Possible	GSE will provide information on security measures local communities should take in such cases. This will include description of dangers and steps that community members should take to avoid accidents. Residents will be instructed clearly when it is especially dangerous to be under or around the lines (e.g. during extreme winds and electrical storms) and measures to take to ensure that they will be protected. GSE will establish a 24-hour emergency telephone number for reporting problems or damage to the line.
General public	High	Aircraft safety risks for airports in close proximity to OHL	Local High Improbable	The nearest airport of Batumi is in 3-4 km away from the OHL and such risk is not anticipated.
Project workers	High	Health and safety risks due to noxious factors including noise, flue gasses, dust, EMF, electric currents, etc.	Local Medium Possible	Maintenance of OHL includes hazardous works such are working at heights, working with live equipment, working with heavy machinery, etc. All these can impose significant health and safety risks if respective HS procedures are not followed.

7.3.3 Potential impact on regional and national economics

***National and Regional Economy**:* Reliable power transmission system is necessary to ensure intermittent power supply for various economic sectors and support economic development in the country and project regions. As mentioned, the project will strengthen the power transmission capacity throughout the country, and respectively foster long term economic development. Among short term beneficiary effects of the project will be increased market for local suppliers and construction companies on the construction phase. Besides, the OHL will enhance capacity of power supply to neighbouring countries, which demonstrate growing demand on electric power as well. Through being tied into the broader regional energy infrastructure systems, Georgia will benefit from an increased interdependence on neighbouring countries. The long terms economic benefits of this project are significant in terms of both energy independence and strengthening relations with regional allies.

The above described impacts on forestry and agriculture will be the project's adverse impacts on the economic sector. However, as described, the scale of these impacts will be negligible on the regional and the national level.

Impact on Agriculture Sector**:** The area of agricultural land affected will be very small (see Table 7.1.8). In accordance with the project specifics, the clearance of the corridor on agricultural lands (except some orchards, which are negligible within the ROW) is not required. However, on the construction phase certain degradation of agricultural lands is expected due to construction and stringing operations. The construction of access roads in cropland areas is also not required, because usually all cultivated plots have access roads, which will be used as it is or with small improvement for the project purposes.

The crop growing or cattle grazing in under the OHL or in its proximity will not be restricted on the operation phase, with exception of tower sites which will be permanently lost for agricultural use. Specifically, operation phase impact from the project on agricultural land is defined as 360*200m2 which sums up to 7.2 hectars of affected land over 150 km of entire corridor.

The cumulative impact of various projects on local agricultural production will be low, because all projects seek to avoid use of agricultural lands.

Impact on Tourism Sector: The tourism sector has an important economic role in some areas along the transmission line corridor. These include cultural heritage sites and resorts described in the baseline. Impact on tourism sector may have place due to:

- Nuisance factors including construction works and resultant noise, dust, land disturbance, visual intrusion, etc.
- Nuisance factors during operation phase, including visual disturbance and maintenance operations
- Accidental damage to cultural heritage sites or resorts during construction or maintenance works

It is important to note that construction activities at any specific tower site would last from a day to a week or more (for foundation construction). Disturbance would involve noise from equipment and machinery, land disturbance, visual intrusion, and the presence of construction equipment and people in normally undisturbed areas. However, the overall impact of the construction phase on tourists in any particular location will be very short-term, lasting a maximum for few days.

Once the line is operational, main impact type will be disturbance of visual amenities and occasional maintenance works. The OHL routing and design were carried out bearing in mind minimization of visibility of towers and conductors using local landscape features, and/or placing them within already disturbed areas. Besides, the project infrastructure was removed from cultural heritage and touristic sites to the extent possible. Respectively, residual impact will be rather localized. For most part of the OHL corridor it will be low to moderate; however, at places and for individual tourists it may occur to be high.

Impact summary and significance

In the context of the impact on the regional and national economics are discussed factors which can influence economic environment, as well as particular economic sectors (agriculture and tourism) which are leading in the project region. These potential impacts are summarized in Table 7.3.4.

Table 7.3.4 Summary of Significance of Potential Impacts to Regional and National Economics

Receptors	Sensitivity of receptor	Potential Impact	Extent Intensity Probability	Comments
National and Regional Economy	Medium	Increased reliability of power supply, increased opportunity for power export, increased business opportunities for local construction companies and suppliers	Regional or National High Definite	Project implementation will significantly determine reliability of power supply in the project region, and provide increased opportunity for power export to neighbouring countries.
Agricultural sector	Medium	Permanent loss of agricultural lands due to installation of towers, or loss of crops during construction/ maintenance	Regional Low Definite	The area of permanently lost agricultural lands will be negligible on the regional scale (around 10 ha). This will mainly include grasslands. Loss of crops will have place during construction and maintenance works; this will be negligible as well and could not be reflected over total agricultural production in the region.
Tourism sector	Medium	Disturbance of touristic sites and tourists due to nuisance factors (noise, dust, land disturbance, visual interference, etc), or accidental damage to cultural heritage sites or resorts	Regional Low Possible	During OHL routing efforts were taken to avoid cultural heritage sites to the level participle to avoid damages. Measures will be taken to prevent accidental damage of neighbouring cultural heritage sites during works. Construction or maintenance activities at any specific site would last for several days only. Respectively, overall impact on tourists in any particular location will be very short-term, lasting a maximum for few days.

7.3.4 Potential impacts on infrastructure

Transportation: The line will cross 5 major roadways and 2 rail lines. Impact on this infrastructure is expected only during conductoring works, as the routing study ensured removal all construction works from public roads/railway sufficiently to avoid any damage to these infrastructure. Impacts during implementation of conductoring works may include: damage of roads due to movement of heavy machinery and traffic congestion.

To mitigate potential impacts of conductoring works on public roads GSE will work closely with the road authorities to determine when optimal times are for line installation at each crossing so as to minimize congestions. Works will be planned in a way to minimize the time when conductors are laying on roadways or across rails in order to avoid any accidents, or damage to material assets.

While conductoring is taking place, GSE will station workers on highways to block traffic when necessary and to notify drivers to proceed with caution. They also will direct traffic when heavy equipment is crossing the road. The overall impact will be very minor adverse.

Electrical power supply: Official reports state that 99% of households in Georgia have access to electrical power. Due to storms and occasional inconsistent supplies, however, power can be intermittent. The construction of this line will enable regularization capacity for the Georgian power grid and as a result increase reliability of electricity supply to Adjara and entire Georgia. The overall effect will be moderate to major beneficial in some isolated areas and minor to moderately beneficial over the length of the line. It will also be major beneficial in that it integrates the regional system and binds ties with regional allies.

BTC/SCP Pipelines: ***T***he OHL will cross BTC/SCP pipeline in Akhaltsikhe Municipality. This is considered when determining tower sites, which are moved away from the pipeline protection zones to avoid any impact of construction works. The project machinery will be crossing the pipeline corridor during conductoring works. However, all operations within the pipeline protection zone will be agreed with the pipeline operator, and all operations will be implemented in a manner to avoid any adverse impact on these structures.

Airports and aircraft navigation: Power transmission towers, if located near an airport or flight path, can impact aircraft safety directly through collision or indirectly through radar interference. Batumi International Airport is located in proximity to Khelvachauri Substation (about 3-4 km) and it caters to large aircrafts and smaller planes. The proposed transmission line will be located sufficiently far from Batumi airport to not affect normal operations. The placement of visual markers on transmission line is not required; however, this can be installed, if the Aeronavigation authority will require such measures.

Impact summary and significance

Main infrastructure which could be affected by the project includes public roads, electric power system, Batumi airport and BTC/SCP pipelines. Potential impacts on thise infrastructure due to planned construction and OHL operation and maintenance is summarized in Table 7.3.5. In general it could be said that the impact on infrastructure will be negligible as the OHL routing was implemented in the way to sufficiently remove the OHL from all sensitive infrastructure to avoid adverse effects.

Table 7.3.5 Summary of Significance of Potential Impacts to Infrastructure

Receptors	Sensitivity of Receptor	Potential Impact	Extent Intensity Probability	Comments
Public roads and railroad	Low	Traffic congestion due to project vehicles and works	Local Low Possible	GSE will work closely with the road authorities to determine optimal time for line installation at each road crossing so as to minimize congestions. Works will be planned in a way to minimize the time when conductors are laying on roadways or across rails in order to avoid any accidents, or damage to material assets.
Electrical power system	High	Improved reliability of electric system	Regional High Definite	This will be beneficiary impact, which will significantly improve reliability of power supply in the project region
BTC/SCP pipeline	High	Accidental damage of pipelines due to construction and maintenance works	Local Low Improbable	The OHL corridor is sufficiently distanced from the pipelines not to cause any damage. Crossing of the pipeline corridor will be needed during conductoring only, and all precaution measures will be taken to avoid any impact.
Batumi airport	High	Collision of airplains with towers, interference of EMF with radars	Local Low Improbable	Batumi airport is in 3-4 km distance from the OHL. Respectively, collision of aircrafts with OHL, or any impact on radar is not likely.

7.3.5 Potential impact of the project on cultural heritage

This section identifies and assessed potential impacts of the project on cultural heritage sites. Cultural heritage sites including surface level objects, as well as known and potential archaeological areas are described in Section 6. Potential impacts on cultural heritage sites are assessed considering distance to them and potential to damage or otherwise impact them during OHL construction and/or operation.

In case of OHL projects, cultural heritage sites could be exposed to the following impacts:

- Physical damaging of cultural monument or its part: In case of OHL projects, cultural heritage sites could be physically damaged as a result of accidental collision of construction machinery, vibration induced by heavy machinery movement and/or explosive works (for foundation excavations in rocky areas), excavations for foundations and earth moving works. Collision incidents and vibration could be impact factors for above-ground cultural heritage sites, or already excavated archaeological sites, meantime then undiscovered archaeological sites could be damaged during soil excavations/ earth moving. Respectively, above-ground monuments could be damaged both during the construction and maintenance works, whist potential archaeological sites could be affected only during construction works, when all earthworks are implemented. Cultural sites exposed to these impact factors are those situated in immediate proximity of construction works/transportation routes.
- Visual deterioration of cultural heritage: This type of impact results from landscape alteration in surroundings of cultural sites. As described in the respective section, the project activities with the potential of landscape alteration are vegetation clearance and installation of OHL structures. Removal of high trees within RoW and OHL structure can permanently change landscapes and visual amenities for cultural heritage sites. Visibility of RoW and OHL (towers and cables) depends on topographic and landscape features, and respectively varies by locations. Construction/maintenance works can also visually deteriorate them due to presence of construction activities, machinery and workers; though, this is short term effect.

Considering the above described potential impacts and impact sources, sensitivity criteria provided in Table 7.3.6 have been introduced for assessment of the project's impact.

Table 7.3.6 Sensitivity Criteria for Cultural Heritage

Sensitivity	Criteria
High	- Immovable cultural heritage sites of national or international importance in close proximity or within construction area and transportation routes - Immovable cultural heritage sites of national or international importance, which could undergo significant visual impact
Medium	- Above-ground cultural heritage sites in immediate proximity to construction and transportation operations - Known or unknown archaeological sites at tower installation sites, or on transportation routes
Low	- Known/unknown cultural heritage sites sufficiently distanced from the project corridor to be damaged - Cultural heritage sites sufficiently distanced from the OHL, to be exposed to high visual impact, or protected against high visual impact by landscape features

As described in the baseline section, cultural heritage for the project corridor was studied via literature review and field visits, when entire project corridor was walked through to determine layout of the project facilities and access roads towards cultural heritage sites. In total 129 known and potential cultural heritage sites were recorded in 5-6 km radius from the OHL, part of which (63) is classified as immovable cultural monument of the national importance. Great majority of these sites are on safe distance from the OHL corridor to be damaged during construction or transportation operations. However, still some of them are close to the project.

As the field survey showed, among the nationally important sites only one – Dandalo Bridge (#78 in Table 6.4.1and cultural heritage maps) falls within the 25 m corridor of the project. AP85 of the OHL is located in about 100 m west of the bridge, on the right bank of the Adjaristskali River. The construction works will be rather distanced from the bridge to damage it. The risk of accidental damage by project machinery is of low likelihood, as traffic management plan will be developed and introduced. The discovery of archaeological remains is highly likely for this area during earthmoving works. Besides, visual impacts on the construction and operation phases will have place on this site. This will be mainly due to presence of towers and cables. Visual impact on this site is assessed in Section 7.1.5 and visibility model is developed. According to the modelling, the OHL will be well-visible on this section; however, it should not be highly intrusive as this OHL section will be built in already developed area. Section 7.1.5 gives estimation of visual impact for some other cultural heritage sites as well. According to the findings, significant visual deterioration of cultural sites is not likely.

Other OHL sections sensitive in terms of cultural heritage are comprised between AP26 and AP27, AP29 and AP30, and next to AP30 (see Figure 7.3.2 below). These are known or potential archaeological sites referred as #27, #35 and #36 in Table 6.4.1. In particular:

- Site #27 is the Late Classical-Early Medieval settlement of Benara within 25 km corridor of the OHL, on AP26 - AP27 section, in about 300 meter from towers.
- Site #35 is the Settlement Hill of the Bronze Age-Iron Age north of Ude, between AP29 and AP30, just next to the road going to Ude. This road has already cut western and south-western slopes of the settlement, and the project's heavy machinery can harm the site.
- Site #36 is the Settlement Hill of Classical Period. It is found to be less than in 50 meters west from AP30. It is highly likely that earthworks for AP30 will encounter on archaeological remains. In addition, a ruined Medieval Church is found in about 350 m from AP30, north-west it. Discovery of a Medieval settlement in the vicinity of this site is possible.

All these archaeological sites could be adversely affected by heavy building machinery moving nearby. Besides, boundaries of these archaeological sites are not known and it may happen that they extend up to tower locations. In this case they may be damaged during earthworks. Respectively, the archaeological monitoring is required during implementation of earth works on these sections to avoid damage, destruction or negligence of new archaeological sites. The chance finding procedures, as described below, should be adopted and implemented for the project. Specific mitigation measures which should be respected for each cultural heritage site with higher sensitivity level are provided in the Section 8 "Mitigation Measures".

It should be mentioned that the final OHL design is not implemented yet. Respectively, there is possibility that angle towers will be moved to different areas. Besides, the location of suspension towers is not known. Respectively, the number of cultural heritage sites which occur within direct impact zone may change. In general, it is recommended to avoid approximation of towers to sensitive archaeological/ cultural heritage sites to avoid damage during construction or transportation operations.

Chance Finding Procedure

According to the Georgian Law on Cultural Heritage *(2007)*, if cultural heritage is discovered or the grounds for assuming its existence are revealed during the construction works, the implementer of works is legally bound to stop the activities that bear the risk of damaging cultural heritage and inform the Ministry of Culture and Monument Protection of Georgia in writing within 7 days.

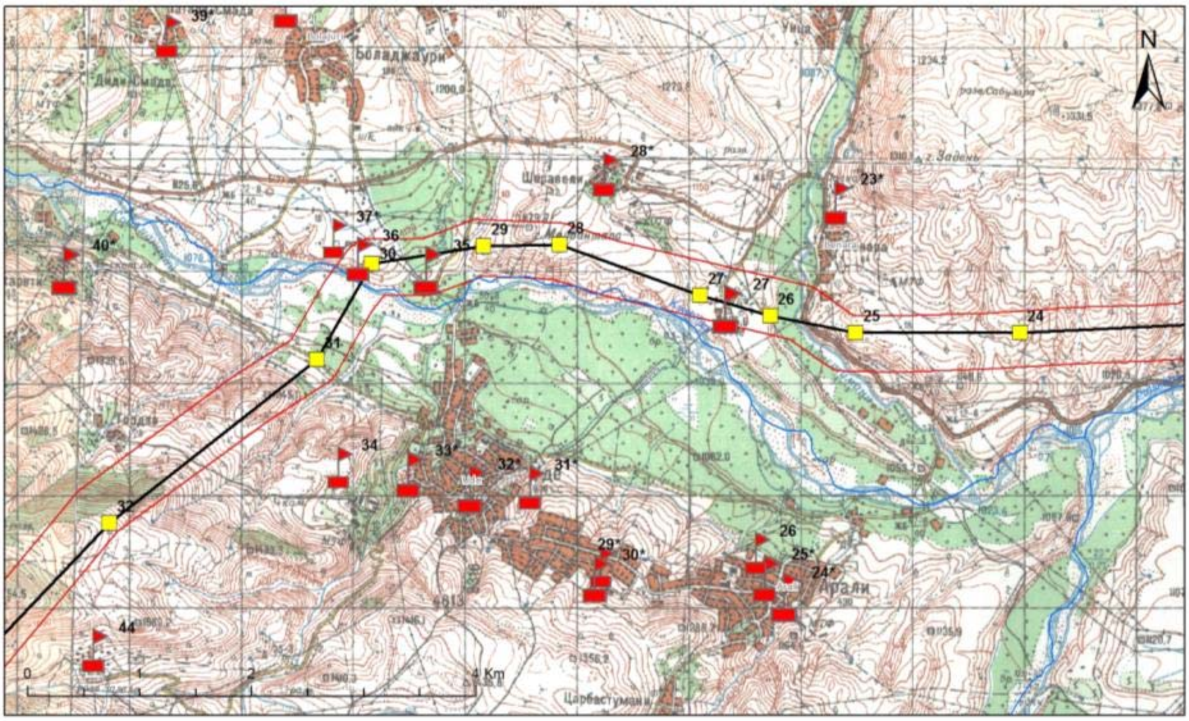
The Ministry of Culture and Monument Protection of Georgia has to verify the discovered cultural heritage (or the grounds for supposing the discovery) and inform the concerned party about the verification results in writing no later than in 2 weeks after receipt of the notification.

If the Ministry of Culture and Monument Protection of Georgia fails to communicate the results of such verification within 2 weeks, the implementer has the right to renew activities as initially planned.

In case of the existence of adequate grounds, the Minister shall ensure the state inventory of the discovered cultural heritage in accordance with the rules established by Law. The Ministry shall immediately inform the concerned person about this, as well as the relevant bodies of local self-governance.

If cultural heritage is revealed works must be stopped, and chance finds must be reported immediately by the archaeologists, who will be part of the construction supervisions team, to the authorities. Work will resume after a decision has been made by the authorities (e.g. rescue recovery, archaeological excavations, etc.).

Figure 7.3.2 Known and Potential Archaeological Sites between AP26 - AP30



*N.B. Numeration is the same as in Table 6.4.1***Error! Reference source not found.** *in the baseline section*

7.4 Cumulative Impact

Cumulative impact is the incremental/compounding impact on the environment that results from the impact of the proposed project when added to other past, present, and reasonably foreseeable future actions/projects, regardless of which agency or person undertakes them. Although each impact may not be significant alone, cumulatively, these impacts may be significant if they occur close together in terms of location and time, resulting in incremental, widespread, often slow change of environmental conditions. Effects can be direct or indirect, positive or negative. When cumulative impacts on the environment are anticipated, the IFI procedures and the Georgian legislation require that such impacts be described. Cumulative impacts of the project with those of existing, planned or future activities should be accounted for. This is typically done by adding predicted impacts to existing conditions. The potential cumulative impacts are discussed in detail in this section.

7.4.1 Co-activities/projects to be considered

To determine cumulative effects in the analysis area - past, present, and future actions within the same geographic region were evaluated. For the Akhaltsikhe-Batumi 220kV Transmission Line project these actions predominantly include temporary cumulative impact due to coinciding in time with construction of new hydropower plants in Shuakhevi and Koromkheti, development of ski resort in Beshumi, and maybe some municipal infrastructure rehabilitation projects for roads and water utilities. Cumulative effects may also occur with the existing power transmission lines of Batumi-Muratli 154 kV OHL and Akhaltsikhe–Beshumi 110 kV OHL, black sea 500 kV, especially at the transforming substations when single impacts from number of transmission lines result in a compounding effect.

Past projects and activities are those that have been completed and their physical features are part of the current/existing landscape and environment. Residual (i.e., permanent) effects from these past projects/activities may be considered to be potentially cumulative with the effects of the proposed Project. However, it is assumed the impacts of these projects are already reflected in existing environmental conditions as described in Section 8, Environmental and Social Baseline and considered during project impact assessment.

7.4.2 Long-term cumulative impacts

For each impact and issue analysed, this ESIA considers existing conditions in the future, when the project would be fully operational, including known transportation, infrastructure, and development plans, public policies, and general background growth. As discussed in this section above, the proposed project is not expected to result in any significant adverse impacts, including cumulative impacts. In summary, the proposed action in combination with other ongoing or future projects in the area (listed above) would result in changes in environmental and socio-economic background conditions of the project study areas, but would not be expected to create significant adverse cumulative impacts. At the same time the proposed project would yield cumulative benefits by accommodating anticipated growth and development in the region. Similarly, the proposed 220kV transmission line would serve to accommodate much of the potential new growth associated with the proposed local development projects by providing for future load growth and increased system reliability.

The cumulative traffic effects, and the incremental and associated air quality and noise effects, of the proposed project in combination with the local and regional transportation and development projects have been included in the impact assessment and mitigation sections. In summary, considering mitigation measures and coordination, the proposed project would not significantly affect traffic circulation, would generate only a small number of vehicle trips, and would not involve any stationary sources of emissions or noise; therefore, the proposed project would not be expected to result in cumulative adverse impacts on traffic, air quality, and noise.

7.4.3 Short-term cumulative impacts

Temporary cumulative effects could occur if the above mentioned projects have construction timetables overlapping with the proposed transmission line, combined with a physical proximity to the RoW. The construction phase of the proposed Project is currently expected to start in Summer 2014 and to last for approximately 15 months. As noted in this section above, the proposed Project is not expected to generate significant off-site construction impacts in terms of truck traffic and other activities. Nonetheless, temporary cumulative effects could occur if other projects in the vicinity of the RoW (for instance new HPPs or local municipal infrastructure/utility rehabilitation projects) are constructed at the same time as the proposed OHL.

In addition to operational residual impacts associated with the neighbouring projects, when considering the cumulative impacts of these projects in terms of present activities, additional short-term impacts associated with concurrent and/or successive construction schedules also needs to be addressed. Cumulative impacts associated with concurrent construction projects within geographic proximity of the proposed Project include short-term alterations to soils, terrestrial vegetation, wildlife, wetlands, land use, visual resources, water resources, air quality (primarily dust), noise, and socioeconomics (predominantly positive impacts on local economies). Where construction projects are successive (as opposed to concurrent) and within geographic proximity of the proposed Project, similar short-term impacts would occur across these resources. While successive construction timeframes would result in reduced magnitude of concurrent short-term impacts, the time period over which short-term impacts would occur would increase.

The projects with the highest likelihood of overlapping temporary cumulative effects would be the Shuakhevi and Koromkheti HPP developments. By careful coordination between the two projects, the overlap of construction activity and any cumulative construction impacts could be avoided. It should be noted that the planned roads and water utility infrastructure rehabilitation projects do not have a specific date for construction and are not in close enough physical proximity to the RoW to expect overlapping cumulative construction impacts, because as it is stated in impact analysis for construction phase (presented above), the construction period for towers installation would be short and off-site impacts limited.

7.5 Summary of potential impacts

Receptor	Sensitivity of Receptor	Potential Impact	Consequence				Impact Duration	Impact Significance
			Criteria			Rating		
			Extent	Intensity	Probability			
Water Bodies								
Streams and Rivers	Medium	Sedimentation caused by sediment laden runoffs due to soil excavation and disturbance by project vehicle and other construction equipment along access roads and right-of-way.	Local	Medium	Definite	Medium	Short	Low
Streams and Rivers	Medium	Placement of towers in floodplains can impede flood flows and produce flooding in upstream areas.	Local	Low	Possible	Low	Long	Low
Streams and Rivers	Medium	Sedimentation and increase of turbidity due to transportation of soil eroded as a result of clearing of trees and shrubs in the corridor and along the access roads.	Local	Low	Definite	Low	Short	Low
Streams and Rivers	Medium	Contamination caused as a result of in channel spill or transportation of pollutants spilled on ground by surface runoff.	Local	low	Possible	Low	Medium	Very low
Streams and Rivers	Medium	Vegetation control techniques that use herbicides can introduce environmental contaminants into the soil, surface water and groundwater	Local	low	Probable	Medium	Long	Medium
Streams and Rivers	Medium	Impact caused by the machinery operation in streams and at stream crossings	Local	low	Probable	Medium	Short	Low
Air Quality								
Residents	Medium	Impact on agriculture by the dust generated during the construction activities	Spot	Medium	Definite	Low	Short	Very low
Residents	Medium	Fugitive dust generation during construction	Local	Medium	Probable	Low	Short	Very low
Residents	Low	Fugitive dust generation during maintenance	Local	Very Low	Definite	Low	Short	Very low
Residents	Low	Vehicle (flue gas) emissions during construction and maintenance	Local	Low	Possible	Low	Short	Very low

Receptor	Sensitivity of Receptor	Potential Impact	Consequence				Impact Duration	Impact Significance
			Criteria			Rating		
			Extent	Intensity	Probability			
Residents	Low	Makes hydropower-generated electricity more available to the local population, reduces reliance on combustion generation	Local	Low	Definite	Medium Positive	Long	Medium
Biodiversity	Low	Impact on biodiversity due to degradation of air quality during the construction (dust, smell disturbance)	Regional	Low	Possible	Low	Short	Very Low
Geology, soils and geohazards								
Soils	High	Soil compaction and rutting by vehicle and other construction equipment along access roads and ROW	Local	Low	Definite	Low	Short	insignificant
Soils	High	Clearing of trees and shrubs make the soil more susceptible to erosion and mass movement	Local	Medium	Definite	Low	Medium	Low
Soils	High	Blasting for tower foundations may trigger mass movement of soil, or avalanches in high snow areas.	Spot	Low	Possible	Low	Short	insignificant
Soils	High	Soil contamination from the use, improper handling and spills of hazardous materials (fuels and lubricants, paints, etc.), which could be used during the construction and maintenance works.	Local	Low	Possible	Medium	Short or Long	Low
Soils	High	Vegetation control techniques that use herbicides can contaminate the soil.	Local	low	Improbable	Low	Long	Very low
Soils	High	Soils excavated for foundations may be exposed to wind and water impact for long periods	Spot	Medium	Probable	Low	Long	Low
Soils	Very High	Damage to soil structure in the Alpine meadows area	Local	Medium	Possible	Medium	Long	Medium
Geohazards	High	The placement of poles on unstable areas, or areas with geohazard activation risk can cause landslides	Local	High	Probable	High	Long	Medium
Potential impact on land use								
Residential Houses	High	Physical displacement of households	Local	Low	Probable			
Agriculture	Medium	Permanent or temporary loss of croplands and grasslands	Local	Low	Definite			
Forestry	Medium to High	Forest clearing for construction and conducting works, and OHL safety	Regional	Low	Definite			

Receptor	Sensitivity of Receptor	Potential Impact	Consequence				Impact Duration	Impact Significance
			Criteria			Rating		
			Extent	Intensity	Probability			
Alpine meadows	High	Temporary degradation of alpine meadows within the ROW due to construction and conductoring works, and permanent loss of small sites used for tower installation	Local	Low	Definite			
Riparian / riverbank forests	High	Clearing of riparian forests for construction and conductoring works, and OHL safety	Local	Low	Possible			
Potential impact on biological environment								
Forest ecosystems	Low to Medium	Permanent loss of forest habitats for wildlife due to RoW clearance, tower installation, conductoring and construction of access roads	Regional	Low	Definite	Medium	Long	Medium
Forest ecosystems	Low to Medium	Fragmentation of forest habitats due to RoW clearance, tower installation, conductoring and construction of access roads	Regional	Low	Improbable	Medium	Long	Medium
Forest ecosystems	Medium	Increased risk of forest fires due to residual forest slash, improper vegetation control within RoW, or carelessness of project workers when handling flammable materials	Regional	Low	Possible	Medium	Long	Medium
Forest ecosystems	Low to Medium	Introduction of invasive species into forested ecosystems	Regional	Low	Possible	Low	Short	Low
Sub-alpine and alpine meadows	Medium	Temporary loss of habitat	Local	Low	Definite	Low	Long	Low
Aquatic ecosystems	Low	Water quality deterioration as a result of sediment laden or chemically polluted surface runoffs from construction sites due to vegetation clearance, earth moving works and machinery movement.	Local	Low	Definite	Low	Short	Low
Aquatic ecosystems	Low	Direct impact/ damage due to river crossing by machinery to access tower locations where other access is not available.	Local	Medium	Definite	Low	Medium	Low
Aquatic ecosystems	Low	Direct impact/ damage to riparian forests due to machinery movement and vegetation clearance	Local	Low	Definite	Low	Medium	Low
Aquatic ecosystems	Low	Introduction of invasive species	Local	Low	Improbable	Low	Long	Low

Receptor	Sensitivity of Receptor	Potential Impact	Consequence				Impact Duration	Impact Significance
			Criteria			Rating		
			Extent	Intensity	Probability			
Fauna in sensitive areas	Medium to High	Destruction of dens/ nest, injury/mortality of animals during construction and maintenance activities	Local	Low	Definite	Low	Long	Low
Fauna in sensitive areas	Medium to High	Avian and bat collisions/ electrocution from contact with power lines.	Local	Low-to-Medium	Definite	Low	Long	Low
Fauna in non-sensitive areas	Low	Destruction of dens/ nest, injury/mortality of animals during construction and maintenance activities	Regional	Low-to-Medium	Definite	Low	Long	Low
Fauna in non-sensitive areas	Low	Avian and bat collisions/electrocution from contact with power lines.	Local	Low	Definite			
Flora in sensitive areas	Medium to High	Damage/removal of vegetation due to RoW clearance, construction works and machinery operation	Local	Low-to-Medium	Definite			
Flora in non-sensitive areas	Low	Damage/removal of vegetation due to RoW clearance, construction works and machinery operation	Regional	Low-to-Medium	Definite			
Potential impact on socio-economics								
Potential impacts to local population, project workers and general public								
Construction phase								
Residents in 0-500 m from the OHL centreline	Medium to High	Potential health risks due to noxious factors (noise, flue gasses, dust)	Local	Low	Definite			
Residents in 0-500 m from the OHL centreline	Medium to High	Potential safety risks from project machinery movement	Regional	Low	Possible			
Communities along OHL	Low	Propagation of communicable disease from introduced workers	Regional	Low	Improbable			
Project workers	High	Potential health risks due to noxious factors (noise, flue gasses, dust)	Local	Low	Definite			
Residents in 30 m from the OHL centreline	High	Resettlement of households from 30 m buffer zone	Local	Low	Possible			
Landlords within OHL	High	Economic displacement due to land acquisition to install towers and crop losses occurred as a result of construction	Local	Low	Definite			

Receptor	Sensitivity of Receptor	Potential Impact	Consequence				Impact Duration	Impact Significance
			Criteria			Rating		
			Extent	Intensity	Probability			
corridor		works						
Communities along OHL	Low	Demographic changes due to resettlement or introduced workers	Local	Low	Improbable			
Operation phase								
Residents in 0-500 m from the OHL centreline	Medium to High	Potential health risks due to noxious factors (noise, flue gasses, dust)	Local	Low	Definite			
Residents in 30-50 m from the OHL centreline	High	Nuisance due to OHL noise	Local	Low	Improbable			
Residents in 30-50 m from the OHL centreline	High	Health risks due to EMF radiation	Local	Low	Improbable			
People living or working in proximity of towers and lines	High	Safety risks due to falling of towers or live cables	Local	High	Possible			
General public	High	Aircraft safety risks for airports in close proximity to OHL	Local	High	Improbable			
Project workers	High	Health and safety risks due to noxious factors including noise, flue gasses, dust, EMF, electric currents, etc.	Local	Medium	Possible			
Potential impact on regional and national economics								
National and Regional Economy	Medium	Increased reliability of power supply, increased opportunity for power export, increased business opportunities for local construction companies and suppliers	Regional or National	High	Definite			
Agricultural sector	Medium	Permanent loss of agricultural lands due to installation of towers, or loss of crops during construction/ maintenance	Regional	Low	Definite			

Receptor	Sensitivity of Receptor	Potential Impact	Consequence				Impact Duration	Impact Significance
			Criteria			Rating		
			Extent	Intensity	Probability			
Tourism sector	Medium	Disturbance of touristic sites and tourists due to nuisance factors (noise, dust, land disturbance, visual interference, etc), or accidental damage to cultural heritage sites or resorts	Regional	Low	Possible			
Potential impact on infrastructure								
Public roads and railroad	Low	Traffic congestion due to project vehicles and works	Local	Low	Possible			
Electrical power system	High	Improved reliability of electric system	Regional	High	Definite			
BTC/SCP pipeline	High	Accidental damage of pipelines due to construction and maintenance works	Local	Low	Improbable			
Batumi airport	High	Collision of airplains with towers, interference of EMF with radars	Local	Low	Improbable			

8. Impact Mitigation

This section identifies generic/common and specific mitigation measures for the anticipated negative impacts at the design, construction and operations phases of the Project. Decommissioning phase of the project has not been assessed in details, due to lack of information about the process (and, subsequently, the magnitude of the impact) and the future timing of decommissioning, at which point the sensitivity of receptors may have changed. However, the environmental and social impacts of the decommissioning phase usually are similar to those of project construction.

As project proponent, the GSE acknowledge the need for mitigation measures to minimize or eliminate the negative impacts resulting from construction and operation of the proposed transmission line. As described in the previous section, potential adverse environmental impacts during construction and operation of the transmission line may include,(a) temporary degradation of air quality from construction dust emissions, (b) impacts on water quality from pollutants and sediment in stormwater runoff, (c) soil quality degradation (d) temporary generation of noise from construction traffic and machinery (f) impacts on biological resources, especially forests and avifauna (g) temporary generation of solid waste, and (f) socio-economic impacts. Mitigation measures should be monitored on a continuous basis in order to achieve the highest control with minimum risks. GSE management personnel will be responsible for ensuring that mitigation measures are implemented correctly.

The set of site-specific mitigation measures on flora and fauna, especially forests and avifauna, are presented below, and further followed by extensive list of standard OHL applicable mitigation measures at design, construction and operation phases, which partially are included in ESMP provided in this report and later, as more precise items, shall be included into Contractor's detailed management plans.

Mitigation measures for the **impact on flora** mainly include demarcation of construction/transportation areas to prevent any disturbance outside the OHL corridor, and implementation of reinstatement measures to enhance re-vegetation. To reduce construction/maintenance stage impacts, work crews will gain access to tower locations by driving to existing road crossings and entering the right-of-way by driving over the ground (with subsequent erosion control) or along dirt access roads. Neither permanent nor temporary paved/gravel access roads are proposed to be constructed in the right-of-way.

The **impact on higher value forests** is avoided through the OHL re-routing. The need for forest cutting was reduced to minimum practicable level through use of favourable topographic features and shifting OHL to open/sparse forest areas wherever possible. Implementation of such design measures is important not only in terms of preservation of wildlife habitats and biodiversity, but also for prevention of natural hazards (erosion, landslides, floods, mudflows) what is ensured by these ecosystems.Due to the potential risk for forest fires in the forested areas, mitigation/precaution measures will be employed to minimize the potential for fires. This will include removal of vegetation slash after vegetation control activities, safe handling procedures of farmable materials and other measures presented in planned mitigation measures. At the same time, it is important to highlight, that cleared and properly maintained OHL corridor can serve as firebreak, to prevent fast spread of forest fires.

To minimize potential **impact on fauna** to the extent possible, construction and maintenance in sensitive areas will not take place during breeding seasons, and other actions will be taken to avoid disturbance. Most populations will be able to recover, particularly considering that the project avoids critical areas and sensitive habitats and incorporates the appropriate design and management measures, described further in this section.

As the provided discussion shows, **impact on birds** and especially raptors is likely to be high. It is expected that impact reduction and mitigation measures applied during the OHL routing and at the design stage will decrease bird collision and mortality rate. Bird monitoring will be ensured at the OHL operation phase to check birds' mortality rate, verify effectiveness of mitigation, and determine the need for additional measures. Design measures were ensured to minimize avian/bat collision with OHL. These include re-routing of the OHL to locations less sensitive for birds/ bats, and designing of conductors/towers up to best practices. Bird reflectors will be used to increase OHL visibility. Bird monitoring program will be implemented on the operation phase to check effectiveness of existing mitigation measures and identify if further mitigation is required.

It should be mentioned that exact locations of middle towers were not known at a time of the baseline study. Accordingly, some sensitive wildlife spots could be missing in this report. **Pre-construction survey**, including biodiversity component, will be required prior to mobilization at each tower foundation. The biodiversity specialist should conduct final check of the parcel after demarcation by the topography team is finalized. In case if any specific sensitive spot identification at impact area of specific tower, avoidance of such areas should be ensured through micro-siting of towers in order to ensure, that biological diversity is respected and impact is at minimum level. Implementation of Pre-construction Survey and Biodiversity Management Plan are required to avoid potential impacts on sensitive fauna areas or to minimize the impact. The impact on wildlife will be minimized through pre-construction survey of the project RoW, when dens/nests and other important wildlife areas will be identified to avoid their disturbance to the level practicable. This will be achieved through micro-siting of towers and proper routing of new access roads. Implementation of biodiversity management plan will enable minimization of impact on wildlife. Pre-construction survey is advisable after preparation of the final OHL design to determine whether high flora sensitivity areas are impacted and ensure micro-siting of towers in a way to avoid/minimize impact. Further mitigation of impact should be ensured through implementation of Biodiversity Management Plan. Reinstatement activities should be ensured in sensitive areas, if natural re-vegetation in such areas is ineffective. Implementation of best management practices and Biodiversity Management Plan is deemed to minimize impact on biodiversity. Natural vegetation of the RoW (except trees) will be allowed during the entire post construction period.

GSE will develop and implement a **safety program** that meets international norms, and will ensure that every manager and worker receives training before they perform any work on the line, and are provided refresher training at least every year thereafter. Every single day, each crew will participate in a safety meeting/briefing, and the languages of all crew members will be used. At this meeting, the crew will be told the day's activities, the hazards that may encounter, actions to take or to avoid in order to minimize risk, and how to respond in case of illness or injury. The foreman and at least one other person in every crew will be trained in first aid, and each crew will have a first aid kit with them at all times. Foremen will always know where the nearest medical facilities are located, and should have the telephone number available at all times. Mitigation measures such are use of ear protectors, limitation of working hours in noisy areas could be required to prevent hearing damages. These and other standard mitigation measures, as provided further in this section, will keep these impacts within acceptable level. GSE will provide information on security measures local communities should take in such cases. This will include description of dangers and steps that community members should take to avoid accidents. Residents will be instructed clearly when it is especially dangerous to be under or around the lines (e.g. during extreme winds and electrical storms) and measures to take to ensure that they will be protected. GSE will establish a 24-hour emergency telephone number for reporting problems or damage to the line.

In order to get prepared for **physical and economic displacement** and ensure their implementation in compliance with national and international standards, Resettlement Policy Framework document has been prepared for the project. The framework document identifies categories of affected assets and the groups of affected people, with indicative valuation of costs of compensation per unit of affected livelihood or other assets – up to the level of entitlement framework. This does not cover the preparation of the final entitlement matrix with exact names of PAPs, precise number and size of affected land plots, title status, volume/inventory of affected assets and entitled compensations. These tasks will be accomplished only after detailed cadastral survey, delineation and registration of affected non-registered property and preparation of cadastral maps. In summary, the adverse impact on physically and/or economically displace people could be moderate to significant without mitigation, but should be negligible to minor if planned restoration of living conditions and compensation for all damages or losses is ensured.

To mitigate potential impacts of conductoring works on public roads and **traffic**, GSE will work closely with the road authorities to determine when optimal times are for line installation at each crossing so as to minimize congestions. Works will be planned in a way to minimize the time when conductors are laying on roadways or across rails in order to avoid any accidents, or damage to material assets. While conductoring is taking place, GSE will station workers on highways to block traffic when necessary and to notify drivers to proceed with caution. They also will direct traffic when heavy equipment is crossing the road. The overall impact will be very minor adverse.

The following mitigation is proposed for the **cultural heritage** and archaeological sites:

#	Name of the Site	Mitigation measures
27	Late Classical-Early Medieval settlement of Benara	1. Avoiding local roads that currently are passing nearby the archaeological site. 2. Monitoring construction of towers #26 and #27 by archaeologist
35	Settlement Hill of the Bronze Age-Iron Age north of Ude	Avoiding the road that currently is passing nearby the archaeological site will prevent the its damage. Since the cemetery of this settlement hill is expected somewhere in the vicinity of the site ground works for the towers #29 and #30 must be monitored by archaeologist
36	Settlement Hill of Classical Period north-west of Ude	Monitoring construction of tower #30 by archaeologist. In case of discovery of archaeological remains, full-scale archaeological investigations will be necessary
78*	Dandalo Bridge	Monitoring construction of tower #85 by archaeologist. In case of discovery of archaeological remains, full-scale archaeological investigations will be necessary

Mitigation of impact on migratory birds by installing overhead line markers

The overall detailed analysis of potential impacts from the OHL line construction was used for definition of specific impact mitigation measures within the corridor. The highest impact on migratory birds and especially on migratory raptors was identified on the section of line within the Batumi Bottleneck area. This is section from AP 141 to the end of power line AP 160. The routing and power line corridor was designed in a way to minimize the potential impact on migratory birds. However, taking into account high sensitivity of the section, additional impact mitigation measures have been proposed to ensure that impact on migratory birds is properly managed and mitigated as much as possible. The international good practice guidelines recommend useing bird protection marking (Installation of bird diverters and reflectors) for this purpose.

We have investigated mentioned section of power line between AP 141 and 160 in more detail to evaluate where the installation of bird diverters are necessary and appropriate. The most sensitive parts of section are located close to the river,other towers are located on the hill side and as shown in Figure 7.2.5. The figure shows height of towers is insignificant with scale of section altitudes, resulting that the power line and poles will be under landscape “shadow”.

Based on above, it is concluded, that the collision risks in the middle of section will be less than in the sections located close to the river channel. The installation of the power line markers is proposed in the high collision risk sections, those are sections from AP141-AP144 near to the village Kibe, and section of AP156-160 from Makho Bridge to the power substation in Batumi (approximately 2km long section). The information regarding proposed types and models of markers is presented below.

The next section with high collision risks is located downstream from the Adjaristskali and Skhalta river confluence near to Shuakhevi town. This section is also sensitive to the line crossings of river channel. The power line corridor study has indicated that in mentioned section the crossing of river is unavoidable, so two crossings are included in final design between AP 66 and AP 68. The power line crosses the river twice in such a small section. The installation of line markers is considered in order to ensure, that potential impact on birds is properly mitigated.

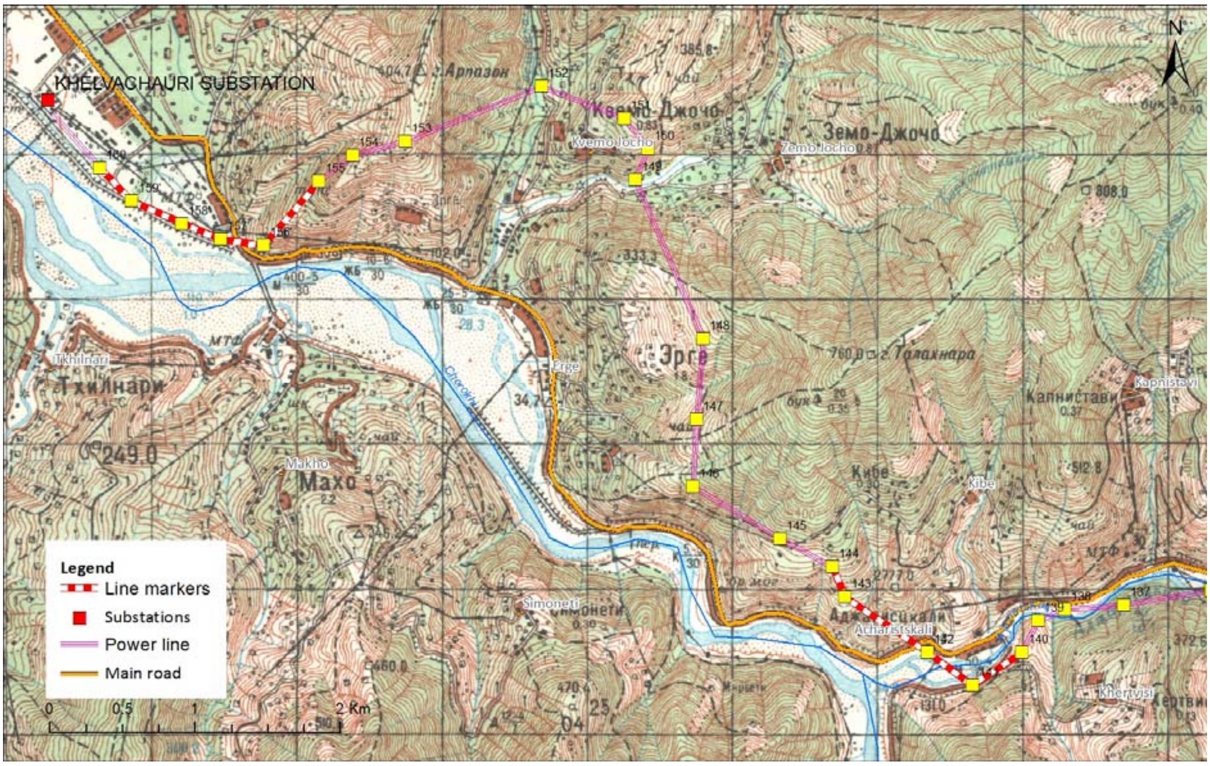


Figure 8.1.1 Section AP141 -AP160 with indication of line marker locations

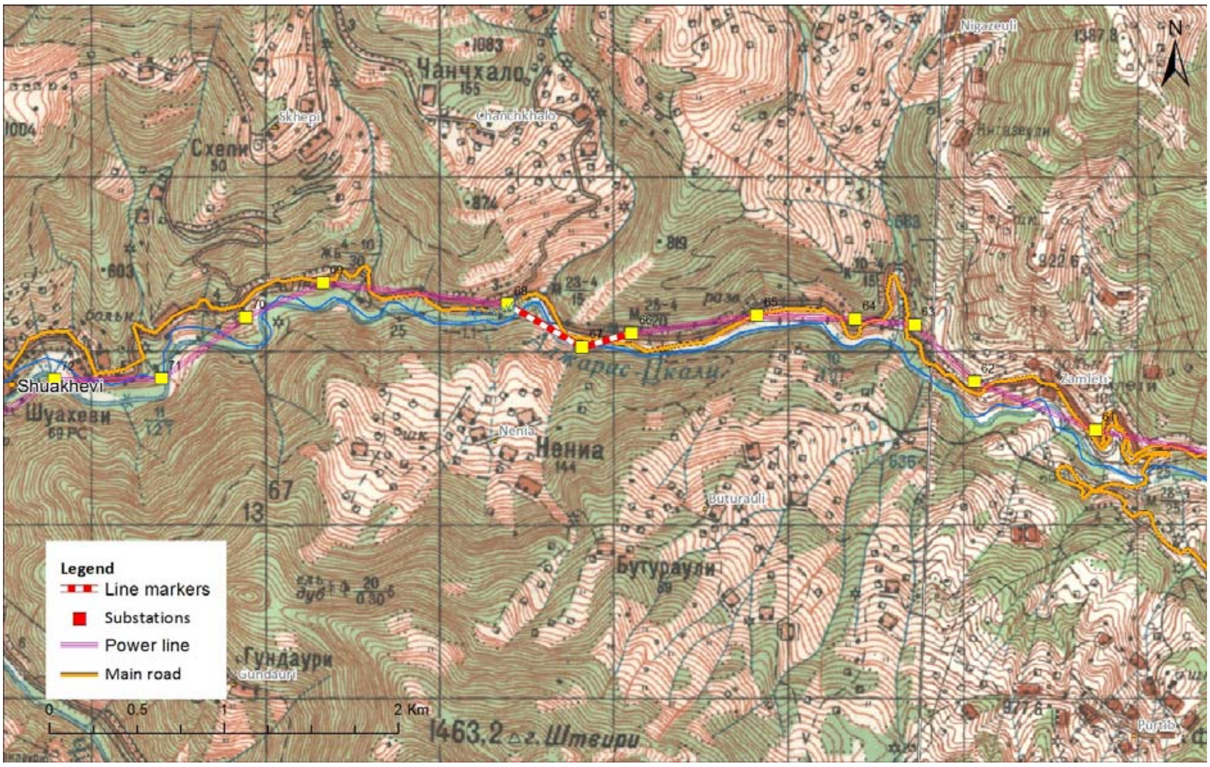


Figure 8.1.2 Section AP66 –AP68 with indication of line marker locations

Another section where the installation of power line markers was evaluated is section near to the Zamleti village, where the power line crosses the Adjaristskali River between AP 59- AP 61. Detailed and complex investigation of subject revealed, that the installation of line markers in these sections is not recommended, due to expected low effectiveness, potential additional impacts on landscapes etc.

Various types of line markers are available. Their effectiveness is reported to be in the range of 50-94% (Prinsen et all, 2011). These devices include aviation balls (spheres), swinging plates, flags, tapes, etc. Prinsen et all (2011) recommends using of moving and contrast devices, as they demonstrate higher effectiveness; however, according to various reference materials (Prinsen et all, 2011, APLIC, 2012), flags, flappers and other moving and small size devises are mostly used for small birds. As for the project main concern species are raptors, the use of bird balls is recommended; however, considering that balls are fixed devices, we suggest their combination with flappers/swinging devices for Batumi bottleneck section, which is high sensitivity zone and use of only balls for other sections. Typical balls and flappers/swinging devices are shown in Figure 8.1.3 and Figure 8.1.5.

Bird balls are available in variety of diameters: from 23 cm to 137 cm, of which most used are 23 cm and 30.5 cm size one (APLIC, 2012). Considering sensitivity of the Batumi flyway, we recommend using of ca. 30-40 cm diameter balls. Ball markers are available in international orange, gloss white or gloss yellow. International orange is not considered to be most effective for all visibility conditions; yellow one is considered useful as it is better visible at dawn and dusk, and does not blend in with background colours as readily as orange (APLIC, 2012). Therefore, we suggest sequencing of international orange-white with gloss yellow. Usually, manufacturers provide recommended spacing between markers; however, according to APLIC (2012), utility industry practices are usually different and comprise 30m-100m.

In case of high voltage lines preferable is to place markers on ground wire, as it is reported to cause most causalities. More specifically, it is believed that most collisions occur with the central 60% portion of a ground wire and marking only this section is recommended (APLIC, 2012) (Figure 8.1.3). We suggest using this approach when marking the Akhaltsikhe-Batumi OHL. Assuming the average span between the towers is 400 m, the central 60% will comprise 240 m. Considering the utility industry practices, we suggest to place ball markers with 60 m interval, or 4 balls between two poles. As recommended above, these should be combined with flappers/swinging devices. They are usually installed at 5-10 m intervals; however, as they will be combined with balls, they could be installed at larger intervals. We suggest placing of two flappers/swinging devices between two balls, that is flappers/swinging devices will be installed in 20 m distance from each other and from balls; in total 6 flappers/swinging devices will be placed between two poles. However, these figures should be adjusted in accordance with specifications and recommendations of line marker supplier, after GES approval.

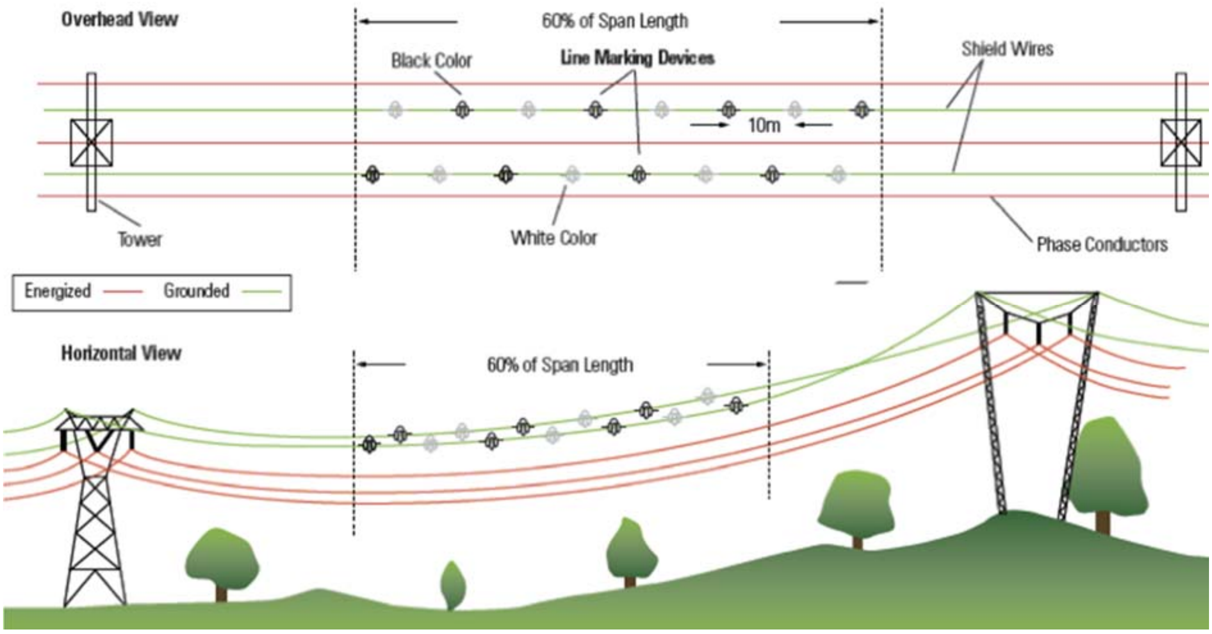


Figure 8.1.3 **Positioning of line marking devices on the central portion of two ground wires (source: APLIC 2012)**

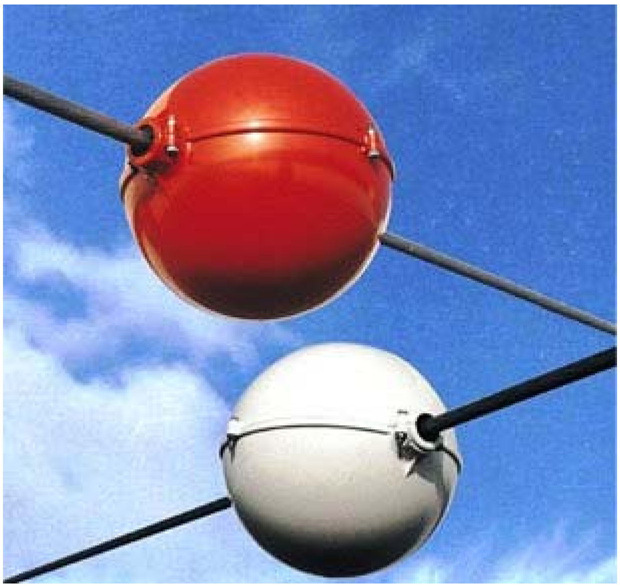


Figure 8.1.4 Typical bird balls

Figure 8.1.5 Typical flippers/swinging devices

8.2 Mitigation measures at pre-construction/design phase

The following mitigation measures are proposed to reduce anticipated adverse impacts of the Project at the **pre-construction/design phase**:

Impacts on socio-economic and environmental conditions, land use and visual:

- Alternatives analysis to estimate relevant impacts of each alternative proposed for power transmission line routes.

- As much as possible avoid critical habitat areas through use of existing utility and transport corridors for transmission and distribution, and existing roads and tracks for access roads, whenever possible.
- Special considerations should be given to minimize the number of river crossings, avoid settlements and residential areas, and avoid (if possible) natural protected areas and natural reserves.
- Site power line with due consideration to landscape views and important environmental and community features.
- Locate high-voltage transmission and distribution line in less populated areas, where possible.
- Carry out extensive public consultations during the project planning phase, e.g. RoW routing and siting of power line and towers (see also SEP - Stakeholders Engagement Plan)
- Displacement and relocation of project affected parties (PAPs) - not anticipated at present that there will be a requirement for physical relocation.
- Project (GSE) will compensate any PAPs with regard to loss of land and crops. Compensation will be undertaken as per the criteria in the Resettlement Framework.

Impact on flora and fauna:

- Survey of entire line by qualified flora expert to identify protected/sensitive species and communities.
- Preparation of Flora Conservation Plan to ensure mitigation/ conservation needed, and deliver required monitoring program.
- Survey of all sensitive areas identified in ESIA by qualified experts to identify protected/sensitive species and critical habitat.
- Preparation of Fauna Conservation Plan to ensure mitigation/ conservation needed, and deliver required monitoring program.

Collision risk and risk of electrocution for birds:

- Design overhead high voltage line to reduce or eliminate electrocution risk for birds, found in the habitats through power line crosses.
- Align power line route to avoid critical aquatic habitat (wetlands, riparian areas, watercourses etc.) where migratory waterfowl may congregate.
- Design separation of conductors on the circuit and other energized hardware by the maximum protected bird species wingspan to prevent electrocution. Some of the crane and vulture species can have wingspans approaching 3 m.
- Establish and implement an Avian Protection Program to be used for during ongoing operations.
- Include in the design marking overhead lines with bird deflectors and diverters to reduce collision risk

Impact of electro-magnetic fields (EMF):

- Avoid areas potentially critical to EMF for power line, such as schools, residential areas, offices etc.)
- Establish a minimum 30 m buffer zone from the centerline on both sides of the power line.
- Ensure that no residential housing is located within at least 30 m of the line.

Access roads and construction camps planning:

- Clearly identify and demarcate access roads on large scale topographic maps before construction

- Identify access points from main roads where crews can access tower locations by driving along ROW as much as possible to minimize the need for access roads outside the ROW.
- Confine equipment to demarcated areas and assign temporary construction camps, including a base camp, where majority of equipment will be temporarily stored.
- To minimize vegetation clearings.
- Develop and implement run-off and erosion control measures, especially in mountainous, hilly terrain areas and on slopes. Implement these measures for both construction and operation periods.
- Develop a waste and hazardous materials management and handling plan for the construction base camp and secondary construction camps.
- Conduct a photographic survey of state of structures (i.e. homes) in close proximity of access roads to be prepared to respond to future claims of damages from truck traffic and vibration.

8.3 Mitigation measures at construction phase

The following mitigation measures are proposed to reduce anticipated adverse impacts of the Project at the construction phase:

Impacts on soils:

- Avoid damage to areas outside construction activities
- Provide erosion control (e.g. silt fence) downgradient of all topsoil stockpiles.
- Where clearing in shrubland and forested areas, the ground should be tilled and seeded with native grass species immediately after clearing activities are complete.
- Apply erosion control measures. To extent possible, minimize activities during wet conditions. When activities must occur in wet conditions, control stormwater by using fabric, straw bales, and other measures to impede stormwater flow and prevent erosion.
- Utilize erosion mats (e.g. plastic temporary roads) in wet areas to prevent rutting and disturbance of habitat.
- Soils excavated for tower foundations will be used for backfilling excavations and will not be left exposed to wind or water for long periods.
- Construction traffic will follow defined temporary access routes to be established as part of the works so as to avoid damaging the soil structure in the wider area.
- The contractor will minimise and avoid as far as possible tracking over steep terrains during the transportation of construction materials or during way-leave clearance.
- Repairs to access roads will be undertaken to maintain the surfacing and prevent soil erosion.
- Degraded areas will be re-planted with local species endemic to the area to improve ground cover.

Impact on surface water:

- Existing water flow regimes in rivers, streams and other natural or manmade irrigation channels will be maintained and/or re-established where they are disrupted by the works.
- Where clearing in shrubland and forested areas, the ground should be tilled and seeded with native grass species immediately after clearing activities are complete.
- Place silt fence downgradient of all areas of exposed soil within ROW to capture sediment in runoff.

- Where an OHTL route crosses a river, the crossing will be designed such that the required procedures are maintained.
- All vessels (drums, containers, IBCs etc.) containing oil, fuel and other hazardous chemicals shall be stored away from watercourses and bunded in order to contain spillages.
- Site workers will be trained in clearing up spillages and spillage kits including suitable PPE will be available in storage areas.
- All waste containers, litter and any other waste generated during the construction shall be collected and disposed off at designated disposal sites in line with applicable government waste management regulations.
- Effluents containing soil, cement or oil will not be allowed to flow into any water drainage or water courses.
- Water from washing out of equipment will also not be discharged into water courses or road drains.
- Temporary stockpiles shall be located away from drainage and surface run off shall be directed away from stockpiles to prevent erosion.
- Abstraction of both surface and groundwater for the construction works will only occur with the consultation of the local community and after obtaining a relevant permit.
- Wastewater from sanitation on the worker camps will be collected in mobile containers and discharged into pit latrines which will be decommissioned on completion.
- It will be necessary to locate such disposal sites in a way that the effluent does not contaminate water resources such as boreholes used by the local community.
- The discharge of any effluents will be carefully managed with agreement of MoE with regard to the detailed methods of disposal.
- Standard good working practices should ensure that any impacts due to the quality of water discharging from the project are insignificant.

Impact of sedimentation:

- Place large stone buffer apron at entry points from access roads to paved roadways.
- Wash tires and undercarriage of construction vehicles prior to leaving construction zones.

Impact of soil compaction, soil rutting, and dust generation on ROW and access roads

- Use of weight distribution matting/thatching in wet/clay soils and in low spots to prevent rutting.
- Spray water regularly over exposed soil areas where work is occurring during dry and windy periods.
- Till and re-seed compacted areas of bare soil after construction activities are completed

Impact from generation of fugitive dust

- Confine vehicles to demarcated roadways.
- Restrict unnecessary traffic.
- Supply workforce with dust masks.
- Sprinkle the roads during warm (summer) period to suppress dust.
- Minimize size of material/spoil storage piles.
- Utilize truck bed covers when hauling materials

Impact on air quality from machinery emissions

- Implement regular vehicle maintenance and repair procedures at designated areas.

- Utilize fuel efficient equipment and vehicles.
- Restrict unnecessary traffic.
- Utilize emission control devices such as catalytic converters.
- Implement regular vehicle maintenance and repair procedures at designated areas.
- Air quality impacts associated with the construction process would be minimised through the implementation of a construction environmental management plan.

Impact from generation of noise

- Confine construction activities to daylight hours within 500 m of settlements.
- Provide workforce with hearing protection as needed
- Noise emitted during the construction phase will be minimised through use of noise reduction technologies such as silencers/mufflers and provision of hearing protection devices for workers.
- Additional noise abatement measures may need to be implemented e.g. close to residential and sensitive wildlife areas, including careful selection and use of plant and hours of working.
- Noise impacts associated with the construction process would be minimised through the implementation of a construction environmental management plan.

Impact from generated waste

- Provide adequate facilities for disposal of garbage (bins, litter trays)
- Train workforce in waste management
- Organize clean-ups of existing garbage around each temporary construction camp.
- Solid wastes arising from construction such as metals, papers, plastics, will be disposed of at approved sites in line with applicable government waste management regulations.
- Construction waste will be removed and reused or disposed off on a regular basis.
- No waste will be left on any site at the end of the works.
- Waste generation will be minimised as far as possible and waste materials reused or recycled as far as possible.

Impact from Materials Usage

- Local materials will be used as far as possible to avoid importation of foreign material and long distance transportation.
- Materials, e.g. wood and sand, will be responsibly sourced and it's provenance known.
- Appropriate licenses/permits shall be obtained from relevant authorities to operate quarries or borrow pits.
- Such sites will not be located in the vicinity of settlement areas, cultural sites, of high scenic value.

Impact on ecosystems, flora and fauna

- Placing of towers in a way to avoid disturbance of isolated populations.
- Re-scheduling construction to avoid breeding seasons.
- Re-routing of access roads to avoid high sensitivity wildlife areas.
- Conducting maintenance outside of breeding seasons.
- Monitoring to detect interference with breeding animals, or any injuries or mortality (to species of concern).

- Placement of breeding platforms for large birds, away from the line.
- Minimum clearing of vegetation and that re-vegetation of disturbed areas occurs following construction.
- Areas requiring clearance either for the OHL or worker camps will be clearly marked out prior to clearance works.
- There will be no clearing of riparian zones and there will be a selective removal of tall growing trees.
- Clearing will be undertaken manually, 'slash and burn' and mechanical methods (e.g. the use as bulldozers) will not be employed.
- Construction workers will be discouraged from engaging in the exploitation of natural resources such as hunting and collection of forest products such as wood.
- Ensure that food is not disposed of along the transmission line. Feeding wild animals can contribute to behavioural change, which may encourage them to raid homes for food.
- On completion of the construction works, the transmission line way-leave will be allowed to re-vegetate with indigenous species. Invasive species will be prevented from colonising.

Visual Impact and Reinstatement

- In addition to the mitigation already incorporated into the design of the line route, awareness raising through public consultation should also help to lessen adverse reaction to the OHTL.
- Suggestions from the consultation regarding the line routing will be taken into consideration in the final choice of design and routing.
- Temporary access roads will be ripped and rehabilitated after the completion of the construction phase where these would not serve either the ongoing maintenance of the OHTL or the local community.
- Depots, worker camps and buildings erected during construction will be removed and the area restored to its original condition in order to avoid deterioration into shanty-areas unless an alternative usage is foreseen and is agreed with the local administration.
- Following construction, natural vegetation should be restored in non-operational areas of the site and/or additional landscape planting with local indigenous species used to improve views into the site.

Risk of forest fires

- Remove all cut vegetation and slash from ROW during construction and ongoing maintenance and dispose at composting facility.

Impact on Aviation

- The transmission line will be located sufficiently far from Batumi Airport to not affect normal operations.
- Visual markers will be placed on line as an indication for light aircraft and helicopters flying at lower altitudes than larger commercial aircraft.
- The transmission line will meet the requirements of the KCAA.

Occupational H&S and Accidents

- Provide and require use of personal protective equipment (head, hand, and foot protection) by all workers
- Provide safety training to all workers.
- Minimize drop height of materials.

- Minimize size of material/spoil storage piles.
- Establish and maintain a small infirmary capable of handling routine problems
- Ensure trained first aid providers are on-site at all times
- Construction workers will be provided with appropriate sanitary facilities and informed of associated risks from HIV/AIDs.
- Other measures to be applied will include counselling and HIV/AIDs testing, and provision of condom dispensers for construction staff.
- Provide adequate heating, showering and cooking facilities during construction

Community H&S and Accidents

- The local community, and in particular children, will be informed about the dangers of construction sites prior to and during the works.
- Excavation for foundations will be closed up as practicable to prevent people or animals falling into the excavations;
- Appropriate signage in Georgian language will be erected
- Stockpiled materials will be secured within the site compound.
- No children will be employed in the undertaking of the site works.
- Adequate first aid facilities will be provided at all sites where construction activities are being undertaken including on mobile sites.
- Anti climb devises and danger warning plates in the local language will be fitted to all towers prior to their operation.
- Adequate road signs to warn pedestrians and motorists of construction activities, diversions, etc. shall be provided at appropriate points in the local language.
- The transport of heavy and abnormal loads will be undertaken out of normal working hours whenever possible.
- The locating of access roads and design of detours shall be undertaken in consultation with the local community.
- Construction vehicles shall not exceed maximum speed limit of 40km per hour in residential areas.

Other socio-economic impacts

- The use of local labour should be maximized during the construction of the projects (e.g. as security and site workers and in vegetation control etc) and training provided so as to provide capacity building.
- Gender Issues - As an enhancement measure, it is recommenced that equal employment opportunities are given to women within the project skills requirements and that the procurement of local products and services is maximized.
- Pay wages at least average for the area
- Provide adequate heating, showering and cooking facilities during construction

Archaeology and cultural heritage

- Discovery of ancient heritage, relics or anything that might or believed to be of archaeological or historical importance during the execution of works will be immediately reported to the Proponent/Engineer so that the appropriate authorities can be expeditiously contacted and measures implemented to protect historical or archaeological resources. Cemeteries and graves will generally be avoided.

Impact from construction camps

- Clearly demarcate access roads to the base camp and secondary camps along the segments of access roads, where construction equipment will be moved and stored.
- Clearly demarcate construction, other equipment storage areas and temporary tank farm areas, including a helicopter pad and chopper fueling area.
- Confine vehicles to demarcated roadways.
- Provide erosion control measures at the base camp.
- Establish native grasses around the base camp after the construction works are completed.
- Water spray the roads during warm (summer) period to suppress dust.
- Minimize size of material/spoil storage piles
- Implement regular vehicle maintenance and repair procedures at designated areas.
- Utilize fuel efficient equipment and vehicles.
- Restrict unnecessary traffic.
- Utilize emission control devices such as catalytic converters.
- Implement regular vehicle maintenance and repair procedures at designated areas.
- Develop a waste management and handling plan for construction base camp and secondary construction camps. Properly store and dispose construction, sanitary and oily waste.
- Reduce amount of waste to maximum extent possible.
- Collect solid, oily and chemical waste and store until transported to a designated waste disposal places.
- Collect sanitary waste in septics.
- Transport sanitary waste to designated off-site disposal facilities.
- Provide adequate facilities for disposal of garbage (bins, litter trays)
- Train workforce in waste management
- Organize clean-ups of existing garbage around each temporary construction camp.
- Properly organize tank farm areas (ASTs). Establish a secured designated fuel and chemical storage area, with an impervious base and sufficient containment volume. .
- Store all fuel, oil and chemical storage in the designated secure area only.
- Check hoses and valves regularly for signs of wear, ensure they are turned off and securely locked when not in use.
- Place diesel pumps and similar items on drip trays to collect minor spillages. Check trays regularly and remove any accumulated oil.
- Provide supplies for cleanup of minor spills.
- Implement vehicle maintenance and repair procedures at designated areas.

8.4 Mitigation measures at operation and maintenance phase

The following mitigation measures are proposed to reduce anticipated adverse impacts of the Project at the construction phase:

Impact from accessing the line for maintenance

- Restrict unnecessary traffic and ensure that exposed ground is reseeded or otherwise stabilized
- Implement regular vehicle maintenance and repair procedures.

- Utilize fuel efficient equipment and vehicles.
- Utilize emission control devices such as catalytic converters

Impact of irregular maintenance of vegetation within the RoW

- Remove invasive plant species, whenever possible, and cultivate native plant species.
- Implement an integrated vegetation management approach (IVM): the selective removal of tall-growing tree species and the encouragement of low-growing grasses and shrubs.

Impacts of RoW and access roads periodic clearing

- Place silt fence downgradient of all areas of exposed soil within ROW to capture sediment in runoff.
- Where clearing in shrubland and forested areas, the ground should be tilled and seeded with native grass species immediately after clearing activities are complete.

Impact on Drainage, Surface Waters and Water Resources

- Avoid excessive vegetation clearings (trees and shrubs) around the power transmission lines. This is especially true for the towers located on the floodplains, stream terraces and hill slopes.
- All vessels (drums, containers, IBCs etc.) containing fuel and other hazardous chemicals shall be stored away from watercourses and bunded in order to contain spillages.
- Site operatives will be trained in clearing up spillages and spillage kit including suitable PPE will be available in storage areas.

Impact on avian fauna

- Conduct monitoring of bird collisions or electrocutions along the transmission line, and where evident in any significant numbers, will put wire-marking reflectors in place.

Risk of forest fires

- Thorough monitoring of ROW vegetation and periodic clearings.
- Remove blowdown and other high-hazard fuel accumulations.
- Timely vegetation thinning and slashing
- Proper disposal of maintenance slash by trucks
- Planting and managing fire resistant species (e.g. hardwoods) within the ROW

Impact of vegetation control techniques that use herbicides

- Control vegetation using manual techniques which do not require the use of herbicides.

Socio-economic impacts

- The employment of local labour should be maximised during the operational phase of the projects (e.g. in providing security, undertaking vegetation control etc) and training provided so as to provide capacity building.
- Gender Issues. As an enhancement measure, it is recommenced that equal employment opportunities are given to women within the project skills requirements and that the procurement of local products and services is maximized.
- Measure EMF within buildings within 100m of the line, if levels exceed international guidance, install shielding or otherwise protect occupants/residents.

Emergency Situations and Accidents

- Earthing and lightning protection system should be installed, earthing of transmission lines according standards;

- Emergency response plan developed and preparedness ensured.
- Permanent monitoring of OHL safety and timely maintenance of transmission lines.

8.5 Mitigation of Cumulative impacts

In terms of ***mitigation of cumulative impacts***, following the GSE policy, the Contractor should coordinate activities with development projects neighboring the Project area by agreeing plans/schedules for major construction processes. The cumulative impact of noise and emissions (dust) on populated areas should not be significant due to remote location, mobile/moving source, very short construction period. The cumulative environmental impacts of the proposed Project can be mitigated by set of measures comprising the following:

(i) Good pre-construction surveys by Contractor to determine specific mitigation where possible/appropriate;

(ii) Careful planning of construction works and coordination with other projects and construction activities in the area;

(iii) Adequate provision of environmental mitigation via clauses in work contracts (technical specifications for site clearance, excavation for foundations, fill and site reclamation);

(iv) Proper development and implementation of site-specific detailed environmental management plans (based on this ESIA and ESMP); and

(v) Efficient contract management.

A common problem encountered during implementation of environmental management plans of such projects is lack of environmental awareness among engineers and managers concerned with day to day construction activities, which can be solved through regular internal environmental training, proper supervision and monitoring.

9. Environmental and Social Management Plan (EMP)

An Environmental and Social Management Plan provides a framework for managing, mitigating and monitoring environmental and social impacts of the Project at construction and operation/maintenance phases, and can be used to demonstrate that sound practices (environmental and social) will be followed throughout.

The Environmental and Social Management Plan for this Project consists of **Environmental and Social Mitigation Matrix**, developed to clearly identify mitigation measures and management practices that should be implemented to minimize, reduce or eliminate the adverse impacts identified in the ESIA, and the **Monitoring Program** for the monitoring over the implementation of mitigation measures and of the residual impacts at the construction and operation phases of the Project, following the best management practices.

Generic environmental and social management practices, as well as specific mitigation measures for the 220kV Akhaltsikhe-Batumi Power Transmission Line Project, are identified and presented in Environmental and Social Mitigation Plan matrix (please see Section 8). The **Mitigation Matrix** will be provided to prospective bidders for the construction contracts, to ensure that detailed environmental mitigation measures and costs are included into their technical and financial proposals. GSE will ultimately be responsible for ensuring that the Mitigation Plan is implemented on site via **Monitoring Program** and its own Environmental and Social Management System (ESMS), which considers environmental and social supervision capacities/resources (within GSE, or contracted out to Supervision Consultant) for the monitoring over the implementation of the Project.

9.1 Environmental and Social Mitigation

The Environmental and Social Mitigation Matrix provides a logical framework within which the negative environmental and social impacts identified during the ESIA study can be mitigated and any beneficial environment effects can be enhanced.

Environmental and social impact mitigation measures have to be further elaborated upon Pre-Construction Survey undertaken by selected/awarded Contractor before proceeding with initial stages of construction (i.e., RoW clearance, topsoil stripping for foundations, arrangement of access roads, etc.), to ensure that they consider and carefully plan the implementation of each mitigation measure under their responsibility. Contractors will be required to prepare their own specific EMPs based on ESMP provided as part of this ESIA, describing in detail the actions they will take to provide each measure. The contractor's specific ESMPs should include (but not limited to) the following documents: Waste Management Plan, Traffic Management Plan, Pollution Prevention Plan, Biodiversity Management Plan, Community Engagement Plan, Local Recruitment Plan, Reinstatement Management Plan, Health & Safety Management Plan (including working on heights and prevent electrocotion, etc.), Emergency Response Plan, Cultural Heritage Management Plan (including Chance Finding Procedure), Community Liaison and Local Recruitment Plan, other documents as necessary, that have to be prepared and submitted by the Contractor to the Client (GSE) (or its Construction Supervision Consultant) for approval, prior to initiation of construction works. GSE, as Project Developer, is also responsible for auditing Contractor's Environmental and Social Management System (ESMS) to ensure that there are institutional and human capacities in place (environmental and social managers, field officers, coordination mechanisms with construction managers, etc.) to ensure proper and timply implementation of the approved specific ESMPs requirements.

The above mentioned set of Contractor's ESMPs should contain all generic and site-specific mitigation measures and should oblige Contractor to: clearly demarcate necessary construction zone and avoid excavations, storage of spoil or waste and other type invasion on adjacent territories; prepare and implement site specific reinstatement and landscaping plan upon completion of construction to restore the original conditions of landscape to the extent possible; enhance landscape by introducing anti-erosion measures and revegetating areas with the native floral species, as well as local floral species most appropriate as anti-erosion protection; provide mitigation by biosurveys immediately before construction to micro-locate towers and other project elements, also use of restricted construction timing if needed to avoid impacts on breeding birds/animals or migrating birds; for sensitive species, restrict construction season if needed; conduct permanent supervision over the construction works to prevent any unsanctioned invasions on private land plots not acquired for the project; compensate any losses related to damages to the private property, business interruption; restore any infrastructure elements damaged during the construction works.

Table 9.2.1 comprises the environmental and social mitigation measures and management practices for the 220kV Akhaltsikhe-Batumi Power Transmission Line Project, to be used by Contractors and included in their set of ESMPs.

Chance Finds Procedure should be developed by the Contractors as a part of Cultural Heritage Management Plan, to ensure that any important archaeological material is properly recognized, recorded and preserved if necessary. The Chance finding procedure prepared by Contractor, should be based on principles described in section 7.3.5, (subsection – Chance finding procedure) and should describe in detailes contractors set up, permitting for excavation works, decision making and responcibilities for implementation, reporting and monitoring.

Should any archeological deposits be found during the construction of tower foundations, a full measured, drawn and photographic survey should take place prior to any further works. Additional mitigation measures should be agreed with the Department of Historical Monuments under the Ministry of Culture of Georgia. If, as a result of the work method statement developed by the Contractor, there is a possible impact on any cultural monument, this impact should be avoided and the method statement revised. In the unlikely event that impact is genuinely unavoidable, further mitigation measures should be agreed with the Ministry of Culture of Georgia.

9.2 Monitoring Program

Environmental monitoring is a very important component of environmental management to safeguard the protection of environment at both construction and operation stages of the Project. The Georgian regulation on Environmental Impact Assessment requires environmental self-monitoring at all stages of the project lifetime. As part of the EIA report, the proponent is required to (i) determine methods of environmental control and monitoring; (ii) develop prevention and mitigation plans of identified or expected negative impacts on the environment; (iii) elaborate an environmental strategy and management plan for each stage of the activity. Monitoring should also include plans for expected social impacts. It should ensure that the commitments made in the EIA, and in any subsequent assessment reports, together with any license approvals or similar conditions, are implemented.

In response to environmental impacts identified during this ESIA study, the Monitoring Program has been developed as an integrated part of Environmental Management Plan and is presented in Table 9.2.2. An Environmental and Social Monitoring is needed to verify the effectiveness of the proposed mitigation measures in reducing impacts and also to allow mitigation measures to be refined or developed as needed to address actual impacts and future effects/developments.

More specifically, the objectives of a monitoring program are:

- to record project impacts during construction and operation and assess the changes in environmental conditions;
- to monitor the implementation and evaluate the effectiveness of the mitigation measures;
- to indicate potential problems and identify any shortcomings in order to allow prompt implementation of corrective actions, refinement and/or enhancement of mitigation measures;
- to meet legal requirements, corporate commitments and community obligations;
- to allow development of mitigation measures to deal with unforeseen issues or changes in operations;
- to allow GSE and international lender (World Bank) to verify that requirements of loan agreements are being met.

The Monitoring Program describes the parameters to be monitored, the activities to be executed, locations, time and frequency of monitoring activities, and the collection, analysis, and reporting of monitoring data. Monitoring can include:

- Baseline monitoring which may be carried out over seasons or years to quantify ranges of natural variation and/or directions and rates of change that are relevant to impact prediction and mitigation (both environmental and social systems);
- Compliance monitoring which aims to check that specific regulatory standards and conditions are met (e.g. in relation to pollution emissions);
- Impact and mitigation monitoring which aims to compare predicted and actual (residual) impacts and hence determine the effectiveness of mitigation measures.

Monitoring can aim to monitor conditions at the sources of the potential disturbances or at the locations of impact receptors. Impact monitoring is particularly relevant with regard to social impacts, as the cause of impacts is often not any single impact, but rather an accumulation of diffuse impacts.

The GSE should ensure that the contract documents contain a listing of all required mitigation measures and a time frame for the compliance monitoring of these activities. The ESMP should be included in tender/contract documents so that the contractor is fully aware at bidding stage of what is expected of him in terms of environmental stewardship and can build the necessary costs into his tender pricing. The monitoring will comprise supervision and surveillance to check whether the contractor is meeting the provisions of the contract during construction.

Environmental supervision and monitoring, as part of the Developer's (GSE) Environmental and Social Management System (EMS) are conducted throughout all phases of project development and implementation, with the aim of:

(i) Ensuring that action necessary to provide the required mitigation is taken;

(ii) Ensuring that the mitigation protects the environment as intended; and

(iii) Determining the actual environmental and social impacts that occur once mitigation has been applied, to establish whether there are any residual or unexpected impacts that require further action.

The Monitoring Program is considered for pre-construction, construction, and operational phases of the 220kV Akhaltsikhe-Batumi power transmission line project. It is assumed that the GSE (or its project execution agency), through the qualified environmental staff and/or consulting company will be responsible for all monitoring activities, and that the results would be reported to GSE, the Ministry of Energy, Ministry of Environment and other stakeholders as appropriate. In addition, lenders (World Bank) may wish to receive full reports or selected data.

ble 9.2.1 ESMP - Mitigation Measures to Prevent or Reduce Potential Impacts

Potential Impacts/Issues of concern	Significance of Impact[2]	Mitigation /Enhancement Measures or Best Management Practice	Responsibility	Further Information
1. DESIGN PHASE				
ssues to consider: Compliance with national and nternational (WB and FC) standards and requirements in environmental conservation and carrying out ESIA for power transmission lines construction projects.	Required for further project implementation	Ensure that all government and funding/co-funding agencies requirements and procedures relating to ESIA are complied with. This preliminary assessment should be completed prior to the construction stage and should verify that: - All necessary permits for Project construction and operation are or will be obtained after the ESIA submittal (construction permit, permit for RoW clearing/tree felling in forested areas). - All issues, associated with land use/property and ROW acquisitions are settled down/coordinated and/or negotiated, including National and WB and IFC requirements for compensation, payments and potential resettlements of residents along the route (RAP implementation) - Completion of the analysis of Project design and specifications and its cumulative impacts on	Design Consultant, ESIA Consultant, and GSE (or Project Execution Agency)	This is reflected in ESIA Section 1 and Section 2

No	Activities or Aspects	Potential Impacts/Issues of concern	Significance of Impact[2]	Mitigation /Enhancement Measures or Best Management Practice	Responsibility	Further Information
				conditions. The analysis is to ensure the Project is in line with best international practices and allows incorporation of appropriate measures to minimize/reduce/avoid adverse environmental and socio-economic effects of the project implementation with enhancement of beneficial impacts. - Assurance that properly developed environmental and social mitigation and monitoring plan will be in compliance with WB, IFC and National standards.		
2. PLANNING (KEY ISSUES)						
2.1	Power transmission line, ROW planning	Impacts and issues to consider: Adverse impacts on land use and visual impacts Adverse impacts on environmental and socio-economic conditions Occupational and Public Health and Safety	Negligible to Moderate adverse Negligible to Major adverse NA	- Alternatives analysis to estimate relevant impacts of each alternative proposed for power transmission line routes. - As much as possible avoid critical habitat areas through use of existing utility and transport corridors for transmission and distribution, and existing roads and tracks for access roads, whenever possible. - Special consideration to minimize the number of river crossings, avoid settlements and residential areas, and avoid (if possible) natural protected areas and natural reserves.	Design Consultant, ESIA Consultant, and GSE (Project Execution Agency)	ESIA Section 3 and Section 4.

No	Activities or Aspects	Potential Impacts/Issues of concern	Significance of Impact[2]	Mitigation /Enhancement Measures or Best Management Practice	Responsibility	Further Information
				- If it is impossible to avoid sensitive areas (such as forests), - take and implement all necessary mitigation measures to minimize/mitigate the adverse impacts on environmental and social conditions during construction and operation phases of the Project. - Accurately assess changes in property values due to power line proximity (social and economic issue – for details refer to Social Management Plan and RAP) - Carry out extensive public consultations during the Project Planning phase, e.g. siting of power line, ROW (social and economic issue – for details refer to Annex 6 - Stakeholders Engagement and Public Consultation Plan (SEP)		
				- Site power line with due consideration to landscape views and important environmental and community features. - Locate high-voltage transmission and distribution line in less populated areas, where possible. - GSE and the Prime Contractor should assign Environmental and Social Officers who will be responsible for environmental conservation issues and controlling		

No	Activities or Aspects	Potential Impacts/Issues of concern	Significance of Impact[2]	Mitigation /Enhancement Measures or Best Management Practice	Responsibility	Further Information
				proper implementation of mitigation and protection measures during the Project construction and operation.		
		Occupational and Public Health and Safety issues (EMF-Electro-Magnetic Fields)	NA	- Avoid areas potentially critical to EMF for power line, such as schools, residential areas, offices etc.) - Establish a minimum 30 m buffer zone from the centerline on both sides of the power line. - Ensure that no residential housing is located within at least 30 m of the line.	Design Consultant, and GSE (Project Execution Agency)	Details in the EMP and in ESIA Sections 7 and 8
2.2	Access roads planning	Impacts to consider: Physical impact on soils, vegetation clearings, surface and groundwater, loss of land (grasslands) and alteration of habitats	Negligible to Major adverse	- Clearly identify and demarcate access roads on large scale topographic maps before construction - Identify access points from main roads where crews can access tower locations by driving along ROW as much as possible to minimize the need for access roads outside the ROW. - Confine equipment to demarcated areas and assign temporary construction camps, including a base camp, where majority of equipment will be temporarily stored.	Design Consultant, and GSE (Project Execution Agency)	ESIA Sections 3, 7 and 8
		Soil erosion Contamination of soil	Negligible to Minor adverse	- Develop and implement run-off and erosion control measures, especially in mountainous, hilly terrain areas and on slopes. Implement these		

No	Activities or Aspects	Potential Impacts/Issues of concern	Significance of Impact[2]	Mitigation /Enhancement Measures or Best Management Practice	Responsibility	Further Information
		with litter Local contamination of surface and groundwater from oil, petrol and other hazardous materials spills		measures for both construction and operation periods. - Develop a waste and hazardous materials management and handling plan for the construction base camp and secondary construction camps.		
2.3	220kV overhead lines conductoring	Collision risk and risk of electrocution for birds.	Minor with proper mitigation	- Design overhead high voltage line to reduce or eliminate electrocution risk for birds, found in the habitats through power line crosses. - Align power line route to avoid critical aquatic habitat (wetlands, riparian areas, watercourses etc.) where migratory waterfowl may congregate. - Design separation of conductors on the circuit and other energized hardware by the maximum protected bird species wingspan to prevent electrocution. - Establish and implement an Avian Protection Program to be used for during ongoing operations. - Include in the design marking overhead lines with bird deflectors and diverters to reduce collision risk	Design Consultant and GSE (Project Execution Agency)	ESIA Sections 3, 7 and 8
3. CONSTRUCTION PHASE						
3.1	**- Construction of the base camp, transmission line, access roads, temporary camps along the line.**					

No	Activities or Aspects	Potential Impacts/Issues of concern	Significance of Impact[2]	Mitigation /Enhancement Measures or Best Management Practice	Responsibility	Further Information
3.1.1	Construction of the base camp (if planned) and staging areas	Damage to topsoil/subsoil, vegetation clearings and loss of grassland/habitat. Soil erosion	Minor adverse	- Clearly demarcate access roads to the camps and staging areas along the segments of access roads, where construction equipment will be moved and stored. - Clearly demarcate construction, other equipment storage areas and temporary tank farm areas, - Confine vehicles to demarcated roadways. - Provide erosion control measures at the base camp. - Establish native grasses around the base camp after the construction works are completed.	Contractor, GSE (Project Execution Agency) and/or Supervision Consultant	ESIA Sections 7 and 8
		Generation of fugitive dust	Negligible adverse	- Confine vehicles to demarcated roadways. - Use gravel for the access roads into the base camps. - Restrict unnecessary traffic. - Supply workforce with dust masks. - Water spray the roads during warm (summer) period to suppress dust. - Minimize size of material/spoil storage piles.	Contractor, GSE (Project Execution Agency) and/or Supervision Consultant	ESIA Section 7 and 8
		Contamination of air from vehicle and other construction equipment emissions (bulldozers etc.)	Negligible adverse	- Implement regular vehicle maintenance and repair procedures at designated areas. - Utilize fuel efficient equipment and vehicles.		

No	Activities or Aspects	Potential Impacts/Issues of concern	Significance of Impact[2]	Mitigation /Enhancement Measures or Best Management Practice	Responsibility	Further Information
				- Restrict unnecessary traffic. - Utilize emission control devices such as catalytic converters.		
		Generation of noise	Negligible adverse	- Confine construction activities to daylight hours within 500 m of residential areas. - Provide workforce with hearing protection as needed.	Contractor, GSE (Project Execution Agency) and/or Supervision Consultant	
		Domestic and construction waste generation. Oily and chemical waste generation on-site. Contamination of soil and surroundings with litter and construction debris	Negligible adverse or no impact if mitigation measures applied	- Develop a waste management and handling plan for construction base camp and secondary construction camps. Properly store and dispose construction, sanitary and oily waste. - Reduce amount of waste to maximum extent possible. - Collect solid, oily and chemical waste and store until transported to a designated waste disposal places.	Contractor, GSE (Project Execution Agency) and/or Supervision Consultant	
				- Collect sanitary waste in septics. - Transport sanitary waste to designated off-site disposal facilities. - Provide adequate facilities for disposal of garbage (bins, litter trays) - Train workforce in waste management - Organize clean-ups of existing garbage around each temporary construction camp.		

No	Activities or Aspects	Potential Impacts/Issues of concern	Significance of Impact[2]	Mitigation /Enhancement Measures or Best Management Practice	Responsibility	Further Information
		Local soil, surface water and groundwater contamination from oil, diesel and chemical spills	Negligible adverse	- Properly organize tank farm areas (ASTs). Establish a secured designated fuel and chemical storage area, with an impervious base and sufficient containment volume. - Store all fuel, oil and chemical storage in the designated secure area only. - Check hoses and valves regularly for signs of wear, ensure they are turned off and securely locked when not in use. - Place diesel pumps and similar items on drip trays to collect minor spillages. Check trays regularly and remove any accumulated oil. - Provide supplies for cleanup of minor spills. - Implement vehicle maintenance and repair procedures at designated areas.	Contractor, GSE (Project Execution Agency) and/or Supervision Consultant	ESIA Sections 7 and 8
3.1.2	ROW clearing, construction of access roads and towers					
3.1.2.1	Typical activities during ROW clearing and access roads and tower construction works include, but not limited to: - General earthwork activities - Clearing and grubbing	Impacts on soils - clearings of trees and shrubs that make the soil more susceptible to erosion and dust generation as the soils under these plants are now	Negligible to Minor adverse	- Avoid damage to areas outside construction activities - Provide erosion control (e.g. silt fence) downgradient of all topsoil stockpiles. - Where clearing in shrubland and forested areas, the ground should be tilled and seeded with native grass	Contractor, GSE (Project Execution Agency) and/or Supervision Consultant	ESIA Sections 7 and 8

No	Activities or Aspects	Potential Impacts/Issues of concern	Significance of Impact[2]	Mitigation /Enhancement Measures or Best Management Practice	Responsibility	Further Information
	of vegetation for access roads and ROW - Construction of tower foundations - Installation of tower structures - Installation of conductor wires (stringing) - Transport, delivery of equipment and vehicle traffic.	exposed to wind and precipitation.		species immediately after clearing activities are complete. - Apply erosion control measures. To extent possible, minimize activities during wet conditions. When activities must occur in wet conditions, control stormwater by using fabric, straw bales, and other measures to impede stormwater flow and prevent erosion. - Utilize erosion mats (e.g. plastic temporary roads) in wet areas to prevent rutting and disturbance of habitat.		
		Impact on surface water due to ROW and access road clearings that increase sediment loads into receiving water bodies with stormwater runoff	Negligible to Minor adverse	- Where clearing in shrubland and forested areas, the ground should be tilled and seeded with native grass species immediately after clearing activities are complete. - Place silt fence downgradient of all areas of exposed soil within ROW to capture sediment in runoff.	Contractor, GSE (Project Execution Agency) and/or Supervision Consultant	
		Mud could be carried off the site on vehicle tires and could result in sedimentation in off-site areas.	Negligible adverse	- Place large stone buffer apron at entry points from access roads to paved roadways. - Wash tires and undercarriage of construction vehicles prior to leaving construction zones.	Contractor, GSE (Project Execution Agency) and/or Supervision Consultant	
		Soil compaction, soil rutting, and dust generation on ROW	Negligible adverse	- Use of weight distribution matting/thatching in wet/clay soils and in low spots to prevent rutting.	Contractor, GSE (Project Execution	

No	Activities or Aspects	Potential Impacts/Issues of concern	Significance of Impact[2]	Mitigation /Enhancement Measures or Best Management Practice	Responsibility	Further Information
		and access roads.		- Spray water regularly over exposed soil areas where work is occurring during dry and windy periods. - Till and re-seed compacted areas of bare soil after construction activities are completed.	Agency) and/or Supervision Consultant	
		Blasting for tower foundations will remove vegetation, topsoil, and near-surface rock making the soil susceptible to increased erosion and dust generation. Geohazards: landslides and mudslides	Negligible to Minor adverse	- Use low-yield downhole blasting techniques to minimize surface impacts. - Cover blasting areas to prevent dust escape. - The ground should be tilled and seeded with native grass species immediately after blasting activities are complete.	Contractor, GSE (Project Execution Agency) and/or Supervision Consultant	
		Generation of fugitive dust	Negligible adverse	- Confine vehicles to demarcated roadways. - Restrict unnecessary traffic. - Supply workforce with dust masks. - Sprinkle the roads during warm (summer) period to suppress dust. - Minimize size of material/spoil storage piles. - Utilize truck bed covers when hauling materials	Contractor, GSE (Project Execution Agency) and/or Supervision Consultant	
		Disruption of surface water flow and	Minor adverse	- Avoid excessive tree cuttings around the ROW	Contractor, GSE (Project	

No	Activities or Aspects	Potential Impacts/Issues of concern	Significance of Impact[2]	Mitigation /Enhancement Measures or Best Management Practice	Responsibility	Further Information
		impact on water quality conditions of nearby streams/creeks		- Plant native grass along the route	Execution Agency) and/or Supervision Consultant	
		Air pollution from vehicle and other construction equipment emissions (bulldozers etc.)	Negligible adverse	- Implement regular vehicle maintenance and repair procedures at designated areas. - Utilize fuel efficient equipment and vehicles. - Restrict unnecessary traffic. - Utilize emission control devices such as catalytic converters.	Contractor, GSE (Project Execution Agency) and/or Supervision Consultant	
		Risk of forest fires	Negligible adverse	- Remove all cut vegetation and slash from ROW during construction and dispose at composting facility.		
		Generation of noise	Negligible adverse	- Confine construction activities to daylight hours within 500 m of settlements. - Provide workforce with hearing protection as needed	Contractor, GSE (Project Execution Agency) and/or Supervision Consultant	
		Local contamination of soil and waters of shallow aquifer with oily and chemical substances	Negligible adverse	- At temporary camps and staging areas, establish a designated area for fuel, hydraulic oil, diesel and chemical storage (drums, small reservoirs etc.). The area of storage should have an impervious base and impermeable bund walls, and be protected from precipitation. Capacity must be sufficient to	Contractor, GSE (Project Execution Agency) and/or Supervision Consultant	

No	Activities or Aspects	Potential Impacts/Issues of concern	Significance of Impact[2]	Mitigation /Enhancement Measures or Best Management Practice	Responsibility	Further Information
				contain full volume within a bund and secured area - Store all fuel, oil and chemical storage in the designated secure area only - Conduct regular inspections of construction vehicles to identify and repair leaks or damaged fuel/lubricant lines. - Repair vehicles only in specially designated maintenance areas.		
		Impacts on ecosytems, flora and fauna	Negligible to Major	Implement mitigation required in ESIA through Biodiversity Management Plan. Mitigation may include: - Movement of tower or other locations to avoid disturbance of isolated populations. - Re-scheduling construction to avoid breeding seasons. - Re-routing of access roads to avoid ecologically important areas. - Conducting maintenance outside of breeding seasons. - Monitoring to detect interference with breeding animals, or any injuries or mortality (to species of concern). - Placement of breeding platforms for large birds, away from the line.	Contractor, GSE (Project Execution Agency) and/or Supervision Consultant	ESIA Sections 7 and 8
		Adverse impact on landscape and views	Negligible	- Develop Waste Management Plan;	Contractor,	

No	Activities or Aspects	Potential Impacts/Issues of concern	Significance of Impact[2]	Mitigation /Enhancement Measures or Best Management Practice	Responsibility	Further Information
		from litter and garbage (plastic bags, bottles, etc.)	adverse	- Provide adequate facilities for disposal of garbage (bins, litter trays) - Train workforce in waste management - Organize clean-ups of existing garbage around each temporary construction camp	GSE (Project Execution Agency) and/or Supervision Consultant	
		Accidents to workers/injuries		- Develop H&S Management Plan, - Provide and require use of personal protective equipment (head, hand, and foot protection) by all workers - Provide safety training to all workers. - Minimize drop height of materials. - Minimize size of material/spoil storage piles. - Establish and maintain a small infirmary capable of handling routine problems - Ensure trained first aid providers are on-site at all times	Contractor, GSE (Project Execution Agency) and/or Supervision Consultant	
3.1.2.2	Construction workforce (total number TBD)	Economic impacts (temporary employment)	Minor beneficial	- Develop Community Liaison and Recruitment Management Plan - Employ local labor force to extent possible - Pay wages at least average for the area - Provide adequate heating, showering and cooking facilities during construction	Contractor, GSE (Project Execution Agency) and/or Supervision Consultant	

No	Activities or Aspects	Potential Impacts/Issues of concern	Significance of Impact[2]	Mitigation /Enhancement Measures or Best Management Practice	Responsibility	Further Information
4. OPERATION AND MAINTENANCE PHASE						
4.1	**- Operation and Maintenance of the transmission lines and ROW**					
4.1.1	Transmission line and ROW operation and maintenance					
4.1.1.1	Typical activities for transmission line and ROW O&M would include: - Energizing the transmission line - Maintenance site visits and inspections - Vegetation control in ROW - Tower repairs - Foundation repairs - Repair of damaged/downed wires.	Fugitive dust and vehicles' emissions from maintenance visits. Transmission line maintenance activities involve gas-powered trucks, lawn mowers, grass trimmers, and other equipment. The operation of such vehicles and equipment result in emissions of carbon monoxide, NOx, SO_2, hydrocarbons, and particulate matter	Minor adverse	- Restrict unnecessary traffic and ensure that exposed ground is reseeded or otherwise stabilized - Implement regular vehicle maintenance and repair procedures. - Utilize fuel efficient equipment and vehicles. - Utilize emission control devices such as catalytic converters	GSE and/or maintenance contractor	ESIA Sections 7 and 8
		Disruption to overhead power lines and towers due to irregular maintenance of vegetation within the ROW.	Negligible adverse	- Remove invasive plant species, whenever possible, and cultivate native plant species. - Implement Vegetation Management Plan: the selective removal of tall-growing tree species and the encouragement of low-growing grasses and shrubs.	GSE and/or maintenance contractor	ESIA Sections 7 and 8
		Soil erosion and	Negligible to	- Place silt fence downgradient of all	GSE and/or	ESIA Sections

No	Activities or Aspects	Potential Impacts/Issues of concern	Significance of Impact[2]	Mitigation /Enhancement Measures or Best Management Practice	Responsibility	Further Information
		water quality impacts: periodic clearing of vegetation as part of normal right-of-way and access road maintenance activities may make the soil more susceptible to erosion. Right-of-way and access road clearing also increase stormwater runoff. This could be a long-term and permanent impact along right-of-way areas.	Minor adverse	areas of exposed soil within ROW to capture sediment in runoff. - Where clearing in shrubland and forested areas, the ground should be tilled and seeded with native grass species immediately after clearing activities are complete.	maintenance contractor	7 and 8
		Forest fires due to accumulation of underlying growth or slash from routine maintenance along the ROW	Negligible adverse	- Thorough monitoring of ROW vegetation and periodic clearings. - Remove blowdown and other high-hazard fuel accumulations. - Timely vegetation thining and slashing - Proper disposal of maintenance slash by trucks - Planting and managing fire resistant species (e.g. hardwoods) within the ROW - Establishing a network of fuel breaks of less flammable materials or cleared strips of land to slow progress of fires	GSE and/or maintenance contractor	

No	Activities or Aspects	Potential Impacts/Issues of concern	Significance of Impact[2]	Mitigation /Enhancement Measures or Best Management Practice	Responsibility	Further Information
		Soil contamination along the route with herbicides. Vegetation control techniques that use herbicides can introduce environmental contaminants into the soil and adjacent habitats.	Negligible to Minor adverse	- Control vegetation using manual techniques which do not require the use of herbicides.	GSE and/or maintenance contractor	ESIA Sections 7 and 8
		Impacts on surface water quality due to increased soil erosion rates and sediment loads into the streams.	Minor adverse	- Avoid excessive vegetation clearings (trees and shrubs) around the power transmission lines. This is especially true for the towers located on the floodplains, stream terraces and hill slopes.	GSE and/or maintenance contractor	ESIA Sections 7 and 8
		Impact on flora	Minor to major adverse	- Implement mitigation required by Flora Conservation Plan.		
		Impact on wildlife and habitat	Minor to Major adverse	- Scheduling ROW maintenance activities to avoid breeding and nesting seasons for any critically endangered or protected wildlife species. - Implement mitigation required by Fauna Conservation Plan.		ESIA Sections 7 and 8
		Avian collisions and electrocutions	Negligible to Minor adverse	- Maintain spacing between energized components and grounded hardware or, where spacing is not feasible, cover energized parts and hardware.	GSE and/or maintenance contractor	ESIA Sections 7 and 8

No	Activities or Aspects	Potential Impacts/Issues of concern	Significance of Impact[2]	Mitigation /Enhancement Measures or Best Management Practice	Responsibility	Further Information
				- Mark overhead lines with bird deflectors/diverters to reduce collision risk		
4.2	**- Occupational and public Health and Safety for transmission line operation and maintenance activities**					
	Occupational and public Health and Safety for transmission line and ROW operation and maintenance activities	Health and Safety issues for maintenance workers and local residents include: - EMF - Live power lines - Working at heights on poles and structures - Risks of electrocution - Electromagnetic interference - Exposure to chemicals and PCBs	NA	- Measure EMF levels in all buildings within 100 meters of the line. - Allow only trained and certified workers to install, maintain or repair electrical equipment. Allow only trained workers to work at heights - Ensure that live-wire work is conducted by trained personnel with strict adherence to specific safety and insulation standards.	GSE and/or maintenance contractor, Technical Consultant and a certified monitoring agency	ESIA Sections 7 and 8
				- To prevent hazards of electrocution, use signs, barriers (locks, doors, gates, steel posts surrounding transmission towers) at all towers. - To prevent shocks, ground conducting objects (e.g. metal fences and other metal structures) installed near power lines.	GSE and/or maintenance contractor, Technical Consultant and a certified monitoring agency	

Table 9.2.2. Environmental and Social Monitoring Program for 220kV Akhaltsikhe-Batumi OHL Project

Environmental and Social Monitoring Program for 220kV Akhaltsikhe-Batumi OHL Project **Construction Phase (Responsibility of Construction contractor)**						
Receptor/ Media	**Project phase**	**Parameters/Activities**	**Standard**	**Location**	**Frequency**	**Duration and deliverables**
Ambient air quality	Construction	Opacity (visibility through dust) Excessive emissions from improperly maintained machinery	Minimum impairment of visibility for >1 minute Best practices	Construction and vehicle operation locations	Daily	Supervision reports. Daily
Ambient air quality	Construction	Watering of Access roads used	As required to meet the opacity requirements Best practices	Construction and vehicle operation locations, unpaved roads located within settlements	Daily	Supervision reports. Daily
Ambient noise	Construction	Noise levels (subjective)	Audibly loud noises	Vehicle and equipment operation locations. Access roads through the settlements used by construction machinery	Daily	Supervision reports. monthly
Groundwater and surface water resources	Construction	pH, BOD_5, TSS, TDS TPH	Georgia Standards and Best practices Georgian national surface and drinking water quality standards	At construction base camps Downstream from river crossings Any other natural waters used as potable water (none known at this time)	Monthly After any chemical, oil and hazardous materials spills	1 sample per location, report to GSE
Soil quality and erosion	Pre-construction	Assessment of soil disturbance and erosion.	Best practices	Along all access roads and ROW At construction base camp	Once before construction at each area	Photographic and narrative record at each location.

Environmental and Social Monitoring Program for 220kV Akhaltsikhe-Batumi OHL Project **Construction Phase (Responsibility of Construction contractor)**						
Receptor/ Media	**Project phase**	**Parameters/Activities**	**Standard**	**Location**	**Frequency**	**Duration and deliverables**
	Construction	Assessment of erosion rate and slope stability in hilly areas.		All areas disturbed by construction equipment and workers All access and auxiliary roads	Continuous during construction,	Checklist observation Photographic and narrative record at each location where the change is noticeable
Landslides	Construction	Earth movement, excavation or blasting for tower foundations.	Best practices	200-500 m within all blasting locations and nearest steep rocky surface	Before and after every blasting sessions, if any.	Records of seismic conditions
Birds	Pre-construction	Evidence of nesting by raptors, other large birds, or sensitive species within 0.5 km of corridor. Includes active and old nests	International best practices	Along the access roads and the line with special attention to places of high sensitivity.	Once before construction start on each section	Birds breeding survey results, report to liaison officer
Flora	prior to construction start at each location	Protected or endemic species and habitat - assessment for relocation or other action needs.	Best practices	Along entire line, with special attention to ESIA-identified sensitive areas	At each particular site, before the clearance activity start.	Flora conservation plan for each section. Performed activity monitoring report to verify success. Summary to lenders in accordance to lender's requests.
Forest Habitats	Construction	RoW clearance and works in forested areas	Tree felling license conditions. Best practices	Along OHL sections in forested areas	Daily during construction works, section by section	Daily supervision reports. Monitoring report after construction and completion of mitigation to verify success. Summary to lenders

Environmental and Social Monitoring Program for 220kV Akhaltsikhe-Batumi OHL Project **Construction Phase (Responsibility of Construction contractor)**						
Receptor/ Media	**Project phase**	**Parameters/Activities**	**Standard**	**Location**	**Frequency**	**Duration and deliverables**
Alpine Meadows Habitats	Construction	Minimize tracking over steep alpine terrains during the RoW clearance, transportation of materials. Assessment of soil disturbance and erosion. Clear demarcation of RoW	Best practices	Along OHL sections in alpine areas	Daily during construction works	Daily supervision reports Monitoring report after construction in each section and completion of mitigation to verify success
Fauna	Pre-construction	Protected species and habitat	Best practices, EMP, Contractor's Biodiversity Management Plan	Sensitive areas identified in ESIA	Once before construction, Once more at specific location if construction to take place during breeding season (spring/early summer)	Report results of survey, mitigation measures needed. Monitoring report after construction and completion of mitigation to verify success.

Environmental and Social Monitoring Program for 220kV Akhaltsikhe-Batumi OHL Project **Construction Phase (Responsibility of Construction contractor)**						
Receptor/ Media	**Project phase**	**Parameters/Activities**	**Standard**	**Location**	**Frequency**	**Duration and deliverables**
Occupational and Public Health and Safety	Construction	Noise, fire safety, hazardous materials, waste management. Workplace inspections for presence and use of PPE, noise, fire safety, hazardous materials registrar, solid and sanitary waste registrar, traffic safety, blasting, etc. Records of safety training.	Georgia and GSE occupational and community HS standards, Best practices	At tower sites, construction base camp, temporary camps, residential areas in close proximity to construction/ transportation sites	Monthly	Designated safety officers (not part of work crews) report to GSE as Project Execution Agency.
Community involvement/public consultation	Prior to construction start	Foreman training on local issues (including for minority communities) Staff training on same Briefings/notifications of community leaders of activities	WB and IFC Requirements	All work locations	Before every mobilization	Throughout construction period, report to lenders
	Construction	Foreman training sessions Safety training sessions Consultations/briefings of local communities. Accidents and safety incidents Complaints by citizens or stakeholders	WB and IFC Requirements	All work locations	Training: As workers begin jobs and refresher training thereafter Safety reports annually Complaints: monthly	Throughout project life, reports to Ministry of Energy and lenders

Environmental and Social Monitoring Program for 220kV Akhaltsikhe-Batumi OHL Project **Operation Phase (Responsibility of GSE)**						
Receptor/Media	*Project phase*	*Parameters/Activities*	*Standard*	*Location*	*Frequency*	*Duration and deliverables*
Soil quality and erosion	Operation	Assessment of soil disturbance and erosion. Assessment of erosion rate and slope stability in hilly areas.	Best practices	All access roads and in areas with high potential for erosion	Every maintenance visit	Checklist observation Annual photographic record
Birds	Operation	Bird injury/mortality.	Best practices	Along the power line route	1. Survey of Batumi bottleneck section sections once during each migration season. 2. Annual survey for large bird mortality due to electrocution	Throughout project life: annual bird survey report, report to liaison report, summary to lenders
Flora	Operation	All locations	Flora conservation plan	Entire RoW with maximum attention to areas where mitigation was implemented	Annually and every visit to location for maintenance	Annual Environmental monitoring report Standard maintenance report
Forest Habitats	Operation	Vegetation control during maintenance, fire protection measures	Best practices	Along OHL sections in forested areas	Routine maintenance visits/walkovers	Standard Maintenance report
Alpine Meadows Habitats	Operation	Minimize tracking over steep alpine terrains during the RoW clearance, transpor-tation of materials. Assessment of soil disturbance and erosion.	Best practices	Along OHL sections in alpine areas	Routine maintenance visits/walkovers	Standard Maintenance report

Environmental and Social Monitoring Program for 220kV Akhaltsikhe-Batumi OHL Project **Operation Phase (Responsibility of GSE)**						
Receptor/Media	*Project phase*	*Parameters/Activities*	*Standard*	*Location*	*Frequency*	*Duration and deliverables*
Fauna	Operation	Monitor residual impacts after construction and design mitigation to repair any damages	Best practices. EMP	Along the route and in sensitive areas identified in ESIA	As specified in EMP	Implement measures specified in EMP. Note the wide range of mitigation measures specified in ESIA.
Fauna	Operation	Presence of protected species, injured or dead animals	Best practices	Each area visited	During routine maintenance activities/inspection s	Standard maintenance report
Occupational and Public Health and Safety	Operation	Vehicle safety, PPE, training records	Georgia and GSE occupational and community HS standards, Best practices	Staging area for line inspectors	Weekly by inspection supervisor and inspector	Reports compiled for annual summaries to Ministry of Energy
		Presence of fences, warning signs and placards	Best practices Georgia standards	All towers	At every inspection or visit	Monthly reports on status of signs and actions
		EMF	International and Georgia standards (most stringent)	All buildings within 100 meters of line and other buildings as requested by owner/resident	Every two years, or as requested	Annual report on monitoring and results to Ministry of Energy and lenders
Community involvement/public consultation	Operation	Consultations/briefings of local communities. Accidents	WB and IFC Requirements	Along entire line	Safety reports annually Complaints: monthly	

10. ESIA public disclosure

The activities performed in the field of public information and public consultations were accomplished in accordance to the Stakeholder engagement plan prepared at initial stage of the Environmental and social impact assessment study for 220 KV Akhaltsikhe - Batumi Overhead Transmission line project. The information regarding stakeholder ingagement is described in the present report and the SEP as alone standing document is attached in Volume 2 – Annex 5.

The first round of Public consultations dedicated to the Environmental and Social impact assessment of 220KV Akhaltsikhe Batumi Overhead Transmission line project was undertaken in July 2013 in all 6 municipalities crossed by the project corridor. The municipality representative have been informed regarding the meetings planned with request to inform local population and all interested parties. The attendees have been informed regarding the planned project, it's role and need for the local development, potential environmental and social impacts. The alternative routes of project corridor were also presented and discussed with municipality representatives. The minutes of meetings have been created at the end of each consultation round and documents were signed by the municipality representatives and consultants. The special attention was given to the issues, which from the point of municipality representatives were important and ESIA group had to consider during environmental and social impact assessment process. The municipality representatives were provided with copies of project brochures, potential corridor maps inclusive alternative routes and other relevant information.

The informal consultation meetings have been held in each village crossed by the proposed OHL line during August – September 2013. The representative of ESIA consultant's social and public information groups have been participating in the meetings with local population. The information regarding proposed OHL corridor, potential impacts on population and environment, general issues regarding approaches to be used during the resettlement etc. have been discussed.

The second round of public consultations was held during the scoping process. The meetings were organized in September 2013. The invitations for participation in the meetings were published in newspaper. Additionally the information was distributed through Caucasus Environmental NGO network (CENN) mailing list. Also advertisements were published on the web sites of Georgian state Electrosystem and Adjaristskali Georgia web sites. The Batumi Meeting announcement was also placed on the web site of Civic Information center of Batumi. The representatives of Municipalities were informed regarding the meetings in advance and have been asked to support in dissemination of information with all interested parties.

The detailed information regarding the meetings itself and issues discussed during the meetings have been included in minutes of meetings. The copies of mentioned documents are provided in annex 7 (volume 2). The issues raised by the meeting attendees were considered during the preparation of ESIA report and included in present version of the report.

The final round of public consultation meeting on draft version of ESIA and RPF documents prepared for 220KV Akhaltsikhe Batumi Overhead Transmission line project was held in Tbilisi and Batumi on 20^{th} and 24^{th} March 2014 (respectively). The information regarding planned meetings were published in the newspaper, was distributed through the Caucasus Environmental NGO network (CENN) mailing list. Also advertisements were published on the web sites of Georgian state Electrosystem and Adjaristskali Georgia web sites. Information regarding Batumi Meeting was also placed on the web site of Civic information center of Batumi. The individuals and organizations actively involved in previous stages of consultation were additionally invited in order to ensure, that they have received information on meetings.

The special posters and advertisements have been placed around the venue location in order to simplify access of attendees. The information regarding meetings were placed on the posters.

The advertisements were published using following communication means:

- The advertisement in newspaper '24 Hours' was published by GSE in advance of meetings;
- The information was published on the web sites of Georgian State Elecrosystem;
- The information was distributed in each municipality affected by the project and was distributed to each settlement under direct impact of the project..

- The invitations for participation in public information meeting was distributed through mailing list of Caucasus Environmental NGO network (CENN)
- The e-mails with invitations were sent to the organizations and individual actively involved in previous public information meetings;
- The information regarding Batumi meeting was placed on the web site of Civic information center of Batumi.

The interested parties including representatives of specialized environmental and human rights NGOs have participated in the mentioned meetings. The representative of media have also participated. The meeting was recorded on Video. The detailed information regarding meetings, the issues and topics discussed are included in the meeting minutes attached to the present report (see Volume 2 Annex 7).

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