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High Voltage Electric Networks

Caucasus Energy Network Project

Environmental and Social Impact Assessment

Final Version
Deliverable 04

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Acronyms and Abbreviations

BtB	Back-to-Back
CC	Construction Contractor
CCGT	Combined Cycle Gas Turbine Power Plant
CE	Consultant Engineer
CJSC	Closed Joint Stock Company
dB	Decibel
DNP	Dilijan National Park
EHS	Environmental, Health, and Safety
EHV	Extra High Voltage
EIA	Environmental Impact Assessment
EMF	Electric and Magnetic Fields
EPSO	Electro Power System Operator, Armenia
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
GDP	Gross Domestic Product
GPS	Global Positioning System
GRM	Grievance Redress Mechanism
GTPP	Gas Turbine Power Plant
HPP	Hydro Power Plant
HSEMS	Health, Safety, and Environment Management System
HSMP	Health and Safety Management Plan
HSMS	Health and Safety Management System
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
HVEN	High Voltage Electric Networks, Armenia
ICNIRP	International Commission on Non-Ionizing Radiation Protection
IFC	International Finance Corporation
kV	Kilo Volts
MW	Mega Watts
NGO	Non-Governmental Organization
NP	National Park
OPGW	Optical Fiber Ground Wire
OHL	Overhead Transmission Line
PAP	Project Affected People
PIC	Project Implementation Consultant
PPE	Personal Protective Equipment
RA	Republic of Armenia
RAP	Resettlement Action Plan
ROW	Right of Way
RPF	Resettlement Policy Framework
RTEP	Regional Power Transmission Extension Plan
SNCO	State Non-Commercial Organization
s/s	Substation
ToRs	Terms of Reference
TPP	Thermal Power Plant
USD	US Dollar

1. Executive Summary

1.1 Project Description

The Caucasus Energy Network Project aims to provide a reliable, flexible and mutually profitable cross-border energy exchange within the South Caucasus by connecting the Armenian and the Georgian power grid via 500/400/220 kV High Voltage Direct Current BtB Converter Station (HVDC BtB) in Ayrum and therefore will represent a regional integration of energy systems among Georgia, Iran, and Russia.

The connection from the Georgian side will be effected via a 500 kV OHL from the new substation Marneuli, the connection from the Armenian side via a 400 kV OHL from new substation Ddmashen.

The Project includes construction of new 500/ 400/ 220 kV BtB s/s Ayrum and new 400/ 220 kV s/s Ddmashen as well as connection of s/s Ayrum to the already existing 220 kV OHL Alaverdi-2 - Gardabani (Georgia) and connections of s/s Ddmashen to already existing 220 kV OHLs Marash and Noraduz and to 330 kV OHL Artarbekyan.

For replacement of 220 kV Lori OHL and 110 kV OHLs Tumanyan-1 and -2 *Fichtner* prepared an ESIA Study and a Resettlement Policy Framework (RPF) in 2014. The ESIA and RPF were conducted under the given pre-condition that most of the existing towers of the lines could remain. In order to keep environmental and social impacts of rehabilitation of these lines as low as possible, the corridor of the existing lines will be used under consideration of the bypasses already proposed in the ESIA for Lori and Tumanyan-1 and -2 OHLs. Rehabilitation of these lines will be implemented after construction and commissioning of BtB s/s Ayrum and 400 kV OHL Ayrum - Ddmashen, as Lori line can then be disconnected, dismantled and reconstructed in the already existing line corridor under consideration and extension of ESIA and RPF reports prepared by Fichtner in 2014. These studies will be amended based on the current conditions.

As the final location of planned Hyusisayin GTPP and the relating line routing of connection line to 400 kV OHL Ayrum - Ddmashen is still not known, the environmental and social impacts of this connection line cannot be evaluated at this time. However, the implementation of a double circuit line with only one circuit installed (at this stage) is foreseen in the project.

1.2 Objectives and Methodology of the ESIA

The Caucasus Energy Network Project includes construction of new OHLs and substations which will have several impacts on various environmental and social components. The main objectives of the ESIA were to identify and assess magnitude of these expected impacts and to provide measures for their mitigation commensurate with the national and international standards. The ESIA report provides useful information to HVEN on how the high voltage power lines and the substations should be designed and planned, to avoid or mitigate negative impacts and to better capture anticipated environmental and social benefits.

After public disclosure of the draft ESIA report, stakeholder consultation will be carried out to seek feedback and hear concerns of people affected by the planned works.

For carrying out present ESIA, *Fichtner* set up the following multi-disciplinary team:

- International Senior ESIA Expert
- International Senior Environmental and Ecological Expert
- International Socio-Economic Expert
- International Biodiversity Expert
- National Environmental and Legal Experts.

General overview about biophysical settings has been done as desktop study, and field surveys were conducted by the environmental, biodiversity and social experts in December 2015, February and April 2016, visiting the substation sites and the proposed corridors of the lines including some potential hotspots like Dilijan National Park, Margahovit State Sanctuary, Caucasian Rose-Bay Sanctuary, Teghut Mining Site of Vallex Company (Teghout CJSC), the crossing of valleys, forested areas and villages affected by the new line corridors.

Additional information was gained by consultations of representatives of governmental organizations and non-governmental organizations (NGOs). Intensive consultations have also been conducted with members of the Historical and Cultural Monument Protection Agency of the Ministry of Culture, with members of the Ministry of Nature Protection and the Ministry of Agriculture.

Additionally to the field surveys, an evaluation of possible ecological and social impacts was performed by interpretation of high resolution satellite images (date: 2013-2014).

Fichtner already had prepared a Feasibility Study to the Project (Fichtner 2014), including a preliminary environmental and social impact screening, which was taken as a basis for preparing the ESIA.

However, the line routing proposed in the Feasibility Study is not the one recommended in this ESIA, as it is crossing Dilijan National Park including the strict Nature Reserve Zone (rock walls) at the northern boundary of the National Park.

1.3 Legal and Regulatory Framework

The implementation of any activity in Armenia which may cause environmental impacts needs a positive conclusion of an Environmental Impact Assessment (EIA) expertise. Environmental impacts of a planned physical activity or a sectoral/ regional development plan/ program have to be assessed during the preparation period. The Republic of Armenia (RA) Law on Environmental Assessment and Expertise of 2014 stipulates provisions regarding environmental impact assessment, impacting the environment, and conditions under which causing of such impact is allowed, thus being the most important national law for EIA development.

In the RA Law on Environmental Assessment and Expertise "*Overhead transmission lines of 100 kV and higher voltage*" are listed as an item requiring an EIA process. According to EBRD PR 1, the Project falls into environmental **Category A**, thus requiring an ESIA, while according to KfW Development Bank (2014) the Project falls in Category B. According to the national legislation of Armenia, an EIA is also required. Therefore, ESIA was performed despite the fact that the national authorities are yet to review the Project design documents and take formal decision on subjecting this Project to the EIA procedure.

Armenia has ratified a number of international agreements and conventions relating to the protection of the environment and biodiversity. In addition, an important, environmentally relevant international agreement to which Armenia is a signatory is the Aarhus Convention on access to information, public participation in decision-making and access to justice in environmental matters.

With respect to handling of hazardous substances, the Government of the Republic of Armenia ratified the Stockholm Convention and is a party of the Basel Convention.

The KfW Sustainability Guideline (KfW Development Bank 2014) defines that ESIA shall be conducted in line with national laws and regulations as well as in line with international environmental and social safeguard standards (including EU EIA Directive). EBRD Environmental and Social Performance Requirements are the recommended standards for this Project. ESMP shall apply to relevant EU standards, IFC/World Bank EHS guidelines, and IFC Performance Standard for labor and working conditions (IFC PS 2) as per Human Rights Guideline of the German Federal Ministry for Economic Cooperation and Development.

In case of involuntary resettlement, in addition to national legislation and EBRD standards the UN Basic Principles and Guidelines on Development Based Evictions and Displacement shall be applied.

1.4 Analysis of Alignment Options

Five Project Options for 400 kV OHL Ayrum - Ddmashen have been considered with regard to the impacts and challenges crossing or bypassing Dilijan National Park.

Option 1 - OHL Routing according to Feasibility Study
The initial routing as given in the Feasibility Study (Fichtner 2014) leads from s/s Ddmashen in northern direction to the border of Dilijan National Park (DNP), crossing a road west of village Semyonovka. The highest point before descending down into Dilijan valley is 2,500 m a.s.l. The proposed line traverses a forest area of Dilijan NP near Lake Parz and near the territory of Red Deer Introduction zone, traverses Aghstev River valley between villages Teghut (Tavush) and Haghartsin (1,000 m a.s.l.), passes a land-slide zone above Haghartsin and the strict Nature Reserve Zone (rock walls) at the northern boundary of DNP (highest point 2,500 m a.s.l.). In this part the line routing also crosses the Important Bird and Biodiversity Area (IBA) Haghartsin.

From there the routing leads across high alpine meadows and isolated forest patches towards Teghut (Lori), traverses a significant forest area on the eastern border of Teghut Mining territory and passes on small peaks on the eastern side of Teghut/ Shnogh valley.

The Option 1 line contours village Shnogh on its eastern side and crosses agricultural fields (private lands) of Archis village before crossing Debed River towards Chochkan and s/s Ayrum.

This option is not recommended, as it crosses Dilijan National Park and the strict Nature Reserve Zone at the northern boundary of the National Park.

Option 2 - Along 330 kV OHL Corridor through Dilijan National Park
The line routing would lead along the present corridor of the existing 330 kV OHL Artarbekyan (operated as 110 kV) from s/s Ddmashen to the border of Dilijan NP. The 330 kV line leads through the territory of DNP, first along a ridge (mountain meadows) above village Gosh and then leads through dense forest (3.5 km) along several small outcrops into Aghstev valley where the line turns east towards Dilijan passing village Hovk.

If the 330 kV line was dismantled and newly constructed as a combined line 110 kV to Ijevan and 400 kV OHL until Hovk, the present line routing corridor could be maintained without significant new deforestation.

In contrast, a new corridor in approx. 50 m distance from the old line would cause significant new damages, but limited additional visual impact in the National Park territory. High maintenance costs for forest pruning and access road maintenance (partly new construction will be necessary) were noted by HVEN engineers. After leaving DNP territory the line would still follow the 330 kV corridor to the village of Hovk, where the 400 kV line would turn north and lead up the mountain, passing a fishpond, a few houses and then lead through open forest land and along a water supply pipeline to reach a prominent rock-face which it would contour at its base (east).

The rock wall and the forest patches situated at its base are assessed to be a sensitive habitat for mammals, birds (raptors, ravens) etc. The area is yet visually undisturbed by transmission lines and presents a recreation opportunity and high touristic value for the Dilijan National Park.

This option is not recommended as existing access roads in Dilijan National Park will have to be cleared of trees grown up in the last years. Thus, substantial clearing of forest in the corridor would be necessary. Additionally, Option 2 has considerable impacts in the area above village Hovk (visual and environmental), which are not within the park boundaries but in adjacent territory.

Option 3 - Through Gosh - valley (east of Dilijan NP)
Further a variant of Option 2, which nearly totally avoids crossing of Dilijan NP, has been explored. This variant consists in deviating from the corridor of the 330 kV line before reaching the boundary of DNP and passing via Gosh village and Gosh valley to reach the 330 kV corridor and Option 2 at village Hovk.

This variant leads through forests and meadows above village Gosh (in visible distance), before leading through steep rocky terrain above Gosh valley towards Aghstev valley. Construction of this variant would touch sensitive habitats (despite being outside the NP) and make construction of access roads or frequent use of helicopter necessary.

Option 3 avoids Dilijan NP nearly completely, but is not recommendable due to the difficulty/ inaccessibility of the terrain and disturbance of natural habitats, cutting of forest and visibility from the village in the valley of Gosh with monastery Goshavank as a major tourist attraction.

Option 4 - Along 220 kV OHL Gugark-1
Option 4 leaves s/s Ddmashen in north-western direction to join the existing 220 kV OHL Gugark-1 corridor (leading to Vanadzor) and runs then parallel to it. The line traverses the Pambak and Tsakhkunjats mountain range above Margahovit (south of the village), with its highest point at 2,750 m a.s.l. where it crosses IBA Pambak Mountain Chain. Then it descends towards Margahovit passing Caucasian Rose-Bay Sanctuary and Margahovit State Sanctuary on a steep slope for a few hundred meters (over-spanning of forest should be considered).

Then, the line passes on agricultural lands between the villages Fioletovo (Molokan community) and Margahovit (Armenian community) at 1,700 m a.s.l. and leads up the hill on the eastern side of a mixed conifer plantation of Armenian Tree Project (ATP). Then, the line leads above the tree limit through mountain meadows crossing IBA Dsegh in northeastern direction. In this area the line reaches a second high point (2,600 m a.s.l.) and two valleys will be over-spanned which are approx. 600 and 800 m wide.

Then the line runs north on mountain meadows above the forested areas and the villages Aghnidzor and Atan. The line crosses the forest southwest of Teghut (Lori) at its minimal extension (approx. 1 km) (over-spanning of forest shall be considered in this area) and then runs on the western side of Teghut Mining Site of Vallex Company (Teghout CJSC) territory below the forest. In this area the final line routing of 400 kV OHL has to be closely coordinated with Teghout CJSC. North of the mining site the line runs parallel to the newly constructed 110 kV OHL "Teghut Mining" and then crosses Debed River valley (approx. 600 m wide) south of Mets Ayrum.

On the northern side of Debed River valley the line runs across agricultural used lands, mainly parallel to the already existing 110 kV Noyemberyan and 220 kV Alaverdi-Georgia OHLs over-spanning another gorge (approx. 500 m wide) southeast of Mets Ayrum and finally leads to s/s Ayrum. Due to the already existing OHLs, final routing has to consider the minimal required distances to these high voltage lines in this area.

Option 4a - Variant of Option 4
Additionally, a variant to Option 4 was considered, which deviates from the Gugark-1 OHL before reaching the highest point at 2,750 m a.s.l. and which would avoid crossing the Caucasian Rose-Bay Sanctuary and also minimize the forest area crossed in Margahovit State Sanctuary (< 1 km). This routing crosses the valley east of Fioletovo village and joins Option 4 north of the valley.

This is the **preferred option** from an environmental and social perspective and also from environmental NGOs like WWF, Armenian Tree Project (ATP) and Armenian Society for the Protection of Birds (ATPB).

Option 5 – Along Debed River Valley
Leaving s/s Ddmashen this option first follows the same corridor as Option 4/ 4a, however crosses Margahovit State Sanctuary and the valley of Fioletovo a little bit further east in order to avoid the high peak (2,750 m a.s.l.) south of the State Sanctuary. North of Fioletovo Option 5 separates from Option 4/ 4a, running northwest above the forested areas in the north of Fioletovo and Margahovit (including a plantation of ATP which has to be avoided).

In order to avoid crossing the forested areas east of Gugark, Pambak and Vahagnadzor villages, the line routing turns to northern direction between Margahovit and Lermontov, crossing mountain meadows (highest point in this part 2,570 m a.s.l.) until Yeghegnut village. Passing the villages of Yeghegnut, Debet, Chkalov and Dsegh line routing has to avoid crossing of buildings in order to avoid physical relocation of households to the greatest extent possible. Between Debet and Chkalov villages the line routing over-spans a gorge (approx. 1,000 m wide span) and leads over agricultural land to Dsegh village. This gorge is a sensitive area for breeding birds (especially vultures and other birds of prey). In this section Option 5 leads for approx. 23 km through IBA Dsegh, established for the protection of threatened bird species like e.g. vultures (also breeding at the gorge of Debed River) and other birds of prey, as well as endangered Caucasian Grouse (inhabiting the upper tree line with dense rhododendron thickets and adjacent mountain meadows).

North of village Dsegh the valley of Marts River is over-spanned (approx. 1,000 m wide span). The line routing then runs north, passing above Tumanjan village. For the next 10 km the line runs through steep rocky hills with many forested valleys. In order to avoid cutting of trees as much as possible wide-span towers should be put on hilltops to over-span forested areas in the valleys. However, in this part no access roads do exist to reach the hilltops. Tower construction would require new access roads (leading through forested areas, causing further tree cutting) or use of helicopter. A routing on the western side of Debed River valley is not possible due to already existing OHLs (e.g. 220 kV Lori line) and villages (e.g. Odzun).

Turning east (south of Akori village) the line passes the villages Sarahart, Sanahin, and Akner in the south over-spanning another six deep forested valleys, with spans up to 1,000 m. Haghpat village has to be passed in the south and east crossing areas with bushes or forest, as in the west and north of the village a number of other OHLs do already exist (e.g. 220 kV Alaverdi-Georgia, 110 kV Noyemberyan/Lalvar, and 35 kV OHL).

Line routing east of Haghpat until the crossing of Debed River valley south of Pokr Ayrum, again leads through rugged terrain, where wide-span towers have to be put on hilltops, in order to over-span forested areas in the valleys. Due to the existence of the above mentioned OHLs the 400 kV line has to be constructed in a safe distance of these lines, requiring new access roads leading through forested areas. After crossing Debed River valley the line leads over agricultural used land to s/s Ayrum, over-spanning another gorge south of Mets Ayrum (same corridor as Option 4/ 4a).

Main critical issue is the crossing of many forested areas. Even, if wide-span towers are put on hilltops to over-span forested valleys, new access roads leading through forested areas are needed to reach hilltops, or use of helicopters will be required. Sensitive habitats are crossed in IBA Dsegh and when crossing gorges (e.g. near Debet and Dsegh).

No Project Alternative
The "No Project" alternative describes the situation without implementation of the Project. This would avoid all environmental and social impacts of the Project but it would have negative implications on the security of power supply in Armenia and negative consequences on the regional power grid development; including economic opportunities resulting from power export to and transfer between Iran/ Georgia/ Russia and vice versa. Energy security in view of the future of Armenia's Nuclear Power plant is cited as another reason.

1.5 Baseline Conditions

The site for new **s/s Ddmashen** is located at approx. 1,890 m a.s.l. in an agricultural used landscape west of Gagarin village in Kotayk Marz, while the site for new **BtB s/s Ayrum** is located at approx. 585 m a.s.l. in an undulating agricultural used landscape northeast of Chochkan village and west of Haghtanak in Tavush Marz close to the Georgian border.

Proposed line routing for **500 kV OHL** from BtB s/s Ayrum to the border of Georgia (length approx. 8 km) is located in Tavush Marz. Leaving s/s Ayrum to the northeast the line crosses Debed River valley and then runs north to the Georgian border mainly over agricultural used land.

For the line routing of **400 kV OHL** from BtB s/s Ayrum to s/s Ddmashen different options have been studied (see Section 1.4). In order to avoid crossing of Dilijan National Park Option 4a, which bypass Dilijan NP in the west has been agreed with HVEN and KfW to be further developed. Routing of these options is located mainly in Lori Marz and in parts in Kotayk and Tavush Marzes.

While Ayrum (Tavush Marz) and Shnogh (Lori Marz) have a warm and temperate **climate**, the climate in Alaverdi and Vanadzor (Lori Marz), Dilijan (Tavush Marz), Ddmashen (Gegharkunik Marz), and Hrazdan (Kotayk Marz) is cold and temperate. Average yearly precipitation varies between 450 mm in Ayrum and 539 mm in Dilijan.

Armenia is a part of the Transcaucasus great arched fold and medium-Araxian intermountain lowering. These two **geological structural units** are included in the Caucasus-Anatolia-Iranian segment of the Mediterranean plicate zone. Given the time of establishment of geological structural units and accomplishment age of plicate formation the territory of Armenia is divided into the Somkheti-Ghapan complex, Bazum-Zangezur and trans-Araksian zones. The study area is located in the first two complexes.

Armenia is located in a seismically active zone stretching from Turkey to the Arabian Sea. Maximum **seismic risk** is given around the city of Yerevan and in a zone from Gyumri to Vanadzor and the northern part of Lake Sevan, where active faults exist.

Substation Ddmashen and its connection lines will be constructed in this area, as well as the southern part of the 400 kV OHL.

Mainly mountainous forest **soils** with a number of their subtypes are common in the investigation area. Bioclimatic features of brown mountainous forest soils formation promote good growth of forest plants communities and formation of phytomass. In the southern part of the investigation area also soils of mountain steppes and mountain meadows can be found in the mountainous areas around Dilijan National Park.

The Republic of Armenia is covered with a dense net of **rivers** with a mixed feeding - melting, groundwater, and rain. Their flow changes considerably within a year. During summer-time and fall, when water demand is approaching its maximum, the annual water share amounts to 20-25 %, in winter-time to 10-12 % of the total flow, whereas in spring-time is 55-70 %. The proposed line OHL routings cross several smaller and bigger rivers; the most important are Debed and Aghstev Rivers. Smaller rivers which will be crossed by 400 kV OHL are Shnogh, Voskepar, Marts, Aghbugha, Khachaghbyur, and Dzknaget Rivers.

Armenia is remarkable for the diversity of its **flora and fauna** both in the South Caucasus and the Caucasus region in general. The investigation area falls mainly within the Forest Landscape Zones as well as Mountain Meadow Steppes and the High Mountain Subalpine Zone, when crossing the Pambak Mountain Chain and bypassing Dilijan National Park. The Project area is located in the Ijevan Floristic Region in the Caucasian Region. Forests generally cover the mid-zone of mountains, occurring at altitudes between 500 m and 2,100 m in the north. Forests in the study area include a number of evergreen and deciduous trees. Marshlands and forests teem with wildflowers. Detailed literature data about animal and plant species occurring in the study area do not exist except for Dilijan National Park. The park has a rich and various flora and includes 1 % of the territory of Armenia.

In order to lower the risk of birds' collision with conductors or the ground wire, the installation of clearly visible high contrast (i.e. black and white) moving bird flight diverters at the ground wires, respecting a distance of 20 to 25 m between each other, is recommended, where the line is crossing gorges and valleys and in the high-risk areas for migrating raptors, identified by AUA. Installation of bird diverters at the lowest conductor is recommended in areas, where the 400 kV OHL will cross subalpine and alpine meadows near to upper forest edge, especially at IBA Pambak Mountain Chain and IBA Dsegh.

Some **protected areas** will be affected by the new line corridor. Dilijan National Park would be crossed by Options 1 and 2 and in small parts by Option 3 (see Section 1.4). RA Ministry of Nature Protection (Dilijan National Park SNCO) is the sole public agency having authority for national park management.

Option 4 crosses Margahovit State Sanctuary and Caucasian Rose-Bay Sanctuary. Crossing of the latter can be avoided by implementing Option 4a or Option 5. As per national regulation, the construction of overhead transmission lines may be allowed in an Armenian State Sanctuary if the stability of ecosystems of the Sanctuary is not disturbed. The State Sanctuaries are under responsibility of Ministry of Agriculture (Hayantar SNCO).

Other **sensitive areas** which will be crossed by 400 kV line routing are IBA Pambak Mountain Chain and IBA Dsegh (Options 4, 4a and 5) and IBA Haghartsin (Option 1). Bird diverters shall be installed at the earth wires especially at IBA Pambak Mountain Chain and IBA Dsegh and where the line crosses gorges and large valleys.

At present, an effective **waste management** system does not exist in Armenia. Most of the solid waste is just dumped in provisional dump sites and landfills without any segregation. Contractor will clarify with local authorities how to enter into agreement with communal service providers for the disposal of generated wastes.

Most parts of the lines will be located in Lori Marz and Tavush Marz. Lori Marz has a **population** of 228,000 people for a territory of 3,799 km² and a population density of 61 persons per km². Vanadzor is the capital and largest city of the province. Tavush Marz has a population of 126,700 people and a territory of 2,704 km² with a population density of 47 persons per km². Capital of this province is Ijevan.

The settlement structure is concentric with most of the people living in towns and villages. Large parts of the investigation area are uninhabited and represent a mix of private and community lands. Communities of Archis, Shnogh, Teghut (Lori Marz), Atan, Ahnidzor, Margahovit, Fioletovo, Kakavadzor, Zovaber, and Ddmashen are situated in the vicinity of the proposed 400 kV OHL corridor and Deghdzavan and Haghtanak are near to proposed 500 kV OHL corridor.

Several important churches and monasteries are located in the vicinity of Dilijan: Haghartsin Vank, Goshavank, Matosavank, Jukhtakvank, but only Goshavank would be affected by visual impacts of 400 kV OHL routing (Option 3). By implementing Option 5 the OHL would run near to some cultural sites near village Dsegh and would pass near monasteries Sanahin and Haghpat. One area of recent archaeological excavations was identified along the line routing proposed in the Feasibility Study (Option1) near Teghut village in Lori Marz on the property of Shnogh municipality. The area will be avoided by construction of 400 kV OHL west of Teghut Mining Site. A Chance Find Procedure concerning **historical and cultural sites** will be established.

Within the investigation area, **agriculture** is mainly concentrated in the lower mountain slopes of the villages. Agricultural activities include cattle, sheep, goat and pig farming, as well as growing of short crops (potato, tomatoes, cucumbers and eggplant), cereals (wheat and beans), and fruits (peach, apple, apricot). Agriculture is a main source of income for the poorest segments of Armenian society and a main coping strategy to sustain a livelihood. Thus, expropriation of agricultural land is an issue of potential negative impact for the planned OHLs construction.

According to the statistical data published by the National Statistical Service of the Republic of Armenia, the **poverty level** in Lori, Kotayk and Gegharkunik Marzes is above and in Tavush Marz is below Armenia's average. Especially at Kotayk Marz the poverty level and the level of extremely poor is much higher than the national level.

1.6 Disclosure, Consultation, and Participation

Fichtner's environmental, biodiversity and social specialists, held meetings at Yerevan and at Vanadzor with the representatives of HVEN, Ministry of Agriculture, Ministry of Nature Protection, Ministry of Culture, and conducted field trips to the proposed substation sites and OHL corridors. Discussions on the environmental implications of the Project were held with NGOs WWF Armenia, Armenian Society for the Protection of Birds (ASPB), Ecolur, and Armenian Tree Project (ATP). The Ministry of Culture/ Agency for Security of Historical and Cultural Monuments was consulted on the procedures to protect historical and cultural sites.

The Final Draft version of the ESIA, including the ESMP, was disclosed to the public in English and Armenian versions for ten days to allow stakeholders to familiarize with it. The document was not only posted on HVEN's website, but was also delivered in printed copies to the local administration offices and advertisements in local media about their availability and public consultation meeting were done. Printed copies were also provided to representative civil society organizations.

After disclosure of the documents, public consultation meeting on the ESIA was held on 23 September 2016 at Lori Region Administration in Vanadzor city. The consultation meeting concentrated on interpreting the ESIA report to the PAP and seeking their feedback and concerns, which were involved in the Final ESIA report. The Public Consultation meeting was successfully conducted with a good participation. Most of the affected communities were represented by their community leaders or their representatives. Representatives of NGOs also participated actively in the discussion.

Recommendations from the public consultation meeting were:

- There should be a tender process implemented regarding the recommended additional tree planting by an environmental NGO.

- Change the name of Ayrum substation and call it Chochkan substation, as it is located in Chochkan Community.

1.7 Impact Assessment

Main environmental and social impacts of 400 kV OHL Ayrum - Ddmashen routing following Option 4a and of 500 kV OHL Ayrum - Georgian border comprise the following:

- During construction works, impacts to flora and fauna especially at forested areas are unavoidable, including felling of mature trees within the ROW.
- Existing access roads will be used, as far as possible. At the high mountain plateaus tower locations shall be reached using the line corridor (ROW), if no existing access roads are available. However, especially where the line routing will cross mountainous terrain, some new access tracks may have to be constructed. Construction of new access roads shall be agreed with Ministry of Nature Protection.
- Small amounts of construction waste will be generated.
- land acquisition for placement of towers and construction of new access roads
- No physical relocation of houses/ households will be necessary, if the proposed line corridor will be implemented.
- possible damages to crops and trees during final land survey, construction of access roads, construction of towers, conductor stringing, and ROW maintenance
- Line routing of 400 kV OHL has to be closely coordinated with Teghout CJSC for passing the Teghut Mining Site.

A Resettlement Action Plan (RAP) has to be developed by HVEN. The RAP shall be based on the RPF prepared by Fichtner within the present assignment.

ESIA report shows that the Caucasus Energy Network Project will have low to medium environmental and social impacts if the proposed ESMP is implemented and all proposed mitigation measures are applied, and RAP is developed as prescribed by the RPF. According to the ESIA, negative environmental and social impacts occur mainly during the construction phase.

1.8 Environmental and Social Management Plan

The Caucasus Energy Network Project will have impacts on various environmental and social receptors. The ESMP covers a set of measures that need to be taken in order to prevent/ minimize/ compensate these impacts. Monitoring measures are described to ensure implementation of these mitigation measures.

Present ESMP will be included into the tender documents for hiring of design-construct-install company and will be made an integral part of the contract mandatory for implementation.

The local HSE officer of the PIC will monitor the implementation of mitigation measures by the CC, based on regular inspections and monthly reports of the HSE officer of CC. An external internationally experienced auditor will prepare environmental and social performance reports for KfW, based on quarterly site inspections and the monthly reports of PIC's HSE officer. Implementation of mitigation measures regarding cutting of trees and replanting will be monitored by an internationally experienced forest specialist. Implementation of the RAP will be done by HVEN's Social Specialist and supervised by an external auditor. HVEN will be responsible for monitoring of environmental and social performance during operation and maintenance of the OHLs and substations.

Design Phase

Routing of connection lines from planned substations to existing OHLs will cross mainly agricultural land. Final line routing has to consider avoidance of all buildings and settlements in order to avoid any physical relocation.

400 kV OHL from BtB s/s Ayrum to s/s Ddmashen follows the line routings discussed for Option 4/ 4a. In order to avoid crossing of any buildings and to avoid crossing forest areas to the greatest extent possible bypasses are already considered in the line routing. Final routing near to the Teghut Mining Site has to be closely coordinated by HVEN with representatives of Teghout CJSC.

Line routing of 500 kV OHL from s/s Ayrum to the Georgian border will mainly cross agricultural land. A local quarry and some buildings have to be avoided during the final line routing.

Existing access roads to the substation sites will have to be widened and improved for transport of heavy substation equipment. Already existing access roads/ tracks will be used, as far as possible for construction of the OHLs. However, especially where the line routing will cross mountainous terrain, new access tracks will have to be constructed. On the high mountain plateaus tower locations shall be reached using the line corridor (ROW), if no existing access roads are available.

It is recommended to establish a Biodiversity Action Plan (BAP) before construction works start, in order to ensure appropriate management in the project context of IBA territories and other sensitive habitats (e.g. mountain meadows).

Construction Phase

Impacts on flora and fauna will be minimized by preventing removal of trees for clearing areas for workers' camps, strict prohibition of hunting and plant-collecting, and rehabilitation of damaged areas. Most areas along the line route have existing access tracks or roads. However, some new tracks will have to be constructed. Felling of mature trees will also be necessary within the ROW (e.g. in forested areas near Teghut (Lori) village). Construction works at forested areas shall be avoided during breeding/ nesting season (March – June). According to national law a compensatory tree planting plan will be developed and implemented by Hayantar SNCO. Indigenous site-specific tree species will be planted on an area at least twice as big as the area where trees have been felled, in the vicinity of the corridor (e.g. in degraded forest areas). Final planting location and tree species will be fixed by forest departments. Plantation maintenance and re-planting of dead seedlings will be done by Hayantar SNCO for a period of 7 years. Wide-span towers shall be located on hilltops to over-span forested slopes and valleys, thus reducing the cutting of trees in ROW to the sites near to towers, where the necessary clearance between trees and power lines has to be kept. Access roads that are not needed anymore after accomplishing construction will be rehabilitated and replanted. Additionally, it is recommended to contract a NGO (e.g. Armenia Tree Project - ATP) in order to plant an area three times as big as the area where trees have been felled and to implement awareness raising activities. Planted areas will be maintained for a period of 4 years to secure the growth of seedlings.

During earth works required for installation of towers, the topsoil will be stripped, stored separately and used for site restoration once the towers are in place. Areas used for workers' camps will be rehabilitated after decommissioning.

Substations will be designed in state-of-the-art technology including bunds around and oil collecting system beneath transformers to prevent contamination of soil and groundwater from any oil leakages.

Pollution of soil and water will be avoided by maintenance and re-fueling of construction equipment on sealed and enclosed areas, provision of spill-control materials, storage of liquid materials in adequate storage areas, provision of proper sanitation facilities, and training of workers.

Construction Contractor will discuss with the local municipalities how to arrange disposal of waste through the communal service providers. Although there are no standard sanitary landfills in the RA, waste disposal through municipal service providers will at least ensure that there is no free dumping or open air burning of waste. Small amounts of hazardous waste like residual oil, fuel, paint or spill contaminated soil will be securely packed, labeled and stored at new Ayrum and Ddmashen substations at roofed, concreted and bunded storing facilities. Final disposal of hazardous waste is subject to medium- to long term national-level solutions to be decided upon and provided by the Government.

Where the OHL corridor goes near villages or houses, the Construction Contractor has to control noise emissions from all equipment. For residents the noise levels may not exceed 55 dB (A) or result in a maximum increase in background levels of 3 dB (A) at the nearest receptor location off-site. Workers will wear ear protection devices as part of their PPE if they are exposed to noise levels higher than 80 dB (A). Nuisance by construction noise will be minimized by different measures (e.g. truck movements only during daylight, use of low sound power mechanical equipment etc.).

Technical regulations on safety zones for electric networks of Armenia define a distance of 30 m from 400 kV and 500 kV OHLs as a buffer zone. Additionally, the clearance between the conductors (depending on the final design of the towers) has to be considered. Thus, a total corridor width (ROW) of 75 m for 400/ 500 kV OHLs is taken as a basis in this ESIA.

In order to manage human exposure to electric and magnetic fields the limits established by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) have to be applied, which are as follows:

ICNIRP (1998) exposure guidelines for general public exposure to electric and magnetic fields		
Frequency	**Electric Field (V/m)**	**Magnetic Field (µ/T)**
3-150 kHz	87	6.25
10-400 MHz	28	0.092
2-300 GHz	61	0.2

ICNIRP exposure limits for general public exposure to electric and magnetic fields		
Frequency	**Electric Field (V/m)**	**Magnetic Field (µ/T)**
50 Hz	5,000	100
60 Hz	4,150	83

The OHLs will be designed the way to conform with the national and the ICNIRP's standards - whichever is more stringent - and, therefore, people residing in the vicinity of the OHLs will be protected from the negative impacts of exposure to the electric and magnetic fields. The exposures of workers and persons living in close proximity to the proposed project transmission lines has to be below the values mentioned in these guidelines.

Impacts on air quality will be limited by proper maintenance of vehicles and construction machinery, proper storage of construction material to limit dust, prohibition of open waste burning etc. Relevant guidelines for handling SF_6 have to be followed.

All land required for construction of BtB s/s Ayrum and s/s Ddmashen has already been acquired by HVEN. All work on the OHLs will be conducted in full compliance with the RPF and the Resettlement Action Plan (RAP), if needed. Avoidance of displacement to the extent possible is a priority. Bypasses will therefore be created in order not to affect settlements, wherever technically feasible.

All unavoidable damages, felled trees, loss of crops, expropriation of land, resettlement, etc. caused during final land survey, construction and maintenance works have to be fully compensated according to RAP (not part of this scope, but will be done by HVEN following the provisions in the Project RPF).

One area of recent archaeological excavations was identified along the line routing of 400 kV OHL (Option 1) near Teghut village in Lori Marz on the property of Shnogh municipality. If recommended Option 4/ 4a is implemented and the area of Teghut Mining Site is passed in the west, this cultural site will not be crossed or affected.

Although there are no other known physical cultural resources within the OHL corridor, documenting consent of the Ministry of Culture on the proposed locations of towers is required by the national legislation and will be followed through. In case the Ministry has any reservations, location of towers shall be adjusted. Procedures to be followed in case of chance finds are also included into this ESIA report.

Construction Contractor shall have HSE Management Plan and adhere to it at all times while deployed on site.

A non-discriminatory hiring and wage policy (including gender, age, religion, ethnicity etc.) shall be adhered to and employment of local people for construction works shall be prioritized. Recruitment of women shall be improved, compared to the actual employment situation in Armenia. Zero tolerance shall be allowed for sexual harassment at work sites and in workers' camps.

Impacts from/ to traffic will be minimized among others by licensing and training of drivers, keeping to speed limits, collaboration with local communities (e.g. on education about traffic and pedestrian safety, improvement of signage, safety of roads etc.), and clear signage of construction sites.

Local communities shall be informed in advance about upcoming construction works, work areas and hazardous material shall be clearly signed to minimize impacts on public health and safety.

Operation and Maintenance Phase

ROW shall be kept free of high growing vegetation without use of any herbicides. Forested hillsides and valleys shall be over-spanned. Land within the ROW may be used for agricultural purposes or as pasture land. HVEN will develop and implement a Health and Safety Management Plan (HSMP) for its personnel engaged in maintenance of the OHLs during operational phase.

1.9 Grievance Redress Mechanism

In the course of the construction process, project affected people (PAP) may feel treated unjustly, for which case HVEN shall maintain a viable grievance redress mechanism. PAPs are encouraged to proceed in the following way:

a) Contact the contractor's designated grievance staff in the following way: in person via designated telephone number, via email, via regular mail. Alternatively, PAPs can contact their community leader, who would convey their grievance to the contractor's designated grievance staff.
b) Lodge complaint and provide information on the case. Each complaint will be registered and a tracking number will be assigned to it. Responses to all complaints should be provided within 15 days (or 25 days in cases where complaint resolution requires special efforts).
c) Agree with the contractor on mitigation measure.
d) Sign if the mitigation measure has been implemented as agreed
e) Seek redress from HVEN if not satisfied with above mentioned procedure though designated telephone numbers, in person, or via email or regular mail. HVEN should register all grievances and provide response within 15 days.
f) Seek redress from court if all else fails.

Nevertheless, the above mentioned grievance mechanism does not limit the citizen's right to submit the case straight to the court of law just in the first stage of grievance process. The grievance mechanism is designed to avoid lengthy court procedures.

All costs will be provided from the Project budget.

1.10 Costs of Implementation of the ESMP

Most of the costs for mitigation of the impacts during the construction period of the Caucasus Energy Network Project are included in the regular construction costs.

Extra costs with respect to environmental mitigation are related to establishment of a Biodiveristy Action Plan, rehabilitation measures and monitoring at forested areas and installation of bird diverters. Further costs are foreseen for monitoring of construction works by a local HSE officer of PIC, for monitoring by local members of Agency of Protection of Historical and Cultural Monuments, for quarterly supervision of construction sites to be performed by an internationally experienced auditor, for supervision of replanting concept and implementation by an internationally experienced forest specialist, and for training of HVEN staff.

Considering a construction period of about 2 years, costs for implementation of the ESMP sum up to **1,243,000 USD**.

These costs include the implementation of the RAP, but not the costs for preparing the detailed RAP study including asset survey. This will be done by a RAP consultant or HVEN's Social Specialist.

1.11 Conclusion

In summary, from the findings of this Environmental and Social Impact Assessment it can be concluded that the proposed Caucasus Energy Network Project, will have low to medium impacts, if all proposed mitigation measures are implemented. Medium impacts are related to line routing (passing remote areas in the mountains and forested areas), access roads, flora and fauna (by OHLs), and infrastructure (OHL crossing property of Teghout CJSC).

The Project can be constructed and operated without having significant adverse impacts on the social environment.

However, an impact on ecology will remain and cannot be mitigated to zero. This has to be accepted by the decision makers if the project shall be implemented.

2. Introduction

2.1 Project Context

In 2007, in order to support the efforts taken with regards to regional cooperation, the German government has initiated the "Regional Power Transmission Extension Plan" (RTEP) which is designed to establish a concept for the development of an Extra High Voltage (EHV) interconnected system. In essence, the system should allow for flexible and mutually profitable cross-border energy exchange between Georgia and Armenia, which ultimately should assist in the efficient utilization of the respective energy resources of the two countries (*Fichtner* has conducted Study in 2007; later updated in 2009). Although the RTEP focused on the interconnection between Georgia and Armenia, *Fichtner* has considered the power networks of their neighboring countries, Iran as well as Turkey, as well.

Armenia wishes to stay synchronized with Iran. Only after implementation of upgrades in power system control and implementation of various agreements on power system operation and control a direct high voltage alternating current (HVAC) link can be established. Since this may take 7 to 10 years, it has been decided to take the short term option of an interconnection of the Armenian and Georgian power systems by an HVDC Back-to-Back (BtB) converter.

The purpose of the Project is to achieve an asynchronous power connection between Georgia and Armenia and thereby provide a reliable, flexible and mutually profitable cross-border energy exchange not only between Armenia and Georgia but within the South Caucasus and beyond with other regions.

2.2 Main Objective of the Project

The Caucasus Energy Network Project aims to provide a reliable, flexible and mutually profitable cross-border energy exchange within the South Caucasus by connecting the Armenian and the Georgian power grid via 500/400/220 kV High Voltage Direct Current BtB Converter Station (HVDC BtB) in Ayrum and therefore will represent a regional integration of energy systems among Georgia, Iran, and Russia.

The connection from the Georgian side will be effected via a 500 kV OHL from the new substation Marneuli, the connection from the Armenian side via a 400 kV OHL from new substation Ddmashen (at the first stage via the existing 220 kV line from s/s Alaverdi-2 to s/s Gardabani - Georgia).

The interconnecting scheme is expected to provide the following:

- develop cross-border power exchange between Armenia and Georgia and their neighboring countries, like e.g. Iran, Russia, etc.
- match individual countries future needs, assets and shortcomings
- facilitate electricity market operations
- optimize dispatch of active and reactive power and efficient transfer of power between generating and load centers within and between the countries
- improve structural and operational reliability of the networks and security of supply
- improve static and dynamic stability of the network
- improve and maintain voltage profiles according to technical standards
- reduce technical losses
- facilitate parallel operation of the Armenian and Georgian power systems with their respective neighboring systems and
- provide due consideration to existing trade-offs between technical and economic aspects (cost-effectiveness).

The planned transmission lines and substations as agreed on Progress Meeting No.01 with HVEN on 3rd and 4th February 2016 are as follows:

No.	kV	Line Routing and Substation	Line Length
1	500	OHL between the border of Armenia-Georgia and new s/s Ayrum	approx. 8 km
2	500/400/220	Construction of BtB s/s Ayrum	-
3	220	OHL from s/s Ayrum to 220 kV Alaverdi-Gardabani (Georgia).	approx. 8 km
4	400	OHL between Ayrum and Ddmashen substations (tower design for double circuit, conductors etc. first for single circuit)*	approx. 94 km
5	400/220	Construction of s/s Ddmashen	-
6	220	Connection lines from s/s Ddmashen to 220 kV OHLs Marash and Noraduz and to former 330 kV OHL Artarbekyan	approx. 10 km (depending of final routings)
7	220	Replacement of the Lori 220 kV line from s/s Vanadzor to s/s Alaverdi-2	approx. 50 km
8	110	Replacement of Tumanyan-1 and -2 110 kV lines (from s/s Alaverdi-2 to s/s Alaverdi-1)	approx. 3 km

* As the final location of planned Hyusisayin GTPP and the relating line routing of connection to 400 kV OHL Ayrum – Ddmashen is still not known, the environmental and social impacts of this connection line cannot be evaluated. However, the implementation of a double circuit line with only one circuit installed (at this stage) is foreseen in the project. Consequently, the environmental and social impact of the tie-in from the planned Hyusisayin GTPP to the 400 kV transmission line should be performed within the implementation of the GTPP project.

2.3 Overview of Project Phases

The overall project will be carried out in three to four subsequent phases with a planned final transfer capacity of 1,050 MW.

Phase I:

- construction of approx. 8 km 500 kV single circuit overhead line between the border of Armenia and Georgia and Ayrum BtB substation, equipped with OPGW
- construction of Ayrum substation with 500/400 kV levels and the first BtB module with a capacity of 350 MW
- installation of a 400/220 kV transformer at Ayrum substation and two 220 kV bays for connection to the 220 kV Alaverdi – Gardabani (Georgia) OHL including construction of approx. 8 km single circuit OHL
- installation of protection, control, telecommunication and metering equipment for measuring of active and reactive energy power.

Phase IIa:

- construction of approx. 94 km 400 kV AC-400 single circuit overhead line between new Ayrum and Ddmashen substations, equipped with OPGW (layout of towers for future double circuit)
- construction of 400/220 kV Ddmashen substation with four line bays and two transformer feeder 400 kV (3 not fully equipped 400 kV diameters in breaker and a half circuit), five line bays and two transformer feeder 220 kV (4 not fully equipped 220 kV diameter one and a half circuit breaker), control building, auxiliary services
- installation of one 400/220 kV transformer (4 single phase units) at the new Ddmashen substation
- connection from Ddmashen substation to the existing 220 kV OHLs Marash and Noraduz and to former 330 kV OHL Artarbekyan – length in total approx. 10 km
- installation of protection, control, telecommunication and metering equipment for measuring of active and reactive energy power
- replacement of 220 kV Lori OHL from s/s Vanadzor to s/s Alaverdi-2 (approx. 50 km). Towers 1 to 14 shall remain, if possible (rehabilitation of towers and foundations, if necessary), replacement of conductors, insulators, etc.; towers 15 to end: complete replacement (towers etc.)
- replacement of Tumanyan-1 and -2 110 kV OHLs (approx. 3 km from s/s Alaverdi-2 to s/s Alaverdi-1).

Phase IIb:

- construction of approx. 47 km 400 kV AC-400 overhead line between s/s Ayrum and the planned 2 x 270 MW Hyusisayin GTPP (near Vanadzor) and of approx. 48 km 400 kV AC-400 OHL between Hyusisayin and s/s Ddmashen with optical ground wire including additional 400 kV equipment at s/s Ddmashen

- installation of a second 400/220 kV transformer (4 single-phase units) at Ddmashen substation including related HV equipment at 400 kV and 220 kV level
- installation of the second 350 MW HVDC BtB module and additional 500/400 kV equipment at s/s Ayrum
- installation of protection, control, telecommunication and metering equipment for measuring of active and reactive energy power.

It is intended to implement Phase IIa at the same time as Phase I by finishing all the works after a maximum of 40 months. At least the substation Ddmashen including its connections to Hrazdan TPP and the two 400 kV lines from Iran shall be accomplished until the end of December 2017. If the optional Phase IIb will be selected the works for this shall be implemented as parallel as possible.

Phase III:

- construction of 3rd BtB module with a capacity of 350 MW, including the extension of the relevant substation facilities
- installation of protection, control, telecommunication and metering equipment for measuring of active and reactive energy power.

2.4 Scope of Work of the Project

Elaboration of a detailed Environmental and Social Impact Assessment (ESIA) for Phases I to III, including an Environmental and Social Management Plan (ESMP), a Resettlement Screening and a Resettlement Policy Framework (RPF), following the requirements of Armenian and European laws, regulations, guidelines and Directives (EU EIA-Directive 2011/92/EU, amended by Directive 2014/52/EU) and complying with the Equator Principles, as well as international standards acceptable to KfW Development Bank (e.g. EBRD Performance Requirements or UN Basic Principles and Guidelines on Development).

For both, the substations and the transmission lines, land acquisition and/ or land use will be necessary. However, the process of technical design and final line routing is not yet completed. Also, the exact location of the suspension towers and determining the land owners being affected will only be fixed in a later stage of the Project during the detailed survey to be done by the Construction Contractor (CC). Therefore identifying of landowners and negotiations concerning land acquisition for the pylons as well as preparation of a detailed RAP with an inventory of affected assets and an official valuation procedure parallel to the elaboration of the ESIA study is not possible at this stage of the Project.

Thus, *Fichtner* develops as a first step a Resettlement Screening and a Resettlement Policy Framework (RPF). This represents the basis for preparing the detailed RAP including census and official valuation procedure, if it will be necessary. Such a detailed RAP shall be prepared by HVEN as done in other projects in Armenia.

The close cooperation between *Fichtner's* environmental and social experts and the technical team resulted in major avoidance of resettlement during the line corridor design.

For replacement of the 220 kV Lori OHL from s/s Vanadzor to s/s Alaverdi-2 and 110 kV OHLs Tumanyan-1 and -2 from s/s Alaverdi-2 to s/s Alaverdi-1 *Fichtner* had prepared an ESIA Study and a Resettlement Policy Framework (RPF) in 2014. The ESIA and RPF were conducted under the given pre-condition that most of the existing towers of the lines could remain. In order to keep environmental and social impacts of rehabilitation of these lines as low as possible, the corridor of the existing lines will be used under consideration of the bypasses already proposed in the ESIA for Lori and Tumanyan-1 and -2 OHLs. Rehabilitation of these lines will be implemented after construction and commissioning of BtB s/s Ayrum and 400 kV OHL Ayrum - Ddmashen, as Lori line can then be disconnected, dismantled and reconstructed in the already existing line corridor under consideration and extension of ESIA and RPF reports prepared by Fichtner in 2014. These studies will be amended based on the current conditions.

As final location of planned Hyusisayin GTPP and the relating line routing of connection line to 400 kV OHL Ayrum - Ddmashen (Phase IIb) is still not known, environmental and social impacts of this connection line cannot be evaluated at this time. However, the implementation of a double circuit line with only one circuit installed (at this stage) is foreseen in the project.

2.5 Technical Design

The work under the Caucasus Energy Network Project is expected to cause some power outages, especially when existing 220 kV OHLs Marash and Noraduz as well as 330 kV OHL Artarbekyan will be connected to the new s/s Ddmashen and 220 kV OHL Alaverdi - Gardabani to new BtB s/s Ayrum, respectively. HVEN shall develop an energy compensation plan in order to minimize outage duration and ensure power supply to local power consumers.

Construction time for Caucasus Energy Network Project will be about two years.

Technical regulations on safety zones for electric networks of Armenia define a distance of 20 m on each side from 110 kV, 25 m from 220 kV, and 30 m from 400 kV and 500 kV OHLs as a buffer zone (GRA 2009). Additionally, the clearance between the conductors (depending on the final design of the towers) has to be considered.

Thus, the following total corridor widths (ROW) of OHLs are taken as a basis in this ESIA:

Line voltage	Corridor width of OHL
500 kV	75 m
400 kV	75 m
220 kV	60 m
110 kV	50 m

2.6 Location of Substations and OHLs considered in this ESIA

2.6.1 Substations and connection lines to existing OHLs

Ddmashen substation

The site for new s/s Ddmashen is located at approx. 1,890 m a.s.l. in an agricultural used landscape west of Gagarin village in Kotayk Marz (see Photo 2-1 and Map 2-1). Land required for substation site (approx. 16 ha) has already been acquired by HVEN. The existing access track from the main road (M4) to the substation site is approx. 1.6 km long and has to be widened and improved for transport of heavy substation equipment.

As part of the Caucasus Energy Network Project s/s Ddmashen will be connected to the existing 220 kV single circuit OHLs Marash and Noraduz (both running to Hrazdan TPP) and to the former 330 kV single circuit OHL Artarbekyan (currently used as 110 kV OHL). Total length of these connection lines will be approx. 10 km, depending on the final line routing.

Final line routing of all these lines has to be done by the Construction Contractor (CC).

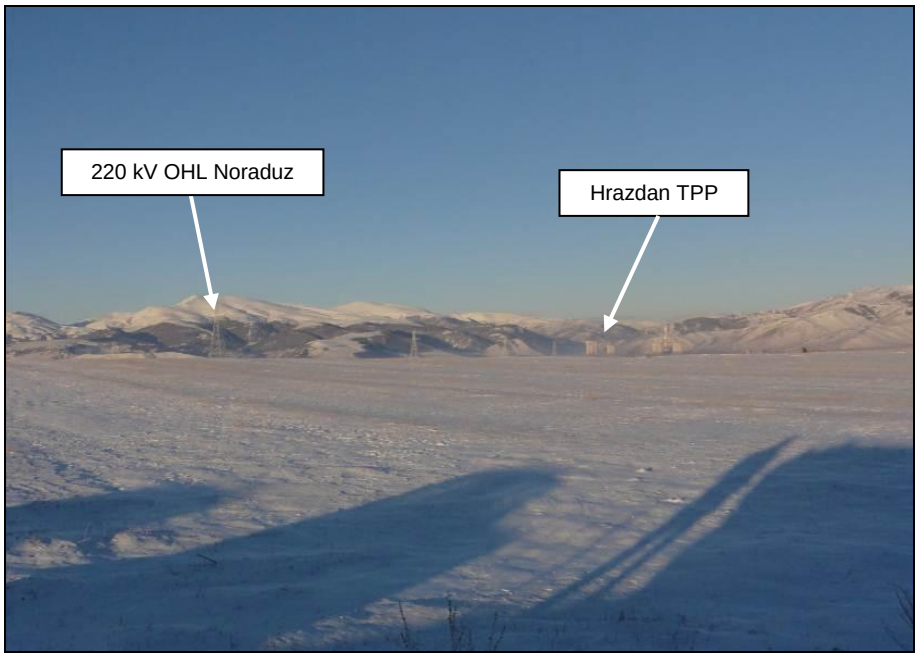
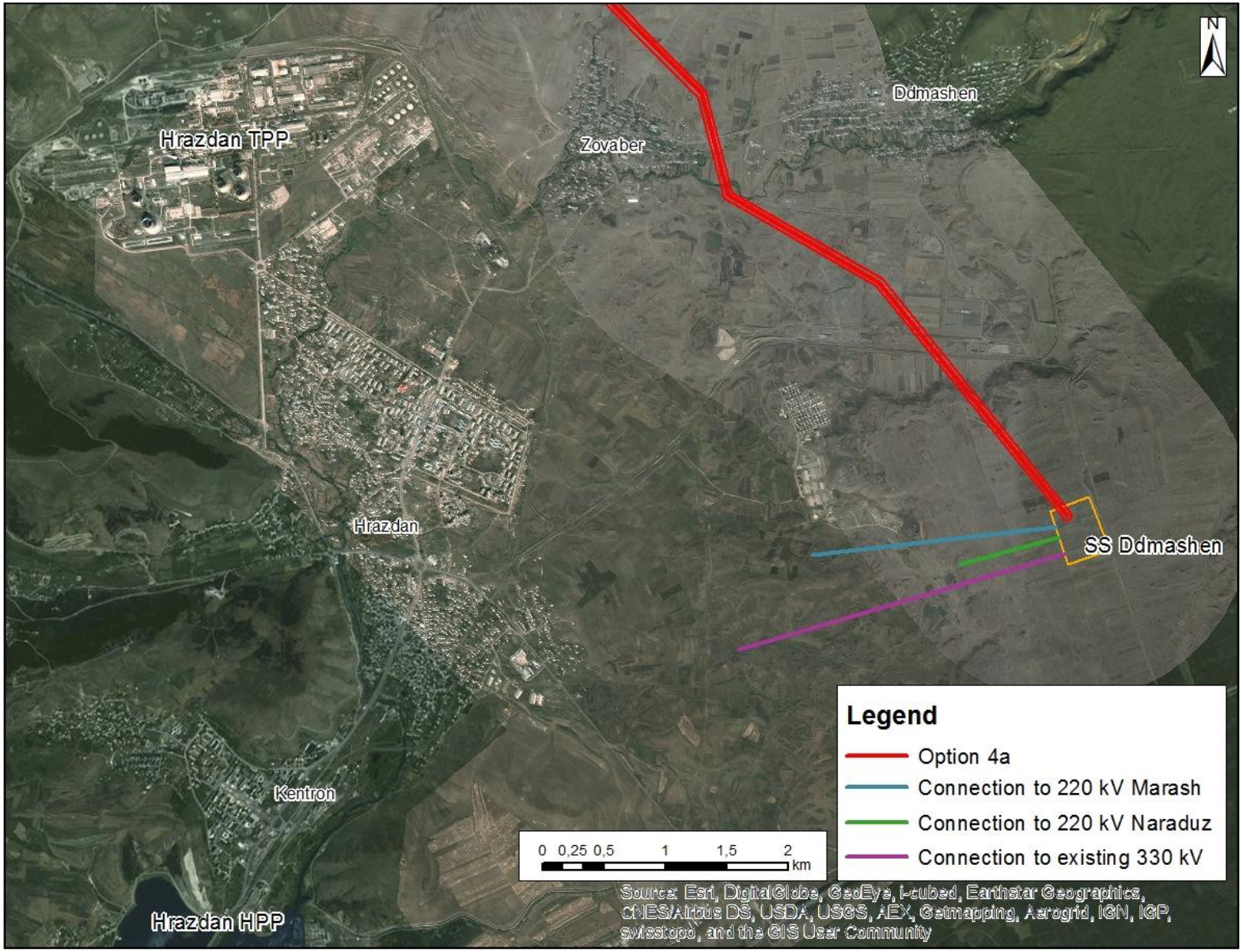


Photo 2-1: Ddmashen s/s site (220 kV OHL Noraduz and Hrazdan TPP in background)



Map 2-1: Location of proposed Ddmashen substation site and foreseen connection lines

Ayrum BtB substation

The site for new BtB s/s Ayrum is located at approx. 585 m a.s.l. in an undulating agricultural used landscape northeast of Chochkan village and west of Haghtanak in Tavush Marz close to the Georgian border (see Photo 2-2 and Map 2-2). Land required for substation site (approx. 64 ha) has already been acquired by HVEN from Chochkan community and private land owners. The existing access road/ track from the main road to the substation site is approx. 3 km long. This access road/ track has to be widened and improved for transport of heavy substation equipment. Connection of new s/s Ayrum to s/s Alaverdi-2 will be realized by connecting to the already existing 220 kV single circuit OHL from s/s Alaverdi-2 to s/s Gardabani (Georgia) at tower 100 of this line. This OHL will cross mainly agricultural used land and will have a length of approx. 4 km (see Photo 2-3). Final line routing of this connection line has to be done by Construction Contractor (CC).

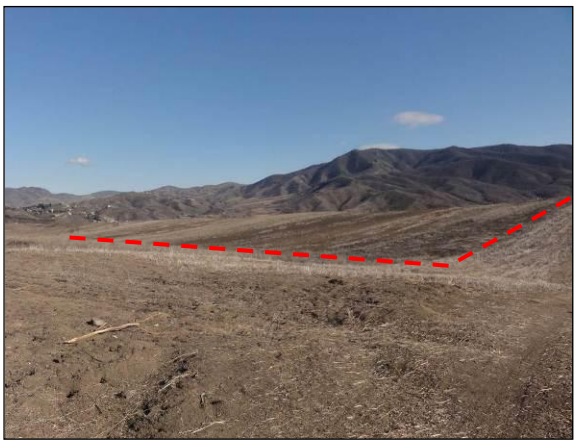


Photo 2-2: Undulating terrain at Ayrum BtB s/s site (view from southwestern corner**)**

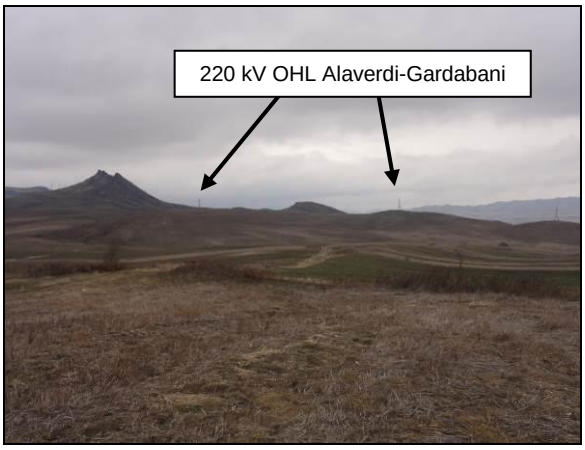
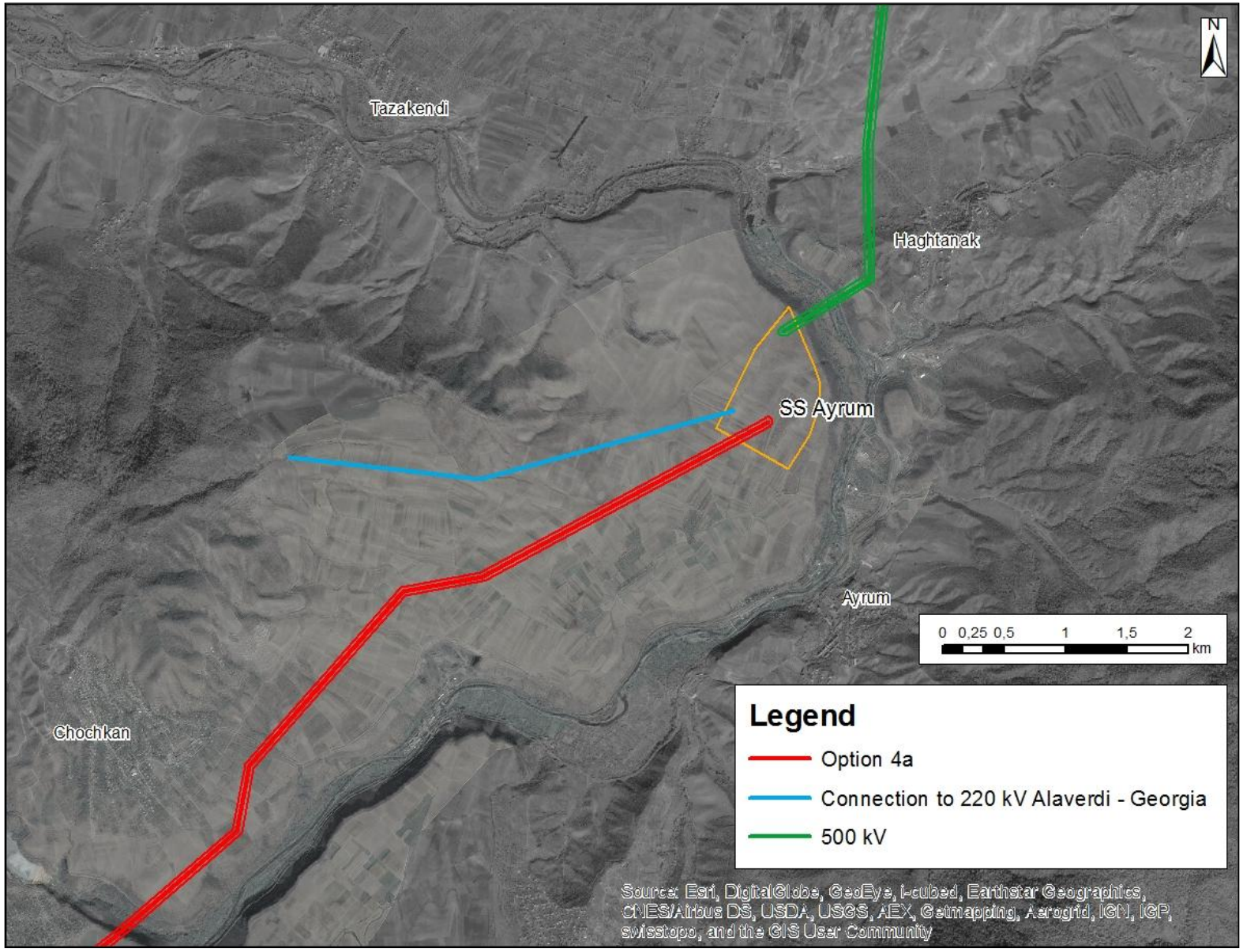


Photo 2-3: 220 kV OHL Alaverdi – Gardabani (Georgia) in background



Map 2-2: Location of proposed Ayrum BtB substation site and connection line to existing 220 kV OHL Alaverdi-2 - Gardabani (Georgia)

2.6.2 Location of 400/ 500 kV Overhead Transmission Lines

500 kV OHL (s/s Ayrum - Georgian border)

Proposed line routing for 500 kV OHL from BtB s/s Ayrum to the border of Georgia (length approx. 8 km) is shown in Map 2-3. This routing includes two small changes compared to the line routing given in the *Fichtner* Feasibility Report (2014) in order to avoid crossing of a quarry and a farm building. Leaving new BtB s/s Ayrum to the northeast the line crosses Debed River valley (width 670 m) with a railroad, a main road, and a house (which may not be over-spanned) down in the valley and then runs north to the Georgian border mainly over agricultural used land. Construction of 500 kV OHL from Georgian border to s/s Marneuli (Georgia) is not part of this Project.

Map 2-3: Location of proposed 500 kV OHL corridor (green) Ayrum - Georgian border

400 kV OHL (s/s Ayrum – s/s Ddmashen)

For the line routing of 400 kV OHL from BtB s/s Ayrum to s/s Ddmashen different options have been studied (see Section 5.2). In order to avoid crossing of Dilijan National Park Option 4a, which bypasses Dilijan NP in the west has been agreed with HVEN and KfW to be further developed.

Option 4a leaves Ddmashen substation in north-western direction to join the existing 220 kV OHL Gugark-1 corridor (leading to Vanadzor) and runs then parallel to it for approx. 8 km. The line traverses the Pambak and Tsakhkunjats mountain range above Margahovit (south of the village), where it crosses the Important Bird and Biodiversity Area (IBA) Pambak Mountain Chain. Then it descends towards Fioletovo village avoiding the crossing of Caucasian Rose-Bay Sanctuary and crosses Margahovit State Sanctuary at its narrowest extension (< 1 km). Over-spanning of forest shall be considered in this area. The highest point in this section is at 2,750 m a.s.l. in the mountain range south of Margahovit State Sanctuary.

This routing crosses the valley east of Fioletovo village. When crossing Fioletovo valley final routing has to be checked in order not to over-span any buildings. North of Fioletovo the line runs on hills in northwestern direction avoiding forest areas and the tree plantations of Armenian Tree Project (ATP). Then, the line leads above the tree limit through mountain meadows crossing IBA Dsegh in northeastern direction. In this area the line reaches a second high point (2,600 m a.s.l.) and two valleys will be over-spanned which are approx. 600 and 800 m wide.

Then the line runs north on mountain meadows above the forested areas and the villages Aghnidzor and Atan. The line crosses the forest southwest of Teghut (Lori) at its minimal extension (approx. 1 km) (over-spanning of forest shall be considered in this area) and then runs on the western side of Teghut Mining Site of Vallex Company (Teghout CJSC) territory below the forest. In this area the final line routing of 400 kV OHL has to be closely coordinated by HVEN with Teghout CJSC. North of the mining site the line runs parallel to the newly constructed 110 kV OHL “Teghut Mining” and then crosses Debed River valley (approx. 600 m wide) south of Mets Ayrum.

On the northern side of Debed River valley the line runs across agricultural used lands, mainly parallel to the already existing 110 kV Noyemberyan and 220 kV Alaverdi-Georgia OHLs over-spanning another gorge (approx. 500 m wide) southeast of Mets Ayrum and finally leads to s/s Ayrum. Due to the already existing OHLs, final routing has to consider the minimal required distances to these high voltage lines in this area.

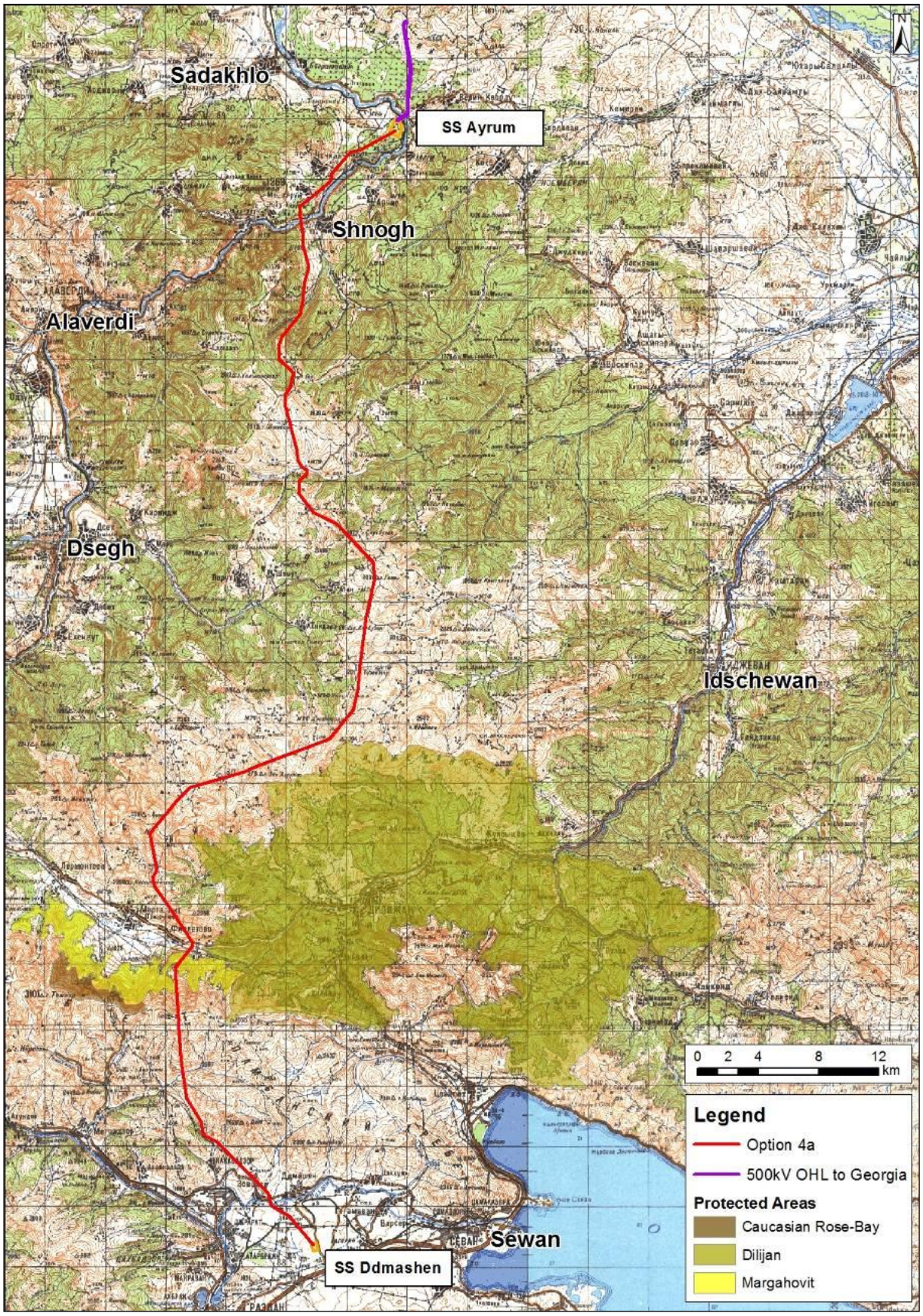
Total length of Option 4a is 94 km with 41 km leading through areas above 2,000 m a.s.l.

220 kV Lori OHL / 110 kV Tumanyan-1 and -2 OHLs

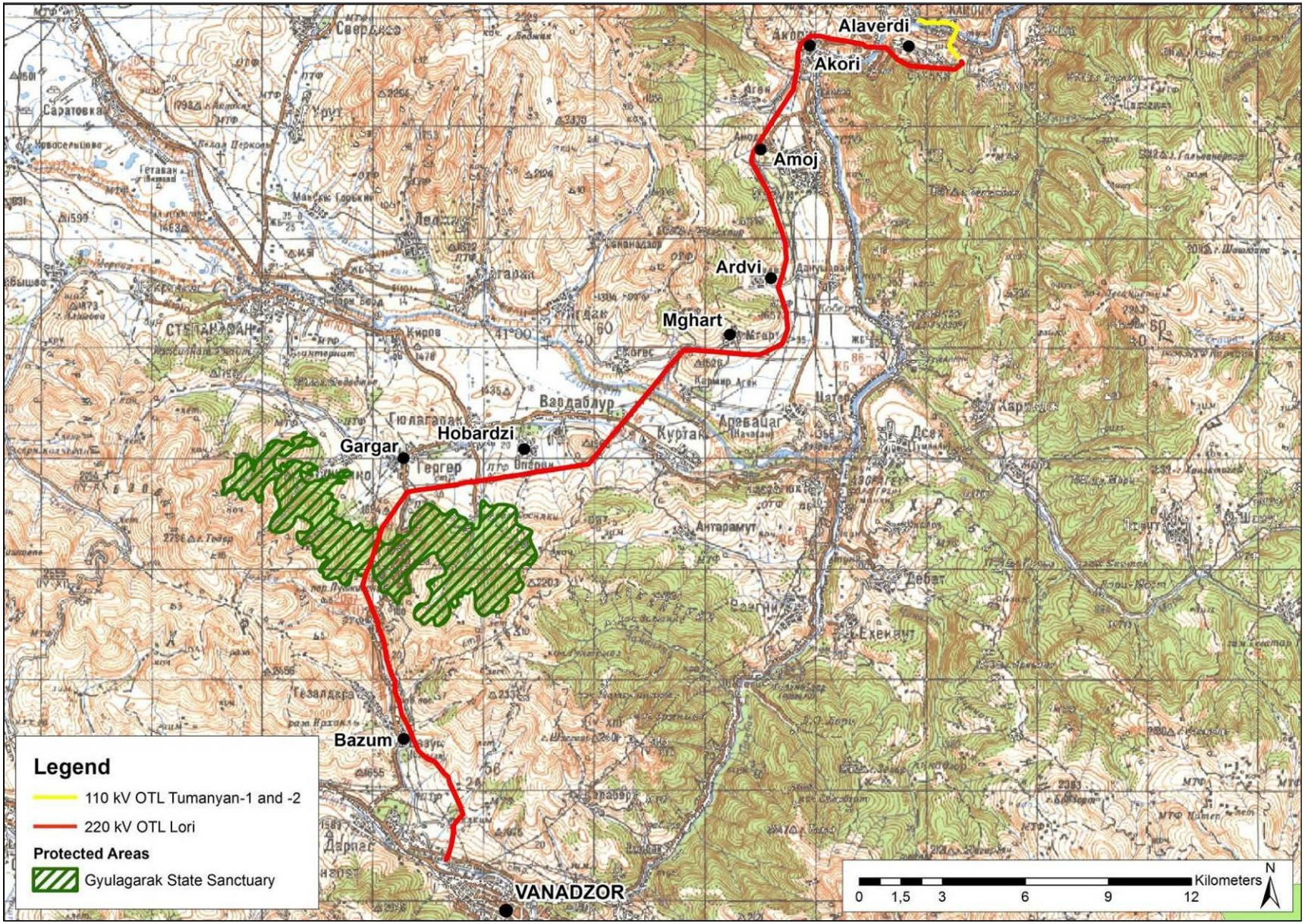
For replacement of the Lori 220 kV OHL and the Tumanyan-1 and -2 110 kV OHLs *Fichtner* already prepared an ESIA Study and a Resettlement Policy Framework (RPF) in 2014. The ESIA and RPF were conducted under the given pre-condition that most of the existing towers could remain. In order to keep environmental and social impacts of rehabilitation of these lines as low as possible, the corridor of the existing lines will be used under consideration of the bypasses already proposed in the ESIA for Lori and Tumanyan-1 and -2 OHLs. Rehabilitation of these lines will be implemented after construction and commissioning of BtB s/s Ayrum and 400 kV OHL Ayrum – Ddmashen, as Lori line can then be disconnected, dismantled and reconstructed in the already existing line corridor under consideration and extension of ESIA and RPF reports prepared by *Fichtner* in 2014. These studies will be amended based on the current conditions. For location see Map 2-5.

Connection to Hyusisayin GTPP

As the final location of planned Hyusisayin GTPP and the relating line routing of connection line to 400 kV OHL Ayrum – Ddmashen is still not known, the environmental and social impacts of this connection line cannot be evaluated. However, the implementation of a double circuit line with only one circuit installed (at this stage) was agreed to be foreseen in the project. Consequently, the environmental and social impact of the tie-in from the planned Hyusisayin GTPP to the 400 kV transmission line should be performed within the implementation of the GTPP project.



Map 2-4: Location of proposed 400 kV OHL Ayrum – Ddmashen (Option 4a in red) and 500 kV OHL s/s Ayrum - Georgian border (in pink) and Protected Areas



Map 2-5: Location of OHLs Lori and Tumanyan-1 and -2 and affected Protected Areas

3. Objectives and Methodology of the ESIA

3.1 Scope and Objectives of the ESIA

Within the scope of this Environmental and Social Impact Assessment (ESIA), *Fichtner* investigated the environmental and social impacts of Phases I to III of the Caucasus Energy Network Project including the construction of new substations and overhead transmission lines of different voltage level.

The Project will have several impacts on different environmental and social components. The main objective of the ESIA was to ensure that requisite environmental and social mitigation measures, commensurate with the national and international standards, are recommended and implemented. The ESIA provides useful information to HVEN on how the substations and the high voltage power lines shall be designed and planned, to avoid or mitigate negative impacts and to better capture anticipated environmental and social benefits.

The main objectives of the ESIA Study are to:

(i) explain the Project framework including the current design and key technical aspects of the Sub-Projects
(ii) analyze the environmental and social baseline in the area of the Project implementation and the resulting requirements for impact assessment in compliance with all relevant international policies (e.g. EBRD Performance Requirements, IFC/World Bank EHS Guidelines, EU EIA Guideline) as well as Armenian national environmental guidelines and requirements
(iii) perform a comprehensive environmental and social impact assessment on the basis of the technical design studies, available data and field surveys with the purpose of understanding the current environmental and social situation in the Project area and to assess the potential positive and negative impacts of the Project
(iv) identify and recommend measures to avoid, minimize or mitigate adverse environmental and social impacts of the Project during the construction and operation phases and recommend referring monitoring measures to be addressed during Project implementation through the preparation of an ESMP.

On the basis of the existing environmental situation, *Fichtner* determined and evaluated the environmental and social impacts during construction and operation of the proposed OHLs and substations. In a second step, appropriate mitigation measures, alternative routings and monitoring measures were considered to reduce possible adverse impacts.

During the investigation, main focus was put on finding line routings that are feasible from an economic and technical point of view avoiding
a) environmental impacts to the extent possible
b) the need of resettlement actions to the greatest extent possible, and
c) crossing of cultural and historical sites as much as possible.

After public disclosure of the ESIA, including the ESMP, public consultations will be executed in order to seek feedback and concerns of people affected by the Project.

3.2 Procedures and Methodology

For carrying out present ESIA, *Fichtner* set up the following multi-disciplinary team:

- International Senior ESIA Expert
- International Senior Environmental and Ecological Expert
- International Socio-Economic Expert
- International Biodiversity Expert
- National Environmental and Legal Experts.

General overview about biophysical settings has been done as desktop study, and field surveys were conducted by the environmental and social experts in December 2015, February and April 2016, visiting the substation sites and the proposed corridors of the lines including some potential hotspots like Dilijan National Park, Margahovit State Sanctuary, Caucasian Rose-Bay Sanctuary, Teghut Mining Site of Vallex Company, the crossing of valleys, forested areas and villages affected by the new line corridors.

Additional information was gained by consultations of representatives of governmental organizations and non-governmental organizations (NGOs). Intensive consultations have also been conducted with members of the Historical and Cultural Monument Protection Agency of the Ministry of Culture, with members of the Ministry of Nature Protection and the Ministry of Agriculture (see Section 11.1 – Appendix I).

Additionally to the field surveys, an evaluation of possible ecological and social impacts was performed by interpretation of high resolution satellite images (date: 2013-2014).

Fichtner already prepared a Feasibility Study to the Project (Fichtner 2014), including a preliminary environmental and social impact screening, which was taken as a basis for preparing the ESIA. However, the line routing proposed in the Feasibility Study is not the one recommended in this ESIA study, as it is crossing Dilijan National Park including the strict Nature Reserve Zone (rock walls) at the northern boundary of the National Park.

According to EBRD PR 1, the Project falls into environmental **Category A**, thus requiring an ESIA, while according to KfW Development Bank (2014) the Project falls in Category B. Also according to the national legislation of Armenia, an EIA is required.

For replacement of the Lori 220 kV OHL and the Tumanyan-1 and -2 110 kV OHLs *Fichtner* prepared an ESIA Study and a Resettlement Policy Framework (RPF) in 2014 (HVEN 2015a, 2015b). The ESIA and RPF were conducted under the given pre-condition that most of the existing towers could remain. In order to keep environmental and social impacts of rehabilitation of these lines as low as possible, the corridor of the existing lines will be used under consideration of the bypasses already proposed in the ESIA for Lori and Tumanyan-1 and -2 OHLs. Rehabilitation of these lines will be implemented after construction and commissioning of BtB s/s Ayrum and 400 kV OHL Ayrum - Ddmashen, as Lori line can then be disconnected, dismantled and reconstructed in the already existing line corridor under consideration and extension of ESIA and RPF reports prepared by *Fichtner* in 2014. These studies will be amended based on the current conditions.

Due to the fact, that there is no official international consensus on an agreed approach for assessing the significance of impacts on the environment, *Fichtner* uses an own evaluation procedure. This transparent evaluation procedure is based upon *Fichtner's* extensive experience over the last fifteen years in performing Environmental and Social Impact Assessments (ESIA) and has proven to be a reliable method for assessing a project's impacts on the environment. It includes identification, prediction (e.g. duration, intensity, severity, status, reversibility of the impact) and evaluation of the significance of impacts based on legal requirements. Wherever possible, impacts are quantified. The focus of the used evaluation procedure is to decide whether the Project is likely to cause significant adverse environmental effects resulting from construction and operation.

For the purpose of a transparent presentation and evaluation, a tabulated evaluation matrix is applied. On the basis of a point scale, the severity of the particular environmental impact together with its general trend - that is negative or positive - is described. The evaluation scale applied is as follows:

Extent of impact:

■ ■ ■	=	high
■ ■	=	medium
■	=	low
○	=	no impact
+	=	locally positive
++	=	regionally positive

For judgments international standards like standards from the World Bank, World Health Organization (WHO) etc. are used (see Section 4.3) supported by national Armenian standards (see Section 4.1). According to these standards the evaluation of impacts is done as follows (Table 3-1):

Table 3-1: Evaluation of impacts using International and National Standards

Extent of impact	Reason
High	International and national standards are exceeded.
Medium	Between international and national standards, international and national standards are barely met.
Low	International and national standards are met.

With the presented method it can be clarified which environmental impacts are most important and for which impacts mitigation measures must be applied in order to reduce negative effects on the environment.

4. Legal and Regulatory Framework

This Chapter presents the policy and legal framework for environmental and social management in the Republic of Armenia, with particular reference to the provisions for conducting EIA/ ESIA. The Project will conform to applicable local/ national and international environmental and social legislation, regulations and guidelines as well as specific procedures and policies of State Authorities and the KfW Development Bank (2014), and other available best practices. These require that an ESIA of the designed works is carried out, and the ESIA report reviewed and approved in the light of prevailing environmental and social policies and regulations.

4.1 National Requirements

Following independence in 1991, the environmental legislation was reviewed, with the aim of developing a more comprehensive state policy towards ecological protection and sustainable use. To this end, a series of laws have been developed, including regulations relating to protected areas, a land code (both 1991) and a forest statute (1994). From 1999 to today, a number of national laws of RA were implemented to regulate the protection of the environment.

In Armenia, the relationship on expropriation of property for public and state purposes is regulated by RA Constitution, RA Law on Expropriation of Property for Public and State Purposes and other legal acts.

Some key laws/ regulations related to the Project are given in Table 4-1 below.

Table 4-1: National laws of RA, implemented to regulate the protection of the environment and expropriation issues

Law/ Policy	Year	Main scopes
Decree of RA Supreme Council on Adoption of Fundamentals of the Nature Protection Legislation of RA	1991	RA nature protection policy is envisaged by fundamentals. Fundamentals are dedicated to maintain protection and using arrangement of the natural environment in the territory of Armenia as well as creation of the necessary legal basis to develop nature protection legislation to regulate relationships regarding mining; use and protection of forest and water, flora and fauna, atmospheric air protection.

Law/ Policy	Year	Main scopes
RA Law on Protection of Atmospheric Air	1994	Subjects of that law are prevention and elimination of atmospheric air pollution and realization of international cooperation within protection of atmospheric air. The main legislative issues in this domain are: - Maintenance of improvement of purity and quality of atmospheric air - Prevention and reduction of chemical, physical, biological and other influences over atmospheric air conditions - Regulation of public relationships within that sphere - Strengthening of legality within that sphere.
RA Law on Environmental Protection and Environmental Usage Fees	1998	That Law provides definition of environmental protection and environmental usage fees, scope of payers, types of fees, calculation and payment rules, and liabilities against breach of that law as well regulates other relationships on fee payments. Types of environmental protection fees are payments: - against emission of hazardous substances at environment (air and water basin) - for industrial waste and household refuse disposal within adopted regulation - against environmentally harmful products. Types of environmental usage fees are payments: - for water use - for resources of extracted minerals, - for bio-resources use.

Law/ Policy	Year	Main scopes
RA Law on Conservation and Use of Historical and Cultural Monuments and Historic Environment	1998	The subjects of that law are: - provision of legal basis within domain of protection and use of monuments and - regulation of relationships, which are begotten within those activities. - The main issues of that law are: - envisaging of general provisions of the state policy within domain of protection and use of monuments - envisaging of regulation principals of recording, conservation, research, restoration, repair, restoration and use of monuments - envisaging of authorities of the state governmental and local self-governmental bodies, legal entities and natural persons within domain of protection and use of monuments - envisaging of special features of ownership rights to possess, use and dispose monuments, which are specific type of real estate.
RA Law on Flora	1999	Law on flora provides RA state policy regarding approved science-based protection, conservation, use and reproduction of natural flora.
RA Law on Fauna	1999	That law provides RA state policy regarding conservation, protection, reproduction and use of species of wild fauna. The subjects of that law are: - conservation, protection, natural reproduction of genetic and species diversity - prevention of infringement of comprehensiveness of animals' living environment - protection of comprehensiveness of animal species, their populations and relatives - protection of animals migration routes - regulation of relationships regarding using of objects of fauna. Responsibilities of different organizations, including government, ministries, state bodies, local self-governmental bodies are envisaged by that law.

Law/ Policy	Year	Main scopes
RA Land Code	2001	That Code provides legal basis of land relationships (regarding improvement of the state regulation, development of the land management in various organizational-legal forms, soil fertility, increment of the efficiency of land use, protection and improvement of favorable environment for human life and health, protection of rights to land) by taking into consideration significant environmental, economic and social essence of land, due to which the land is used and maintained as a condition of life for population in RA. According to the Code, possession, using and disposal of land must not damage the environment, security and defensibility of the state as well as must not violate rights and interests of citizens and other persons that are protected by the law.
RA Water Code	2002	By this legal act, the relationships regarding using of water are mainly regulated. Article 3 of the Code envisages that RA Government through appropriate state authorized bodies realizes purposes of the code, maintain water saving, protection from harmful influence, using of water for public interests aimed at conserving security of each person. Vital principals of water resources management are: - Satisfaction of main vital needs of present and future generations - Maintenance and increase of the volume of the national water resources - Protection of water and related ecosystems and their biological diversity - Recognition of complete and coherent relationship of land, air, water and biological diversity - Regulation of water use through water use permission.

Law/ Policy	Year	Main scopes
RA Law on Waste	2004	This law shall regulate relations on waste collection, transportation, storage, processing, recycling, removal, volume reduction and other relations regarding the before mentioned activities, as well as legal and economical bases for prevention of adverse effects of waste on human health and environment.
RA Code on Forest	2005	That Code regulates relationships regarding sustainable management (conservation, protection, restoration, afforestation and rational use) of forests and forest lands as well as recording, monitoring and control over forest lands.
RA Law On the Real Estate Assessment Function	2005	This law defines the fundamentals of real estate assessment function and regulates the relationships concerning real estate assessment. The article 6 defines the objects of real estate assessment. According to the law (article 8) the real estate assessment is obligatory for the following cases: - alienation of real estate that belongs to state or communities, save for privatization of state property and alienation of state or community lands, - expropriation of property for public and state purposes, - investment of real estate in capital stock of a legal entity or fund, - realization of real estate as a result of exemption, - other as may be defined by the law of RA.

Law/ Policy	Year	Main scopes
RA Law on Expropriation of Property for Public and State Purposes	2006	The law envisages the base, regulation on expropriation of the property for public and state purposes, regulation of the compensation given for the alienated property, the definition of the exceptional prioritized public interest and the regulation of its affirmation. That law applies to all objects (immovable and movable property, property rights, securities etc.) (hereinafter referred to as the Expropriated Property) that belong to the physical person and legal entities as well as communities (hereinafter referred to as the Proprietors) by ownership right, which are situated in RA or are officially registered or recorded in RA in accordance with the law.
RA Law on Specially Protecting Areas of Nature	2006	The current RA Law on Specially Protecting Areas of Nature was adopted on 27th November, 2006. That law regulates legal principles of the state policy on development, restoration, conservation, reproduction and use of RA specially protecting areas of nature as environmental, economic, social, scientific, educational, cultural, aesthetic, health and recreational value of ecosystems, natural complexes and separate objects. According to that law, the National Park is an environmental, scientific, historic, aesthetic, and recreational area, with international or national significance value, which can be used in scientific, educational, recreational, cultural and economic purposes by combination of natural landscapes and cultural values within special protection regime. The law also provides the following functional areas of the national park territory: preserve, reservation, recreational and economic (meaning: area, which is separated from the national park territory, where the provision of the economic activity is provided within national park regime by the permission).

Law/ Policy	Year	Main scopes
RA Decision No. 1045-N: Procedure for Carrying out Operations in the State Forests which are unrelated to the Forest Management and Forest Use	2007	This decision prescribes the procedure for different operations in State Forests like installation of towers and OHLs. Among others the applicant has to submit a project of compensation of damage to forestry including a program for implementation of afforestation works.
RA Law on Environmental Assessment and Expertise	21 June 2014	This law regulates environmental impact assessment (through legal, economic and organizational principles) of proposed activities and concepts.

The implementation of any activity in Armenia which may cause environmental impacts needs a positive conclusion of an EIA expertise. Environmental impacts of a planned physical activity or a sectoral/ regional development plan/ program have to be assessed during the preparation period. The **RA Law on Environmental Assessment and Expertise** of 2014 stipulates provisions regarding environmental impact assessment, realization and terms, thus being the most important national law for carrying out of the EIA.

In the RA Law on Environmental Assessment and Expertise "*Overhead transmission lines of 100 kV and higher voltage*" are listed requiring an EIA process.

According to EBRD PR 1, the Project falls into environmental **Category A**, thus requiring an ESIA, while according to KfW Development Bank (2014) the Project falls in Category B. According to national legislation of Armenia, an EIA is also required. Therefore, ESIA was performed despite the fact that the national authorities are yet to review the Project design documents and take formal decision on subjecting this Project to the EIA procedure.

Consequent steps for obtaining environmental approval, as set forth in the national legislation, are given below:

1) Preliminary stage: During this stage preliminary information regarding the project (activity) is represented to the head(s) of the affected community(ies), and public hearings are organized by the project proponent jointly with the head(s) of community(ies). The general information about the project and the notice should be published on the websites of the project owner and the affected community(ies) or other public media 7 days prior to the date of the public hearing. According to the Draft Government Decree on organization of public hearings the notice should be published on the web sites not less than 7 days prior, and the project information not less than 3 days before. This draft Government decree, however, is not yet in force.

2) An application is then to be submitted to the Ministry of Nature Protection (not to the *Nature Protection Expertise* SNCO directly). This request includes general description of the project, measures for mitigation/ compensation and the results of a first public hearing organized by Community and the project owner.

3) Within 30 days the Ministry of Nature Protection 1) makes a decision about the a necessity of state environmental expertise, 2) provides an impact category to the project (e.g. an overhead transmission line 220 kV = Cat A, 110 kV = Cat B), 3) provides a list of activities and volume and depth of the works for the development of an Environmental Impact Assessment Report (provides the ToRs for the EIA). Within this period, the execution of a second public hearing is needed to be jointly performed by project proponent, heads of affected municipality(ies) and the Ministry of Nature Protection. The same rules for dissemination as for the first public hearing shall be applied.

4) The Project proponent prepares the draft EIA Report and submits it to the Ministry of Nature Protection.

5) The next stage is the main stage of the environmental expertise. During this stage, which lasts 40 days for Projects of Category B and 60 days for Category A, the Ministry of Nature Protection submits the draft EIA report to all involved and specialized parties (e.g. to its departments, to the relevant departments of Academy of Science, the Ministry of Healthcare, the Ministry of Emergency Situations, State Committee for Water Resources, etc.) as an internal procedure of the Ministry. The Project proponent is not involved in this. During this stage the Project proponent, jointly with the Head(s) of Community(ies) and the Ministry, organizes the 3rd public hearing, during which the whole draft EIA report is introduced to the general public. The Ministry provides all the comments and recommendations of all parties involved in the revision of the draft EIA, as well as main comments and recommendations which were arisen during 3rd public hearing. The Project proponent either makes amendments to the draft or justifies the rejection of amendments.

6) At the end, the Ministry organizes the final public hearing, during which it represents all the comments and recommendations provided, the results of these comments and recommendations (if the proposed changes were adopted or not), and gives opinion on the EIA report (approval or rejection).

7) Based on this, the Ministry provides the final approval or rejection of the project, signed by the Minister. Steps 5-7 are included in the total duration (40 days for Category B and 60 days for Category A).

The above procedure is generally consistent with KfW's and EBRD's environmental safeguard policies. The national law requires EIA, while the present draft report is about ESIA, through the Law on the Environmental Impact Assessment and Expertise does require coverage of social aspects of a proposed activity. KfW's and EBRD's policies require that once draft ESIA report is disclosed, sufficient time is allowed for stakeholders to get acquainted with the document prior to participating in a consultation meeting or otherwise communicating their feedback. In case of this ESIA report, it is recommended that at least two weeks will be allowed between document disclosure and stakeholder consultation.

4.2 International Agreements

Armenia has ratified a number of international agreements and conventions relating to the protection of the environment and biodiversity as there are among others:

- The Convention on the Conservation of European Wildlife and Natural Habitats (Bern)
- Convention on Wetlands of International Importance (Ramsar)
- Conservation of Migratory Species of Wild Animals (Bonn)
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (Washington)
- European Landscape Convention (Florence)
- Convention Concerning the Protection of the World Cultural and Natural Heritage (Paris)
- Framework Convention on Climate Change (Rio de Janeiro)
- Convention on Biological Diversity (Rio de Janeiro).

With special respect to handling of hazardous substances:

- Stockholm Convention "On Persistent Organic Pollutants" (ratified by the Government of the Republic of Armenia 2003)
- Basel Convention "On the Control of Transboundary Movements of Hazardous Wastes and their Disposal" (being a party since 1999)

In addition Armenia is a signatory to the Aarhus Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters.

4.3 International Requirements

The KfW Sustainability Guideline (KfW Development Bank 2014) defines that ESIA shall be conducted in line with national laws and regulations as well as in line with international environmental and social safeguard standards (including EU EIA Directive). EBRD Environmental and Social Performance Requirements are the recommended standards for this Project.

ESMP shall apply to relevant EU standards, IFC/World Bank EHS guidelines, and IFC Performance Standard for labor and working conditions (IFC PS 2) as per Human Rights Guideline of the German Federal Ministry for Economic Cooperation and Development. In case of involuntary resettlement, in addition to national legislation and EBRD standards the UN Basic Principles and Guidelines on Development Based Evictions and Displacement shall be applied.

EBRD Performance Requirements (2014):

- PR 1: Assessment and Management of Environmental and Social Impacts and Issues
- PR 3: Resource Efficiency and Pollution Prevention and Control
- PR 4: Health and Safety
- PR 5: Land Acquisition, Involuntary Resettlement and Economic Displacement
- PR 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources
- PR 8: Cultural Heritage
- PR 10: Information Disclosure and Stakeholder Engagement

IFC Performance Standards (2012):

- IFC PS 2: Labor and Working Conditions

World Bank Group EHS Guidelines:

- IFC/World Bank Group general EHS guidelines (2007)
- IFC/World Bank Group EHS Guidelines for Electric Power Transmission and Distribution (2007)

Guidelines of the EU and the UN:

- EU EIA-Directive (2011/92/EU amended by Directive 2014/52/EU)
- EU Directive 2013/35/EC on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields)
- UN Basic Principles and Guidelines on Development Based Evictions and Displacement

Other relevant Guidelines

- ICNIRP (International Commission on Non-Ionizing Radiation Protection): Guidelines for Limiting Exposure to time-varying Electric, Magnetic, and Electromagnetic Fields (up to 300 GHz)
- CIGRE 1998: High Voltage Overhead Lines – Environmental Concerns, Procedures, Impacts & Mitigation
- Recommendations of the International Council on large Electric Systems (CIGRE: SF_6 Task Force: Handling and given Recycling of SF_6 Mixtures) (www.cigre.org)
- IEC 62271-4: High-voltage switchgear and control gear. Handling procedures for sulphur hexafluoride (SF_6) and its mixtures.

4.4 Gap Analysis

The legal framework of the Republic of Armenia does in the essence correspond with the international regulations and safeguards. Gaps however do exist in enforcement of the regulations. There is still a considerable lack of institutional capacities for implementation, monitoring and evaluation.

There have been improvements during recent years, compared to the analysis of CENN (2004) on Effectiveness of Environmental Impact Assessment (EIA) System in Armenia, but some problematic issues still persist. There is a lack of specific Social and Environmental (S&E) qualification of staff and a specific S&E department does often not exist in the implementing institutions, partly the existing structures are overloaded with work and staff is not sufficiently remunerated. In some cases, power relations are unfavorable to guarantee an effective enforcement. To some extent, the number of highly qualified staff is not sufficient to cope with the amount of work to guarantee an effective enforcement of the regulations.

The lack of access to legal support and lack of trust in the institutions, especially for weaker sections of the society may create further gaps concerning implementation of compensation and resettlement. Additional training would be a necessary but however not sufficient component to improve implementation and monitoring performance. Compliance with international safeguards could be increased with independent monitoring by internationally experienced auditors/ consultants.

Putting environmental and social compliance under the responsibility of the Construction Contractor should be clearly defined in Contractor’s ToRs and credible monitoring measures should be implemented.

5. Analysis of Alignment Options

The Georgia-Armenia 400/500 kV BtB interconnector line routing has to overcome several serious obstacles in terms of environmental and social impact areas. Therefore, different options were studied by the *Fichtner* environmental and social team in close cooperation with HVEN social specialist as well as HVEN engineers from Head office and from local branch (Northern Branch).

Main obstacles of the possible line routings are:

- Dilijan National Park (situated in the shortest connection corridor (Option 1 and Option 2)
- Teghut (Lori) Forest Area (Options 1 to 4/ 4a to varying degree)
- Teghut (Lori) Mining Area (Options 1 to 4/ 4a to varying degree)
- Margahovit Forest State Sanctuary (Option 4/ 4a and Option 5)
- Caucasian Rose-Bay Sanctuary (Option 4)
- Village crossings (Avoidance of Houses) (all options)
- Sensitive habitats on alpine meadows (all options), at rock walls (Option 1 and 2) and at gorges (Option 5)
- Steep rocky hills with forested valleys north of Tumanjan village and south of Alaverdi as well as between Haghpat and crossing of Debed River valley south of Pokr Ayrum (Option 5).

5.1 The “No Project” Alternative

The “No Project” alternative describes the situation without implementation of the Project. This would avoid all environmental and social impacts of the Project but it would have negative implications on the security of power supply in Armenia and negative consequences on the regional power grid development; including economic opportunities resulting from power export to and transfer between Iran/ Georgia/ Russia and vice versa. Energy security in view of the future of Armenia’s Nuclear Power plant is cited as another reason.

5.2 Comparison of Options and Preferred Alignment

Five Project Options for 400 kV OHL Ayrum - Ddmashen have been considered (see considered (see Map 5-1 and

Map 5-2), mainly with regard to the impacts and challenges crossing or bypassing **Dilijan National Park**, based on following objectives:

- minimizing the impact on the landscape and negative impacts on biodiversity and interference with Protected Areas

- avoidance of cultural heritage sites and areas of ecological interest
- avoidance of towns and development areas, to minimize involuntary resettlement or the need for land acquisition.

5.2.1 Option 1 - OHL routing according to Feasibility Study

The initial routing as given in the Feasibility Study (Fichtner 2014) leads from s/s Ddmashen in northern direction to the border of Dilijan National Park (DNP), crossing a road west of village Semyonovka (see Map 5-1). The highest point before descending down into Dilijan valley is 2,500 m a.s.l. The proposed line traverses a forest area of Dilijan NP near Lake Parz and near the territory of Red Deer Introduction zone, traverses Aghstev River valley between villages Teghut (Tavush) and Haghartsin (1,000 m a.s.l.), passes a land-slide zone above Haghartsin and the strict Nature Reserve Zone (rock walls) at the northern boundary of DNP (highest point 2,500 m a.s.l.). In this part the line routing also crosses the Important Bird and Biodiversity Area (IBA) Haghartsin.

From there the routing leads across high alpine meadows and isolated forest patches towards Teghut (Lori), traverses a significant forest area on the eastern border of Teghut Mining territory and passes on small peaks on the eastern side of Teghut/ Shnogh valley.

The Option 1 line contours village Shnogh on its eastern side and crosses agricultural fields (private lands) of Archis village before crossing Debed River towards Chochkan and s/s Ayrum.

Critical impacts of this option are the crossing of Dilijan National Park including the strict Nature Reserve Zone and other forest areas and mountain pastures as well as the crossing of Teghut (Lori) forest.

5.2.2 Option 2 - Along 330 kV OHL corridor through DNP

The line routing would lead along the present corridor of the existing 330 kV OHL Artarbekyan (operated as 110 kV) from s/s Ddmashen to the border of Dilijan NP. The 330 kV line leads through the territory of DNP, first along a ridge (mountain meadows) above village Gosh and then leads through dense forest (3.5 km) along several small outcrops into Aghstev valley where the line turns east towards Dilijan passing village Hovk (see Map 5-1).

If the 330 kV line was dismantled and newly constructed as a combined line 110 kV to Ijevan and 400 kV OHL until Hovk, the present line routing corridor could be maintained without significant new deforestation.

In contrast, a new corridor in approx. 50 m distance from the old line would cause significant new damages, but limited additional visual impact in the

National Park territory. High maintenance costs for forest pruning and access road maintenance (partly new construction will be necessary) were noted by HVEN engineers.

After leaving DNP territory the line would still follow the 330 kV corridor to the village of Hovk, where the 400 kV line would turn north and lead up the mountain, passing a fishpond, a few houses and then lead through open forest land and along a water supply pipeline to reach a prominent rock-face which it would contour at its base (east).

The rock wall and the forest patches situated at its base are assessed to be a sensitive habitat for mammals, birds (raptors, ravens) etc. The area is yet visually undisturbed by transmission lines and presents a recreation opportunity and high touristic value for the Dilijan National Park.

Critical impacts of this option are the crossing of Dilijan National Park and sensitive habitats above village Hovk, a visual impact in an important tourism zone for DNP. Further, impacts on mountain pastures and the crossing of Teghut (Lori) forest.

5.2.3 Option 3 - Through Gosh - Valley (east of Dilijan NP)

Further a variant of Option 2, which nearly totally avoids crossing of Dilijan NP, has been explored. This variant consists in deviating from the corridor of the 330 kV line before reaching the boundary of DNP and passing via Gosh village and Gosh valley to reach the 330 kV corridor and Option 2 at village Hovk (see Map 5-1).

This variant leads through forests and meadows above village Gosh (in visible distance), before leading through steep rocky terrain above Gosh valley towards Aghstev valley. Construction of this variant would touch sensitive habitats (despite being outside the NP) and make construction of access roads or frequent use of helicopter necessary.

The variant would not avoid the sensitive habitat and rock wall above village Hovk, its principal advantage being the nearly complete avoidance of Dilijan NP boundaries.

5.2.4 Option 4 - Along 220 kV OHL Gugark-1

Option 4 leaves s/s Ddmashen in north-western direction to join the existing 220 kV 220 kV OHL Gugark-1 corridor (leading to Vanadzor) and runs then parallel to it. parallel to it. The line traverses the Pambak and Tsakhkunjats mountain range range above Margahovit (south of the village), with its highest point at 2,750 m a.s.l. 2,750 m a.s.l. where it crosses IBA Pambak Mountain Chain. Then it descends descends towards Margahovit passing Caucasian Rose-Bay Sanctuary and Margahovit State Sanctuary on a steep slope for a few hundred meters (over- (over-spanning of forest should be considered) (see

Map 5-2).

Then, the line passes on agricultural lands between the villages Fioletovo (Molokan community) and Margahovit (Armenian community) at 1,700 m a.s.l. and leads up the hill on the eastern side of a mixed conifer plantation of Armenian Tree Project (ATP). Then, the line leads above the tree limit through mountain meadows crossing IBA Dsegh in northeastern direction. In this area the line reaches a second high point (2,600 m a.s.l.) and two valleys will be over-spanned which are approx. 600 and 800 m wide.

Then the line runs north on mountain meadows above the forested areas and the villages Aghnidzor and Atan. The line crosses the forest southwest of Teghut (Lori) at its minimal extension (approx. 1 km) (over-spanning of forest shall be considered in this area) and then runs on the western side of Teghut Mining Site of Vallex Company (Teghout CJSC) territory below the forest. In this area the final line routing of 400 kV OHL has to be closely coordinated with Teghout CJSC. North of the mining site the line runs parallel to the newly constructed 110 kV OHL "Teghut Mining" and then crosses Debed River valley (approx. 600 m wide) south of Mets Ayrum (see Map 5-1).

On the northern side of Debed River valley the line runs across agricultural used lands, mainly parallel to the already existing 110 kV Noyemberyan and 220 kV Alaverdi-Georgia OHLs over-spanning another gorge (approx. 500 m wide) southeast of Mets Ayrum and finally leads to s/s Ayrum. Due to the already existing OHLs, final routing has to consider the minimal required distances to these high voltage lines in this area.

Critical issues of this option are the crossing of high pass near Gugark-1 OHL and high mountain area above Margahovit and the traverse of mountain meadows to a great extent.

5.2.5 Option 4a - Variant of Option 4

Additionally, a variant to Option 4 was considered, which deviates from the

Gugark-1 OHL before reaching the highest point at 2,750 m a.s.l. and which would would avoid crossing the Caucasian Rose-Bay Sanctuary and also minimize the the forest area crossed in Margahovit State Sanctuary (< 1 km). This routing crosses crosses the valley east of Fioletovo village and joins Option 4 north of the valley (see

valley (see

Map 5-2).

This is the **preferred option** from an environmental and social perspective and also from environmental NGOs like WWF, Armenian Tree Project (ATP) and Armenian Society for the Protection of Birds (ATPB).

5.2.6 Option 5 - Along Debed River Valley

Leaving s/s Ddmashen this option first follows the same corridor as Option 4/ 4a, 4/ 4a, however crosses Margahovit State Sanctuary and the valley of Fioletovo a little Fioletovo a little bit further east in order to avoid the high peak (2,750 m a.s.l.) south a.s.l.) south of the State Sanctuary. North of Fioletovo Option 5 separates from from Option 4/ 4a, running northwest above the forested areas in the north of of Fioletovo and Margahovit (including a plantation of ATP which has to be avoided) avoided) (see

Map 5-2).

In order to avoid crossing the forested areas east of Gugark, Pambak and Vahagnadzor villages, the line routing turns to northern direction between Margahovit and Lermontov, crossing mountain meadows (highest point in this part 2,570 m a.s.l.) until Yeghegnut village. Passing the villages of Yeghegnut, Debet, Chkalov and Dsegh line routing has to avoid crossing of buildings in order to avoid physical relocation of households to the greatest extent possible. Between Debet and Chkalov villages the line routing over-spans a gorge (approx. 1,000 m wide span) and leads over agricultural land to Dsegh village. This gorge is a sensitive area for breeding birds (especially vultures and other birds of prey). In this section Option 5 leads for approx. 23 km through IBA Dsegh, established for the protection of threatened bird species like e.g. vultures (also breeding at the gorge of Debed River) and other birds of prey, as well as endangered Caucasian Grouse (inhabiting the upper tree line with dense rhododendron thickets and adjacent mountain meadows).

North of village Dsegh the valley of Marts River is over-spanned (approx. 1,000 m 1,000 m wide span). The line routing then runs north, passing above Tumanjan Tumanjan village. For the next 10 km the line runs through steep rocky hills with with many forested valleys. In order to avoid cutting of trees as much as possible possible wide-span towers should be put on hilltops to over-span forested areas in the areas in the valleys. However, in this part no access roads do exist to reach the the hilltops. Tower construction would require new access roads (leading through through forested areas, causing further tree cutting) or use of helicopter. A routing routing on the western side of Debed River valley is not possible due to already already existing OHLs (e.g. 220 kV Lori line) and villages (e.g. Odzun) (see Map 5-1 and

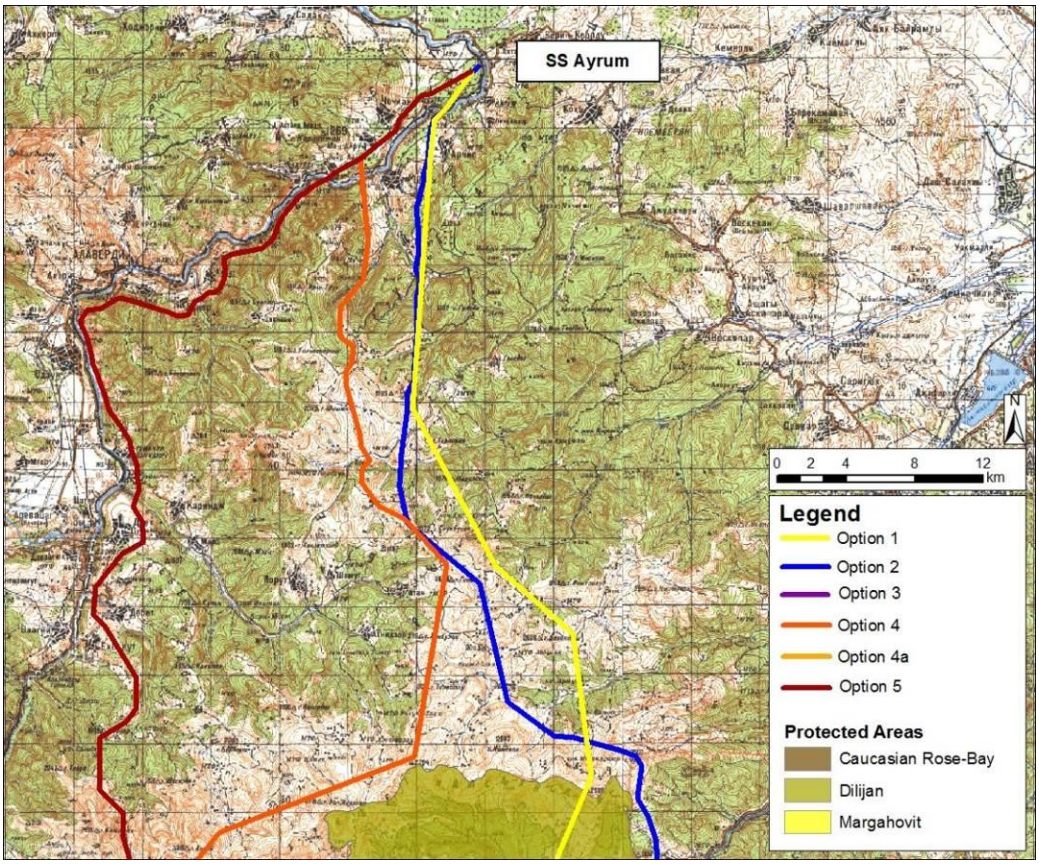
Map 5-2).

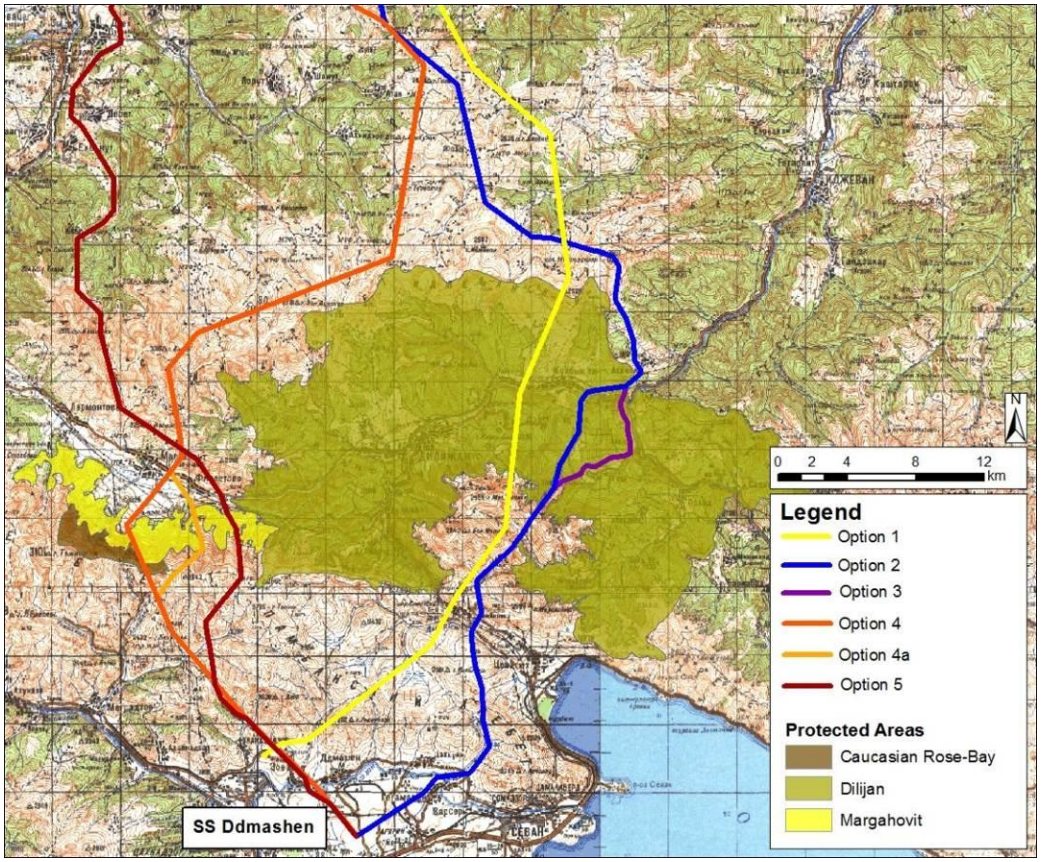
Turning east (south of Akori village) the line passes the villages Sarahart, Sanahin, and Akner in the south over-spanning another six deep forested valleys, with spans up to 1,000 m. Haghpat village has to be passed in the south and east crossing areas with bushes or forest, as in the west and north of the village a number of other OHLs do already exist (e.g. 220 kV Alaverdi-Georgia, 110 kV Noyemberyan/Lalvar, and 35 kV OHL).

Line routing east of Haghpat until the crossing of Debed River valley south of Pokr Ayrum, again leads through rugged terrain, where wide-span towers have to be put on hilltops, in order to over-span forested areas in the valleys. Due to the existence of the above mentioned OHLs the 400 kV line has to be constructed in a safe distance of these lines, requiring new access roads leading through forested areas. After crossing Debed River valley the line leads over agricultural used land to s/s Ayrum, over-spanning another gorge south of Mets Ayrum (same corridor as Option 4/ 4a).

Main critical issue is the crossing of many forested areas. Even, if wide-span towers are put on hilltops to over-span forested valleys, new access roads leading through forested areas are needed to reach hilltops, or use of helicopters will be required. Sensitive habitats are crossed in IBA Dsegh and when crossing gorges (e.g. near Debet and Dsegh).

Map 5-1: Options for 400 kV OHL routing (northern part)





Map 5-2: Options for 400 kV OHL routing (southern part)

5.2.7 Comparison of Options

Above mentioned options of 400 kV OHL routing are compared in Table 5-1. Illustrating photo documentation from field surveys is presented in Section 11.2 – Appendix II).

Table 5-1: Summarizing comparison of different options for 400 kV OHL

Criteria	Option 1	Option 2	Option 3	Option 4 (Option 4a)	Option 5
Total length of 400 kV OHL Ddmashen - Ayrum	87 km (if starting from s/s Ddmashen)	92 km	93 km	94 km	105 km
Maximum altitude	2,500 m a.s.l. north of DNP, 2,500 m a.s.l. south of DNP (1,000 m a.s.l. in valley between peaks)	2,450 m a.s.l., north of DNP	2,450 m a.s.l. north of DNP	2,750 m a.s.l. (near Gugark-1 OHL), 2,600 m a.s.l. north of village Margahovit (1,700 m a.s.l. in valley between peaks)	2,570 m a.s.l. (northwest of Margahovit), 2,560 m a.s.l. south of Margahovit State Sanctuary (1,700 m a.s.l. in valley between peaks)
Average altitude	1,660 m a.s.l.	1,650 m a.s.l.	1,650 m a.s.l.	1,820 m a.s.l.	1,470 m a.s.l.
Length of forest area crossed	17 km in total: 7 km DNP, 7 km Teghut (Lori), 3 km on plateau	5.5 – 11.5 km in total: 3.5 km DNP (existing line), open forest land above Hovk, 2-8 km Teghut (Lori)	5 - 11 km in total: 3 km in Gosh valley (1 km inside DNP), open forest land above Hovk, 2-8 km Teghut (Lori)	3 km in total (< 3km in Option 4a): 1.5 km Margahovit State Sanctuary (in Option 4a < 1km), 2 km Teghut (Lori)	20 km in total: 1 km Margahovit State Sanctuary, 7 km north of Tumanjan, 12 km south of Debed River valley (less if forested valleys are over-spanned using wide-span towers on hilltops)
Mountain meadow s crossed (> 2,100 m a.s.l.)	18.5 km in total: 17 km south of DNP, 1.5 km north of DNP	15 km in total: 12.5 km south of DNP, 2.5 km northwest of Hovk and DNP	15 km in total: 12.5 km south of DNP, 2.5 km northwest of Hovk and DNP	32 km in total: 11 km south of Margahovit State Sanctuary, 21 km west and north of DNP	24 km in total: 10 km south of Margahovit State Sanctuary, 14 km between Margahovit and Dsegh

Criteria	Option 1	Option 2	Option 3	Option 4 (Option 4a)	Option 5
Length of Protected Areas being crossed	Dilijan NP is crossed (8 km), Strict reserve zone in DNP crossed (1 km)	DNP is crossed (4 km)	DNP is crossed (1 km)	No crossing of Dilijan NP, Margahovit State Sanctuary (1.5 km) and Caucasian Rose-Bay Sanctuary (1.5 km) are crossed parallel to existing Guagark-1OHL. In Option 4a Margahovit State Sanctuary is crossed at smallest extension (< 1 km) and Caucasian Rose-Bay Sanctuary is not crossed.	No crossing of Dilijan NP, Margahovit State Sanctuary is crossed (1 km), Caucasian Rose-Bay Sanctuary is not crossed.
Length of Important Bird Areas (IBA) being crossed	7 km IBA Haghartsin	No IBA crossed	No IBA crossed	21 km in total: 14 km IBA Pambak Mountain Chain; 7 km IBA Dsegh	37.5 km in total: 14.5 km IBA Pambak Mountain Chain; 23 km IBA Dsegh
Pristine, remote areas with undisturbed habitats	Forest habitats (inside DNP and e.g. Teghut-Lori), National Park, Red Deer Introduction Zone, sensitive habitat of birds of prey (rock walls), mountain meadows	Rock walls (habitat of vultures and other birds of prey), sensitive habitat of mammals, mountain meadows, forest areas (inside DNP and e.g. Teghut-Lori)	Rock walls (habitat of vultures and other birds of prey), sensitive habitat of mammals, mountain meadows, forest areas (e.g. Teghut-Lori)	No rock walls (nesting sites for birds of prey), mountain meadows, valuable forest habitat (Margahovit State Sanctuary) and other forest areas (e.g. Teghut-Lori), sensitive habitat for Rhododendron (Caucasian Rose-Bay Sanctuary – not crossed in Option 4a)	Rock walls west of Debet and in Debed valley (habitat of vultures and other birds of prey), mountain meadows, valuable forest habitat (Margahovit State Sanctuary) and other forest areas (e.g. north of Tumanjan, east of Haghpat), sensitive habitat for Rhododendron (IBA Dsegh)

Criteria	Option 1	Option 2	Option 3	Option 4 (Option 4a)	Option 5
Access roads	Existing roads can be used partly but new access roads to towers needed; new access roads on high plateau needed	Access roads need to be rehabilitated at existing line; new access roads needed on high plateau	New access roads in difficult terrain needed, use of helicopter may be required	Existing access roads/ tracks in most parts; in highlands use meadows in ROW as access to tower sites (however, even in highlands some access tracks do exist)	Existing access roads/tracks in many parts; no access roads in steep hills north of Tumanjan and in forested areas south of Debed River; in highlands use meadows in ROW as access to tower sites
Agricultural land affected	19 km in total: 11.5 km south of DNP, 2.5 km west of Gomshavar, 2.5 km west of Archis, 2.5 km south of s/s Ayrum	27 km in total: 15.5 km south of DNP, 1 km near Hovk, 2.5 km west of Shnogh, 1.5 km south of Mets Ayrum, 6.5 km near Chochkan	27 km in total: 15.5 km south of DNP, 1 km near Hovk, 2.5 km west of Shnogh, 1.5 km south of Mets Ayrum, 6.5 km near Chochkan	28 km in total: 8.5 km north of s/s Ddmashen, 0.5 km near Fioletovo, 5.5 km north of Fioletovo, 2.5 km southwest of Gomshavar, 2.5 km west of Shnogh, 2 km south of Mets Ayrum, 6.5 km near Chochkan	32 km in total: 8.5 km north of s/s Ddmashen, 0.5 km near Fioletovo, 5 km north of Fioletovo and Margahovit, 1.5 km near Yeghegnut and Debet, 6 km near Dsegh, 2 km south of Pokr Ayrum, 2 km south of Mets Ayrum, 6.5 km near Chochkan
Village land being crossed	9 villages: Gagarin, Geghamavan, Semyonovka, Teghut (Tavush), Haghartsin, Teghut (Lori), Shnogh, Archis, Chochkan	7 villages: Gagarin, Geghamavan, Semyonovka, Hovk, Teghut (Lori), Shnogh, (Archis), Chochkan	8 villages: Gagarin, Geghamavan, Semyonovka, Gosh, Hovk, Teghut (Lori), Shnogh, (Archis), Chochkan	11 villages: Ddmashen, Zovaber, Margahovit, Fioletovo, Atan, Aghnidzor (2 km distance), Teghut (Lori), Shnogh, (Archis), Mets Ayrum, Chochkan	19 villages: Ddmashen, Zovaber, Fioletovo, Margahovit, Lermontovo, Yeghegnut, Debet, Chkalov, Dsegh, Tumanjan, Sanahin Kayaran, Sarahart, Sanahin, Akner, Haghpat, Neghots, Pokr Ayrum, Mets Ayrum, Chochkan
Resettlement and Land Acquisition	Potentially a few houses in Teghut (Tavush). Potential Private lands of villages mentioned above	Potentially 1-2 houses in Hovk. Potential Private lands of villages mentioned above	Potentially 1-2 houses in Hovk. Potential Private lands of villages mentioned above	Probably no physical relocation needed. Potential Private lands of villages mentioned above	Probably no physical relocation needed. Potential Private lands of villages mentioned above

Criteria	Option 1	Option 2	Option 3	Option 4 (Option 4a)	Option 5
Visual impact/ Tourism value/ Historical and Cultural Sites	Visibility: • high in Dilijan National Park; • high in traverse above Haghartsin; • high for passage on eastern side of Teghut Valley; • high passing villages north of Debed River. Historical/ Cultural Sites: • Archaeological excavation near Teghut village (if Teghut Mining Site is passed in the east)	Visibility: • low for Dilijan NP traverse as parallel to existing line or even in same corridor; • high for traverse above Hovk (rock walls); • high passing villages north of Debed River Historical/ Cultural Sites: • Archaeological excavation near Teghut village (if Teghut Mining Site is passed in the east)	Visibility: • high for visitors of Goshavank monastery (major tourism destination); • high for traverse above Hovk (rock walls); • high passing villages north of Debed River Historical/ Cultural Sites: • Archaeological excavation near Teghut village (if Teghut Mining Site is passed in the east)	Visibility: • low, if partly parallel to existing Gugark-1 OHL; • high if crossing valley east of Fioletovo (Option 4a); • high in mountain highlands above Aghnidzor/ Atan/ Gomshavar villages, however mostly not very visible from valleys and roads; • low for passage on western side of Teghut Mining Area; • high passing villages north of Debed River Historical/ Cultural Sites: • Archaeological excavation near Teghut village (if Teghut Mining Site is passed in the east)	Visibility: • high crossing valley east of Fioletovo; • high in mountain highlands between Margahovit and Yeghegnut villages, however mostly not very visible from valleys and roads; • high near villages Yeghegnut, Debet, Chkalov, Dsegh and Tumanjan; • high on hilltops from Tumanjan to Alaverdi; • low to high on hill tops between Alaverdi and crossing of Debed River south of Pokr Ayrum; • high for visitors of Sanahin and Haghpat monasteries (major tourism destinations); • high passing villages north of Debed River Historical/ Cultural Sites: • Ruins of two monasteries (Qarasun Mankants, Bardzrakash St. Grigor) and a khachkar cross-stone (Sirun Khach) near village Dsegh

Criteria	Option 1	Option 2	Option 3	Option 4 (Option 4a)	Option 5
Recommendation of NGOs	Not recommended as crossing Dilijan NP in strict reserve zones.	Not recommended as crossing Dilijan NP.	Not recommendable due to very difficult terrain and sensitive habitats	Recommended by WWF and ASPB; ATP: not to be recommended from an ecological point of view, but better option compared to Option 5	Not recommended by ASPB as crossing IBA Dsegh and habitats of threatened species; not recommended by ATP as crossing more forested areas than Option 4/ 4a
Recommendation from social and environmental point of view	Not recommended as crossing Dilijan NP in strict reserve zones.	Not recommended as crossing Dilijan NP. Option of dismantling existing 330 kV towers and constructing 400/110 kV on common towers in the same corridor has least impacts in NP.	Not recommendable due to very difficult terrain and sensitive habitats	**Preferred option.** However, parts of the line run in high altitude (41 km above 2,000 m a.s.l.). Access tracks exist in most areas. Parts of the high mountain plateau without access tracks shall be reached using meadows in the ROW.	Not recommended as crossing many forested areas, steep rocky hills without access roads to hilltops and sensitive areas for threatened breeding birds in and near IBA Dsegh.

5.3 Assessment of Options

1. From an environmental and social perspective it is preferable to avoid the Dilijan National Park. The principle is to avoid Protected Areas, wherever possible. In the case of Dilijan NP which is in the process of strengthening its acceptance among the local population the non-violation of park boundaries is especially important as it is difficult to communicate to residents that they are not allowed to violate the park regulations, whereas a project in the National Interest has the right to do it. Option 1 is thus not recommended from environmental and social perspective.

2. Option 2 also crosses the Dilijan NP but would avoid additional impacts for DNP, especially if the existing 330 kV was dismantled and newly constructed as 400/110 kV on common towers in the same corridor. However, existing access roads will have to be cleared of trees grown up in the last years. Thus, substantial clearing of forest in the corridor would be necessary. Additionally, Option 2 has considerable impacts in the area above village Hovk (visual and environmental), which are not within the park boundaries but in adjacent territory.

3. Option 3 avoids Dilijan NP nearly completely, but is not recommendable due to the difficulty/ inaccessibility of the terrain and disturbance of natural habitats, cutting of forest and visibility from the village in the valley of Gosh with monastery Goshavank as a major tourist attraction.

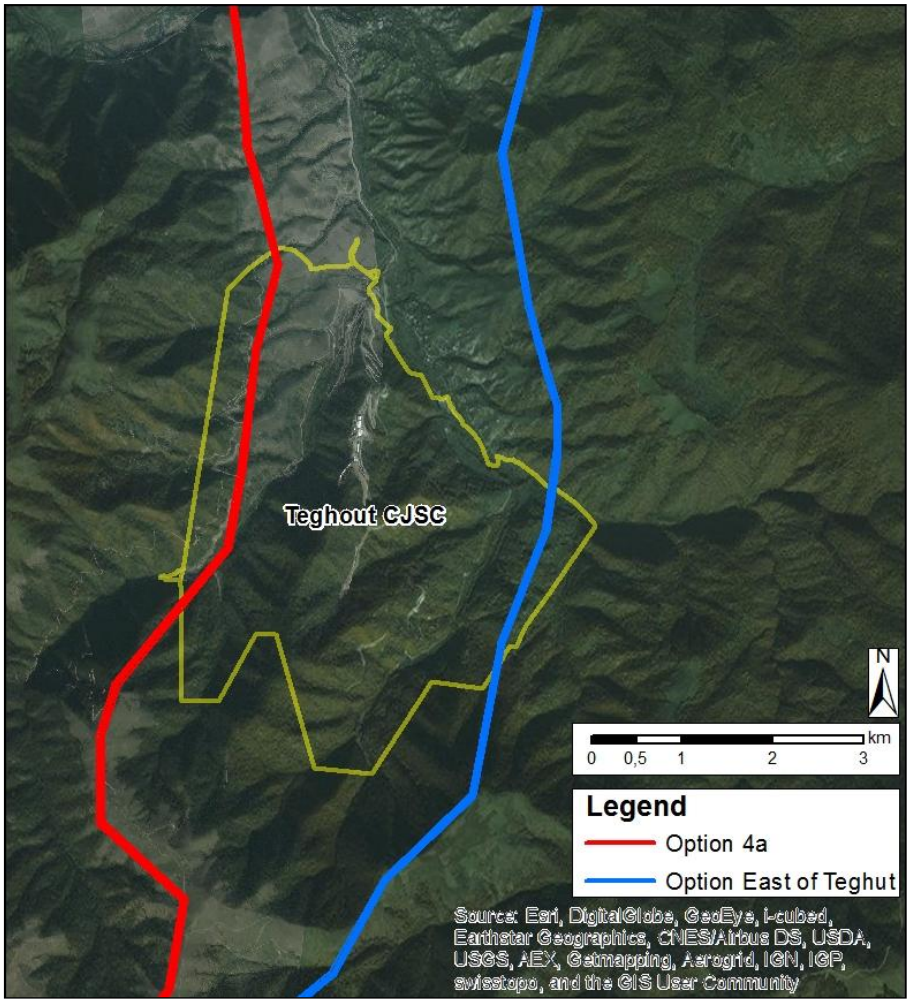
4. Option 4/ 4a is approx. 7 km longer than Option 1 (but similar to Option 2 and Option 3). The major impact is the traverse of mountain meadows to a greater extent than in the other options. The line further needs to avoid two protected areas as far as possible, the Caucasian Rose-Bay Sanctuary and the Margahovit State Sanctuary, which will be crossed by the line if it closely follows the existing Gugark-1 OHL.

5. The traverse of villages Margahovit and Fioletovo would not cause significant resettlement issues as there are no houses in the corridor between the villages (Option 4). However, some private lands would need to be expropriated. Both community leaders in Margahovit and Fioletovo did not object to the possibility of the line passing in the uninhabited land stretch between the two villages.

6. The responsible forest officer (Hayantar SNCO) did not object to the selection of the passage of Margahovit Forest Sanctuary parallel to the Gugark-1 line (Option 4). The NGO Armenian Tree Project (Hrant Dink Memorial Forest Plantation) is pointing on the need to minimize the forest crossings. A routing on the eastern side of village Fioletovo would thus be preferable (Option 4a).

7. Option 4a minimizes the impacts on forest areas, leaving Gugark-1 OHL a few hundred meters before the mountain top and traversing the valley on the eastern side of village Fioletovo at the level of the "landfill mountain" in the valley. However, mountain meadow areas and the exactness of reserve boundaries (especially the traverse of Caucasian Rose-Bay Sanctuary) could not be checked during field survey, due to snow conditions.

8. The option to bypass the Teghut Mining Site on the western side needs to be clarified in close cooperation with Teghout CJSC for all discussed options except Option 5. If feasible, the western option is preferable to the eastern option, which would include the traverse of significantly more forest land on the eastern side of Teghut valley and bypass villages Teghut and Shnogh (see Map 5-3).



Map 5-3: Line Routing options of 400 kV OHL Ayrum – Ddmashen passing Teghut Mining Site west or east – Yellow: property of Teghout CJSC

9. The maximum altitude of Option 4/ 4a is approx. 100 - 200 m higher than in Option 1, whereas the minimal altitude between the highest points is 700 m higher than for Option 1.

10. Option 5 has the advantage to run on lower average altitudes than Option 4. Highest altitude is 2,570 m a.s.l. when passing the mountain meadows between Margahovit and Yeghegnut villages. In total it is 11 km longer than Option 4/ 4a.

11. Option 5 crosses much more forest areas than the other options (especially north of Tumanjan and south of Debed River valley). Even if wide-span towers are put on hilltops over-spanning the forested valleys (where possible) access roads have to be constructed in forested areas in order to reach the hilltops or helicopters have to be used.

12. Margahovit State Sanctuary will be crossed by Options 4/ 4a and 5 with Option 4a crossing the Sanctuary at its smallest extension. IBA Pambak Mountain Chain is also crossed by the above mentioned options. IBA Dsegh is crossed by Option 4/ 4a in its southern part on a length of approx. 7 km, while Option 5 crosses IBA Dsegh on approx. 23 km. Option 5 also crosses some sensitive areas for cliff-breeding birds like vultures and other birds of prey when crossing gorges near villages Debet and Dsegh.

13. Towers and power lines of Option 5 will be highly visible from Sanahin and Haghpat monasteries which are major tourist attractions.

14. In the section south of Debed River valley (from s/s Alaverdi-2 to the crossing of Debed River valley south of Pokr Ayrum) a number of other OHLs do already exist (e.g. 220 kV Alaverdi-Georgia, 110 kV Noyemberyan/Lalvar, and 35 kV OHL). Thus, the new 400 kV OHL has to be constructed in a safe distance of the existing lines, requiring new access roads leading through forested areas.

5.4 Conclusion & Recommendation

The assessment of options was introduced and discussed with HVEN during meetings following the field surveys in February and April 2016.

As detailed above, Option 4a is considered to be the preferred option from an environmental and social perspective. However, this option also requires a line routing crossing remote areas in high altitude up to 2,750 m a.s.l. which will cause environmental impacts that cannot be completely mitigated. In addition these high elevations require prudent design and specification of towers and conductors and is also challenging for construction. But this would be valid for all other options, too.

Fichtner's recommendation is in accordance with HVEN's opinion, as Option 4a avoids crossing of Dilijan National Park and minimizes the crossing of forest areas to the greatest extent possible.

6. Baseline Conditions

Environmental and social baseline conditions are established by collecting information on which receptors and biophysical/ social resources occupy both the proposed corridors and surrounding areas as well as the areas foreseen for BtB converter station/ substation construction and so may be affected by the development proposals. Once the baseline conditions have been established, the impacts of the scheme can be identified and measured and their acceptability assessed in terms of environmental and social effects. The baseline conditions were established through a combination of desk studies and field surveys by the environmental and social experts in December 2015, February and April 2016.

6.1 General Environment and Ecology

6.1.1 Study area

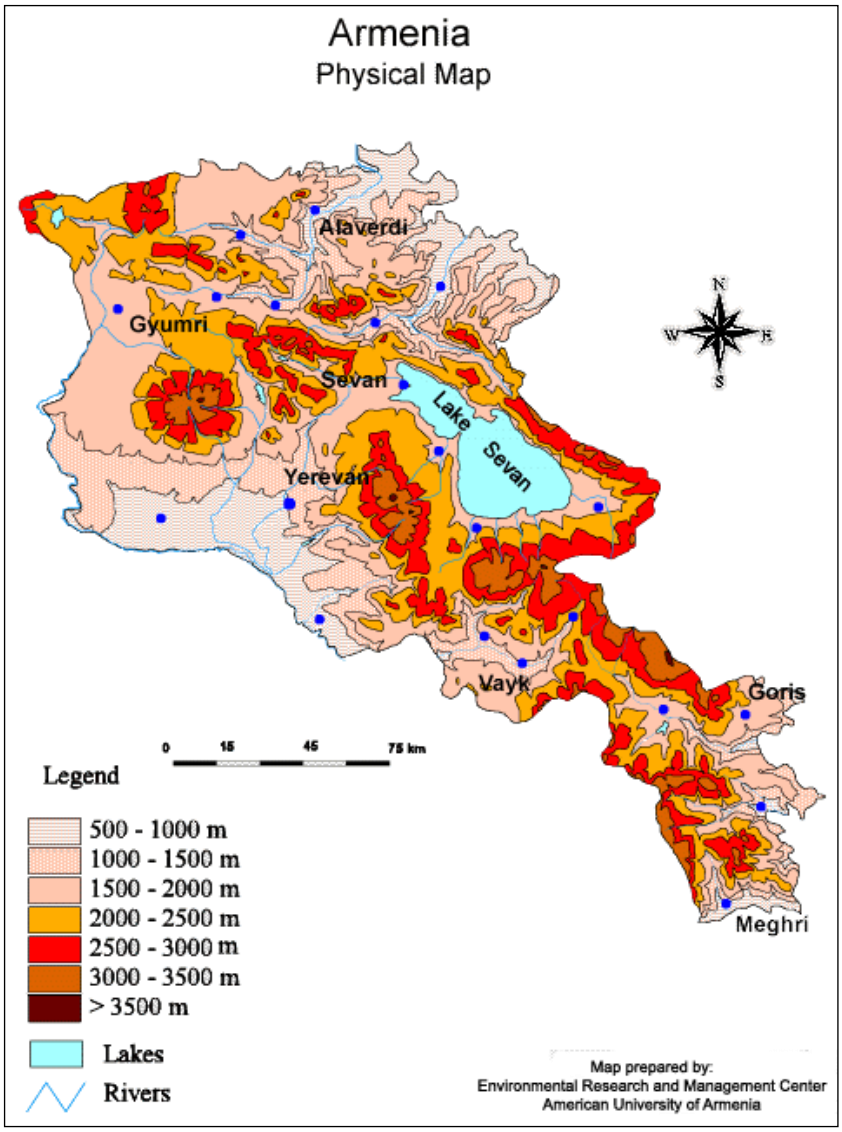
The overhead transmission lines considered in this Project are mainly located in the province Lori Marz (capital Vanadzor) situated in the north of the Republic of Armenia bordering Georgia, and in Tavush Marz (capital Ijevan) located in the northeast of Armenia bordering Georgia and Azerbaijan. Parts of the OHLs are also running through the northeastern part of central province Kotayk Marz (capital Hrazdan) and northwestern part of Gegharkunik Marz (capital Gavar) (see Map 6-1).

Map 6-1: Provinces (marzes) of the Republic of Armenia

BtB substation Ayrum is located near to the Georgian border in the north of Tavush Marz, while Ddmashen substation is located in the northwest of Gegharkunik Marz and Hrazdan TPP in the north of Kotayk Marz.

6.1.2 Topography

Armenia has a multi-form relief (see Map 6-2). The republic is a typical highland country. The lowest spot is in the north on the bank of Debed River at 375 m a.s.l., whereas the highest spot is the northern peak of Mount Aragats at 4,095 m a.s.l.



Map 6-2: Physical Map of Republic of Armenia

The terrain of Armenia can be divided into the following four main geographical/ geological regions[1]:

[1] http://www.cac-biodiversity.org/arm/arm_geography.htm

- Mountainous ridges and valleys in the north-east which occur mainly in the basin of the River Kur (including the ranges of Virahajots, Bazumi, Pambak, Gougarats, Aregouni and Sevan). This region is subject to extensive erosion.
- Regions of volcanic origin, including the mountain ranges of Ashotsk, Aragats, Geghama, Vardenis, Syunik and Mount Aragats. These areas are covered by lava of relatively recent origin (upper Pliocene) and are characterized by gentle slopes. Here, only minor erosion occurs, although larger rivers have built deep gorges and canyons.
- A series of ridged mountains adjacent to the River Arax (ridges on the left bank along with the Urts-Eranossian, Teksar, Vayk, and Zangezour mountain ranges, including the peak of Kapoutdjugh) constitute the Minor Caucasian system. This area is prone to intense erosion.
- The Ararat Valley represents the lowest part of the Ararat depression (which is still undergoing tectonic movement). This area is covered with alluvial and pro-alluvial sediments.

6.1.3 Meteorology and climate

Because of Armenia's position in the deep interior of the northern part of the subtropical zone, enclosed by lofty ranges, its general climate is dry and continental. Nevertheless, regional climatic variation is considerable (see Map 6-3).

Ayrum (Tavush Marz) and Shnogh (Lori Marz) have a warm and temperate climate. The average annual temperature is 12.9°C in Ayrum and 12.3°C in Shnogh, the rainfall averages 450 mm and 463 mm respectively. The driest month is January with a precipitation of 19 mm. With an average of 74 mm in Ayrum and 77 mm in Shnogh the most precipitation falls in May. With an average of 24.6°C in Ayrum and 23.8°C in Shnogh, July is the warmest month. January has the lowest average temperature of the year with 1.0°C in Ayrum and 0.5°C in Shnogh.

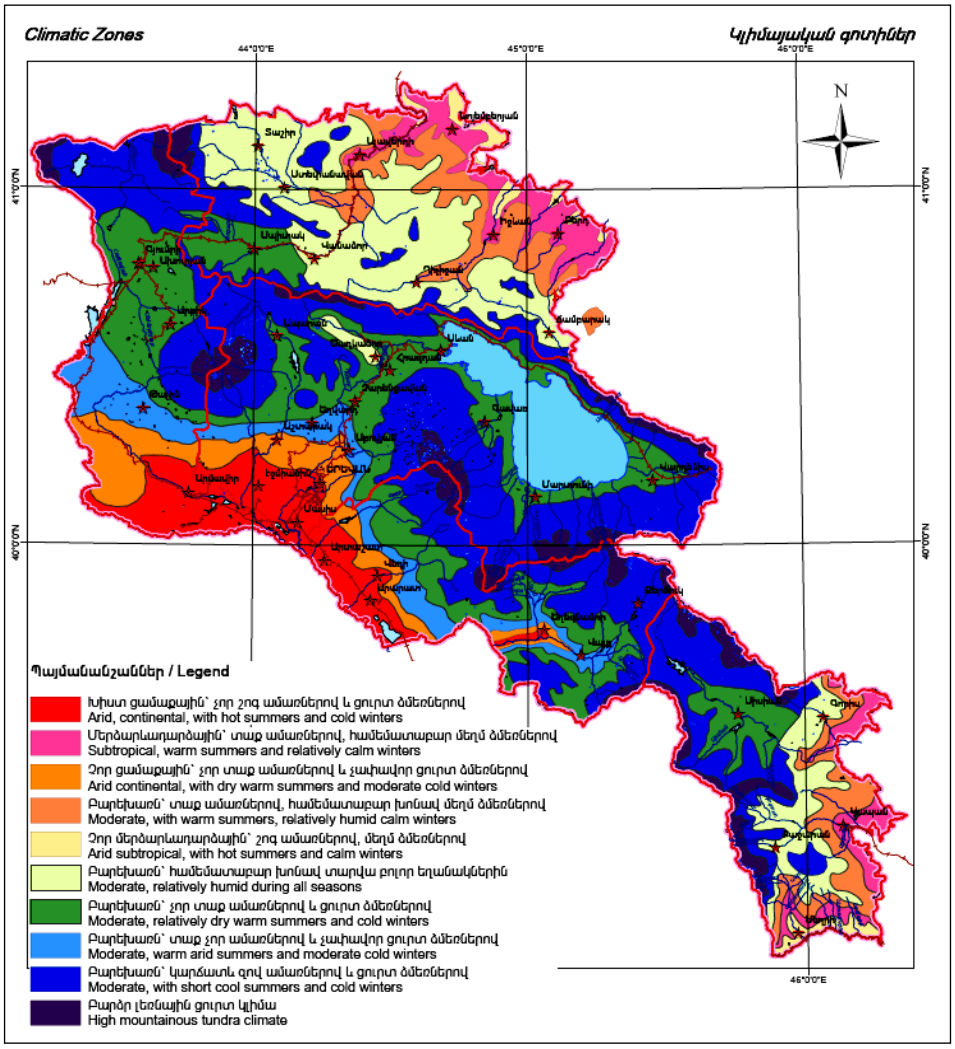
The climate in Alaverdi and Vanadzor (Lori Marz) is cold and temperate. The temperature averages 11.4°C in Alaverdi and 8.1°C in Vanadzor. In a year, the average rainfall is 475 mm and 534 mm, respectively. The driest month is January with 20 mm of precipitation. Most of the precipitation falls in May, averaging 79 mm in Alaverdi and even 94 mm in Vanadzor. July is the warmest month with an average of 22.7°C in Alaverdi and 19.0°C in Vanadzor. January is the coldest month, with temperatures averaging -0.5°C and -3.7°C, respectively.

In Dilijan (Tavush Marz), the climate is also cold and temperate. The temperature averages 8.7°C. About 539 mm of precipitation falls annually. The driest month is January, with 17 mm of rainfall. Most precipitation falls in May, with an average of 92 mm. The warmest month of the year is July, with an average temperature of 19.0°C. In January, the average temperature is -1.9°C. It is the lowest average temperature of the whole year.

Generally, it is cold and temperate in Ddmashen (Gegharkunik Marz). The temperature here averages 6.0 °C. Precipitation here averages 524 mm. The least amount of rainfall occurs in January. The average in this month is 19 mm. In May, the precipitation reaches its peak, with an average of 92 mm. The temperatures are highest on average in August, at around 16.6°C. At -5.0°C on average, January is the coldest month of the year.

In Hrazdan (Kotayk Marz) the climate is also cold and temperate. The temperature here averages 6.0°C. The average annual rainfall is 501 mm. Precipitation is lowest in January, with an average of 19 mm. Most of the precipitation falls in May, averaging 89 mm. With an average temperature of 16.8°C, August is the hottest month of the year. January is the coldest month, with temperatures averaging -5.2°C.

Meteorological data for the above mentioned locations is given in Table 6-1.



Map 6-3: Climatic Zones of Armenia[2]

[2] Ministry of Nature Protection of RA

Table 6-1: Meteorological data[3] of different locations along the OHL routes

Location	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Ayrum (Tavush Marz) / 550 m a.s.l.													
Temperature average (°C)	1.0	2.3	6.4	12.6	17.5	21.4	24.6	24.1	19.8	13.9	7.9	3.1	**12.9**
Average precipitation (mm)	19	25	32	45	74	63	38	34	32	38	31	19	**450**
Shnogh (Lori Marz) / 650 m a.s.l.													
Temperature average (°C)	0.5	1.7	6.0	11.8	16.9	20.6	23.8	23.5	19.2	13.4	7.4	2.6	**12.3**
Average precipitation (mm)	19	25	33	47	77	66	40	35	32	39	31	19	**463**
Alaverdi (Lori Marz) / 1,000 m a.s.l.													
Temperature average (°C)	-0.5	0.8	5.2	11.0	16.2	19.8	22.7	22.6	18.3	12.6	6.7	1.7	**11.4**
Average precipitation (mm)	20	25	33	49	79	68	42	35	33	39	32	20	**475**
Vanadzor (Lori Marz) / 1,350 m a.s.l.													
Temperature average (°C)	-3.7	-2.7	1.8	7.4	12.4	16.0	19.0	18.9	14.9	9.8	3.9	-1.1	**8.1**
Average precipitation (mm)	20	26	36	57	94	83	51	42	33	41	32	19	**534**
Dilijan (Tavush Marz) / 1,500 m a.s.l.													
Temperature average (°C)	-1.9	-1.6	2.8	7.9	12.9	16.5	19.0	19.0	14.8	10.2	4.8	0.1	**8.7**
Average precipitation (mm)	17	24	37	61	92	85	53	42	37	40	31	20	**539**
Ddmashen (Gegharkunik Marz) / 1,800 m a.s.l.													
Temperature average (°C)	-5.0	-4.4	-0.8	4.4	9.2	13.1	16.4	16.6	13.1	8.6	2.7	-2.3	**6.0**
Average precipitation (mm)	19	24	36	57	92	79	49	41	32	43	33	19	**524**
Hrazdan (Kotayk Marz) / 1,675 m a.s.l.													
Temperature average (°C)	-5.2	-4.5	-0.7	4.7	9.4	13.4	16.6	16.8	13.3	8.5	2.7	-2.4	**6.0**
Average precipitation (mm)	19	23	35	55	89	74	46	38	30	41	32	19	**501**

[3] http://www.climate-data.org

6.1.4 Geology and seismicity

According to MNP (2002) Armenia is a part of the Transcaucasus great arched fold and medium-Araxian intermountain lowering. These two geological structural units are included in the Caucasus-Anatolia-Iranian segment of the Mediterranean plicate zone. Given the time of establishment of geological structural units and accomplishment age of plicate formation the territory of Armenia is divided into the Somkheti-Ghapan complex, Bazum-Zangezur and trans-Araksian zones.

The Somkheti-Ghapan complex as a real geosyncline was formed in alpine period. Volcanic, volcanic sedimentary rocks, terrestrial and carbonate ores are involved in the complex structure. The complex is divided into the Ghapan segment and Somkheti-Ghapan multi-arched plicate zone.

The Alaverdi-Shamshadin, Noyemberyan and Lori sub-zones differ by their age, ores composition and structure:

- The Alaverdi-Shamshadin sub-zone is composed mainly of volcanic and sedimentary formations of unique lower Cretaceous period, which are fragmented by inter-igneous rocks of acid composition, within the sub-group composition Alaverdi and Shamshadin multi-arched plicate (anticlinorium) and Ijevan multi-concave plicate.
- The Noyemberyan sub-zone is composed of carbonate and land-carbonate ores, which are extremely inadequately sited on the lower stratums forming a secondary plicate structure.
- The Lori sub-zone is rich in volcanic and sedimentary rocks, which are slightly shifted.

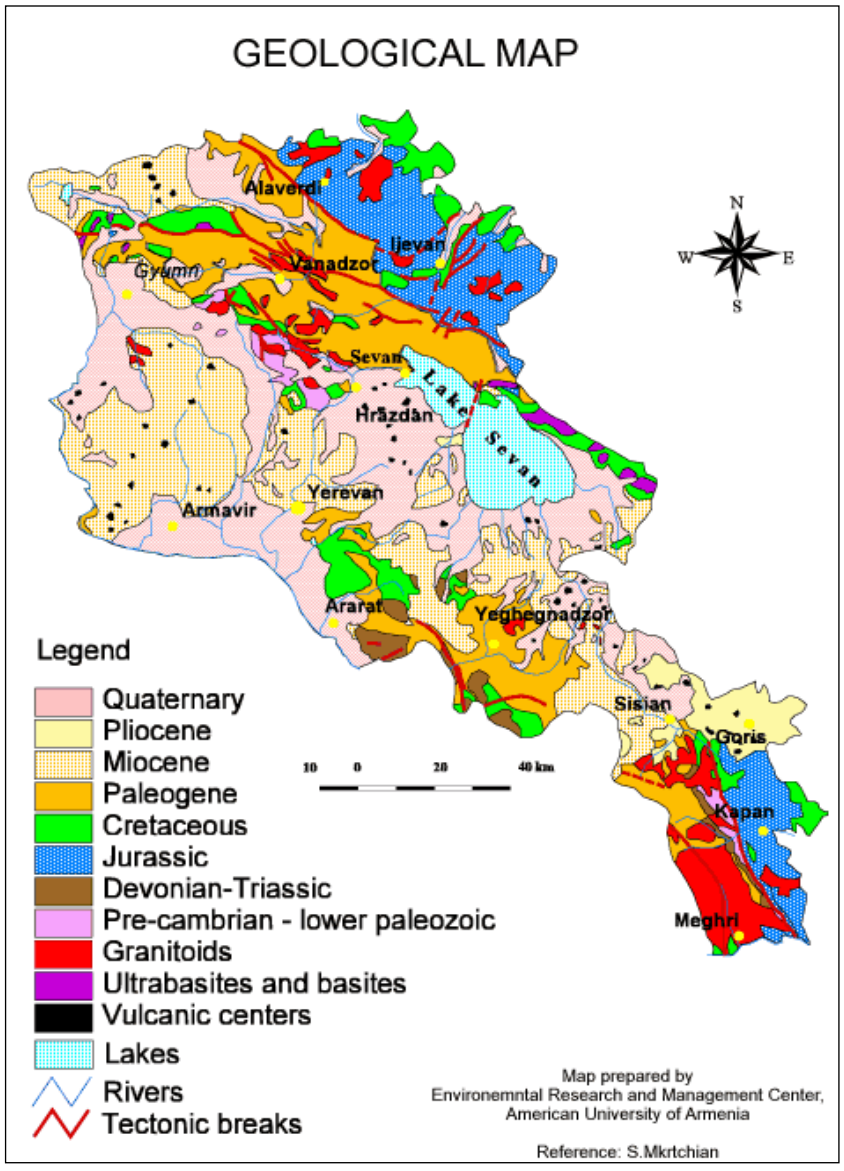
The Bazum-Zangezur intensively plicate zone is involved in the layer section by land-origin volcanic and sedimentary rocks and carbonate ores of Cretaceous period.

The ophiolite sub-zone of Sevan-Amasia and multi-pouted sub-zone of Tsaghkunjats-Zangezur are isolated on the borders of the Bazum-Zangezur zone:

- The Sevan-Amasia sub-zone is characterized by wide prevalence of ophiolete formation rocks and intensively plicate nature. This sub-zone identifies Amasia, Bazum and Sevan multi-arched placate composed of cretaceous sediments and Palaeogene stratums filled by multi-concave plicate splitting them.
- The Tsaghkunyats-Zangezur multi-arched sub-zone is characterized by an extremely inadequate dislocation of Palaeozoic and Palaeocene sedimentation and volcanic sediments, as well as wide prevalence of neogenesis molas and land and volcanic-origin stratums of Quaternary period.

The trans-Araksian weak plicate zone is divided into the Yerevan-Ordubad and orogenic lowering sub-zones:

- The Yerevan-Ordubad sub-zone is located in the south of the Bazum-Zangezur zone and is characterized by meogeocyncline type. Land, carbonate, ophyolite, volcanic and sedimentary formation stratums, as well as volcanic origin and land formations of Quaternary period. The sub-zone is composed of two structural units: the Yerevan-Ordubad concave fold and Urts-Vayots Dzor arched fold.
- The orogenic-lowering sub-zone is composed of a number of concave folds (Nakhijevan, Artashat, Sevan-Yerevan, Aragats, Akhuryan, etc.), which are divided by arched folds (Parakar-Yengija, Ararat, Armavir, etc.).

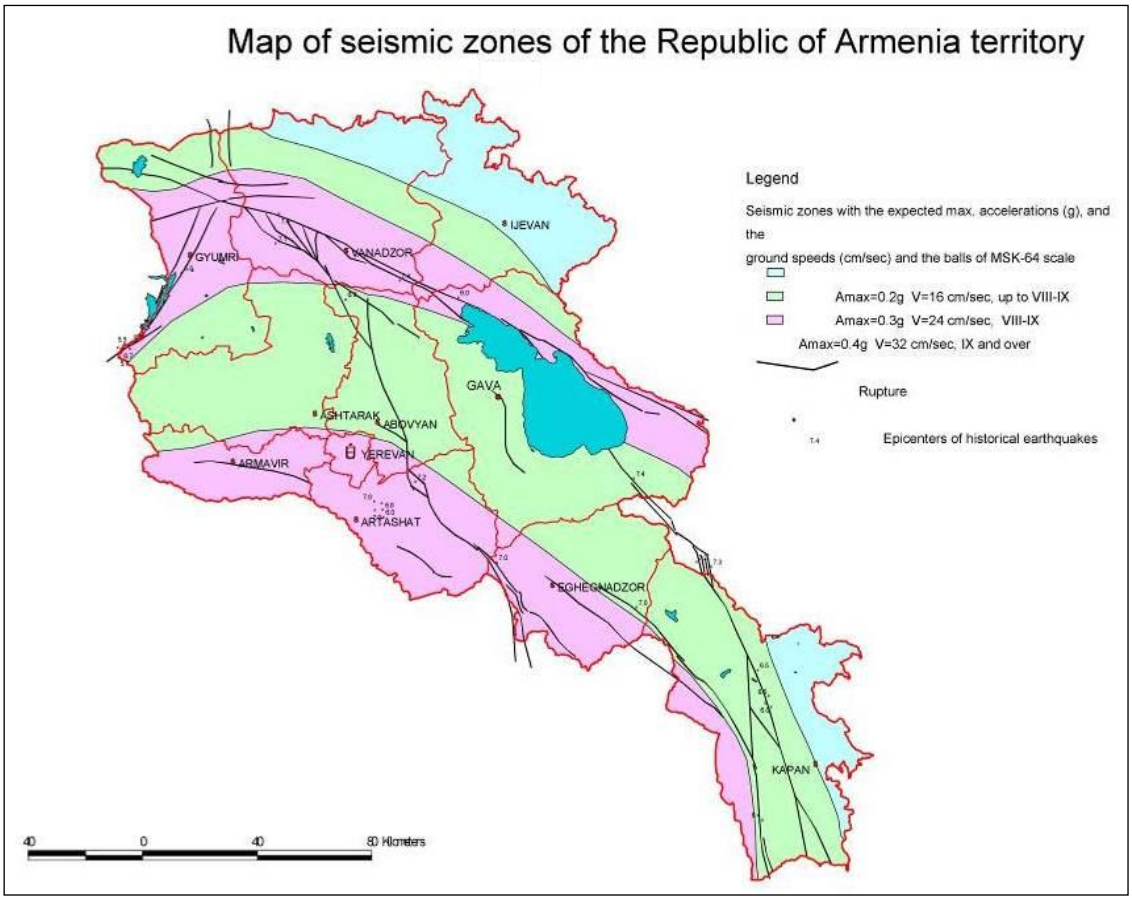


Map 6-4: General geological map of Armenia

Seismic-tectonic conditions:

Armenia is located in a seismically active zone stretching from Turkey to the Arabian Sea. Here, the Arabian landmass slowly collides with the Eurasian plate. As large earthquakes with magnitudes over 5.5 occur in Armenia every 30 to 40 years reaching magnitudes up to 7.1 on the Richter Scale, a high-level seismic hazard is indicated for the country. Maximum seismic risk is given around the city of Yerevan, and in a zone from Gyumri to Vanadzor and the northern part of Lake Sevan (see Map 6-5), where active faults exist. Substation Ddmashen and its connection lines will be constructed in this area, as well as the southern part of the 400 kV OHL.

The Garni earthquake in 1679 was the most destructive one, with a magnitude oscillating between 5.5 and 7. Another destructive earthquake with a magnitude of occurred in Spitak in 1988[4]. In 2011 an earthquake with a magnitude of 3.2 occurred 37 km north of Gyumri[5].



Map 6-5: Seismic zonation of RA territory (MNP 2002)

[4]http://info.worldbank.org/etools/docs/library/114715/istanbul03/docs/istanbul03/09melkumyan3-n%5B1%5D.pdf

[5] http://www.emsc-csem.org/Earthquake/earthquake.php?id=210376

6.1.5 Soils

Mainly mountainous forest soils with a number of their subtypes are common in the investigation area (see Map 6-6). The warm, mild and variable humid climate, the long period of active soil formation, presence of sufficient drainage system and seasonal change in ground streams direction promote deep and intensive weathering of primary minerals, formation of secondary mineral substances and rather thick clay soils. Bioclimatic features of brown mountainous forest soils formation promote good growth of forest plants communities and formation of phytomass. The common soils in the area are leached and carbonated types of brown mountainous forest soils.

Map 6-6: Distribution of main soil types in Armenia

In the southern part of the investigation area also soils of mountain steppes and mountain meadows can be found in the mountainous areas around Dilijan National Park. These soils have comparatively high humus percentage, neutral or weak acid reaction, expanded absorption capacity, medium and low mechanical clay-and-sand composition and favorable hydrophysical properties. Near Hrazdan also mountain black soils can be found. Black soils are characterized by different percentage of humus, above-medium absorption-ability, high aggregation, mainly neutral, sometimes weak acidic and weak basic reaction, as well as with best indicators of material composition and hydrophysical properties.

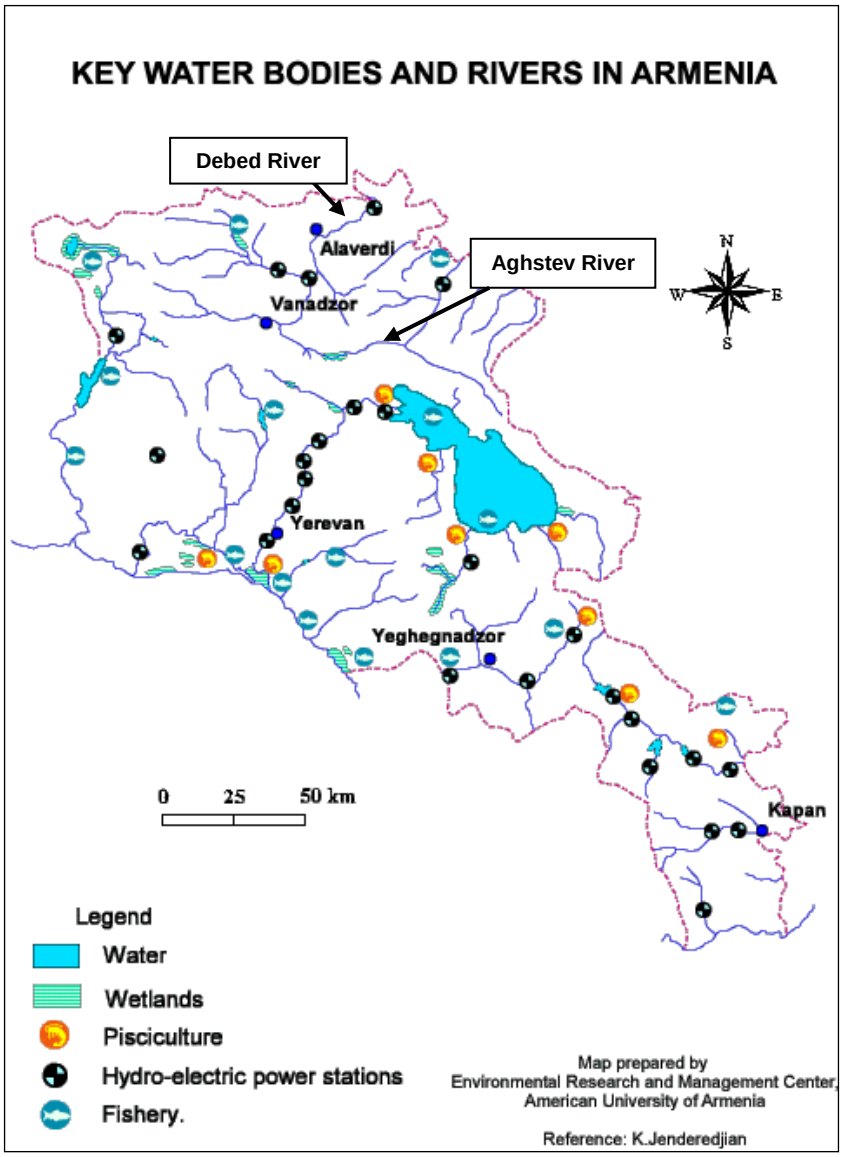
6.1.6 Water resources

The Republic of Armenia is covered with a dense net of rivers (see Map 6-7). Armenian rivers belong to the Caspian Sea basin. Basins of the tributaries of Kur River occupy an area of 700 km^2 (Debed, Pambak, Aghstev, Tavush Rivers, etc.), and basins of the tributaries of Arax River an area of 22,790 km^2 (Akhuryan, Kasakh, Metsamor, Hrazdan, Azat, Vedi, Arpa, Vorotan Rivers, etc.).

Armenia's rivers have mixed feeding - melting, groundwater, and rain. Their flow changes considerably within a year. During summer-time and fall, when water demand is approaching its maximum, the annual water share amounts to 20-25%, in winter-time to 10-12% of the total flow, whereas in spring-time is 55-70%.

The Republic of Armenia is not rich in lakes. Sevan is the biggest lake in the Caucasus and Armenia. Its surface amounts to 1,240 km^2. The lake is located at an altitude of 1,897 m a.s.l. The rest of the lakes in the country (Kari, Akna, and Sev, etc.) are small and mostly located in the highland zones. Lake Arpi and Lake Parz (in Dilijan National Park) are located at a medium altitude highland zone. Lake Ayghr is a lowland lake fed by underground waters.

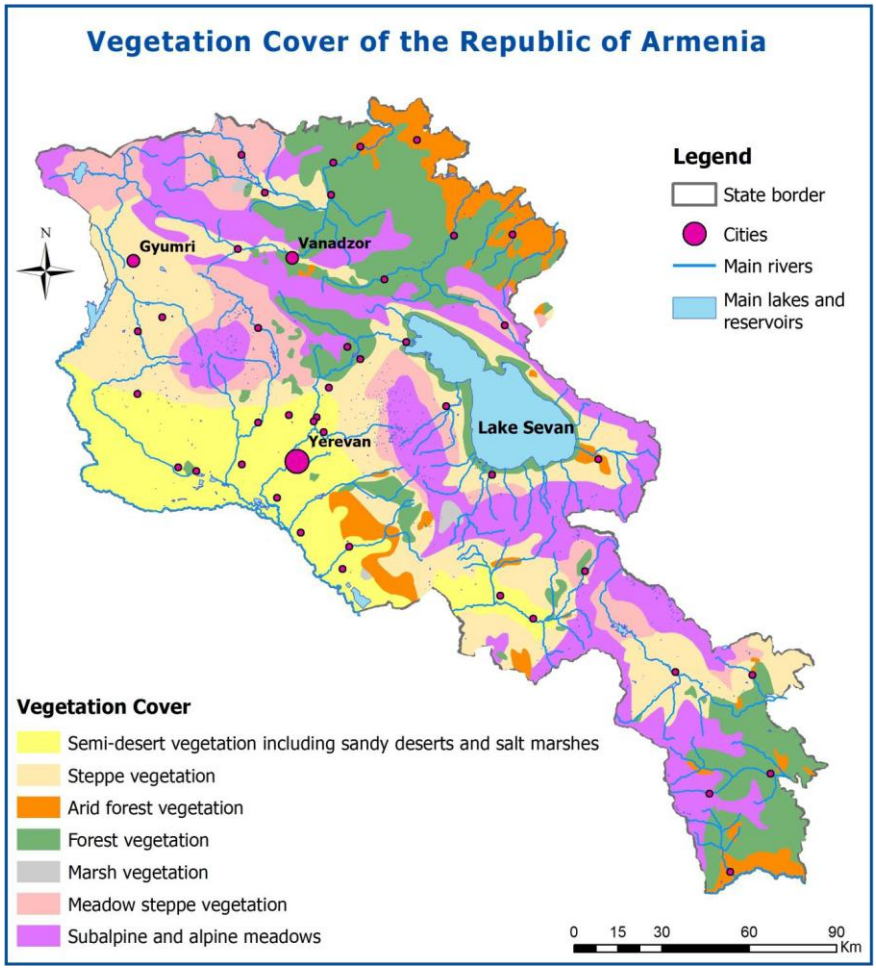
The proposed line OHL routings (Option 4a) cross several smaller and bigger rivers; the most important are Debed and Aghstev Rivers. Smaller rivers which will be crossed by 400 kV OHL from s/s Ayrum to s/s Ddmashen are Shnogh, Voskepar, Marts, Aghbugha, Khachaghbyur, and Dzknaget Rivers.



Map 6-7: Main water resources of Armenia

6.1.7 Flora and fauna

The Project area is located in the Ijevan Floristic Region in the Caucasian Region. Forests include dry and arax oak, eastern beech, Caucasian pine, yew, elm, Georgian oak, and other evergreen and deciduous trees. Marshlands and forests teem with wildflowers. Beech wood, lime tree, maple, elm, and ash tree are also found in the area. The auxiliary species are represented by hazelnut, honeysuckle, medlar, rosehip, blackberry, raspberry, oriental hornbeam, evonymus, dogberry, currant. Some areas are covered with river bank vegetation (poplars, willows and grassy plants in humid areas), as well as plant associations of open forest meadows.



Map 6-8: Vegetation Cover of Armenia[6]

Detailed literature data about animal and plant species occurring in the study area do not exist except for Dilijan National Park (see Section 6.1.10.1). The park has a rich and various flora and includes 1% of the territory of Armenia. More than 25% of Armenian plant species exist here, which belong to 92 families and 424 species. 31 species recorded in Red Book of Armenia are present here. 91 species of the park flora are representatives of dendroflora, which belong to 27 families. 43 species of this dendroflora are trees, 47 are bushes and one liana. The most common species in the park are Oriental Oak, Georgian Oak, and Oriental Beech. The park is also very rich in fauna. It includes 45 species of mammals, 107 birds, 16 reptiles, four amphibians, and six fish species.[7]

According to the Red Book of Armenia[8] following species might be occurring in the greater investigation area of the line routing corridors of 400 kV OHL Ayrum – Ddmashen (Option 4a) and 500 kV OHL Ayrum – Georgian border:

[6] Fifth National Report to the Convention on Biological Diversity, Republic of Armenia, Yerevan 2014
[7] http://www.culturaldilijan.am
[8] Red Book of Armenia (2010) – http://www.mnp.am/red_book_fauna

Mammals:

- Transcaucasian water shrew (*Neomys schelkovnikovi*) – endangered. This species occurs in riparian areas in highlands (up to 2,500 m a.s.l.), semi-deserts and forests and prefers the riverine shrubs and stony banks with sparse herbage. This species might occur in the area where 400 kV OHL crosses Aghstev River between Margahovit and Fioletovo.
- Mehely's horseshoe bat (*Rhinolophus mehelyi*) – vulnerable. This species mainly roosts in caves (summer and winter), both in forests and semi-deserts below 2,000 m a.s.l. The presence of water bodies is essential. This species might occur in the area west of Gomshavar village.
- Schreiber's long-fingered bat (*Miniopterus schreibersi*) – vulnerable. This species lives only in caves, preferably in wide and well-ventilated ones. Flies fast to catch insects from water surface or at forest edges, canyons, squares of villages and towns. It might occur near to Margahovit and Fioletovo villages.
- Eastern barbastelle (*Barbastella leucomelas*) – vulnerable. This species usually lives and hibernates in caves and grottos, occasionally in cellars and lofts. Prefers the areas in sparse forests and near water bodies. This species might occur near Margahovit and in the area west of Gomshavar.
- Brown long-eared bat (*Plecotus auritus*) – vulnerable. This species inhabits cellars of different buildings. It can also occur in tree hollows and rock crevices up to 2,450 m a.s.l. Preference is given to mountain grasslands, forests, scrubs and glades near to water bodies. This species might occur in forest with mature trees.
- Brown bear (*Ursus arctos*) – vulnerable. This large carnivore inhabits arid sparse forests, broadleaf forests, mountain grasslands, as well as subalpine and alpine meadows. Availability of fruits, berries and nuts as the staple food items is an important factor of its distribution.
- Marbled polecat (*Vormela peregusna*) – vulnerable. This species occurs in semi-deserts, arid mountain grasslands, mountain and subalpine meadows at 1,000-2,000 m a.s.l. It might occur in the areas, where mountain and subalpine meadows are crossed by the OHL corridor.
- Wild cat (*Felis silvestris*) – vulnerable. This species occurs in broadleaf forests and arid sparse forests with an essential presence of sufficient food base (rodents, birds) at 700-2,500 m a.s.l.

Birds:

- Bearded vulture (*Gypaetus barbatus*) – vulnerable; Egyptian vulture (*Neophron percnopterus*) – endangered; Griffon vulture (*Gyps fulvus*) – vulnerable. These species nest on high mountain cliffs, preferably in deep rocky gorges, at 800-2,000 m a.s.l. They might occur e.g. in Debed River gorge.
- Short-toed snake eagle (*Circaetus gallicus*) – vulnerable. This species nests in woodland areas and juniper sparse forests. Hunts predominantly in open spaces.
- Levant sparrowhawk (*Accipiter brevipes*) - vulnerable. Occurs in forests, orchards, river gorges and groves at 600-1,200 m a.s.l. Nests are placed in trees, sometimes in orchards.

- Northern goshawk (*Accipiter gentilis*) – vulnerable. This species lives in dense forests (e.g. in Dilijan National Park) with glades and hunts in the places of residence.
- Lesser spotted eagle (*Aquila pomarina*) – vulnerable. This species nests in forests (e.g. in Dilijan National Park), both large tracts and small parcels. Preys in open landscapes.
- Greater spotted eagle (*Aquila clanga*) – vulnerable. This species occurs in foothills of mountain grasslands, mostly in the country's north.
- Golden eagle (*Aquila chrysaetos*) – vulnerable. This eagle nests on cliffs (e.g. in Dilijan National Park) and preys in open landscapes like fields and meadows.
- Booted eagle (*Hieraaetus pennatus*) – vulnerable. This species nests in broadleaf deciduous and mixed forests (e.g. in Dilijan National Park). It often preys in mountain grasslands.
- Peregrine falcon (*Falco peregrinus*) – vulnerable. This falcon occurs in mountain steppes, forests, semi-deserts and farmlands; it nests on cliff brinks or in crevices.
- Caucasian grouse (*Lyrurus mlokosievicsi*) – vulnerable. This species is confined to the edge of the snow-line in the upper edges of the forest and in the subalpine and alpine meadows as well as in rhododendron shrubs at 1,800-2,500 m a.s.l. In winter it occurs at lower elevations. It might occur, where OHL crosses IBAs Pambak Mountain Chain and Dsegh.
- Caspian snowcock (*Tetraogallus caspius*) – vulnerable. This species lives in high mountains, on steep slopes with rocky outcrops at 2,500-3,500 m a.s.l. (e.g. in Dilijan National Park and IBA Dsegh).
- Corncrake (*Crex crex*) – vulnerable. This rail nests in mountain meadows and meadow-grasslands (e.g. in Dilijan National Park and IBA Dsegh). Habitats have been intensively encroached for agricultural use.
- Eurasian eagle-owl (*Bubo bubo*) – vulnerable. This owl occurs in different landscapes from lowland semi-deserts to mountain grasslands at 2,700 m a.s.l. In mountains it undertakes altitudinal migrations and in winter moves downwards to foothills. Nests are built in caves or on cliffs.
- European Roller (*Coracias garrulous*) – vulnerable. This species lives in semi-desert and mountain grassland zones, inhabiting quite steep slopes with arid vegetation and rocky outcrops (e.g. in IBA Dsegh).

Reptiles:

- Spur-thighed tortoise (*Testudo graeca*) – vulnerable. This species inhabits arid grasslands, slopes with sparse herbage, thickets or forests, lowland forests and gardens. Abundance in Armenia is only 900–1,000 individuals. Local densities are 1–5 individuals/10 ha. This species might occur in the northernmost part of the 500 kV OHL corridor.
- Meadow lizard (*Darevskia praticola*) – vulnerable. This species occurs in foothill and montane forests, especially broadleaf ones, where it inhabits forest edges, glades, and shrubs.

- Dahl's lizard (*Darevskia dahlia*) – endangered. This species occurs on relatively arid slopes and rocks at 900-1,700 m a.s.l. within the forest zone. Sometimes penetrates to stony grasslands, retaining fidelity to forest edges, roads and shrubs. It might occur in the hills near to Chochkan village.
- Rostombekov's lizard (*Darevskia rostombekovi*) – endangered. This species is limited to woodlands within northern Armenia. It occurs mostly in the forest zone, sometimes penetrating to grasslands, at 800-1,600 m a.s.l. It might occur in the hills near to Chochkan village.
- Transcaucasian rat snake (*Zamenis hohenackeri*) – vulnerable. This diurnal species is largely found in mountainous areas where it occurs on open, rocky slopes, in wooded ravines, wet valleys and at the edges of deciduous woodland up to 2,200 m a.s.l. It might occur in the northern part of the corridor in the area of Chochkan village.
- Cat snake (*Telescopus fallax*) – vulnerable. This species is mostly found amongst rocks in shrubby landscapes. It can also be found in open or degraded woodland, among old walls and ruins and sometimes close to human habitations up to 2,000 m a.s.l. It might occur in the northern part of the 400 kV corridor in the area of Chochkan village and at the 500 kV OHL corridor.

Armenia does not lie on one of the primary migration paths of birds. These paths bypass the country east and west. However, a study conducted by American University of Armenia Fund (AUA) identified five areas of higher risks for migrating bird species along the 400 kV OHL corridor (see Section 7.3.2 and Section 11.3 – Appendix III).

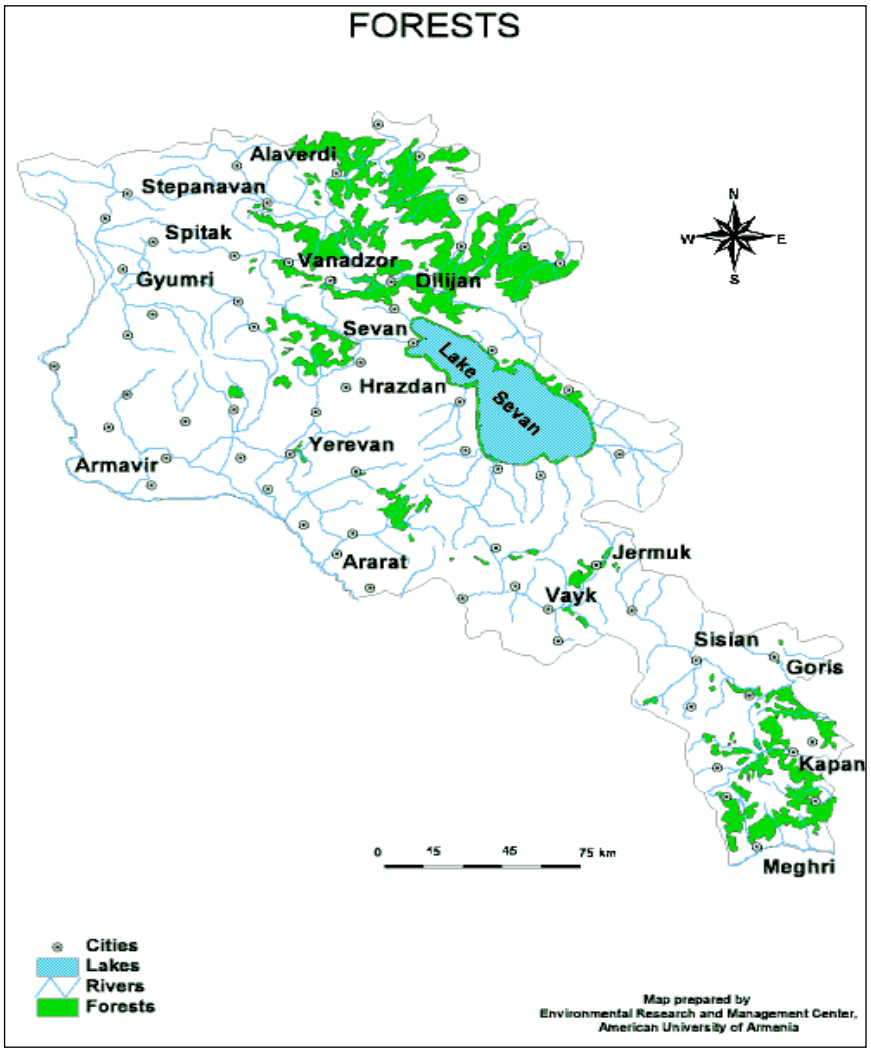
Three Important Bird and Biodiversity Areas identified by Birdlife International are crossed by the proposed routing of 400 kV OHL Ayrum – Ddmashen (Option 4a) or its alternatives (see Section 5.2).

Furthermore some plant species listed in Red Book of Armenia might be affected by the line routing corridors of 400 kV OHL Ayrum – Ddmashen (Option 4a) and 500 kV OHL Ayrum – Georgian border:

- European yew (*Taxus baccata*) – vulnerable. This is an evergreen tree up to 25 m high and 1 m in diameter. It grows in lower and middle mountain belts, at the altitude of 700-1,500 meters a.s.l. along riversides, and in forests (e.g. in Dilijan National Park). Individual trees are met in beech and oak forests.
- Caucasian Rose-Bay (*Rhododendron caucasicum*) – endangered. In Armenia this species grows only at two locations, in the Bazum mountain range and in the Pambak mountain range in the subalpine belt (Caucasian Rose-Bay Sanctuary).

6.1.8 Forests

The investigation area falls mainly in the Forest Landscape Zone. In Armenia forests generally cover the mid-zone of mountains, occurring at altitudes between 500 m and 2,100 m a.s.l. in the north of the country. Armenian forests are predominantly broadleaved (97%). The forest areas in Armenia are shown in Map 6-9. Since the turn of the 19th century, Armenia lost forest cover from 25% of its territory to the current low forest cover, which is estimated to 8-9%.



Map 6-9: Forest cover in Armenia

Forest associations consist of deciduous species such as oak (*Quercus iberica*, *Q. macranthera*), oriental beech (*Fagus orientalis*), common and oriental hornbeam (*Carpinus betulus*, *C. orientalis),* which form homogeneous oak, beech and hornbeam forests as well as mixed forests with different combinations of the species mentioned. Georgian oak (*Quercus iberica*) forests occur on the southern slopes of the middle forest zone and oriental beech forests on the northern slopes.

Generally, the forest areas are overused, even in Dilijan National Park, due to the practice of "sanitary cutting" of trees to ensure fire-wood supply to the local population and self-financing of the National Park. This practice, however, is not sustainable in the long run according to the National Park Director. Forests have been visibly thinned out judging by indicators of trunk diameter, canopy closure and number of tree stumps in the forest.

According to Hayantar SNCO and to most community heads interviewed during field studies, there is a legal use of fire wood which is provided by sanitary cutting and is about 8 m^3 per household and year.

The forests of Dilijan National Park (especially the forest traversed by Option 1 of 400 kV OHL routing) are one of the major tourism attractions in the area (Lake Parz). The proposed transmission line corridor of Option 1 would traverse approx. 7 km of forested areas inside the National Park.

The proposed transmission lines traverse some significant forest areas. Important forest areas are located in Dilijan National Park (Options 1 and 2), at Margahovit State Sanctuary (Options 4/ 4a and Option 5), north of Dilijan NP and in the region of villages Shnogh/ Teghut (Lori) (all options except Option 5). Forested valleys would have to be crossed north of Tumanjan village and between Haghpat and the line crossing of Debed River valley if Option 5 was implemented. Smaller forest areas shall be avoided, wherever possible, or over-spanned.

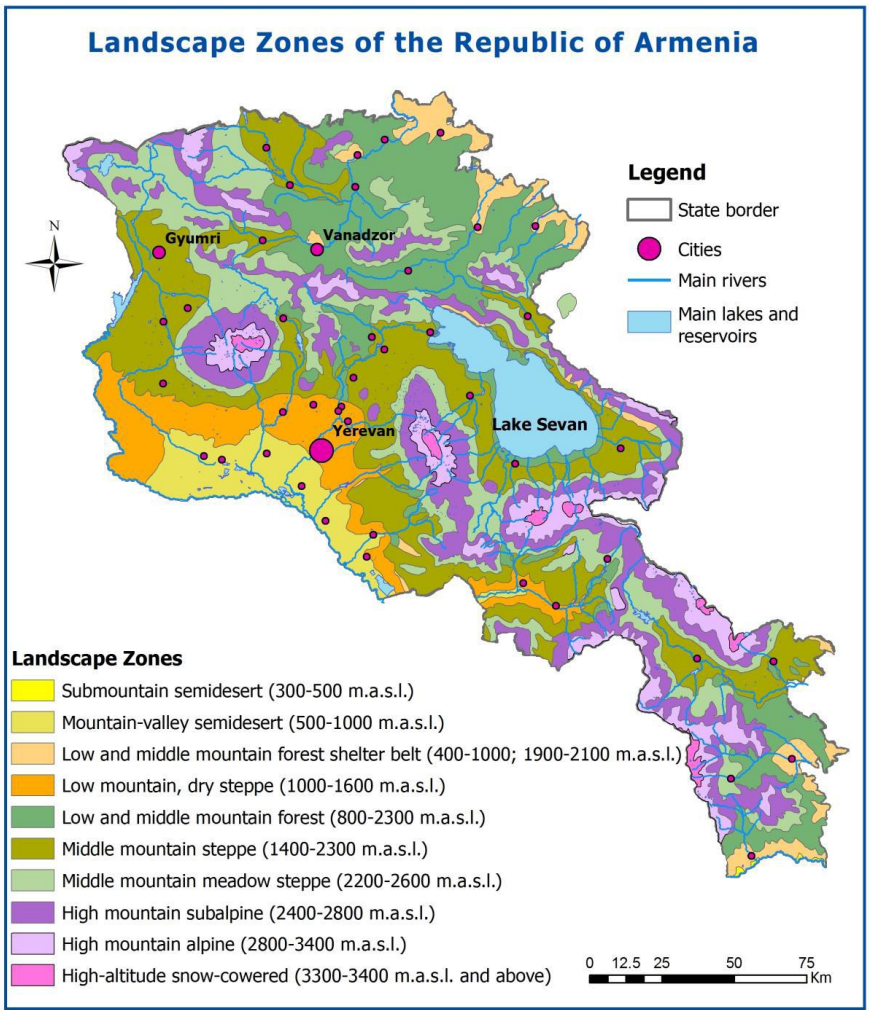
Cutting of trees as well as replantation of forest in Armenia is done by Hayantar SNCO which is part of RA Ministry of Agriculture. According to national legislation replanting is done on an area at least twice as big as the area where trees have been cut. Monitoring of tree cutting and replanting is done by Forest State Monitoring Center SNCO (also part of RA Ministry of Agriculture).

Hrant Dink Memorial Forest (see Photo 6-1) which has been planted by Armenia Tree Project (ATP) near to Margahovit and Fioletovo villages is located near to the 400 kV OHL corridor (Options 4/ 4a and 5) and shall be bypassed by the line corridor.

Photo 6-1: Hrant Dink Memorial Forest planted by ATP near to Margahovit village

6.1.9 Landscape

The investigation area falls mainly within the Forest Landscape Zones as well as Mountain Meadow Steppes and the High Mountain Subalpine Zone, when crossing the Pambak Mountain Chain and bypassing Dilijan National Park (see Map 6-10). The area is a strongly separated sculptured terrain with steep slopes and intervals of pastures and agricultural fields. The existing transmission lines are representing a high visual impact. Dilijan National Park as well as Debed River valley are very scenic and presence of transmission lines represents a visual nuisance from a tourism perspective.



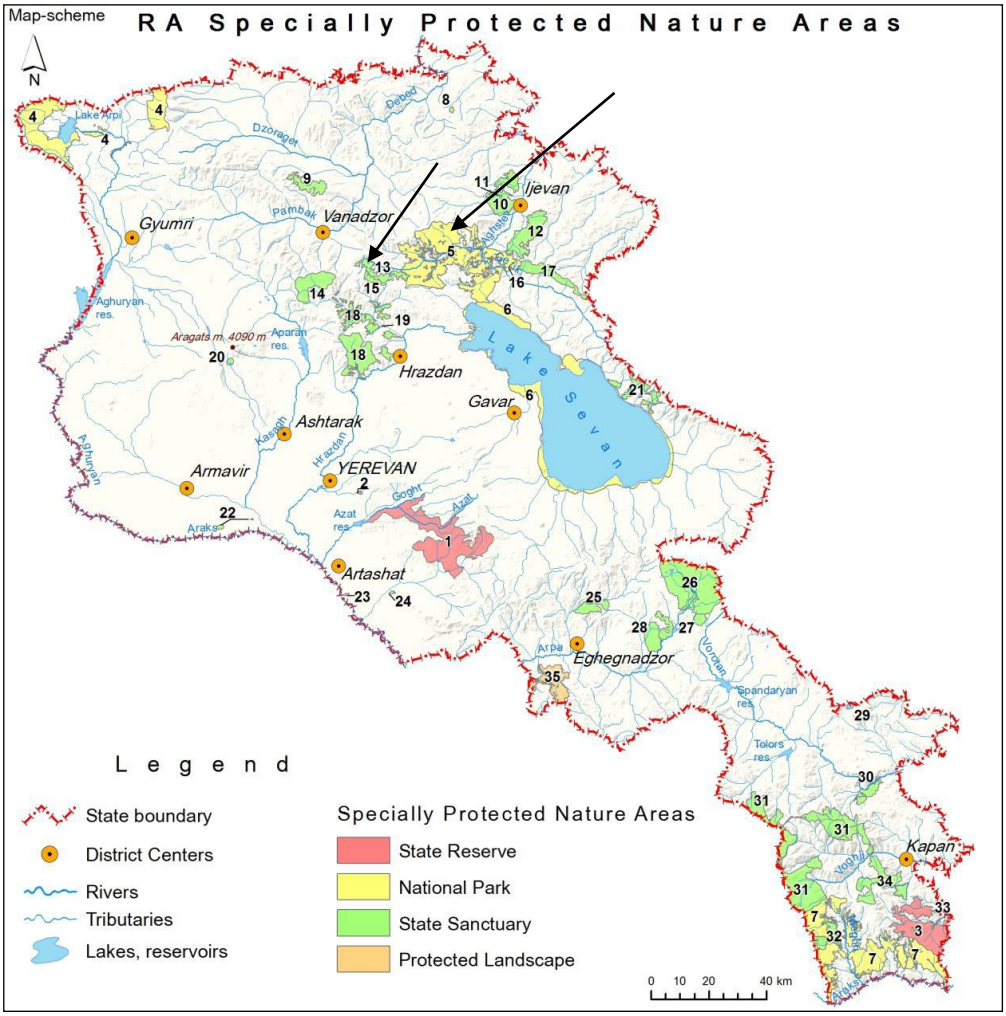
Map 6-10: Landscape zones of Armenia[6]

6.1.10 Protected and sensitive areas

6.1.10.1 Dilijan National Park

According to IUCN, Dilijan National Park (DNP) is classified as Category II, which Category II, which is the third highest category in IUCN ranking. Dilijan NP was NP was established in 2002 on the basis of the State Nature Reserve (1958) of former of former Dilijan and Kuybishev forest enterprises. The territory of the newly newly established NP has stayed unchanged compared to the former Nature Reserve. Reserve. It comprises an area of 33,765 ha in an altitude between 1,070 m and 2,400 and 2,400 m a.s.l. Location of the DNP (No. 5) is shown in

Map 6-11.



Map 6-11: Protected Areas in the Republic of Armenia (MNP 2014)
Arrows indicate location of Dilijan National Park (5), Caucasian Rose-Bay Sanctuary (15) and Margahovit State Sanctuary (13)

Flora and Fauna in Dilijan National Park:

According to the 'Emerald Book' (Hovhannisyan et al. 2014) the main type of the park's vegetation is forest. Deciduous trees are main dominants here: Oriental Beech (*Fagus orientalis*), Georgian Oak (*Quercus iberica*), Caucasian Oak (*Quercus macranthera*), Common Hornbeam (*Carpinus betulus*), Oriental Hornbeam (*Carpinus orientalis*). Beech, oak and oak-hornbeam forests occupy mountain slopes at the altitudes 1,000 - 2,000 m a.s.l. Usually *Fagus orientalis*, *Quercus iberica* (until 1,400 – 1,500 m a.s.l.) and *Quercus macranthera* (on the higher elevations) form mono-dominant communities (beech forests on northern, oak forests on southern slopes). Pure hornbeam forests are not very common, much more often

Carpinus betulus and *Carpinus orientalis* increase their abundance and play role of co-dominants in oak stands.
As components in these forests *Acer campestre, Acer platanoides, Acer trautvetteri, Tilia caucasica, Fraxinus excelsior, Sorbus aucuparia, Sorbus graeca* are very common. Forests of Dilijan National Park are very rich with wild fruits, berries, nuts (*Pyrus caucasica, Malus orientalis, Prunus divaricata, Prunus spinosa, Juglans regia, Corylus avellana, Cornus mas, Mespilus germanica, Grossularia reclinata*, species of *Crataegus, Ribes, Rubus*.

Near the forest upper border in sub-alpine belt open crook-stem birch forests are very common. *Betula pendula, Betula litvinovii, Populus tremula, Salix caprea* are dominants in these communities.

Evergreen coniferous forests are rather common in the National Park, but do not occupy large areas. *Pinus kochiana* is one of the dominants of these communities and forms very dense stands. Natural pine groves are very characteristic relic element of forests of this region, they occupy not very big areas, and now it is rather difficult to distinguish natural stands from artificial pine plantations, which were planted during Soviet time. Juniper open forests usually are distributed close to upper border of forest vegetation (1,800 - 2,000 m a.s.l.). Yew (*Taxus baccata*) is rather common in the territory of National Park, but usually it grows as several individuals.

Above 1,800 - 1,900 m a.s.l. sub-alpine meadows are distributed. The main communities are mixed forbs-grass phytocoenoses. Dominants are *Koeleria cristata, Poa pratensis, Poa nemoralis, Dactylis glomerata, Anthoxanthum odoratum, Trisetum sibiricum*, very often one can meet *Primula macrocalyx, Centaurea cheiranthifolia*. On the same elevation communities with domination of *Anemone fasciculata, Trollius ranunculinus, Veratrum lobelianum* are widespread.

Mammals occurring in Dilijan National Park include Red Deer (*Cervus elaphus maral*) - critically endangered[8], Brown Bear (*Ursus arctos*) - vulnerable, Red Fox (*Vulpes vulpes*), Eurasian Lynx (*Lynx lynx*), Gray Wolf (*Canis lupus*), Wild Boar (*Sus scrofa*), European Wildcat (*Felis silvestris*) - vulnerable, Roe Deer (*Capreolus capreolus*), European Badger (*Meles meles*), Caucasian Squirrel (*Sciurus anomalus*), European Otter (*Lutra lutra*) - endangered, and others.

Birds include Caucasian Grouse (*Lyrurus mlokosievicsi*) - vulnerable, Golden Eagle (*Aquila chrysaetos*) - vulnerable, Bearded Vulture (*Gypaetus barbatus*) - vulnerable, Caspian Snowcock (*Tetraogallus caspius*) - vulnerable, Long-legged Buzzard (*Buteo rufinus*), Black Stork (*Ciconia nigra*) - vulnerable, Middle Spotted Woodpecker (*Dendrocopos medius*), Saker Falcon (*Falco cherrug*) – endangered, and many others.

Reptiles are represented here by lizards, snakes and turtles. Endemic species are Armenian Lizard (*Darevskia armeniaca*), Dahl's Lizard (*Darevskia*

dahlia) - endangered, Rostombekov's Lizard (*Darevskia rostombekovi*) - endangered, and Armenian Viper (*Vipera raddei*) - vulnerable. Amphibians include Marsh Frog (*Pelophylax ridibundus*), Green Toad (*Bufo viridis*), and Tree Frog (*Hyla arborea*).

Legal Restrictions inside Dilijan National Park:

According to Law of the Republic of Armenia Adopted on November 27, 2006 "On Specially Protected Natural Areas", Chapter 4 - Article 19 (Conservation Regime of the National Park), which makes explicit reference to power transmission lines:

"…Construction and exploitation of economic and residential objects, roads, pipelines, power transmission lines and other communication facilities, except the construction of objects necessary for the operation of the national park (forest guard hut, entanglements, marking signs, etc.) and road construction…"

as well as:

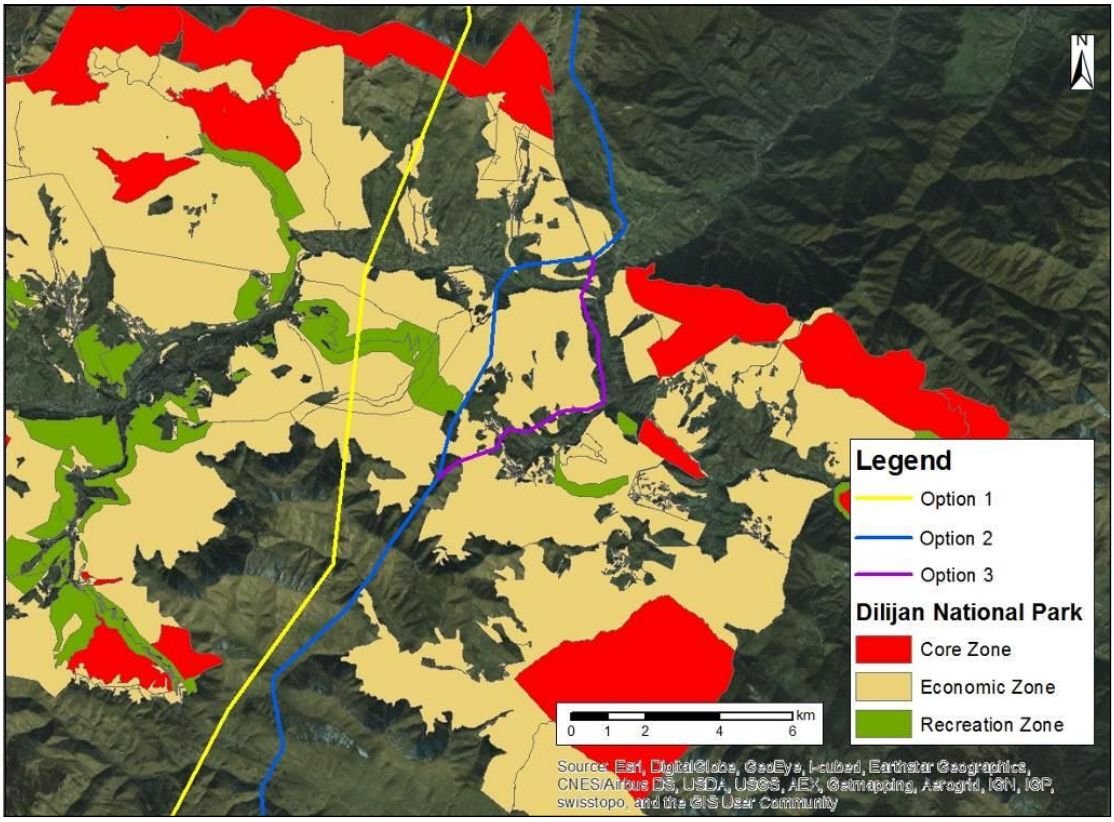
"…Disturbance of conditions of flora and fauna habitats, including logging and animal grazing…"

are prohibited in the reserve zone of the National Park.

Furthermore Chapter 4 - Article 20 (Conservation Regime of the Natural Park) states that any activity in the territory of the natural park causing changes of the landscapes of historical formation and having negative influence on environmental, historical, cultural, aesthetic and recreational values of the area, is prohibited.

Map 6-12 presents the zoning distribution after recent re-zoning of Dilijan National Park with Nature Reserve Zones marked in Red. Whereas the re-zoning plan has been legally adopted, update of the NP management plan is still underway with financing from Caucasus Nature Fund (CNF) supported by KfW Development Bank.

Main threats to Nature Protection in Dilijan National Park are deforestation through cutting of trees for fire- and construction wood as well as infrastructure development mainly by construction in the tourism sector i.e. resort construction in forest areas etc. According to the National Park Director the practice of "sanitary tree cutting" responds to the need of National Park financing and the need for firewood of the local population, but is not corresponding with the National Park objectives on a long run. However, it is the only measure available at present. According to the National Park Director the routing of Option 1 is not optimal as it leads partly through the Reserve Zone of the National Park which is protected against all infrastructure projects (see above). Also traversing the Recreation Zone around Lake Parz should be avoided, since it is a major tourism



attraction, with a network of hiking trails which would be disturbed by the 400 kV OHL.

Map 6-12: Zoning of Dilijan National Park and different Options of 400 kV routing
Yellow: 400 kV line routing as proposed in Feasibility Study - Option 1,
Blue: 400 kV line routing in corridor of existing 330 kV OHL - Option 2
Purple: 400 kV line routing through Gosh valley - Option 3

The planned 400 kV line routing of Option 1 would cross Dilijan National Park on a length of about 8 km including 1 km leading through a Nature Reserve Zone of the Park (see Map 6-12). Thus, the transmission line routing of this option would constitute a violation of the national law on Nature Protection and would not correspond with international standards.

Four alternative transmission line routes (Options 2, 3, 4 and 5) were checked whether they are suitable for the planned 400 kV OHL (see Section 5.2).

6.1.10.2 Margahovit State Sanctuary

This State Sanctuary is located southwest to Dilijan National Park at the northern northern slopes of Pambak Range (see

Map 6-11 No. 13). It was established in 1971 and comprises an area of approx. 2,820 ha in an altitude between 1,900 m and 2,200 m a.s.l. Main conservation aim in this area is the protection of forest animals like brown bear, wolves, roe deer and others. According to information given by the local forest officer of Hayantar SNCO at Margahovit, main tree species are beech, hornbeam and oaks, accompanied by pines, ash, linden, willow and birch. Wild plants include ramsons, horse fennel, wild raspberry and Caucasian rhododendron.
As per national regulation, construction of overhead transmission lines may be allowed in a State Sanctuary, if the stability of the ecosystems of the Sanctuary will not be disturbed. Thus, line routing shall be adapted in a way that the Sanctuary is crossed at the narrowest site (Option 4a) and forested parts shall be over-spanned where possible, in order to minimize cutting of trees in the ROW.

6.1.10.3 Caucasian Rose-Bay State Sanctuary

This State Sanctuary is located directly south and above the Margahovit State Sanctuary and its main objective is the protection of the endangered[8] Caucasian rhododendron (*Rhododendron caucasicum*). In Armenia this species grows only at two locations, in the Bazum mountain range and here in the Pambak mountain range in the subalpine belt. The Sanctuary was established in 1959 and comprises an area of about 770 ha. This area would be crossed by Option 4, but can be avoided by implementing Option 4a.

6.1.10.4 Important bird and biodiversity areas

Important Bird and Biodiversity Areas (IBAs) are identified by Birdlife International but are not necessarily included in national protected areas of the respective country.

IBA (AM 002) Pambak Mountain Chain[9]:

Eastern part of IBA (AM 002) Pambak Mountain Chain would be crossed by by Options 4/ 4a and 5 of 400 kV OHL Ayrum – Ddmashen and would also be be crossed by the line routing proposed in the Feasibility Study (Option 1) (see

(see

Map 6-13). This IBA comprises approx. 56,700 ha in an altitude between 1,550 m and 3,000 m a.s.l. Pambak mountain chain is one of the largest mountain ranges in the central part of northern Armenia, extending for 65 km from the north-west to south-east and evolving two ridges split by the Marmareek River. The mountain range has clearly defined landscape zones; mountain steppe, and subalpine and alpine meadows interspersed with mosaics of woodlands covering steep, north-facing slopes. Trigger species is

[9] BirdLife International (2015): Important Bird and Biodiversity Area factsheets: Pambak Mountain Chain ; Dsegh; Haghartsin - http://www.birdlife.org

Caucasian Grouse (*Lyrurus mlokosiewiczi*) - vulnerable[8] which is confined to the edge of the snow-line in the upper edges of the forest and in the subalpine and alpine meadows. The following bird species of special concern are also present: Bearded Vulture (*Gypaetus barbatus*) – vulnerable and Griffon Vulture (*Gyps fulvus*) - vulnerable, both nesting on high mountain cliffs; Northern Goshawk (*Accipiter gentilis*) - vulnerable and Lesser Spotted Eagle (*Aquila pomarina*) - vulnerable, both nesting in forest areas; Greater Spotted Eagle (*A. clanga*) - vulnerable, Golden Eagle (*A. chrysaetos*) - vulnerable, Radde's Accentor (*Prunella ocularis*), and White-winged Redstart (*Phoenicurus erythrogaster*).

IBA (AM 008) Dsegh[9, 10]:

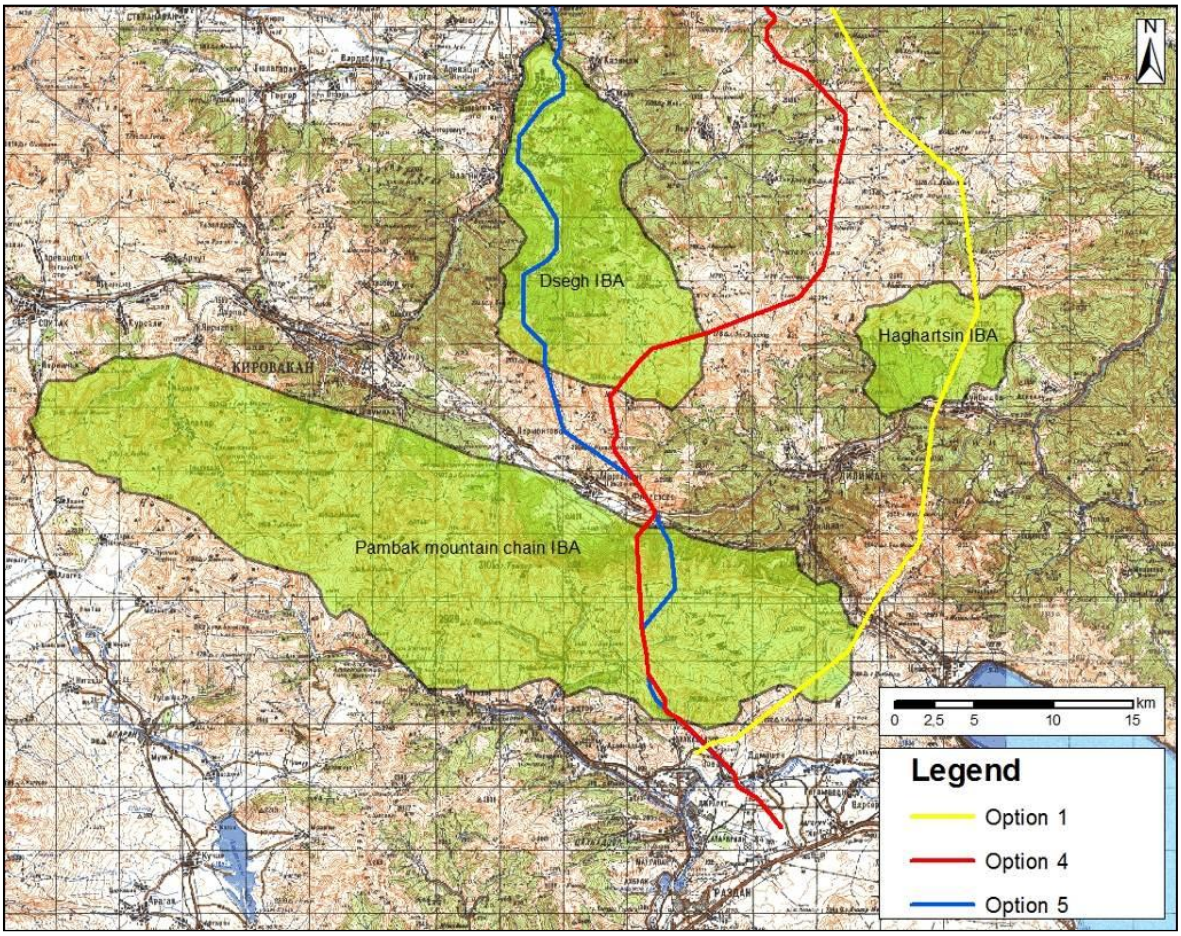
IBA (AM 008) Dsegh is crossed in its southern part for 7 km by line routing of 400 kV Ayrum – Ddmashen (Options 4 and 4a). Option 5 would cross this IBA on a length of 23 km (see Map 6-13). The IBA is covering the territory south of Debed River including the area between Pambak and Martz rivers, up to Halab mountain chain foothills comprising approx. 18,500 ha. The highest elevation point in the IBA is Mount Bovaqar (Halab) (3,016 m a.s.l.), while the lowest point is the estuary of Marts River (829 m a.s.l.). This mountainous area shows a complex geomorphological terrain with deep canyons and high peaks. The territory of the IBA with a fairly vertical altitudinal variation provides landscape habitats that are rich in its diverse range and include mountain steppe with a prominent rocky outcrops, dense stands of forest with closed canopies, subalpine and alpine meadows. Trigger species in this IBA are Caucasian Grouse (*Lyrurus mlokosiewiczi*) - vulnerable[8], which inhabits the upper tree line of the forest with dense rhododendron thickets; Egyptian Vulture (*Neophron percnopterus*) – endangered and Griffon Vulture (*Gyps fulvus*) - vulnerable, both nesting at cliffs in gorges (Debed River gorge and west of Debet village); Long-legged Buzzard (*Buteo rufinus*), and Lesser Spotted Eagle (*Aquila pomarina*) - vulnerable. Breeding birds also comprise Bearded Vulture (*Gypaetus barbatus*) - vulnerable, Levant Sparrowhawk (*Accipiter brevipes*) - vulnerable, European Honey-buzzard (*Pernis apivorus*), Peregrine Falcon (*Falco peregrinus*) - vulnerable, European Roller (*Coracias garrulous*) - vulnerable, Semi-collared Flycatcher (*Ficedula semitorquata*), Corn Crake (C*rex crex*) - vulnerable, and Caspian Snowcock (*Tetraogallus caspius*) - vulnerable. The territory of the IBA is predominantly covered with Oriental beech (*Fagus orientalis*) forest, although wild Common fig (*Ficus carica*) also grows occasionally. The area is especially noteworthy for its Rhododendron thickets growing in the transition zone between the upper line of mountain forest and subalpine meadows. The area provides important habitats to vertebrate fauna such as: Brown bear (*Ursus arctos*), Wild cat (*Felis silvestris*), Eurasian Lynx (*Lynx lynx*), Red Fox (*Vulpes vulpes*), and Caucasian squirrel (*Sciurus anomalus*).

[10] http://dseghcenter.info

IBA (AM 009) Haghartsin[9]:

IBA (AM 009) Haghartsin, which is located mainly inside Dilijan National Park Park would be crossed by the line routing of 400 kV OHL Ayrum – Ddmashen as Ddmashen as proposed in the Feasibility Study (Option 1) (see

Map 6-13). The IBA comprises approx. 6,150 ha in an altitude between 1,200 m and 2,470 m a.s.l. Mainly forest, but also rocky areas, grassland, and wetlands characterize this IBA. Land use is mainly forestry and tourism, but also some agricultural used areas can be found.
Trigger breeding bird species are: Caucasian Grouse (*Lyrurus mlokosiewiczi*) - vulnerable[8], Caspian Snowcock (*Tetraogallus caspius*) - vulnerable, Black Stork (*Ciconia nigra*) - vulnerable, Lesser Spotted Eagle (*Aquila pomarina*) - vulnerable, Golden Eagle (*Aquila chrysaetos*) - vulnerable, and Corn Crake (*Crex crex*) - vulnerable.



Map 6-13: Location of IBAs Pambak Mountain Chain, Dsegh, and Haghartsin[9]
Red: proposed line routing 400 kV OHL Ddmashen – Ayrum (Option 4a)
Yellow: Option 1
Blue: Option 5

6.2 Socio-Economic Conditions

6.2.1 Population in the project area

The planned OHL corridors pass through Lori, Tavush, Kotayk and Gegharkunik marzes. According to National Statistical Service of RA (2015) Kotayk Marz has the highest population number and population density of the marzes crossed by the planned OHLs (see Table 6-2).

Table 6-2: Population parameters of the different marzes[11]

Population parameter	**Lori**		**Tavush**		**Kotayk**		**Gegharkunik**	
Total Population (end of 2014)	228,000		126,700		255,000		233,000	
• Urban population	134,300	59%	53,500	42%	138,500	54%	70,200	30%
• Rural population	93,700	41%	73,200	58%	116,500	46%	162,800	70%
Territory size [km²]	3,799		2,704		2,086		5,349	
Population density [persons per km²]	61		47		122		44	

There are a few ethnic minorities (e.g. Kurds, Yazidis, Russians and Georgians etc.). Some of the members of these minorities might live in a situation of vulnerability; however there is no record of a systematic discrimination or of a general vulnerability situation. Fioletovo and Lermontovo villages are inhabited by Molokans who were moved to the South Caucasus from Russia in the beginning of the 19th century. About 1,300 Molokans are living in Fioletovo and about 1,000 people in Lermontovo. There are no Indigenous Peoples in the project area. OP 4.10 is not triggered.

Large parts of the investigation area are uninhabited and represent a mix of private and community lands. Communities of Archis, Shnogh, Teghut (Lori Marz), Atan, Ahnidzor, Margahovit, Fioletovo, Kakavadzor, Zovaber, and Ddmashen are situated in the vicinity of the proposed 400 kV OHL corridor (Option 4a) and Deghdzavan and Haghtanak are near to proposed 500 kV OHL corridor.

Most agriculture is for subsistence of the household, with additional sales at local and regional markets. Much of the area is economically disadvantaged, with basic infrastructure in need of repair. Many in the younger generations have migrated to the capital Yerevan or abroad, in search of better livelihoods.

[11] National Statistical Service of RA 2015; http://www.armstat.am

The affected villages are situated in rural areas and share many characteristics that are typical for Armenian villages: agricultural livelihood base, lack of economic opportunities, high migration, reliance on remittances, harsh living conditions (especially in mountain areas).

In the following, a short village profile is presented that is based on the results of consultations in February 2016 as no specific official data exist.

Table 6-3: Baseline information of local communities along the line corridor (Option 4a)

No.	Name	Marz	Population (HH = households)	Approx. distance to OHL	Land use	Socio-Economic Situation and Livelihood Priorities
1	Ddmashen	Gegharkunik	750 HH	180 m	Land is used for agriculture and pastures. Community has sufficient lands. 16 ha were sold to HVEN for the substation. No forest lands, heating with gas.	Ddmashen is a growing community, (5-6 people per household), young people stay in the village, daily commuters to Yerevan, 1-2 persons per household have another job, 90 % of the community involved in agriculture and livestock. No complaints about economic situation. Residents look forward to the project for employment opportunities. Around 10 % of vulnerable/ poor people in community (50 families in Social Benefit Program). Needs: Community hall restoration
2	Zovaber	Gegharkunik	1597 pers. (300 HH)	150 m	Agriculture land, pastures of Sevan-Hrazdan high plateau	Zovaber is neighboring Ddmashen. Similar characteristics as Ddmashen.
3	Kakavadzor	Kotayk	Approx. 150 HH	1 km	Located at the foothills of the mountains directly in the vicinity of Hrazdan Thermal Power Plant and MIKA Cement factory.	Kakavadzor is served by local public transportation that brings residents to nearby Hrazdan only four times a day since roads are in poor condition. Air pollution from the MIKA Cement factory in Hrazdan has been a continuing problem for residents.

No.	Name	Marz	Population (HH = households)	Approx. distance to OHL	Land use	Socio-Economic Situation and Livelihood Priorities
4	Fioletovo	Lori	1360 pers. / 380 HH Ethnic group: Molokans	300 m	Altitude: 1670 m a.s.l., Agriculture (potatoes, cabbage) in the valley, pasture lands on slopes. 50 % private lands, 50 % community reserve fund. Community decides to give for rent to households	Inhabitants are from ethnic Molokan Community, immigrants from Russia in 1840 Livestock herding and agriculture, migration, 70 people of 350 hh work outside the village. Cooking is done with gas, heating with wood, 7-8m^3 per hh/year No conflicts between the communities of Margahovit and Fioletovo. Community needs: Road repair
5	Margahovit	Lori	1400 HH	3km	Private lands in the valley, community lands on mountain side. Some forest lands (small) owned by community, other is part of Hayantar SNCO (Margahovit State Sanctuary)	Agriculture and livestock are main local incomes, monetary income from seasonal migration and remittances, all people who are able to work, go to Russia for seasonal and permanent migration (80 % of all households). 350 pupils go to school. No sewage system, waste management contract with Vanadzor, no funds for compactor truck for waste collection Look forward to the project for construction work employment Community needs: Road repair, Waste Compactor truck to improve waste management
6	Aghnidzor	Lori	95 HH (67 permanent)	3.8 km	Small scale mountain agriculture, Mountain pastures, Forest products, Community lands in the mountains	Commercial deforestation is a problem. Road repair is needed, Drinking water supply infrastructure needed; spring water 8 km away

No.	Name	Marz	Population (HH = households)	Approx. distance to OHL	Land use	Socio-Economic Situation and Livelihood Priorities
7	Atan	Lori	84 HH (76 permanent)	1.7 km	Small scale mountain agriculture, Mountain pastures, Meadows used for hay making, Forest products, Wood for heating, Community lands in Mountains	No Health Center, Hospital in Vanadzor, Power cuts are very frequent, Electricity poles not in good condition, only one line for 4 communities More than 60 pers. long term migration and migration for seasonal works frequent. HH live from livestock and remittances. Needs: Road rehabilitation to the village, Drinking water supply system needed, Electricity poles rehabilitation
8	Gomshavar	Tavush	???	Closest settlements 100 m, Village 2.5 km	Pasture Lands, Forest products, small scale agriculture	Not visited due to snow conditions
9	Teghut	Lori	850 persons	2 km (Option West), <100 m Option East	Pasture Lands, Forest products, small scale agriculture, horticulture	Fear of pollution from the mining site, jobs at the mining site, most depend on agricultural products and income from seasonal migration; Water Supply infrastructure needed.
10	Shnogh	Lori	3360 persons	1 km (Option West), <100 m (Option East)	All lands private lands, agriculture (potatoes, wheat, hay making), in former times horticulture production center, Main branch of economy is agriculture	253 persons employed in mining, which helps to prevent migration, Shnogh only community with art school. Drinking water problem solved with ADB project
11	Archis (depending on Option at Teghut Mining (with Option West not affected)	Tavush	1235 persons	Not Affected Option West, > 500 m (Option East)	All lands private lands, agriculture (potatoes, wheat, hay making), in former times horticulture	Vicinity of Shnogh as main village

No.	Name	Marz	Population (HH = households)	Approx. distance to OHL	Land use	Socio-Economic Situation and Livelihood Priorities
12	Mets Ayrum	Lori	116 HH	500 m (Option West), Not Affected Option East	All lands private lands, agriculture (horticulture, fruits, pomegranate, wheat, barley, corn)	Vicinity of Akhtala Mining Site, Jobs at the mine, reduction of staff in recent years, Employment opportunities most needed, Upgrade of drinking water and gas distribution systems needed During definition of tower foundations close cooperation with owners and community administration is required, not during harvest period
13	Chochkan	Lori	2195 persons /490 HH	700 m	1000 ha of arable land, horticulture, fruits, pomegranate, Wheat, barley, corn, sunflower production	School, kindergarden, Health Centre Work in Akhtala and Teghut Mining, Most people work in agriculture. Seasonal migration, especially as Akhtala Mine reduces staff Work opportunities needed, Road upgrade is needed During definition of tower foundations close cooperation with owners and community administration is required Substation Ayrum should be renamed Chochkan S/S
14	Haghtanak	Lori	765 pers.	650 m	All lands private lands, agriculture (potatoes, wheat, hay making), in former times horticulture, a quarry	People live from agriculture and remittances from seasonal and permanent migration
15	Deghzavan	Lori	335 pers.	700m	All lands private lands, agriculture (potatoes, wheat, hay making), in former times horticulture	Border Village, People live from agriculture and remittances from seasonal and permanent migration Water supply system rehabilitated by ADB project Road repair needed

6.2.2 Historical and cultural sites

As the history of human settlement in Armenia goes back to the Neolithic age and the area has since then been important as settlement, trade and agricultural area, numerous historical and cultural sites exist. However, there are no maps indicating exact locations (GPS coordinates) of the sites. Also, only a minor part of the existing monuments are visible and known to the public. Others are known only to a few local experts linked to the Department for the Protection of Monuments of RA.

Several important churches and monasteries are located in the vicinity of Dilijan: Haghartsin Vank, Goshavank, Matosavank, Jukhtakvank, but only Goshavank would be affected by visual impacts of 400 kV OHL routing (Option 3).

One area of recent archaeological excavations was identified along the line routing proposed in the Feasibility Study (Option 1) near Teghut village in Lori Marz on the property of Shnogh municipality. Excavations have started a few years ago.

Near village Dsegh ruins of two monasteries (Qarasun Mankants and Bardzrakash St. Grigor) and Sirun Khach cross-stone are located near to the routing of Option 5.

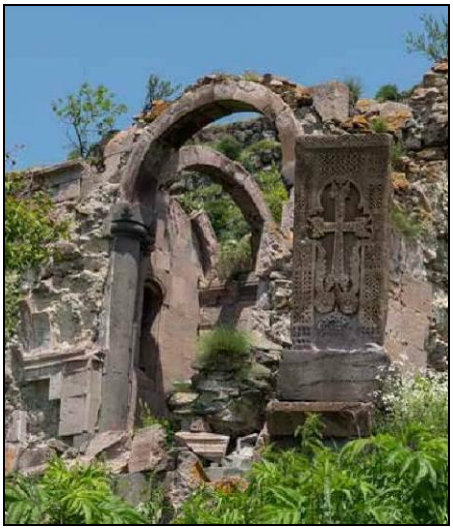


Photo 6-2: Qarasun Mankants Monastery (13th century)*

Photo 6-3: Bardzrakash St. Grigor Monastery (7th century)*

Photo 6-4: Khachkar cross-stone (Sirun Khach) (13th century)*

*Source of photos: Armenian Society for the Protection of Birds (ASPB)

In Sanahin and Haghpat there are also two monasteries which are major tourist attractions (see Photo 6-5). The proposed line routing of Option 5 traverses Sanahin village in the south. However, the monastery will not directly be affected as the line corridor will have a distance of approx. 600 m. Haghpat village will be traversed by the line routing of Option 5 south and east in a distance of approx. 700 m from the monastery. However, all additional towers will have a visual impact to tourists visiting the monasteries.

Photo 6-5: Sanahin and Haghpat Monasteries

On other line sections no cultural or historical sites have been identified. Nevertheless, in compliance with the national procedures, HVEN will send data about planned tower locations and access roads to RA Ministry of Culture. In an unlikely case of disagreement on behalf of the Ministry, HVEN will ensure re-location/ re-alignment of the proposed infrastructure to the satisfaction of the Ministry.

- Generally, Historical and Cultural Sites shall be avoided or, if unavoidable, be over-spanned in sufficient distance.
- A careful construction process for access roads and tower foundations will be necessary.
- A chance find procedure shall be implemented.

6.2.3 Gender aspects

Gender analysis shows that there are major issues regarding the deprivation of women, especially related to their access to human opportunities and their agency i.e., participation of women in all aspects of life and to the development. The existing gap between the legally guaranteed rights and insufficient opportunities to enjoy them in practice hampers the elimination of gender discrimination in Armenian society.

Although women in Armenia have high levels of education and equal capacities for professional productiveness, there is a lack of opportunities for them to utilize their abilities in the labor market and in society. This situation is even more relevant in rural areas. For example, there is no woman community leader in the communities along the line corridor.

Due to frequent out-migration of men from the investigation area, the number of female single headed households is considerable. Female-headed households are particularly vulnerable to falling into extreme poverty since women are left alone with the burdens of income generation, household and childcare responsibilities. Another consequence of male migration has been the growth in "parallel families", where migrant male workers establish another family in their new location. This increases the vulnerability of women especially when men return home in poor health or infected with sexually transmitted diseases.

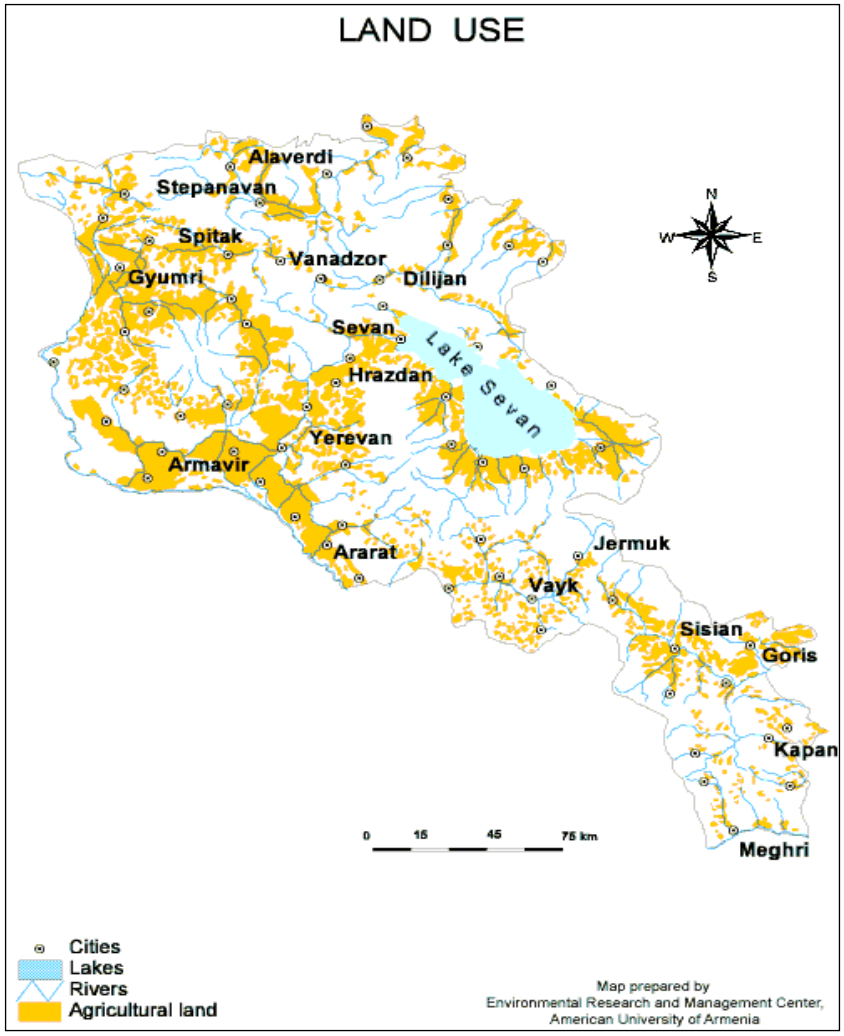
The situation of women in Armenia, especially in rural areas is characterized by a precarious livelihood situation, where even minor shocks, trends or seasonality can contribute to a situation of extreme vulnerability, without possibility of coping strategies. The loss of housing, land or other assets might be critical in this situation.

The lack of "public voice" may lead to a situation where women's concerns are overlooked or not taken seriously and are consequently not addressed. The lack of empowerment may even lead to a situation where women do not address their grievances, because they have psychologically internalized their lack of "voice".

As such, gender issues will be considered and gender sensitivity ensured during PAPs consultations as well as during technical design, compensation, relocation and monitoring activities related to the present project.

6.2.4 Land use pattern and agriculture

Relating to the Statistical Yearbook of Armenia (2014)[12] RA has about 2 million ha of agricultural land, meaning about 70% of the country's land area, generating 22% of Armenia's GDP. Most of this, however, are pastures (about 1 million ha). Cultivable land comprises about 448,200 ha arable land, 33,300 ha perennial grass, 121,800 ha plough-land, and 392,400 ha others. Main agricultural land areas of Armenia are shown in Map 6-14.



Map 6-14: Agricultural land in Armenia

According to ICARE (2015) both, plant growing and animal husbandry are important part of Armenian agriculture. The distribution of output between these two groups is largely defined by weather conditions and the price of imported goods, as well as the price of agricultural products during the previous season.

[12] http://www.armstat.am/file/doc/99489163.pdf

The general trend suggests that animal husbandry has remained nearly at the same level for several years, but experienced sizeable growth in 2011. Crop production patterns, despite a higher dependency on the weather, have provided stable growth during years 2004 to 2013.

Nearly 74% of all agricultural output in 2010 was produced by five regions. Armavir and Ararat are the main producers of fruits and vegetables in the country, because they are located in Ararat Valley and have favorable climatic conditions and fertile land suitable for this. Gegharkunik and Shirak are the main producers of cereals and potatoes, and have alpine meadows that are just right for cattle breeding. Main agricultural output of the marzes in the study area for the year 2010 is given in Table 6-4.

Table 6-4: Agricultural land and output distribution by regions of Armenia

Marz	Total agricultural land (ha)[11]	Arable land (ha)[11]	Main agricultural outputs (2010) (Source: ICARE 2015)
Lori	**251,139**	42,096	Cereals, potatoes, vegetables, animal husbandry, meat processing
Tavush	**110,773**	25,593	Cattle, pig, cereals, grapes, beekeeping, wine, brandy, tobacco
Kotayk	**154,628**	37,766	Poultry, fruits, dairy cattle, cereals
Gegharkunik	**345,574**	81,740	Cereals, potatoes, vegetables, livestock, fish, food processing, beverages

Within the investigation area, agriculture is mainly concentrated in the lower mountain slopes of the villages. Agriculture is a main source of income for the poorest segments of Armenian society and a main coping strategy to sustain a livelihood. Due to the decline of industry, dependence on agriculture has increased since independence.

Due to the importance of agriculture for people's livelihoods and the high fragmentation and small size of landholdings, expropriation of agricultural land is an issue of potential negative impact for the planned OHLs construction. About 30% of the proposed 400 kV line corridor (Option 4a) is used for agriculture, and about 3% are forested areas (assessed on basis of satellite images from 2013-2014). Regarding the 500 kV line corridor, about 42% are agriculturally used.

6.2.5 Living standards

According to the statistical data published by the National Statistical Service of the Republic of Armenia, the poverty level in Lori, Kotayk and Gegharkunik Marzes is above and in Tavush Marz is below Armenia's average (see Table 6-5). Especially at Kotayk Marz the poverty level of 42.5% and the level of extremely poor with 5.1% is much higher than the national level with 32% and 2.7%, respectively.

The main cause of poverty in the rural communities is the lack of industrial businesses, underdeveloped infrastructure and a long distance from larger population.

Table 6-5: Main poverty statistics, 2013[11]

Marz (Region)	Poor population	Extremely poor fraction of poor population
Lori	38.6%	2.6%
Tavush	27.7%	2.5%
Kotayk	42.5%	5.1%
Gegharkunik	35.8%	2.4%
Armenia	**32.0%**	**2.7%**

7. Environmental and Social Impacts and their Management

Main environmental and social impacts of 400 kV OHL Ayrum - Ddmashen routing following Option 4a and of 500 kV OHL Ayrum - Georgian border are presented in this chapter. Impacts of Option 1, Option 2, Option 3, and Option 5 (which all are not recommended to be implemented) are discussed in Section 5.2.

In order to keep environmental and social impacts of rehabilitation of 220 kV Lori OHL from s/s Vanadzor to s/s Alaverdi-2 and 110 kV OHLs Tumanyan-1 and -2 from s/s Alaverdi-2 to s/s Alaverdi-1 as low as possible, it is recommended to use the corridor of the existing lines under consideration of the bypasses proposed in the ESIA for Lori and Tumanyan-1 and -2 OHLs. Rehabilitation of these lines shall be implemented after construction and commissioning of BtB s/s Ayrum as Lori line can then be disconnected, dismantled and reconstructed in the already existing line corridor under consideration and extension of ESIA and RPF reports prepared by Fichtner in 2014.

As the final location of planned Hyusisayin GTPP and the relating line routing of connection line to 400 kV OHL Ayrum – Ddmashen is still not known, the environmental and social impacts of this connection line cannot be evaluated. However, the implementation of a double circuit line with only one circuit installed (at this stage) is foreseen in the project. Consequently, the environmental and social impact of the tie-in from the planned Hyusisayin GTPP to the 400 kV transmission line shall be performed within the implementation of the GTPP project.

7.1 Environmental Impacts and their Mitigation during Design

7.1.1 Line routing

Routing of connection lines from planned substations to existing OHLs (s/s Ayrum to 220 kV OHL Alaverdi – Gardabani (Georgia), s/s Ddmashen to 220 kV OHLs Noraduz and Marash, s/s Ddmashen to 330 kV OHL Artarbekyan) will cross mainly agricultural land. Final line routing has to consider avoidance of all buildings and settlements in order to avoid any physical relocation.

400 kV OHL from BtB s/s Ayrum to s/s Ddmashen follows the line routing discussed for Option 4a (see Chapter 5). The routing was chosen under consideration of avoiding crossing of any buildings and avoiding crossing forest areas as well as protected or sensitive areas to the greatest extent possible. Final line routing by CC has to consider avoidance of all buildings and settlements in order to avoid any physical relocation.

The final routing near to the Teghut Mining Site has to be closely coordinated by HVEN with Teghout CJSC representatives (see Section 7.4.5).

Where the new 400 kV OHL runs parallel to already existing other lines (e.g. 220 kV OHL Gugark-1, 110 kV OHL to Teghut Mining site, 110 kV OHL Noyemberyan/ Lalvar, 220 kV Alaverdi - Georgia), a minimum distance between the new line and the other power lines has to be chosen, that ensures the width of the ROW of both parallel running lines.

Line routing of 500 kV OHL from s/s Ayrum to the Georgian border will mainly cross agricultural land and pastures. A local quarry is bypassed by the proposed routing and all buildings will have to be avoided during the final line routing.

Impact of/ on	Sensitivity	Extent of Impact on/ by	Duration of Impact	Direct/ Indirect
Line routing	■■	■■	Long term	Direct

7.1.2 Access roads

Existing access roads to the substation sites will have to be widened and improved for transport of heavy substation equipment (see Photo 7-1).

Photo 7-1: Access track to BtB s/s site Ayrum

Already existing access roads/ tracks will be used, as far as possible for construction of the OHLs. Inside forested areas no new access tracks will be necessary. On the high mountain plateaus tower locations shall be reached using the line corridor (ROW), if no existing access roads are available. However, especially where the line routing will cross mountainous terrain, some new access tracks may have to be constructed. Construction of new access roads shall be agreed with Ministry of Nature Protection.

Erosion prevention measures as roadside plantation with bushes and drainage systems will have to be implemented especially in the hilly and mountainous areas. Access roads that are not needed anymore after accomplishing construction will be rehabilitated and replanted.

Access tracks/ roads will be designed avoiding any historic sites and graveyards. Anyway, their alignment will be agreed with the Ministry of Culture and in an unlikely case of objection, HVEN will ensure re-alignment of roads to the satisfaction of the Ministry.

Existing tracks will be used to the greatest extent possible. In the case that any PAPs experience temporary losses of access to land or livelihoods during road construction and land survey (if any), these will be addressed in line with the terms of the Project Resettlement Policy Framework (RPF).

Impact of/ on	Sensitivity	Extent of Impact on/ by	Duration of Impact	Direct/ Indirect
Access roads	■■	■■	Long term	Direct

7.2 Environmental Impacts and their Mitigation during Construction

7.2.1 Landscape

Visibility of towers will be high, especially where over-spanning valleys and on high mountain ridges. For Option 4a the main visual impact area is the crossing of Margahovit/ Fioletovo valley, which will have a high visual impact.

In the mountain highlands above villages Aghnidzor and Atan, and west of Gomshavar visual impacts of 400 kV OHL will also be high, as there are presently no other high-voltage transmission lines in this area (see Photo 7-2). However, these areas are not very visible from the valleys and from roads, so that visual impact is rated medium.

Photo 7-2: Planned line routing of 400 kV OHL above forest near village Atan

North of Debed River valley the corridor of 400 kV OHL will run parallel to already existing lines. Thus, the additional visual impact in this area will be low. Overall the visual impact of the line routings is rated medium.

Impact of/ on	Sensitivity	Extent of Impact on/ by	Duration of Impact	Direct/ Indirect
Landscape	■	■■	Long term impacts by the physical presence of towers and substations	Direct by the physical presence of OHLs and substations

7.2.2 Flora and fauna

Sites for BtB s/s Ayrum and s/s Ddmashen are located in agricultural used areas (see Photo 7-3). Impacts on flora and fauna by construction of the substations are thus considered to be low.

Photo 7-3: Agricultural used land at BtB s/s site Ayrum

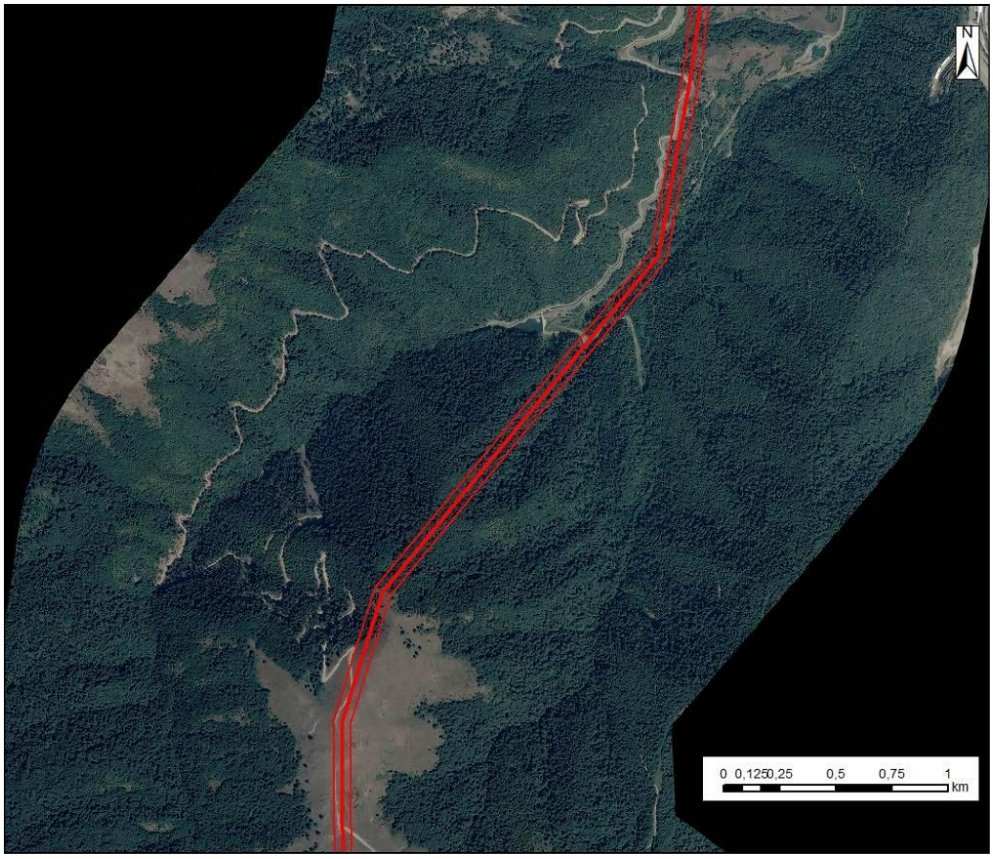
Impact of/ on	Sensitivity	Extent of Impact on/ by	Duration of Impact	Direct/ Indirect
Flora and Fauna by s/s construction	■■	■	Long term	Direct

Most of the land to be crossed by the OHLs consists of agricultural land, pasture land, hilly and mountainous terrains. However, also some forested areas are affected by the proposed line corridor. The construction process will be carried out with due precaution in order to limit damages to flora and fauna. The Protected Area Dilijan National Park will not be crossed by the proposed line routing. Option 4a crosses Margahovit State Sanctuary at its narrowest extension and avoids Caucasian Rose-Bay Sanctuary. IBAs Pambak Mountain Chain and Dsegh are also crossed as well as several high mountain areas including montane meadows.

Installation of bird flight diverters, where the power line over-spans valleys or canyons and where the power line crosses IBAs Pambak Mountain Chain and Dsegh, and fitting towers with “bird guards” are recommended, in order to minimize risks of birds’ electrocution and collision (see Section 7.3.2).

Forested valleys shall be over-spanned wherever possible or bypassed to avoid additional forest cutting (e.g. 400 kV OHL near Kakavadzor – see Map 7-1). However, impacts to forested areas are unavoidable; as some parts of the ROW (e.g. in forested areas south of Teghut (Lori) village) will have to be cleared of high trees which may lead to habitat alteration or loss (see Map 7-2).

Map 7-1: Forested area to be over-spanned near to Kakavadzor
(red: planned corridor of 400 kV OHL)



Map 7-2: Forested area to be crossed south of Teghut (Lori) village

A total area of about 23 ha of the line corridor of 400 kV OHL Ayrum – Ddmashen (Option 4a) is forested. The area, where trees will be replanted, and the final costs for replanting will be determined after final design of tower locations.

According to national legislation, the wood of felled trees in State Forests belongs to the Forest Department. If trees are removed from community-owned forests, then the community has to decide about its use.

It is recommended to establish a Biodiversity Action Plan (BAP) before construction works start, in order to ensure appropriate management in the project context of IBA territories and other sensitive habitats (e.g. mountain meadows). This BAP shall be developed by qualified experts (e.g. American University of Armenia Fund - AUA), with the participation of responsible authorities and of NGOs active in the area of nature protection (see BAP Outline in Section 11.7 – Appendix VII).

If the proposed mitigation measures are implemented the impact on flora and fauna is rated to be medium. Among others those measures include:

- Construction works at forested areas shall be avoided during breeding/ nesting season (March - June).
- Wide-span towers shall be located on hilltops to over-span forested slopes and valleys, thus reducing the cutting of trees in ROWs to the sites near to towers (to keep necessary clearance between trees and power lines) and to a narrow corridor needed for stringing of the guide rope.
- Inside forested areas no new access tracks will be built, as tracks already exist on both sides of these areas (e.g. see Map 7-2). As trees have to be cut in the corridor, next tower location shall be reached using the ROW.
- Tower locations which have no existing access tracks shall be reached along the ROW (e.g. at high mountain plateaus) in order to avoid unnecessary road construction.
- Access roads that are not needed anymore after accomplishing construction will be rehabilitated and replanted.
- Hunting activities and plant-collection of workers shall be prohibited.
- According to RA Decision No. 1045-N a compensatory tree planting plan will be developed and implemented by Hayantar SNCO. Indigenous site-specific tree species will be planted on an area at least twice as big as the area where trees have been felled, in the vicinity of the corridor (e.g. in degraded forest areas). Final planting location and tree species will be fixed by forest departments. Plantation maintenance and re-planting of dead seedlings will be done by Hayantar SNCO for a period of 7 years.
- Tree cutting and replantation will be monitored by Forest State Monitoring Centre SNCO.

Additionally, it is recommended to contract a NGO (e.g. Armenia Tree Project - ATP) in order to plant an area three times as big as the area where trees have been felled and to implement awareness raising activities.

The planted areas shall be maintained for a period of 4 years to secure the growth of seedlings. The Yerevan office of ATP manages three state-of-the-art tree nurseries and two environmental education centers, partners with villagers to create tree-based micro-enterprise opportunities, creates urban green belts for public use, restores degraded forest lands, and employs hundreds of part-time workers to plant new forests. ATP's Mirak Family Reforestation Nursery in Margahovit village has a capacity to grow one million tree seedlings, and it supports the reforestation operations in the Lori region of northern Armenia.

Impact of/ on	Sensitivity	Extent of Impact on/ by	Duration of Impact	Direct/ Indirect
Flora and Fauna by OHL construction	■■	■■	Long term	Direct

7.2.3 Soil erosion

Loss of vegetation and soil compaction increases the soils' vulnerability to erosion. It can be difficult for vegetation to recolonize bare and compacted areas of ground. Once vegetation is lost and not restored, the areas affected by erosion often tend to spread through the effects of wind and rain. Soils will be particularly vulnerable when the ground was wet, as then vehicle traffic is likely to cause the greatest damage.

Erosion of exposed soil and the resulting sediment produced can occur from project development, causing air (from dust) and water pollution (from sedimentation due to soil being transported to water bodies). 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 and cause fugitive dust and particulate matter to become airborne. Soil erosion can adversely affect water quality and biological communities in receiving water bodies due to increases in turbidity and rates of sediment deposition. The potential risk for erosion is increased by placing project components in areas with steep slopes; on unstable soils such as peat, humus and alluvial soils; and on clays, which are fine-grained and susceptible to dust and erosion in dry conditions. Additionally, the potential risks to water quality are increased with proximity to stream, rivers, and lakes.

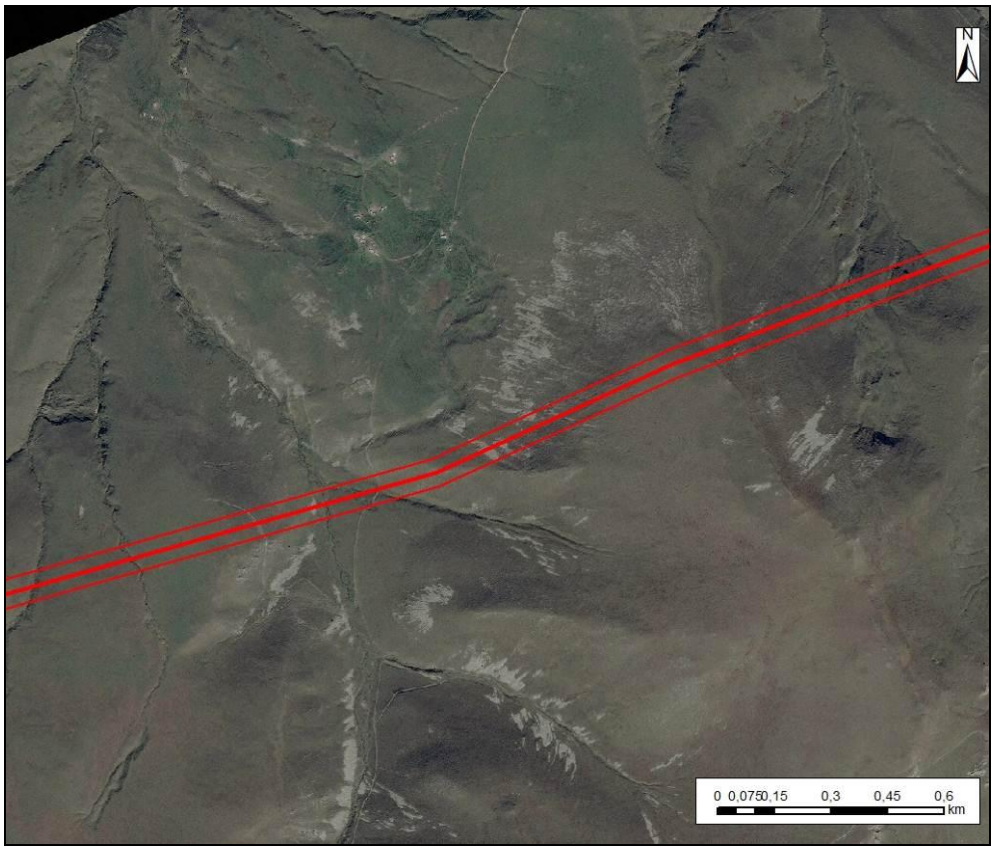
Damage to soils also has further effects on land-use. When soil is compacted, it cannot support native grasses or other vegetation. This in turn reduces the pasturage that can be used by the livestock of local herders or that is available for other creatures. The loss of grass affects biodiversity, since grass is a food source for small mammals, which in turn provide food for predators.

Removal of topsoil around tower feet will be minimized. Topsoil will be brought back after construction and soil will be replanted when towers are erected in steeper slopes. Access roads that are not needed anymore after accomplishing construction will be rehabilitated and replanted.

There are several river crossings of smaller and bigger rivers, the most important are Debed and Aghstev Rivers. Especially when crossing the valleys of these rivers a careful design (including adequate distance from gorges, avoiding deposits of loose spoils on steep slopes, immediate replanting of disturbed areas) will be necessary to prevent occurrence of erosion phenomena, when constructing new towers for over-spanning these valleys.

The undulating terrain at Ayrum s/s site (see Photo 7-3) has to be leveled or terraced before construction of the substation. Topsoil shall be stored separately protected from runoff and shall be brought back after construction works.

In the mountainous area north of Dilijan National Park the line routing of 400 kV OHL runs near to some landslide prone areas (see Map 7-3). Transmission line construction in this area will need to take the geological situation into account and tower foundations and access tracks will need to be carefully selected.



Map 7-3: Landslide prone areas north of Dilijan National Park

Additional to the mitigation measures given in Section 8.1.2, preparation and implementation of specific erosion control plans is required, once the final technical design of the OHLs and substations is available, as this final design will present information about location of towers and access roads, type of tower fundaments and necessary earthworks for construction.

Impact of/ on	Sensitivity	Extent of Impact on/ by	Duration of Impact	Direct/ Indirect
Soil Erosion	■■	■	Long term	Direct

7.2.4 Soil and water resources

The Project's impacts on soil are particularly associated with activities for substation and tower site preparation, excavation of holes and construction of concrete ground feet for the towers, tower erection and installation of substation equipment, preparation of access roads for transport of heavy equipment, installation of conductors, etc.

Soil sealing, excavation and removal will lead to permanent and/ or temporary acquisition of soil in the ROWs as well as at the substation sites, the future access roads, the workers' camps, and the laydown and deposit areas. Following soil functions will be lost at least temporarily: food and biomass production, present habitat function, source of raw materials.

Substations will be designed in state-of-the-art technology including bunds around and oil collecting/ draining system beneath transformers to prevent contamination of soil and groundwater from any oil leakages.

There is a low risk of pollution of soil and groundwater by fuel and lubricants from the construction vehicles and machinery, which can be avoided by proper maintenance. Additionally, oil/ fuel/ paint/ chemicals/ soil run-off during construction could pollute surface waters. Measures to prevent pollution of soil and water resources by oil and chemical spills have to be implemented during construction phase of OHLs and substations.

The towers and conductors will not present a hazard with respect to soil contamination unless paint or other coating is used. The conductors are made of aluminum, which should not corrode or rust. The towers are made of steel. The leaching potential for these elements from these structures is extremely low. If paint or other coating is used to prevent rust or corrosion of the steel towers, or to protect the aluminum from the elements, drips and spills could contaminate the soil. Plastic or other protective cloth shall be placed under any areas where towers or other materials will be painted. If soil will be contaminated by drips and spills it will be cleaned up and removed for safe disposal.

Operation of work camps - namely functioning of sanitation and catering facilities, storage and servicing of equipment, stockpiling of construction materials and waste - can lead to sewage and garbage pollution and spills from construction equipment operation and servicing. Construction camp must be equipped with toilets according to IFC/ EBRD Guidance Note[13] - separately for men and women - and waste bins to accommodate the entire labor force during construction period. The measures preventing pollution of surface and ground water and soil with chemical products must be applied at the construction site. Dismantlement of construction camps and harmonization of the area with the landscape shall be implemented after completion of construction works.

River crossings should be avoided if possible or specific mitigation measures shall be put in place (i.e. use of wide-span towers). The proposed 400 kV OHL routing crosses several smaller and bigger rivers; the most important are valleys of Debed and Aghstev Rivers. Smaller rivers which will be crossed are Shnogh, Voskepar, Marts, Aghbugha, Khachaghbyur, and Dzknaget Rivers. During construction, measures to avoid water pollution and disturbances of the riverbed and vegetation need to be implemented.

Smaller streams are crossed on the high mountain plateaus. Pollution of these water bodies during construction needs to be strictly avoided as they serve for drinking water supply for downstream communities.

Impact of/ on	Sensitivity	Extent of Impact on /by	Duration of Impact	Direct/ Indirect
Soil	■■	■	Short term during construction	Direct
Water Resources				
a) Groundwater	■	■		
b) Surface Water	■■	■		

7.2.5 Waste

Some line sections will be erected in remote areas without proper landfills. The sensitivity of the line corridors for solid waste is assessed to be medium. Solid wastes generated during construction include excavated soil and rocks, concrete, asphalt, bricks, metals and glass, packaging materials like plastics and paper as well as domestic waste. The generation of solid waste will be minimized by a proper waste management implemented by the Construction Contractor.

[13] see IFC / EBRD Guidance Note on Workers' Accommodation (2009)

Small amounts of hazardous waste like residual oil, fuel, paint or spill contaminated soil may accrue and shall be stored in adequate storage sites (lockable, roofed, ventilated, concreted and bunded floor) at new s/s Ayrum and s/s Ddmashen. All hazardous wastes shall be securely packed in sealed drums or other suitable containers and clearly identified by labels. Final disposal of hazardous waste is subject to medium- to long term national-level solutions to be decided upon and provided by the Government.

The Construction Contractor will have to clarify with Department of Communal Services for Waste, where the different types of waste may be disposed of.

Impact of/ on	Sensitivity	Extent of Impact on/ by	Duration of Impact	Direct/ Indirect
Waste (generated by construction activities and by workers)	■■	■	Short term during construction	Indirect

7.2.6 Noise

Workers will wear ear protection devices as part of their PPE if they are exposed to noise levels higher than 80 dB (A).

Wherever the line corridor or the substation sites are near to villages or houses, the construction contractor has to control noise emissions from all equipment. For residents the noise levels may not exceed 55 dB (A) or result in a maximum increase in background levels of 3 dB (A) at the nearest receptor location off-site (see also Table 7-1).

In order to keep nuisance from construction noise low, construction works near villages or houses shall be done between 9 am and 4 pm. However, due to the limited time of the construction period and the sparsely populated area for the largest part of the transmission line route, nuisance from noise during construction activities will be generally low.

Impact of/ on	Sensitivity	Extent of Impact on/ by	Duration of Impact	Direct/ Indirect
Noise	■	■	Short term during construction	Direct

7.2.7 Climate change and air quality

The construction activities will cause dust emissions resulting from earthworks, material storage (e.g. storage of sand and cement) and vehicle movements, which are limited in time.

Gaseous emissions to the air (mainly NO_X, SO_2 and PM) will be caused by vehicles used for transport of building materials, construction vehicles and machines as well as asphalting of access roads (if necessary). Such gaseous emissions are due to combustion of fuel. They will mainly appear along the roads used during construction and near worksites.

SF_6 is the strongest known greenhouse gas (for details see Section 11.5 - Appendix V). It is used to insulate circuit breakers at the planned substations. Relevant guidelines for handling SF_6 (see Section 11.5 - Appendix V) have to be followed.

In general, construction activities and vehicular traffic will result in a reduced ambient air quality and increased dust emissions, both being locally and temporary in effects. All the described emissions are limited to the construction time and will not have measurable impacts on climate change.

Vegetation clearing will affect a number of trees. As forest conservation is essential to counteract climate change, plantation measures are necessary for mitigation. As compensation for felled trees an area at least twice as big as the area where trees have been felled will be replanted according to national law of RA by Hayantar SNCO. Additional tree planting by a NGO (e.g. ATP) on an area three times as big as the area where trees have been felt, is recommended (see Section 7.2.2).

Due to the limited time of the construction period the impacts on ambient air quality by construction activities will be low. Machines and vehicles will be checked regularly to minimize exhausted pollutants. Dust generated by construction activities will be suppressed by spraying water, where necessary.

Impact of/ on	Sensitivity	Extent of Impact on/ by	Duration of Impact	Direct/ Indirect
Climate Change/ Air Quality	■■	■	Short term during construction	Direct

7.3 Environmental Impacts and their Mitigation during Operation

7.3.1 Flora

Growing trees and shrubs within the ROW have to be cut from time to time to keep the minimum safety clearance between vegetation and the conductor cables. If forested hillsides and valleys will be over-spanned and minimum clearance can be kept, no further cutting of trees is required during maintenance. No biocides will be used for corridor clearance.

In exceptional cases, if any of such application would be required, no extremely or highly hazardous pesticides (WHO classes I a and I b)[14] may be utilized by any of the end-users. Moderately hazardous pesticides (WHO class II) are not to be used, unless the end-user has appropriate controls established with respect to the manufacture, procurement, or distribution and/or use of these chemicals. These chemicals should not be accessible to personnel without proper training, equipment, and facilities in which to handle, store, apply, and dispose of these products properly.

Agricultural land within the ROWs can be cultivated with most of the original crops as before, except for the tower sites themselves. Pasture land can also be used as before.

The vegetation under new towers and along new access roads/ tracks will partly be destroyed permanently. The vegetation within the ROWs is cleared on a regularly basis during operation of the OHLs without using any herbicides. Thus, the impact of the proposed Project on the flora in the line corridor during operation is assessed to be low, as the main impact already occurs during the construction phase.

Impact of/ on	Sensitivity	Extent of Impact on/ by	Duration of Impact	Direct/ Indirect
Flora	■	■	Long term	Direct

7.3.2 Fauna

The presence of substations will not disturb animals significantly as they will be located in agricultural used areas without much wildlife.

Birds are the animal group which may be most affected by OHLs in operation, mainly by risk of electrocution and risk of collision.

Armenia does not lie on one of the primary migration paths of birds which are located east and west of the country. However, a study conducted by American University of Armenia Fund (AUA) identified five areas of higher risks for migrating bird species along the 400 kV OHL corridor. These areas are located at the slopes of mountain ridges where migration of raptors usually takes place most probably due to wind updrafts. Especially during unfavorable weather conditions raptors might fly as low as 50 m, thus increasing the collision risk (see Section 11.3 – Appendix III).

Option 4a of the planned 400 kV OHL Ayrum - Ddmashen crosses two Important Bird and Biodiversity Areas identified by Birdlife International (see Section 6.1.10.4).

[14] http://www.who.int/ipcs/publications/pesticides_hazard/en/

Over-spanning of gorges will not impact structure-bound birds living in bushes or trees down in the valley and moving along these habitat structures, thus not flying in a height where they can collide with the wires. However, big raptors (vultures and other raptors have been observed at Debed River canyon) overflying the gorges, as well as big water-bound birds like herons, cranes, swans and pelicans might collide with the conductors or ground wires. Different bird species may also use the towers for perching, thus risking electrocution.

The installation of bird diverters will increase the visibility of the power lines and especially of the thinner ground wire. Studies in different habitats in Germany showed that the risk of bird collision is significantly reduced by bird diverters - up to 90% if clearly visible high contrast (i.e. black and white) moving bird flight diverters (see Figure 7-1) are installed at the conductors or the ground wire (VDE/FNN 2014).

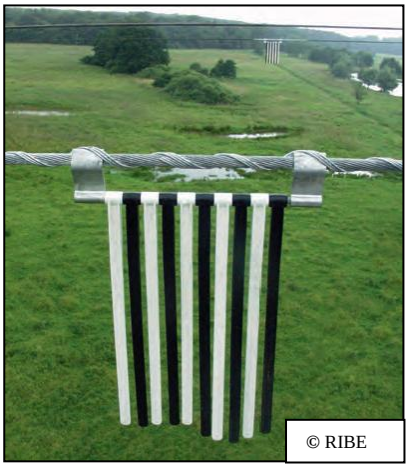


Figure 7-1: Black and white, rigid plastic pieces that swing on a rod attached at both ends to ground wire or conductor

It is therefore recommended to install such kind of bird diverters at the ground wire, respecting a distance of 20 to 25 m between each other, where the line is crossing river gorges (e.g. Debed and Aghstev Rivers) and valleys (e.g. near Mets Ayrum), and in the high risk areas for migrating bird species identified by AUA (see Maps 11-1 to 11-5 in Section 11.6 – Appendix VI). The length will sum up to approx. 10.5 km along 400/ 500 kV OHLs.

The bird diverters can be added to the ground wire during construction using line cars or line bicycles (see Figure 7-2).

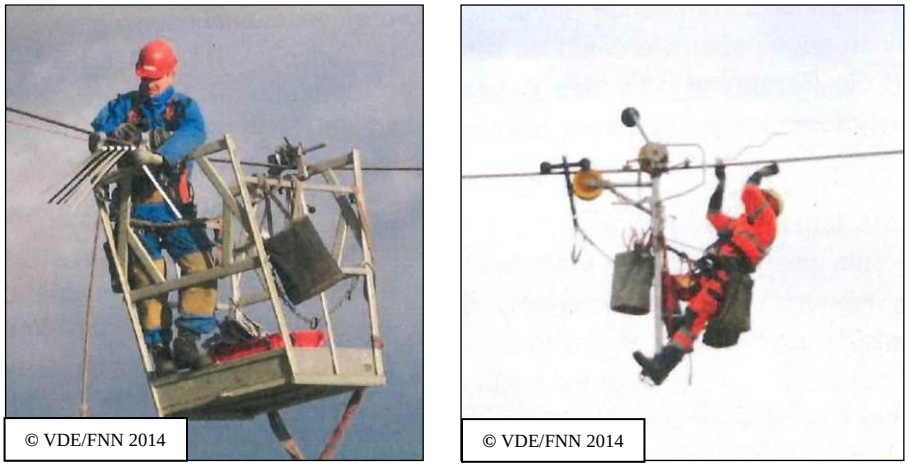


Figure 7-2: Installation of bird diverters using a line car (left) or a line bicycle (right)

Caucasian Grouse (*Lyrurus mlokosiewiczi*), which is categorized as vulnerable in the Red Book of Armenia[8] occurs at upper forest edge and in subalpine and alpine meadows. Studies from different European countries showed that grouse species are particular collision prone regarding transmission lines (Bernotat & Dierschke 2015, Nopp-Mayr & Grünschachner-Berger 2011, Bevanger & Brøseth 2004). Therefore, it is recommended to install bird diverters at the lowest conductor in areas, where the 400 kV OHL will cross subalpine and alpine meadows near to upper forest edge, especially at IBA Pambak Mountain Chain and IBA Dsegh (see Maps 11-1 to 11-5 in Section 11.6 – Appendix VI). The length will sum up to approx. 4.5 km along 400 kV OHL.

"Bird guards" shall be foreseen in the functional preliminary tower design in order to minimize the risk of electrocution (e.g. stainless steel needle strips that extend sufficiently horizontally beyond the protected location and be applied to all surfaces a bird can sit on).

Collision of bats with the conductors is not likely, due to their extraordinary capacity of orientation and therefore the expected impact is negligible (Ledec et al. 2011, DG Consulting 2013, LLUR 2013).

Concerning habitat alteration and habitat loss the main impacts (if any) already occur during the construction phase even though the results are of permanent nature. But, also corridors can fulfill ecological functions (e.g. for invertebrates and birds).

Impact of/ on	Sensitivity	Extent of Impact on/ by	Duration of Impact	Direct/ Indirect
Fauna	■■	■	Long term	Direct

7.3.3 Waste

The Construction Contractor will agree with municipal authorities about using services of communal service providers for waste disposal purposes during construction period. These services shall also be used during operation of the substations for disposal of waste produced by substation staff. Any hazardous waste shall be stored at secure storage areas at the substation sites (see Section 7.2.5).

Impact of/ on	Sensitivity	Extent of Impact on/ by	Duration of Impact	Direct/ Indirect
Waste (generated during operation by s/s staff)	■■	■	Long term during operation	Indirect

7.3.4 Noise

The intensity of corona noise is influenced by weather conditions. Wet weather, fog or rain increases the noise level. For population following limit values are valid (General WB/IFC EHS Guideline):

Table 7-1: Limit values for noise regarding population (WB/IFC EHS Guideline)

Receptor	One Hour $L_{Aeq\ (dB\ A)}$	
	Daytime 7:00 – 22:00	**Night-time 22:00 – 7:00**
Residential; institutional; educational	55	45
Industrial; commercial	70	70

The impacts through noise resulting from the operation of the OHL are assessed to be low. Noise emitted by conductors (corona effect) will be minimal. Specific mitigation measures are not necessary.

Noise levels for workers within the substations will also not be exceeded. As stipulated in the General EHS Guidelines of the World Bank Group, '*no employee should be exposed to a noise level greater than 85 dB (A) for a duration of more than 8 hours per day without hearing protection*'. Such high noise levels are not to be expected to occur within a substation designed as state-of-the-art during regular operation.

Impact of/ on	Sensitivity	Extent of Impact on/ by	Duration of Impact	Direct/ Indirect
Noise	■■	■	Long term	Indirect

7.3.5 Climate change and air quality

During transmission line and substation operation CO_2 will be emitted from vehicles used for maintenance works but only small amounts and very temporary.

SF_6 which is used in small amounts in the generator circuit breakers of the planned substations is a strong greenhouse gas. Relevant guidelines for handling SF_6 (see Section 11.5 - Appendix V) have to be followed.

As maintenance activities in the ROWs are limited in time, there is only a very low contribution of CO_2 emissions to the air by vehicles. The greenhouse gas contribution of the new substations (using SF_6) will be also very low due to the use of efficient control technologies.

Impact of/ on	Sensitivity	Extent of Impact on/ by	Duration of Impact	Direct/ Indirect
Climate change/ Air Quality	■■	■	Long term	Indirect

7.4 Social Impacts and their Mitigation during Construction

7.4.1 Land use and land acquisition

All land required for construction of BtB s/s Ayrum and s/s Ddmashen has already been acquired by HVEN.

With a length of approx. 94 km (400 kV OHL) and approx. 7 km (500 kV OHL) the planned transmission lines are likely to affect land use. Some private land may need to be acquired for the tower locations and for new access roads. This does not constitute a legal problem (Law on Alienation of Property for Social and State Needs, 2006), but could impact the lives of local residents, change land use practices temporarily and permanently and cause damages to trees and crops.

The strategy adopted is to avoid and to minimize impacts wherever possible and to compensate Project Affected People (PAP) for impacts that cannot be avoided. As the lines pass agricultural used lands and mountain pastures it will have an impact on land use. Once the tower locations will be defined, the cadastral information will exactly determine the ownership status of the affected land. Additionally, legal experts will support PAP that are not registered land owners with legalization of land titles.

Impact on land use (Agriculture):

Within the investigation area, agriculture is mainly concentrated in the lower mountain slopes of the villages. Agricultural activities range from cattle, sheep, pig, and goats to short crops such as potato, tomatoes, cucumbers and eggplant, to cereals such as wheat and beans, and to fruit tree plantations (e.g. apricots). Fields are fragmented and size is often very small. Agriculture will be possible in ROW after construction period. It is recommended to plan construction works not to interfere with harvesting period in order to avoid damages to crops, as far as possible. Crossing of fruit tree plantations shall be avoided wherever possible, or plantations shall be over-spanned if avoiding is not feasible.

Photo 7-4: Fruit tree plantation near to access road to BtB s/s site Ayrum

Impact on land use (Grazing Lands):

Most of the grazing lands/ mountain pastures are communal lands used by livestock owners. Grazing will be allowed within the corridor. Permanent as well as temporary impacts are expected to be limited. However, all use of communal lands will be done only with the consent of the community authority overseeing the community lands. Any private landowners of grazing lands will be compensated for any temporary or permanent impacts on their access to grazing resources.

Impact on land use (Access Roads):

Impact of access roads can either be permanent, if the change of land use is not reversible (e.g. access roads to substation sites) or temporary, if the former land use can be continued after construction. The extent of permanent impact of access roads on private lands is estimated to be limited. However, if private lands are irreversibly changed for the construction of access roads, the same expropriation procedure applies as for tower locations and lands with settlements. In case of a temporary impact, damages to crops and production capacity of the land will have to be fully compensated.

Impact of/ on	Sensitivity	Extent of Impact on/ by	Duration of Impact	Direct/ Indirect
Land Use and Land Acquisition	■■	■	Long term	Direct

7.4.2 Involuntary resettlement

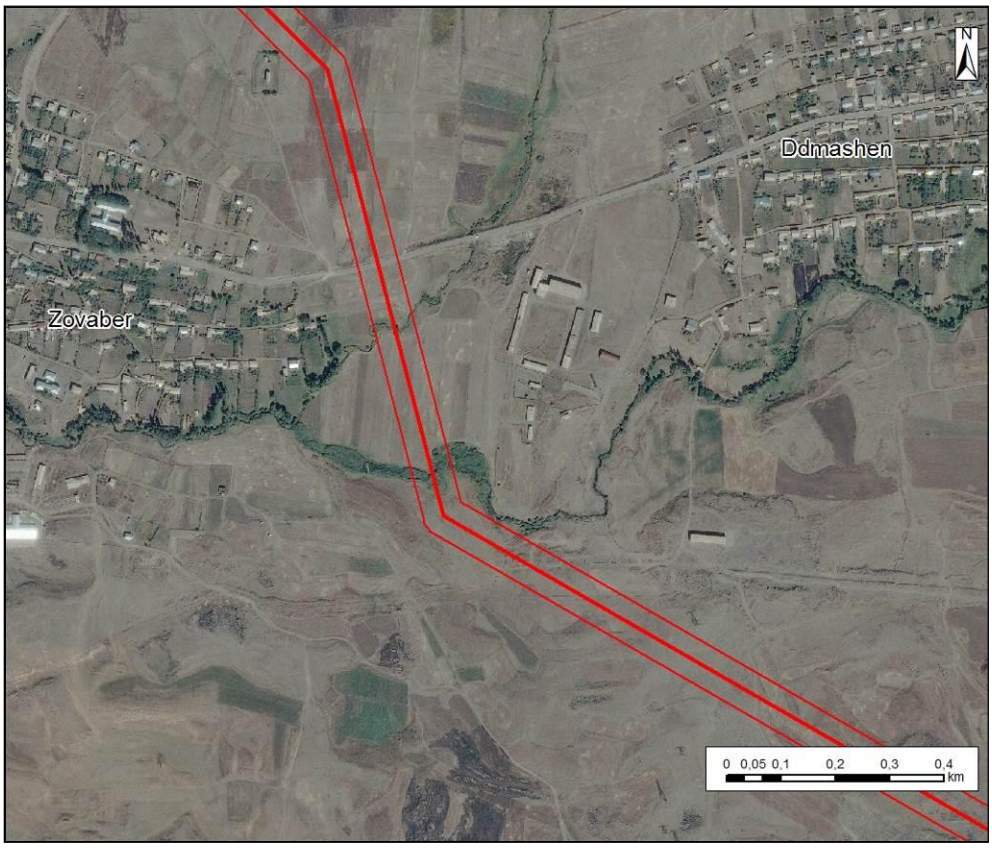
Involuntary resettlement has a big impact on the livelihood of affected people and is one of the most serious issues of infrastructure projects. Such a resettlement shall be avoided or at least minimized. Losses of houses and livelihood have to be fully compensated.

The EBRD Performance Requirement PR 5 (Land Acquisition and Involuntary Resettlement) provides safeguards to address and mitigate impoverishment risks related to involuntary resettlement under development projects. The main objectives of EBRD PR 5 are that involuntary resettlement should be avoided where feasible. At least, its social and economic impacts should be minimized and affected parties should be enabled to share the project benefits. PAP should be consulted and be given the opportunity to participate in the planning and implementation of the resettlement program. Displaced persons should be assisted to improve their livelihoods or at least to restore them to pre-project levels.
To address the negative impacts of involuntary resettlement, it is required that affected persons are:

- informed about their options and rights pertaining to resettlement
- consulted on and provided with feasible resettlement alternatives
- provided with prompt and full replacement costs for losses of assets
- provided with assistance such as moving allowances during relocation
- provided with development assistance in addition to the compensation, such as credit facilities, training or job opportunities
- Vulnerable persons among the displaced people, such as the handicapped, elderly people, women, widows, and children should be provided with specific social assistance.

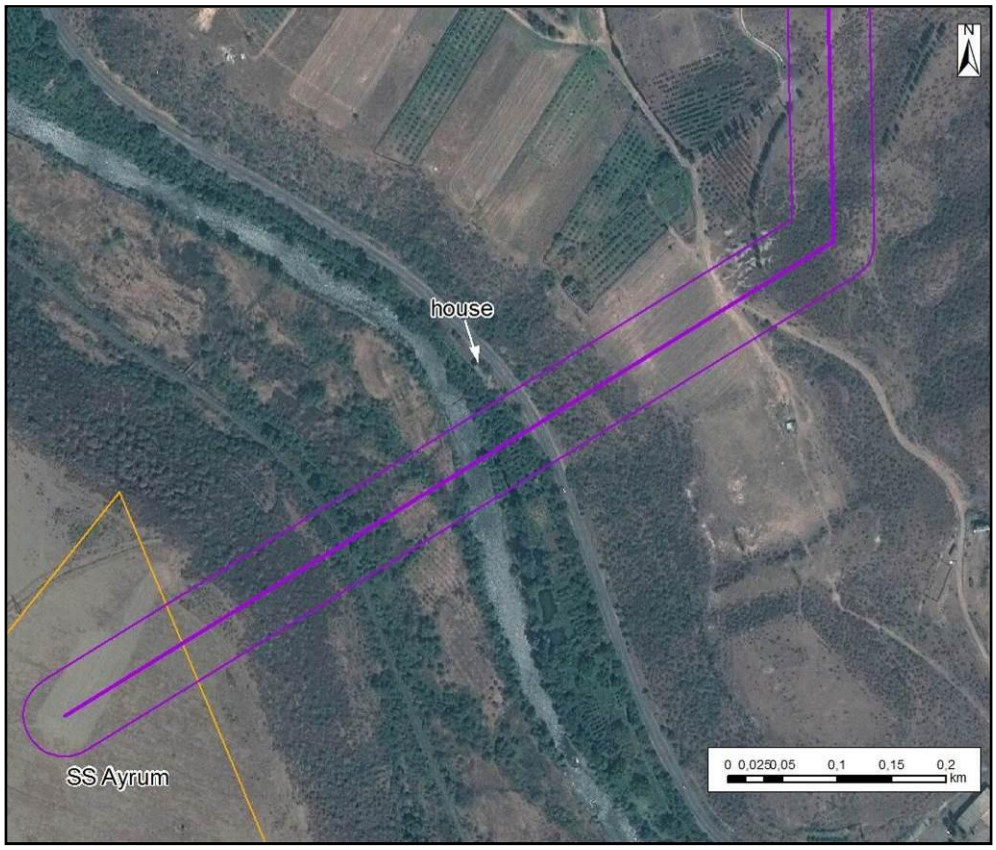
The potential impact on settlements has been analyzed by interpretation of satellite images and during field-visits.

All work on the OHLs will be conducted in full compliance with the RPF and the Resettlement Action Plan (RAP), if needed. Avoidance of displacement to the extent possible is a priority. Bypasses will therefore be created in order not to affect settlements, wherever technically. For example between villages Ddmashen and Zovaber 400 kV line routing was adapted in order to avoid crossing of any building (see Map 7-4).



Map 7-4: Buildings between Ddmashen and Zovaber avoided by line routing

When over-spanning river valleys (e.g. Debed and Aghstev Rivers) no buildings located down in the valley may be over-spanned. Line routing was adapted accordingly e.g. for 500 kV OHL between Ayrum s/s and Haghtanak (see Map 7-5).



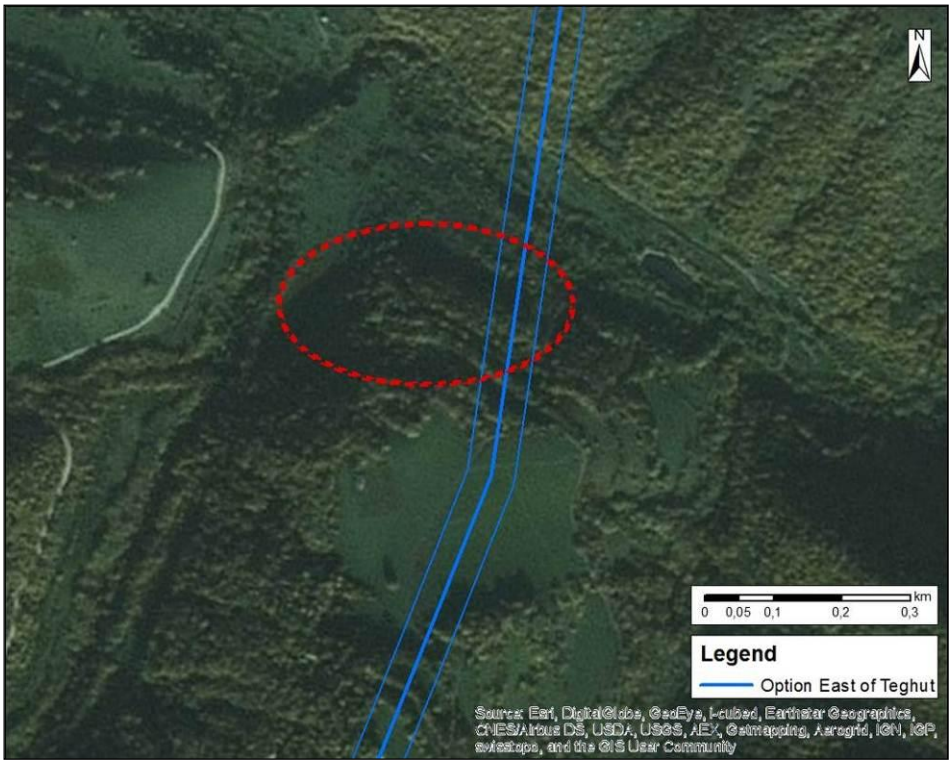
Map 7-5: House between Ayrum s/s and Haghtanak to be avoided by 500 kV OHL

Impact of/ on	Sensitivity	Extent of Impact on/ by	Duration of Impact	Direct/ Indirect
Loss of Houses and Livelihood Involuntary Displacement	■■	■ if any	Long term	Direct

7.4.3 Historical and cultural sites

The investigation has been done during field visits and with support of satellite images. Only sites in the proximity (500 m distance) of the existing and planned lines have been considered. Major cultural sites e.g. monasteries that are located in a few km distance (see Section 6.2.2) will not be mentioned here, as they won't be directly affected by the line construction.

An area of recent archaeological excavations was identified near Teghut village in Lori Marz on the property of Shnogh municipality (see Map 7-6 and Photo 7-5). Reportedly, the site is situated on a meadow with fruit trees and gardens and harbors remains of an old city. Excavations have started a few years ago. Information was provided by a local farmer. The area shall be avoided. If the property of Teghout CJSC is passed in the west, this cultural site will not be crossed or affected. If the mining site was passed in the east this cultural area would have to be avoided.



Map 7-6: Identified Cultural Site south of Teghut village (Lori)

Photo 7-5: Cultural site south of Teghut village (Lori)

No other known physical cultural property is located within the ROWs. Nonetheless, HVEN will send data about planned tower locations and access roads to RA Ministry of Culture, which will issue final opinion whether any physical or cultural property exists at proposed tower locations before construction works. In an unlikely case of the Ministry having any reservations in regard to individual towers, HVEN will suggest and the Ministry will approve their relocation. This is a common pre-construction procedure established by the national law.

Chance Find Procedure:

For the case of unexpected encounter of Cultural and Historical Sites a Chance Find Procedure has to be implemented. In case of any chance finds, the construction has to be stopped immediately and the Agency of Protection of Historical and Cultural Monuments/ Ministry of Culture has to be informed to agree on further steps (as according to Armenian Law). The Chance Find Procedure will include:

- stop the construction activities immediately in the area of the find
- notify the responsible local authorities and the Ministry of Culture
- evaluation of the findings to be performed by the archaeologists of the Agency of Protection of Historical and Cultural Monuments/ Ministry of Culture
- decision on how to handle the find to be taken by the responsible authorities and implementation of the decision concerning the management of the finding
- construction work could resume only after written permission is given from the responsible local authorities and the Ministry of Culture concerning safeguard of the heritage.

For implementing the Chance Find Procedure no costs will arise for the Construction Contractor and the related excavation and conservation costs will be paid from the Government budget. The Construction Contractor will not be entitled for compensation for idle time while Chance Finds are dealt with, because due to linear nature of the infrastructure, Contractor will be able to continue works on other sections of the OHLs.

Impact of/ on	Sensitivity	Extent of Impact on/ by	Duration of Impact	Direct/ Indirect
Historical and Cultural Sites	■■■	■	Short term during construction; long term by the physical presence of towers	Direct and indirect by the physical presence of the line (visual aspect)

7.4.4 Health and safety

Within HVEN the Safety Engineering and Reliability Service is responsible for all safety aspects at the high voltage substations and overhead transmission lines.

Direct impacts on Health and Safety during construction of the planned transmission lines and substations may result from various factors as electrocution during construction, working at height, sanitary situation during construction (e.g. contamination of water), sexually transmitted diseases (STD) - especially HIV/AIDS due to contact of workers and population etc.

According to the General EHS Guidelines of the World Bank Group, '*no employee should be exposed to a noise level greater than 85 dB (A) for a duration of more than 8 hours per day without hearing protection*'. In case this limit is exceeded workers shall wear ear plugs.
As the construction will be undertaken in an environment, where other functioning lines are present in the vicinity the risk of electrocution may be increased in some areas, especially those where the distance between the lines is small or where crossing of existing lines is planned.

A potential impact for the health and safety of workers could be further related to work accidents during construction of the line or due to contaminated drinking water or food.

Workers' camps have to meet the requirements of IFC/ EBRD guidance note on worker accommodations[13], including e.g. provision of an adequate number of sanitation facilities, medical facilities, dormitory facilities etc.

Indirect impacts on Health and Safety are related to the stability and functioning of the Armenian Power Grid. The indirect impact of the Project will only gradually increase a risk that exists without relation to the Project e.g. in case of a natural disaster.

The Construction Contractor will develop an appropriate Health, Safety and Environment Management Plan for the construction phase and implement a Health, Safety and Environment Management System (HSEMS) during construction. An H&S manager of the CC shall be on duty all the time during construction period.

Electric and Magnetic Fields

Technical regulations on safety zones for electric networks of Armenia define a distance of 20 m on each side from 110 kV, 25 m from 220 kV, and 30 m from 400 kV and 500 kV OHLs as a buffer zone (GRA 2009). Additionally, the clearance between the conductors (depending on the final design of the towers) has to be considered.

WB/IFC Performance Standards are internationally used to manage human exposure to electric and magnetic fields. WB/IFC Performance Standards require respecting the limits established by the International Commission on Non-Ionizing Radiation Protection (ICNIRP), which are as follows:

ICNIRP (1998) exposure guidelines for general public exposure to electric and magnetic fields		
Frequency	**Electric Field (V/m)**	**Magnetic Field (μ/T)**
3-150 kHz	87	6.25
10-400 MHz	28	0.092
2-300 GHz	61	0.2

ICNIRP exposure limits for general public exposure to electric and magnetic fields		
Frequency	**Electric Field (V/m)**	**Magnetic Field (μ/T)**
50 Hz	5000	100
60 Hz	4150	83

The OHLs will be designed the way to conform with the national and the ICNIRP's standards - whichever is more stringent - and, therefore, people residing in the vicinity of the OHLs will be protected from the negative impacts of exposure to the electric and magnetic fields.

For workers at the substations EMF measurements shall be performed and areas with high electric or magnetic fields, if any, shall be signed.

The exposures of workers and persons living in close proximity to the proposed project transmission lines has to be below the values mentioned in these guidelines.

The impact on human health for the public and for workers through during construction can be assessed to be low.

Impact of/ on	**Sensitivity**	**Extent of Impact on/ by**	**Duration of Impact**	**Direct/ Indirect**
Health and Safety	■■	■	Short term during construction	Direct

7.4.5 Infrastructure/ cumulative impacts

Minimal ground clearance will be sufficient in order to avoid negative interference to the traffic that occurs in case of road crossings. Proper traffic management will avoid negative impacts on traffic as far as possible.

Where the new OHLs run parallel to existing other lines (e.g. 220 kV OHL Gugark-1, 110 kV OHL to Teghut Mining site, 110 kV OHL Noyemberyan/ Lalvar, 220 kV Alaverdi - Gardabani), a minimum distance between the new line and the other power lines has to be chosen, that ensures the width of the ROW of both parallel running lines. Where existing lines are crossed by the new OHLs adequate precaution measures have to be taken and adequate minimum distances between the conductors have to be ensured.

The work under the Caucasus Energy Network Project is expected to cause some power outages, especially when existing 220 kV OHLs Marash and Noraduz as well as 330 kV OHL Artarbekyan will be connected to the new substation Ddmashen and 220 kV OHL Alaverdi - Gardabani to new BtB s/s Ayrum, respectively. HVEN shall develop an energy compensation plan in order to minimize outage duration and ensure power supply to local power consumers.

Northwest of Haghtanak village the corridor of 500 kV OHL Ayrum – Georgian border shall avoid crossing a local quarry by bypassing it in the east (see Photo 7-6).

Photo 7-6: Quarry located northwest of Haghtanak village bypassed by line routing

Teghout CJSC, a member of Vallex Group of Companies, is an open-pit copper and molybdenum concentrator facility near to Teghut village in Lori Marz. Line routing of 400 kV OHL will cross parts of Teghout CJSC property. During field study in February 2016 the line routing was discussed with an Electricity Specialist of Teghout CJSC who recommended the routing west of the mining site below the forested areas (see Photo 7-7).

Photo 7-7: Rough line routing of 400 kV OHL west of Teghut Mining Site

Line routing in the east of the mining side would also cross parts of Teghout CJSC property. However, it would traverse significantly more forest land on the eastern side of Teghut valley, bypass the villages Teghut and Shnogh and cross agricultural land of village Archis before crossing the valley of Debed River (see Photo 7-8 and Photo 7-9).

Photo 7-8: Rough line routing of 400 kV OHL east of Teghut Mining Site, above village

Photo 7-9: Rough line routing of 400 kV OHL southeast of Teghut, crossing forest

Considering environmental and social impacts the line routing west of the mining side is preferable. This routing has also been proposed by the Electricity Specialist of Teghout CJSC. However, the final line routing in this area has to be developed by HVEN in close cooperation with Teghout CJSC.

Cumulative impacts exist, where 400 kV OHL crosses Teghout CJSC property and where the new 400 kV OHL will run near to already existing transmission lines (e.g. north of Debed River valley), as in these areas impacts have already occurred due to previous construction activities. These cumulative impacts are unavoidable, but can be minimized by constructing the new 400 kV OHL in parallel and as near as technically possible to the existing transmission lines and by crossing Teghout CJSC property below the forested areas.

Impact of/ on	Sensitivity	Extent of Impact on/ by	Duration of Impact	Direct/ Indirect
Infrastructure/ Cumulative Impacts	■■	■■	Short to long term during construction	Direct

7.4.6 Gender aspects

The construction of the lines and substations may increase existing gender disparities, as benefits from construction work will be earned mostly by men and access and control over compensation payments are likely to be at the disposal of men and not of women, which increases the probability that the family will benefit less. There are a considerable percentage of single women headed households in the area, who are among the most vulnerable people. If resettlement issues arise, for single women headed households the same procedure applies as for vulnerable people.

Impact of/ on	Sensitivity	Extent of Impact on/ by	Duration of Impact	Direct/ Indirect
Gender Aspects	■■	■ if any	Short term	Indirect

7.4.7 Vulnerable people

In Lori Marz the incidence of poverty is about 38.6%, in Tavush Marz 27.7%, in Kotayk Marz 42.5%, and in Gegharkunik Marz 35.8%, including urban areas, where poverty incidence is expected to be lower. In remote areas and above 1,500 m altitude poverty incidence is generally considerably higher. People make a living from subsistence based agriculture and shepherding. Most of the poor people are vulnerable to trends, shocks and seasonality, meaning that a reduction in rainfall due to climate change, unexpected events like earth quakes or simply at the end of the winter season brings them to the edge of sustaining their livelihood.

Possible impacts on vulnerable people will only occur during construction. Potential impacts as expropriation of land or damages to crops could reduce the livelihood base of vulnerable people to the extent that their livelihood is critically endangered. Most of the vulnerable people do not have land titles or own very little land. In this case already the loss of a surface of a tower foundation could result in vulnerability. In most cases safe drinking water, medical assistance, education etc. are also issues of concern.

The lack of social capital and trust in institutions and legal support makes people below the poverty line especially vulnerable to injustices regarding compensation payments and resettlement. Full livelihood restoration as suggested in EBRD PR 5 means that people additionally to cash compensation receive the support to build up a future livelihood. A formal cooperation with specialized NGOs is suggested.

As mentioned above, often vulnerable people are reluctant to voice their complaints in public and often do not seek legal support when treated unfairly. It is suggested that during construction process, a social specialist undertakes field visits and conducts interviews with Project affected households to confirm absence of dissatisfaction or – in case unrevealed issues are identified – supports the affected people in bringing their cases forward.

Households below the poverty line and otherwise vulnerable households may lose their livelihood base if impacted by loss of land or relocation. In this case, a special livelihood support program shall be implemented.

Impact of/ on	Sensitivity	Extent of Impact on/ by	Duration of Impact	Direct/ Indirect
Vulnerable people	■■■	Still unknown	Long term	Direct

7.4.8 Local workforce

During the construction period local workforce will be employed for the construction of substations, towers and stringing procedures. This will contribute to much needed monetary income in remote rural areas and towns, where the industrial basis has eroded. However, the income generation opportunity is not of long term duration.

Impact of/ on	Sensitivity	Extent of Impact on/ by	Duration of Impact	Direct/ Indirect
Local Workforce	■■■	+	Short term limited to construction period	Direct

7.5 Social Impacts and their Mitigation during Operation

7.5.1 Land use

All required land at the foreseen substation sites has already been acquired by HVEN. An area of approx. 200 m² per new tower will have to be expropriated and partly sealed for tower foundations as a permanent impact (of the construction phase). Permanent access roads will have to be established for maintenance purposes. Land for widening of access roads has to be acquired by HVEN. The remaining land of the line corridors can be used as agricultural land or as pasture land as before. Maintenance works are not expected to have a major social impact. Minor impacts, as damages to crops during maintenance works of the ROWs will be compensated.

Impact of/ on	Sensitivity	Extent of Impact on/ by	Duration of Impact	Direct/ Indirect
Land Use	■	■	Long term	Direct

7.5.2 Health and safety

Health and Safety of Workers

Maintenance workers and substation staff will be exposed to electric and magnetic fields and noise (corona effect). They could also have accidents by trips, falls, handling of tools etc.

Impacts on health and safety of the workers could result from maintenance works of the ROW, local road repairs and operating and maintaining the transmission lines and substations. During operation and maintenance works of the transmission line, some hazardous materials would be used bearing risks. For example, transformers of the substations would be filled with insulating oil and new circuit breakers would be filled with sulfur hexafluoride (SF_6) gas. The incorrect transport, use, or management of these materials and wastes could result in health impacts on the workers.

Once the substations and transmission line are in operation there are risks of electrical shocks, electrocution, fires and explosions given.

With respect to workers in substations, in general, the strongest electric and magnetic fields (EMF) around the outside of a substation come from the transmission lines entering and leaving the substation. The strength of the EMF from equipment within the substation, such as transformers, reactors, and capacitor banks, decreases rapidly with increasing distance.

Beyond the substation fence or wall, the EMF produced by the substation equipment is typically indistinguishable from background levels.

Based on a recent in-depth review of extensive scientific literature (World Health Organization's International EMF Project), the WHO has concluded that "despite extensive research, to date there is no evidence to conclude that exposure to low level electromagnetic fields is harmful to human health". The internationally used standards/ limit values concerning electric and magnetic fields (50 Hz) are described in Section 11.4 (Appendix IV). At workplaces a maximum of 10 kV/m for the electric field and 500 µT for the magnetic field, respectively are recommended. From experience gained in other transmission line projects, the resulting EMF are below the given standards/ limit values.

Health and Safety of the Population

Time limited noise emissions will result from maintenance works at the substations and the corona effect.

All habitation and structures are excluded from the ROW to ensure the safety of people from EMF. The internationally used standards/ limit values concerning electric and magnetic fields (50 Hz) are described in Section 11.4 (Appendix IV). Following limit values for the public are internationally accepted:

Electric field:	max. 5 kV/m
Magnetic field:	max. 100 µT.

From experience gained in other transmission line projects, the resulting EMF are below the given standards/ limit values.

With respect to substations, in general, the strongest EMF around the outside of a substation comes from the power lines entering and leaving the substation. The strength of the EMF from equipment within the substations, such as transformers, reactors, and capacitor banks, decreases rapidly with increasing distance. Beyond the substation fence or wall, the EMF produced by the substation equipment is typically indistinguishable from background levels. However, measurements of EMF inside substations and along the fence line near substations, at some selected houses located closest to the line, and right below the conductor in a height of 1.7 m are recommended, once when the line is under full load.

The impacts on health and safety of workers and the public during operation are assessed to be low in general.

Impact of/ on	Sensitivity	Extent of Impact on/ by	Duration of Impact	Direct/ Indirect
Health and Safety	■■	■	Long term	Direct

7.6 Summary of Impacts

Table 7-2: Summary of impacts during design phase

Impact of/ on	Sensitivity	Extent of Impact on/ by	Duration of Impact	Direct/ Indirect
Line routing	■■	■■	Long term	Direct
Access roads	■■	■■	Long term	Direct

Table 7-3: Summary of impacts during construction phase

Impact of/on	Sensitivity	Extent of Impact on/by	Duration of Impact	Direct/ Indirect
Landscape	■	■■	Long term impacts by the physical presence of towers and substations	Direct by the physical presence of the line and substations
Flora and Fauna a) by substation construction b) by OHL construction	 ■■ ■■	 ■ ■■	Long term	Direct
Soil Erosion	■■	■	Long term	Direct
Soil Water Resources a) Groundwater b) Surface Water	■■ ■ ■■	■ ■ ■	Short term during construction	Direct
Solid Waste (generated by construction activities and by workers)	■■	■	Short term during construction	Indirect
Noise	■	■	Short term during construction	Direct
Climate Change/ Air Quality	■■	■	Short term during construction	Direct
Land Use and Land Acquisition	■■	■	Long term	Direct
Loss of Houses and Livelihood Involuntary Displacement	■■	■ if any	Long term	Direct

Impact of/on	Sensitivity	Extent of Impact on/by	Duration of Impact	Direct/ Indirect
Historical and Cultural Sites	■■■	■	Short term during construction and long term impacts by the physical presence of towers	Direct and indirect by the physical presence of the line (visual aspect)
Health and Safety	■■	■	Short term during construction	Direct
Infrastructure/ Cumulative Impacts	■■	■■	Short to long tern during construction	Direct
Gender Aspects	■■	■ if any	Short term during construction	Indirect
Vulnerable people	■■■	Still unknown	Long term	Direct
Local Workforce	■■■	+	Short term limited to construction period	Direct

Table 7-4: Summary of impacts during operation phase

Impact of/ on	Sensitivity	Extent of Impact on/ by	Duration of Impact	Direct/ Indirect
Flora	■	■	Long term	Direct
Fauna	■■	■	Long term	Direct
Waste (generated by s/s staff)	■■	■	Long term	Indirect
Noise	■■	■	Long term	Indirect
Climate Change	■■	■	Long term	Indirect
Land use	■	■	Long term	Direct
Health and Safety	■■	■	Long term	Indirect

Extent of impact:

■■■	=	high
■■	=	medium
■	=	low
o	=	nil
+	=	locally positive
++	=	regionally positive

Extent of sensitivity

■■■	=	high
■■	=	medium
■	=	low

8. Environmental and Social Management Plan

The ESMP establishes a critical link between the management and mitigation measures specified in this report and the proper implementation of the measures during design, construction and operation phases of the Project. It summarizes the anticipated environmental and social impacts and provides details on the measures; responsibilities to mitigate these impacts; the costs of mitigation; and, the ways in which implementation and effectiveness of the measures will be monitored and supervised.

The ESMP will be part of the tender documents for Caucasus Energy Network Project and will become integral part of civil works contract(s). Construction Contractor will have to establish the full ESMP for construction.

HVEN will have overall responsibility for the implementation of the ESMP and may supplement its in-house capacity for environmental and social monitoring of works by contracting high quality consultant services for technical supervision of works that would include oversight on the adherence of civil works providers with ESMP.

8.1 Mitigation Measures

8.1.1 Mitigation measures for the design and pre-construction phase

Table 8-1: Summary of Mitigation Measures for Design and Pre-Construction Phase

Mitigation measures to be applied during design and pre-construction phase		
Issue for Mitigation: Line routing, access roads		
Mitigation measures	**Responsible Party**	**Budget for implementing (USD)**
Implementation of recommended line routing (Option 4a) of OHL corridors and/ or shifting of tower locations to avoid any physical relocation and minimize crossing of Protected Areas (Margahovit State Sanctuary, Caucasian Rose-Bay Sanctuary), forested areas and historical/ cultural sites (see Chapter 5)	Design Contractor HVEN Construction Contractor	Included in construction costs
"Bird friendly" design of towers (e.g. fitted with bird diverters)		
Adopt design of towers to the seismic risk level in the investigation area		
Use wide-span towers in order to bridge valleys, thus reducing number of felled trees in forested areas		
Keep a distance of 100 m from riparian areas, if possible (at least 50 m) for towers		
Towers are not to be placed in orchards, vineyards, etc. (bypass/ over-span). Place towers at edge of fields, if possible.		
Avoid crossing quarry northwest of Haghtanak by implementing recommended line routing		
Final line routing of 400 kV OHL crossing Teghut Mining Site has to be closely coordinated with Teghout CJSC		
Locate towers near to existing roads, to minimize construction of new access tracks/ roads		
Inform Agency for the Protection of Monuments/ Ministry of Culture about construction of towers or access roads, to avoid crossing of historical or cultural sites. Consider bypasses, if necessary.		
Avoid conducting land survey during harvest period, in order to keep damages low		
Inform PAP prior to land survey that plantations/ trees could be affected		
Inform PAP prior to land survey on compensation mechanisms		
Pay compensation for all damages caused during the land survey in compliance with the project RPF		
HVEN shall develop an energy compensation plan in order to minimize possible power outage duration and ensure power supply to local power consumers.		

Mitigation measures to be applied during design and pre-construction phase		
Issue for Mitigation: Line routing, access roads		
Mitigation measures	**Responsible Party**	**Budget for implementing (USD)**
HVEN shall develop an overarching Environmental, Health & Safety (EHS) Policy (if not already existing), which should be communicated to all levels of the organization (see Section 8.3).	HVEN	HVEN budget
HVEN shall develop and implement an Emergency Preparedness and Response Plan (EPRP) for engineering contingencies, collisions, natural hazards and other emergencies during construction and operation (see Section 8.3).		
HVEN shall develop and implement a Stakeholder Engagement Plan (SEP) including appointment of a member of staff as a focal community liaison officer and implementation of stakeholder grievance mechanism (see Section 8.3).		
It is recommended to establish a Biodiversity Action Plan (BAP), in order to ensure appropriate management in the project context of IBA territories and other sensitive habitats (e.g. mountain meadows); developed by qualified experts, with the participation of responsible authorities and of NGOs active in the area of nature protection (see BAP Outline in Section 11.7 – Appendix VII).	HVEN PIC	**30,000**

8.1.2 Mitigation measures for the construction phase

Table 8-2: Summary of Mitigation Measures during Construction Activities concerning Protection of Flora and Fauna

Mitigation measures to be applied during construction phase		
Issue for Mitigation: Flora and Fauna		
Mitigation measures (considering EHS-Guidelines: Electric Power Transmission and Distribution)	**Responsible Party**	**Budget for implementing (USD)**
Avoid construction during breeding/ nesting season (March - June) in forested areas and in IBAs	Construction Contractor	Included in construction costs
Determination of necessary lay down areas together with the environmental site manager to prevent the cutting of trees		
Avoid complete clearing of the ROW during construction works		
Protect large trees located adjacent to the construction sites with wooden barriers to prevent unintended destruction		
Protect root zones of large trees from excessive weight of machinery or excavated material		
Mark extent of the lay down areas and the routing of the access roads		
Prohibit plant-collecting and hunting; instruct workers not to disturb animals; do not allow access to the forest		

Mitigation measures to be applied during construction phase		
Issue for Mitigation: Flora and Fauna		
Mitigation measures (considering EHS-Guidelines: Electric Power Transmission and Distribution)	**Responsible Party**	**Budget for implementing (USD)**
Use existing roads/ tracks as far as possible; refurbish existing access roads/ tracks, if necessary	Construction Contractor	Included in construction costs
Tower locations without access track shall be reached along the ROW if possible, to minimize construction of new access roads/ tracks. Unavoidable construction of new access tracks shall be agreed with Ministry of Nature Protection		
Careful design of new access roads; avoid access roads crossing creeks and rivers		
Minimize introduction of foreign soil and avoid introduction of alien invasive plants to the power line corridor		
Installation of clearly visible high contrast moving bird flight diverters at the ground wire is recommended, where the line crosses river gorges and valleys and installation at the conductors in areas, where the line will cross mountain meadows near to upper forest edge, especially at IBAs Pambak Mountain Chain and Dsegh. (see Section 7.3.2)	Construction Contractor	**135,000** for installation
Implementation of management plan for replanting of forest trees by Hayantar SNCO, according to national law: area at least twice as big as area, where trees were felled; replanting of indigenous site specific tree species near to sites where trees were felled (e.g. in degraded forest areas); maintenance for 7 years	Construction Contractor Hayantar SNCO	**300,000**
Record of all removed trees kept in a log book, including data on the size and species of trees		
Re-vegetate all disturbed areas and rehabilitate access roads, workers' camps, lay down and deposit areas with site specific and adaptive plant species		
Additional tree planting by a NGO (e.g. ATP) on an area three times as big as the area, where trees were felled and maintenance for 4 years, is recommended	NGO	**300,000**
Awareness raising activities implemented by a NGO (e.g. ATP) are recommended		**10,000**

Table 8-3: Summary of Mitigation Measures during Construction Activities concerning Erosion Control

Mitigation measures to be applied during construction phase		
Issue for Mitigation: Erosion		
Mitigation measures (considering EHS-Guidelines: Construction and Decommissioning)	**Responsible Party**	**Budget for implementing (USD)**
Minimize removing topsoil at tower sites and at substation sites	Construction Contractor	Included in construction costs
Store topsoil in line with international good practice, so that it can be re-used after construction		
Bring back topsoil to its original place, after having finished the erection of towers and substations		
Reseeding/ replanting of native grass/ shrub species at tower sites		
Careful selection of locations for new access roads (Selection to be done by CC, HVEN environmental specialist, and HSE officer of PIC in order to avoid damages, as far as possible)	Construction Contractor HVEN PIC	
Implement erosion prevention measures at access roads (e.g. drainage control for permanent access roads, revegetation of temporary access roads)	Construction Contractor	
Avoid deposits of loose spoils on steep slopes or near rivers and drainage channels		
Protect excess spoils from runoff		
Excess spoil and soil will be left in orderly piles, covered with topsoil, and re-vegetated with native species		
Implement drainage control measures (culverts, berms, etc.) on permanent access roads, if they are in steep or erosion-prone areas		
Rehabilitation of new access roads not needed anymore after construction works		
Repair landscape damage due to work in wet weather as soon as possible when construction is complete in that area		
Minimize off-road vehicle and equipment use		
Avoid construction near watercourses		
Preparation and implementation of specific erosion control plans (when final technical design is available) are required and must be undertaken by Construction Contractor		

Table 8-4: Summary of Mitigation Measures during Construction Activities concerning Soil and Water Pollution

Mitigation measures to be applied during construction phase		
Issue for Mitigation: Soil and Water pollution		
Mitigation measures (considering EHS-Guidelines: Water and Sanitation, Wastewater and Ambient Water Quality, Waste Management, Hazardous Material Management)	**Responsible Party**	**Budget for implementing (USD)**
Regular maintenance of all vehicles and machines at regular service stations, if possible	Construction Contractor	Included in construction costs
Maintenance and re-fueling of the construction equipment only on sealed and enclosed areas		
Store all liquid materials (e.g. fuel, engine oil, etc.) and lubricants in locked tanks and on sealed and roofed areas		
Store construction material as bags of cement etc. in containers in order to avoid rinsing out		
Provide proper sanitation facilities with hand-washing facilities in adequate number, separately for men and women according to IFC/ EBRD Guidance Note (2009)[15]		
Train workers in appropriate sanitation practices		
Place plastic or other protective cloth under any areas where towers or other materials will be painted		
Train transporters and workers in spill prevention and control especially in handling of oil and fuel		
Provide spill-control materials to drivers and workers, in order to clean up spills, if necessary		
Report and respond to spills promptly and train workers in how to report		
Remove contaminated soil if spills occur and handle as hazardous waste		
Collect contaminated spill materials and manage as hazardous waste		
Construct bunds around and oil collecting/ drainage system beneath transformers to prevent contamination of soil and groundwater from any oil leakages		
Repair any damage to riparian areas, including riverbanks and riverbeds (if any), as soon as construction is complete		
Smaller streams are crossed on the high plateaus crossed by 400 kV OHL. Pollution of these water bodies during construction needs to be strictly avoided as they serve for drinking water supply for downstream communities.		

[15] see IFC/ EBRD Guidance Note on Workers' Accommodation (2009)

Table 8-5: Summary of Mitigation Measures during Construction Activities concerning Waste Management

Mitigation measures to be applied during construction phase		
Issue for Mitigation: Risks from Waste		
Mitigation measures (considering EHS-Guidelines: Water and Sanitation, Wastewater and Ambient Water Quality, Waste Management, Hazardous Material Management)	**Responsible Party**	**Budget for implementing (USD)**
Collect all type of wastes including domestic and sanitary wastes. CC will agree with municipal authorities about using services of communal service providers for waste disposal purposes.	Construction Contractor Local authorities	Included in construction costs
Development of Waste Management Plan within the HSE Management Plan considering following principles: (i) waste management hierarchy of avoidance-minimization-reuse-treatment-disposal; (ii) segregation of waste; (iii) minimization of construction waste by good technical planning; (iv) training of staff	Construction Contractor	Included in construction costs
Implementation of a Waste Management System		
Store all hazardous waste (e.g. oil, fuel, paint, spill contaminated soil) in adequate storage sites (lockable, roofed, ventilated, concreted and bunded floor) at new s/s Ayrum and s/s Ddmashen		
Pack all hazardous wastes securely in sealed drums or other suitable containers and clearly identify them by labels		
Train workers in handling and disposal of recyclable, sanitary, solid, liquid and hazardous waste		

Table 8-6: Summary of Mitigation Measures during Construction Activities concerning Landscape and Visual Aspects

Mitigation measures to be applied during construction phase		
Issue for Mitigation: Landscape and Visual Aspects		
Mitigation measures	**Responsible Party**	**Budget for implementing (USD)**
Dismantling of workers' camps and harmonization of the areas with the landscape	Construction Contractor	Included in construction costs

Table 8-7: Summary of Mitigation Measures during Construction Activities concerning Noise

Mitigation measures to be applied during construction phase		
Issue for Mitigation: Noise		
Mitigation measures (considering EHS-Guideline: Noise Management)	**Responsible Party**	**Budget for implementing (USD)**
Optimization of transportation management to avoid needless truck drives	Construction Contractor	Included in construction costs
Allow truck movements only during daylight, but not between 7 pm and 6 am		
Reduce vehicle speeds (stick to recommended speeds) in populated areas		
Use low sound power mechanical equipment, whenever possible		
Regular maintenance and service of building machinery and other vehicles during construction works		
Shut down or throttling down of noisy machinery to a minimum		
For workers noise levels shall be kept below 80 dB (A), wherever possible. In case of exceeding this value, hearing protections must be provided to workers and warning signs must be installed		
For residents the noise levels may not exceed 55 dB (A) or result in a maximum increase in background levels of 3 dB (A) at the nearest receptor location off-site		
Notify nearby residents and businesses at least 24 hours in advance if particularly noisy activities are anticipated		
Conduct noise-generating activities near to occupied buildings only between 9 am and 4 pm		

Table 8-8: Summary of Mitigation Measures during Construction Activities concerning Air Quality and Climate Change

Mitigation measures to be applied during construction phase		
Issue for Mitigation: Risks for Air Quality and Climate Change		
Mitigation measures (considering EHS-Guideline: Air Emissions and Ambient Air Quality)	**Responsible Party**	**Budget for implementing (USD)**
Limitations of size, weight or axe loads of vehicles using particularly difficult roads	Construction Contractor	Included in construction costs
Reduction of speed and limited movement of vehicles		
Optimize transportation management to avoid needless truck trips		
Maintain vehicles and construction machinery properly, as recommended by suppliers		
Cover truck beds with tarps during material transport		

Mitigation measures to be applied during construction phase		
Issue for Mitigation: Risks for Air Quality and Climate Change		
Mitigation measures (considering EHS-Guideline: Air Emissions and Ambient Air Quality)	**Responsible Party**	**Budget for implementing (USD)**
Use dust-suppressing water spray during civil works, where necessary	Construction Contractor	Included in construction costs
Store and handle material appropriately to limit dust (e.g. protect cement with tarpaulins)		
Avoid unnecessary idling of construction machines and vehicles		
Prohibit open burning of construction/ waste material at the site		
Follow relevant guidelines for handling SF_6 (see Section 11.5 - Appendix V)		

Table 8-9: Summary of Mitigation Measures during Construction Activities concerning Historical and Cultural Sites

Mitigation measures to be applied during construction phase		
Issue for Mitigation: Risks for Historical and Cultural Sites		
Mitigation measures	**Responsible Party**	**Budget for implementing (USD)**
Avoid any damage to cultural sites in line corridor and keep tower locations in an adequate distance (see Section 7.4.3)	Construction Contractor HVEN Dep. Protection of Monuments and Historical Sites of RA	Included in construction costs
Avoid archaeological excavation near Teghut village (Lori)		
Implementation of Chance Find Procedure (see Section 7.4.3) and training of the construction workers		
Report chance finds immediately to the Ministry of Culture of RA, Dep. Protection of Monuments and Historical Sites		
Agree with representatives of Dep. Protection of Monuments and Historical Sites of RA about location of towers and new access roads (including proposed bypasses) in advance of construction		
Shifting of tower locations have to be approved by Dep. Protection of Monuments and Historical Sites of RA		

Table 8-10: Summary of Mitigation Measures during Construction Activities concerning Employee Health and Safety

Mitigation measures to be applied during construction phase		
Issue for Mitigation: Risks for Employee Health and Safety		
Mitigation measures	**Responsible Party**	**Budget for implementing (USD)**
Development of an HSE Policy for the construction phase, in advance of construction activities	Construction Contractor	Included in construction costs
Development of an HSE Management Plan for the construction phase (shall include sub-plans: see Section 8.3), in advance of construction activities		
Installation of an HSE Management System (HSEMS) during the construction phase, including HSE Officer		
Make sure that all workers have a health insurance		
Provide proper sanitation facilities with hand-washing facilities in adequate number, separately for men and women[15]		
Provide HIV/AIDS protection equipment for workers		
Awareness raising regarding sexually transmitted diseases (STD) should be provided to workforce		
Install warning signs “Danger of Electrocution” at towers, substations etc.		
Consider possible occurrence of poisonous snakes during working.		
Accommodation of workers in adjacent towns/ villages has the first priority. In the case that construction camps are necessary these will be located in accordance with relevant municipal authorities		
Workers’ camps have to meet the requirements of IFC/ EBRD guidance note (see Section 7.4.4)		
Provide workers with appropriate protective equipment (PPE) (dust, noise, etc.)		
Train workers accordingly regarding work at heights, electrical and vehicular safety, handling of hazardous materials, PPE, hazard avoidance and reduction measures, use of first aid and rescue techniques, emergency response etc.		
All work crews shall have at least one person (two is strongly preferred) trained in first aid		
Provide first aid kits and fire extinguishers at all Project sites and in all vehicles		
If work crews are in remote areas, they shall be equipped with cellular phones or radios		
Forbid alcohol and other drugs at construction sites/ workers’ camps		
Set up mobile clinics for workers capable of treating all injuries and diseases occurring at the construction sites		
Assure transfer of injured workers to hospitals in the case of serious accidents		
Identify area emergency responders, hospitals, and clinics, and provide advance notice of Project activities		
Implement programs for medical screening, health and safety monitoring, and reporting		
Limit occupational exposure to EMF by use of shielding materials, and train workers accordingly		

Mitigation measures to be applied during construction phase		
Issue for Mitigation: Risks for Employee Health and Safety		
Mitigation measures	**Responsible Party**	**Budget for implementing (USD)**
Record work-hours as well as all accidents and incidents	Construction Contractor	Included in construction costs

Table 8-11: Summary of Mitigation Measures during Construction Activities concerning Public Health and Safety

Mitigation measures to be applied during construction phase		
Issue for Mitigation: Risks for Public Health and Safety		
Mitigation measures (considering EHS-Guideline: Community Health and Safety)	**Responsible Party**	**Budget for implementing (USD)**
Notification of the public on upcoming construction activities in adjacent villages and through media, in advance of construction period	Construction Contractor	Included in construction costs
Public education and outreach efforts to provide information about hazard awareness, safety measures, reporting unsafe conditions and environmental impacts in adjacent villages, in advance of construction period		
Awareness raising regarding sexually transmitted diseases (STD) should be provided to local communities		
Inform population along public roads in advance in case of transporting heavy equipment		
Provide adequate security measures to prevent accidents and injury (e.g. keeping speed limits on public roads, grounding objects)		
Use warning signs at access points along main roads, and around work sites near villages or residences		
Provide clear and adequate signage to identify work areas and hazardous equipment, before commencement of relevant construction		
Install warning signs at all towers and sensitize the community on dangers of electricity, and risks of electrocution		
Provide adequate security to prevent public access to the substations, work sites, hazardous materials and waste		
Establish worker code of conduct to help prevent friction or conflict with communities		
No houses are allowed in corridor (wayleave) of the overhead lines (corridor widths see Section 2.5)		
Regular community liaison/stakeholder engagement activities should be undertaken during construction (and also through operation)	HVEN Construction Contractor	Included in construction costs

Table 8-12: Summary of Mitigation Measures during Construction Activities concerning Traffic Management and Other Infrastructure

Mitigation measures to be applied during construction phase		
Issue for Mitigation: Risks from / for Traffic and for Other Infrastructure		
Mitigation measures	**Responsible Party**	**Budget for implementing (USD)**
Announce start and duration of works through media and signs to the public in advance of construction period	Construction Contractor	Included in construction costs
Keep speed limits in public roads		
Establish rights-of-way, speed limits onsite (20 km/h, walking pace for heavy trucks), vehicle inspection requirements, operating rules and procedures before commencement of construction		
Licensing and training of drivers; improvement of driving skills		
Training and licensing industrial vehicle operators in the safe operation of specialized vehicles, including safe loading/ unloading, and load limits		
Maintain vehicles regularly and use manufacturer approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure		
Arrange worker bus transport in advance of construction period to minimize external traffic during construction		
Collaborate with local communities and authorities to improve signage, visibility and overall safety of roads, particularly along stretches located near schools or other locations where children may be present, in advance of construction period		
Collaborate with local communities on education about traffic and pedestrian safety, in advance of construction period		
Allow the traffic to pass through the work in progress where possible		
Erect signs that the traffic is aware from far, where the actual construction sites are located		
Coordination with emergency responders		
Ensure all equipment is visible to the traffic through either illumination or suitable marking		
Ensure that the work areas are lighted well		
Sign the actual construction site area sufficiently at night		
Keep minimum distance to existing power lines, that ensures the width of the ROW of both parallel running lines		
Where crossing existing power lines adequate minimum distances between the conductors have to be ensured		
Avoid crossing quarry northwest of Haghtanak by implementing recommended ROW	HVEN Construction Contractor	Included in construction costs
Final line routing of 400 kV OHL crossing Teghut Mining Site has to be closely coordinated with Teghout CJSC		
HVEN shall develop an energy compensation plan in order to minimize possible power outage duration and ensure power supply to local power consumers.	HVEN	HVEN budget

Table 8-13: Summary of Mitigation Measures during Construction Activities concerning Social Impacts

Mitigation measures to be applied during construction phase		
Issue for Mitigation: Social Impacts		
Mitigation measures	**Responsible Party**	**Budget for implementing (USD)**
Limitation of construction of access roads and careful routing to minimize impacts on agricultural land	Construction Contractor	Included in construction costs
Location of laydown areas close to existing roads in non-productive areas to minimize interference with agricultural activities and to facilitate site clean-up and rehabilitation		
Minimize surface of and damage caused by workers' camps		
Shift towers to avoid orchards, vineyards, gardens		
Adjust construction works not to interfere with harvesting period in order to avoid damages to crops as far as possible		
Zero tolerance for sexual harassment at the work place or in workers' camps/ overnight locations		
Make sure that women are included in public consultations and that gender equality is respected for compensation payments		
Cash compensations shall be made in presence of male and female household members		
Bank accounts shall be accessible both for male and female household members		
Implement and communicate an accessible grievance mechanism for PAP to address complaints at the local level (see Section 8.6).		
Presence of impartial person to receive complaints during construction process and to forward complaints to HVEN		
Legal experts will support PAP who are not registered land owners with legalization of land titles		

Table 8-14: Summary of Mitigation Measures during Construction Activities concerning Labor Conditions

Mitigation measures to be applied during construction phase		
Issue for Mitigation: Labor Conditions		
Mitigation measures	**Responsible Party**	**Budget for implementing (USD)**
Develop and implement a non-discriminatory hiring and wage policy (clearly stating that the company will not discriminate in hiring and salaries based on gender, age, religion, ethnicity or place of origin)	Construction Contractor	Included in construction costs
Prosecute offenses related to payment of wages by sub-contractors strictly		
Prioritize employment of local people for construction works (offer job opportunities in nearby villages)		
Improve recruitment of women for construction works		
Adhere to Core Labor Standards and IFC PS 2[16]		

Table 8-15: Summary of Mitigation Measures during Construction Activities concerning RAP Development and Implementation

Mitigation measures to be applied during construction phase		
Issue for Mitigation: RAP Development and Implementation		
Mitigation measures	**Responsible Party**	**Budget for implementing (USD)**
Develop and implement a RAP based on the Project related RPF (Consultation with PAP about their development priorities in the framework of RAP development)	HVEN	For cost of RAP implementation see RPF and Table 8-28
Pay compensation to PAP for damages and loss of crops and for expropriation of land		
Documentation of compensation payments		
Develop and implement a RAP implementation compliance report	Consultant	Included in the project budget

[16] IFC Performance Standards (PS) accessible at: http://www.ifc.org

8.1.3 Mitigation measures for the operation and maintenance phase

Table 8-16: Summary of Mitigation Measures during Operation and Maintenance Activities concerning Protection of Flora and Fauna

Mitigation measures to be applied during operation and maintenance		
Issue for Mitigation: Flora and Fauna		
Mitigation measures (considering EHS-Guidelines: Electric Power Transmission and Distribution)	**Responsible Party**	**Budget for implementing (USD)**
Avoid complete clearing of the ROW during maintenance works	Operator (HVEN)	Included in operational costs
Cut down only mature and tall trees from the corridor while not tampering understory plants		
Selective felling and pruning of trees adjacent to the corridor		
Avoid maintenance during breeding/ nesting season (March – June) in forested areas		
Prohibit plant-collecting and hunting in the vicinity of the ROW; do not allow access to the forest		
Use of berms at roads is recommended to limit vehicle access by trespassers at forested areas		
Strict prohibition of herbicide use for maintaining the ROW. In exceptional case, if any of such application would be required, no extremely or highly hazardous pesticides (WHO classes I a and I b) may be utilized by any of the end-users. Moderately hazardous pesticides (WHO class II) are not to be used, unless the end-user has appropriate controls established with respect to the manufacture, procurement, or distribution and/or use of these chemicals. These chemicals should not be accessible to personnel without proper training, equipment, and facilities in which to handle, store, apply, and dispose of these products properly.		
Check proper adjustment of bird diverters during maintenance works		

Table 8-17: Summary of Mitigation Measures during Operation and Maintenance Activities concerning Soil and Water Pollution

Mitigation measures to be applied during operation and maintenance		
Issue for Mitigation: Soil and Water Pollution		
Mitigation measures (considering EHS-Guidelines: Water and Sanitation, Wastewater and Ambient Water Quality, Waste Management, Hazardous Material Management)	**Responsible Party**	**Budget for implementing (USD)**
Provide proper sanitation facilities at substations and for maintenance workers	Operator (HVEN)	Included in operational costs
Train substation staff and maintenance workers in appropriate sanitation practices		
Train substation staff and maintenance workers in proper management of recyclable, sanitary, solid, liquid, and hazardous wastes		
Provide spill-control materials at substations, to drivers and maintenance workers, in order to clean up spills, if necessary	Operator (HVEN)	Included in operational costs
Report and respond to spills promptly and train maintenance and substation workers in how to report		
Remove contaminated soil if spills occur and handle as hazardous waste		
Collect contaminated spill materials and manage as hazardous waste		

Table 8-18: Summary of Mitigation Measures during Operation and Maintenance Activities concerning Waste Management

Mitigation measures to be applied during construction phase		
Issue for Mitigation: Risks from Waste		
Mitigation measures (considering EHS-Guidelines: Water and Sanitation, Wastewater and Ambient Water Quality, Waste Management, Hazardous Material Management)	**Responsible Party**	**Budget for implementing (USD)**
Collect all type of wastes including domestic and sanitary wastes at substation sites and during maintenance works. Make arrangements for proper waste handling, treatment and disposal with municipal authorities about using services of communal service providers for waste disposal purposes.	Operator (HVEN) Local authorities	Included in operational costs
Store all hazardous waste (if any) in adequate storage sites (lockable, roofed, ventilated, concreted and bunded floor) at new s/s Ayrum and s/s Ddmashen	Operator (HVEN)	
Train substation and maintenance workers in handling and disposal of recyclable, sanitary, solid, liquid and hazardous waste		

Table 8-19: Summary of Mitigation Measures during Operation and Maintenance Activities concerning Noise

Mitigation measures to be applied during operation and maintenance		
Issue for Mitigation: Noise		
Mitigation measures (considering EHS-Guideline: Noise Management)	**Responsible Party**	**Budget for implementing (USD)**
Use low sound power mechanical equipment, whenever possible	Operator (HVEN)	Included in operational costs
Reduce vehicle speeds (stick to recommended speeds) in populated areas		
For workers noise levels shall be kept below 80 dB (A), wherever possible. In case of exceeding this value, hearing protections must be provided to workers and warning signs must be installed		
For residents the noise levels may not exceed 55 dB (A) or result in a maximum increase in background levels of 3 dB (A) at the nearest receptor location off-site		
Notify nearby residents and businesses at least 24 hours in advance if particularly noisy activities are anticipated		
Conduct noise-generating activities near to occupied buildings only between 9 am and 4 pm		

Table 8-20: Summary of Mitigation Measures during Operation and Maintenance Activities concerning Air Quality

Mitigation measures to be applied during operation and maintenance		
Issue for Mitigation: Risks for Air Quality		
Mitigation measures (considering EHS-Guideline: Air Emissions and Ambient Air Quality)	**Responsible Party**	**Budget for implementing (USD)**
Maintain vehicles and engines properly, as recommended by suppliers	Operator (HVEN)	Included in operational costs
Avoid unnecessary idling of vehicles		
Train maintenance workers accordingly		
Apply relevant international guidelines for handling SF_6 (see Section 11.5 - Appendix V)		
Train substation personnel in handling SF_6 parts correctly		

Table 8-21: Summary of Mitigation Measures during Operation and Maintenance Activities concerning Employee Health and Safety

Mitigation measures to be applied during operation and maintenance		
Issue for Mitigation: Employee Health and Safety		
Mitigation measures	**Responsible Party**	**Budget for implementing (USD)**
It is recommended to develop a Health and Safety Management Plan (HSMP) and implement an Health and Safety Management System (HSMS) for operation and maintenance	Operator (HVEN)	HVEN budget

Table 8-22: Summary of Mitigation Measures during Operation and Maintenance Activities concerning Public Health and Safety

Mitigation measures to be applied during operation and maintenance		
Issue for Mitigation: Public Health and Safety		
Mitigation measures (considering EHS-Guideline: Community Health and Safety)	**Responsible Party**	**Budget for implementing (USD)**
Conduct Information/ Awareness Campaigns on the dangers of high voltage lines and substations (before start of operation)	Operator (HVEN)	Included in operational costs
Provide proper signage to identify work areas and hazardous equipment		
Keep speed limits on public roads during maintenance works		
No houses are allowed in corridor (wayleave) of the overhead lines (corridor widths see Section 2.5)		
Regular community liaison/stakeholder engagement activities should be undertaken during operation		

Table 8-23: Summary of Mitigation Measures during Operation and Maintenance Activities concerning Social Impacts

Mitigation measures to be applied during operation and maintenance		
Issue for Mitigation: Social Impacts		
Mitigation measures	**Responsible Party**	**Budget for implementing (USD)**
Land within the ROW can further be used for agricultural purposes and as pasture land	Operator (HVEN)	Included in operational costs
Inform local residents before undertaking maintenance measures involving clearing of land in ROW or potential damage to crops		
Pay compensations for damaged crops during maintenance		

8.2 Environmental and Social Monitoring

The local HSE officer of the PIC will monitor the implementation of mitigation measures by the CC, based on regular inspections and monthly reports of the HSE officer of CC. An external internationally experienced auditor will prepare environmental and social performance reports for KfW, based on quarterly site inspections and the monthly reports of PIC's HSE officer. Implementation of mitigation measures regarding cutting of trees and replanting will be monitored by an internationally experienced forest specialist. Implementation of the RAP will be done by HVEN's Social Specialist and supervised by an external auditor. HVEN will be responsible for monitoring of environmental and social performance during operation and maintenance of the OHLs and substations.

8.2.1 Monitoring measures during design and pre-construction phase

Table 8-24: Summary of Monitoring Measures during Design and Pre-Construction Phase

Activity / Impact	**What** (Is the parameter to be monitored?)	**Where** (Is the parameter to be monitored?)	**How** (Is the parameter to be monitored?)		**When** (Define the frequency / or continuous?)	**Who** (Is responsible for monitoring?)
			Method	**Indicator**		
Implementation of recommended line routing (Option 4a) of OHL corridors and/ or shifting of tower locations to avoid any physical relocation and minimize crossing of Protected Areas forested areas and historical/ cultural sites	Recommended line routing (Option 4a) implemented and/ or towers shifted to avoid over-spanning of buildings, minimize crossing of Protected Areas, forested areas, historical sites, etc.	Margahovit State Sanctuary	Visual inspection of planning documents	State Sanctuary crossed at narrowest part	During Design Phase	HVEN PIC
		Caucasian Rose-Bay Sanctuary		Sanctuary not crossed		
		Forested areas south of Teghut (Lori)		Forested areas avoided as far as possible		
		Archeological site southeast of Teghut (Lori)		Archeological site not affected by construction of towers		

Activity / Impact	**What** (Is the parameter to be monitored?)	**Where** (Is the parameter to be monitored?)	**How** (Is the parameter to be monitored?)		**When** (Define the frequency / or continuous?)	**Who** (Is responsible for monitoring?)
			Method	**Indicator**		
Impact on birds	"Bird friendly" design of towers	Location of towers	Visual inspection of planning documents	"Bird friendly" design of towers (e.g. fitted with bird diverters)	During Design Phase	HVEN PIC
Seismic impacts	Adopt design of towers to the seismic risk level	Location of towers	Visual inspection of planning documents	Towers adopted to seismic risk level	During Design Phase	
Over-spanning valleys	Use wide-span towers in order to bridge valleys, thus reducing number of felled trees	Location of towers	Visual inspection of planning documents	Long span towers used at valleys	During Design Phase	
Impact on riparian areas	Keep a distance of 100 m from riparian areas, if possible (at least 50 m) for towers	Location of towers	Visual inspection of planning documents	Distance (at least 50 m) from riparian areas kept	During Design Phase	
Impact on land use	Towers are not to be placed in orchards, vineyards, etc. Place towers at edge of fields, if possible.	Location of towers	Visual inspection of planning documents	No towers located in orchards, vineyards and fields	During Design Phase	
Impact on local quarry	Avoid crossing quarry northwest of Haghtanak by implementing recommended line routing	Quarry northwest of Haghtanak village	Visual inspection of planning documents	Quarry not affected by line routing	During Design Phase	
Over-spanning parts of Teghut Mining Site	Final line routing of 400 kV OHL crossing Teghut Mining Site has to be closely coordinated with Teghout CJSC	Teghut (Lori) Mining Site	Visual inspection of planning documents	Finale line routing agreed with Teghout CJSC	During Design Phase	
Construction of new access roads	Locate towers near to existing roads, to minimize construction of new access tracks / roads	Location of towers	Visual inspection of planning documents	Towers located near to existing roads, if possible	During Design Phase	
Historical and cultural sites	Inform Agency for the Protection of Monuments/ Ministry of Culture about construction of towers or access roads, to avoid crossing of historical or cultural sites. Consider bypasses, if necessary.	Location of new towers and new access roads	Inspection of records	Ministry informed about construction of towers and access roads	During Design Phase	

Activity / Impact	**What** (Is the parameter to be monitored?)	**Where** (Is the parameter to be monitored?)	**How** (Is the parameter to be monitored?)		**When** (Define the frequency / or continuous?)	**Who** (Is responsible for monitoring?)
			Method	**Indicator**		
Damage to crops	Avoid conducting land survey during harvest period	Location of towers	Visual inspection of planning documents Inspection of complaints	No damages to crops; no complaints from land owners	During Design Phase	HVEN PIC
Impacts on plantations / trees etc.	Inform PAP prior to land survey about possible affection	Places of PAP's residence	Interviews with PAP	PAP informed about possible affection	During Design Phase	
	Inform PAP prior to land survey on compensation mechanisms			PAP informed about compensations		
	Pay compensation for all damages caused during the land survey in compliance with the project RPF		Inspection of compensation payments	All compensations paid	After damages due to land survey	
Power outage	HVEN shall develop an energy compensation plan in order to minimize possible power outage duration and ensure power supply to local power consumers.	HVEN office	Visual inspection of planning documents, interviews	Energy compensation plan developed	During Design Phase	PIC
Environmental, Health and Safety Policy	HVEN shall develop overarching EHS Policy, which should be communicated to all levels of the organization.			EHS Policy developed	During Pre-Construction Phase	
Emergency Preparedness and Response Plan	HVEN shall develop and implement EPRP for engineering contingencies, collisions, natural hazards and other emergencies during construction and operation.			EPRP implemented		
Stakeholder Engagement Plan	HVEN shall develop and implement SEP including appointment of a member of staff as a focal community liaison officer and implementation of stakeholder grievance mechanism.			SEP implemented		

Activity / Impact	What (Is the parameter to be monitored?)	Where (Is the parameter to be monitored?)	How (Is the parameter to be monitored?)		When (Define the frequency / or continuous?)	Who (Is responsible for monitoring?)
			Method	Indicator		
Impacts on biodiversity; Biodiversity Action Plan	BAP establishment, to ensure appropriate management in the project context of IBA territories and other sensitive habitats; developed by qualified experts, with the participation of responsible authorities and NGOs.	HVEN office	Visual inspection of planning documents, interviews	BAP outline used, NGOs and authorities involved	During Pre-Construction Phase	HVEN PIC

8.2.2 Monitoring measures during construction phase

Table 8-25: Summary of Monitoring Measures during Construction Activities

Activity / Impact	What (Is the parameter to be monitored?)	Where (Is the parameter to be monitored?)	How (Is the parameter to be monitored?)		When (Define the frequency / or continuous?)	Who (Is responsible for monitoring?)
			Method	Indicator		
Impacts on Flora and Fauna from laydown areas and access roads	Determination of necessary lay down areas together with the environmental site manager to minimize cutting of trees	Construction sites	Visual inspection	Lay down areas determined accordingly	Regularly during construction	HVEN PIC External auditor
	Mark extent of the lay down areas and the routing of the access roads		Visual inspection of planning documents	Lay down areas and access roads marked		
	Use existing roads/ tracks as far as possible; refurbish existing access roads/ tracks, if necessary			Existing access roads used; refurbished if necessary		

Activity / Impact	**What** (Is the parameter to be monitored?)	**Where** (Is the parameter to be monitored?)	**How** (Is the parameter to be monitored?)		**When** (Define the frequency / or continuous?)	**Who** (Is responsible for monitoring?)
			Method	**Indicator**		
Impacts on Flora and Fauna from laydown areas and access roads	Careful design of new access roads; avoid access roads crossing creeks and rivers	Construction sites	Visual inspection Visual inspection of planning documents	No creeks/ rivers crossed by access roads	Regularly during construction	HVEN PIC External auditor
	Reach tower locations without access tracks along ROW if possible			As few new access tracks as possible		
	Unavoidable construction of new access tracks shall be agreed with Ministry of Nature Protection			Agreement with Ministry of Nature Protection		
	Re-vegetate all disturbed areas and rehabilitate access roads, worker's camps, lay down areas with site specific and adaptive plant species			All mentioned areas replanted accordingly		
Impacts on Flora and Fauna from construction activities	Avoid construction during breeding/ nesting season (March - June) in forested areas and IBAs	Construction sites at forested areas and IBAs	Visual inspection	No construction in relevant areas during breeding season	Regularly during construction	HVEN PIC External auditor
	Prohibit plant-collecting and hunting; instruct workers not to disturb animals; do not allow access to the forest	Construction sites	Visual inspection	No incidents		
	Installation of clearly visible high contrast (i.e. black and white) moving bird flight diverters at the ground wires, where the line crosses river gorges and valleys	Construction sites at gorges and valleys		Bird diverters installed in relevant areas		
	Installation of bird flight diverters at the conductors, where the OHL crosses mountain meadows near to upper forest edge (e.g. IBAs).	Construction sites at mountain meadows		Bird diverters installed in relevant areas		
	Avoid complete clearing of the ROW during construction works	Construction sites		ROW not completely cleared		

Activity / Impact	**What** (Is the parameter to be monitored?)	**Where** (Is the parameter to be monitored?)	**How** (Is the parameter to be monitored?)		**When** (Define the frequency / or continuous?)	**Who** (Is responsible for monitoring?)
			Method	**Indicator**		
Impacts on Flora and Fauna from construction activities	Protect large trees located adjacent to the construction sites with wooden barriers to prevent unintended destruction	Construction sites	Visual inspection	Large trees protected accordingly	Regularly during construction	HVEN PIC External auditor
	Protect root zones of large trees from excessive weight of machinery or excavated material					
	Minimize introduction of foreign soil and avoid introduction of alien invasive plants to the power line corridor			No foreign soil and alien invasive plants introduced		
Extraction of trees	Record of removed trees kept in a log book, including data on the size and species of trees	Construction sites at forested areas Replanting sites	Visual inspection	Log book in place with adequate entries	During tree planting and on monthly basis throughout Project live	HVEN PIC External auditor
	Implementation of management plan for replanting of forest trees by Hayantar SNCO, according to national law: area at least twice as big as area, where trees were felled; replanting of indigenous site specific tree species near to sites where trees were felled (e.g. in degraded forest areas); maintenance for 7 years	Replanting sites	Visual inspection	Compensatory Tree Planting Plan in place with required information included		
	Compensatory Tree Planting Plan implemented					
	Additional tree planting by a NGO (e.g. ATP) on an area three times as big as the area, where trees were felled and maintenance for 4 years, is recommended			Plantations in place with required number of seedlings of required age and species composition		

Activity / Impact	**What** (Is the parameter to be monitored?)	**Where** (Is the parameter to be monitored?)	**How** (Is the parameter to be monitored?)		**When** (Define the frequency / or continuous?)	**Who** (Is responsible for monitoring?)
			Method	**Indicator**		
Extraction of trees	Awareness raising activities implemented by a NGO (e.g. ATP) are recommended	Villages near replanting sites	Interviews	Awareness raising activities implemented	Regularly during construction	HVEN PIC External auditor
Minimize erosion at substation sites and tower locations	Minimize removing topsoil at tower sites and substation sites	All tower locations and substation sites	Visual inspection	Topsoil stored accordingly and brought back to original place	Regularly during construction	HVEN PIC External auditor
	Store topsoil in line with international good practice, so that it can be re-used after construction					
	Bring back topsoil to its original place, after erection of towers and substations					
Minimize erosion at tower locations	Reseeding/ replanting of native species at tower sites	All tower locations	Visual inspection	Reseeding/ replanting implemented	Regularly during construction	
Minimize erosion at construction sites	Avoid deposits of loose spoils on steep slopes or near rivers and drainage channels	All construction sites	Visual inspection	No deposits of loose spoils on steep slopes or near rivers	Regularly during construction	HVEN PIC External auditor
	Protect excess spoils from runoff			Excess spoils protected		
	Excess spoil and soil will be left in orderly piles, covered with topsoil, and re-vegetated with native species			Excess spoil and soil covered with topsoil and re-vegetated		
	Repair landscape damage due to work in wet weather as soon as possible when construction is complete in that area			All landscape damages repaired	After relevant construction activities	
	Minimize off-road vehicle and equipment use			No off-road vehicle and equipment use	Regularly during construction	
	Avoid construction near watercourses			No construction near watercourses		

Activity / Impact	**What** (Is the parameter to be monitored?)	**Where** (Is the parameter to be monitored?)	**How** (Is the parameter to be monitored?)		**When** (Define the frequency / or continuous?)	**Who** (Is responsible for monitoring?)
			Method	**Indicator**		
Minimize erosion at construction sites	Preparation and implementation of specific erosion control plans (when final technical design is available) are required	All construction sites	Inspection of erosion control plans	Erosion control plan developed and implemented	In advance of construction	HVEN PIC External auditor
Minimize erosion at access roads	Careful selection of locations for new access roads (if necessary)	Location of new access roads	Visual inspection	Access roads carefully selected	In advance of construction	HVEN PIC External auditor
	Implement erosion prevention measures at all access roads			Measures implemented		
	Implement drainage control measures (culverts, berms, etc.) on permanent access roads, if they are in steep or erosion-prone areas			Measures implemented		
	Rehabilitation of new access roads not needed anymore			All access roads not needed anymore rehabilitated	After construction works	
Soil and Water Pollution from vehicles and construction equipment	Regular maintenance of all vehicles and machines at regular service stations, if possible	Construction sites	Inspection of maintenance records	Vehicles and machines adequately maintained	Regularly during construction	HVEN PIC External auditor
	Maintenance and re-fueling of the construction equipment only on sealed and enclosed areas		Visual inspection of maintenance and re-fueling areas	No unsuitable areas used for maintenance and re-fueling		
Soil and Water Pollution from inadequate storage	Store all liquid materials and lubricants in locked tanks and on sealed and roofed areas	Construction sites	Visual inspection	All materials adequately stored	Regularly during construction	HVEN PIC External auditor
	Adequate storage of construction material in containers					
Soil and Water Pollution from sanitation facilities	Provide proper sanitation facilities with hand-washing facilities in adequate number, separately for men and women	Construction sites	Visual inspection	Adequate number of sanitation facilities separately for men and women; and in proper condition	Regularly during construction	HVEN PIC External auditor

Activity / Impact	**What** (Is the parameter to be monitored?)	**Where** (Is the parameter to be monitored?)	**How** (Is the parameter to be monitored?)		**When** (Define the frequency / or continuous?)	**Who** (Is responsible for monitoring?)
			Method	**Indicator**		
Soil and Water Pollution from sanitation facilities	Train workers in appropriate sanitation practices	Construction sites	Inspection of training records	All workers trained accordingly	Regularly during construction	HVEN PIC External auditor
Soil and Water Pollution from spills	Place plastic or other protective cloth under any areas where towers or other materials will be painted	Construction sites	Visual inspection	No spills from painting	Regularly during construction	HVEN PIC External auditor
	Train transporters and workers in spill prevention and control especially handling of oil and fuel		Inspection of training records	All workers trained accordingly		
	Provide spill-control materials to drivers and workers, in order to clean up spills, if necessary		Inspection of equipment	Spill-control equipment provided		
	Report and respond to spills promptly and train workers in how to report		Inspection of spill reports, and training records	Number of spill reports All workers trained accordingly		
	Remove soil contaminated by spills and handle as hazardous waste	Construction sites Storage areas at s/s Ayrum and s/s Ddmashen	Inspection of spill reports and storage areas	All contaminated materials adequately stored		
	Collect contaminated spill materials and manage as hazardous waste					
	Construct bunds around and oil collecting/ drainage system beneath transformers to prevent contamination of soil and groundwater from any oil leakages	Substation sites	Visual inspection	Bunds and oil collecting system in place		
Soil and Water Pollution from construction	Repair any damage to riparian areas, including riverbanks and riverbeds, as soon as construction is complete	Riparian areas	Visual inspection	All damages repaired	After relevant construction	HVEN PIC External auditor

Activity / Impact	**What** (Is the parameter to be monitored?)	**Where** (Is the parameter to be monitored?)	**How** (Is the parameter to be monitored?)		**When** (Define the frequency / or continuous?)	**Who** (Is responsible for monitoring?)
			Method	**Indicator**		
Soil and Water Pollution from construction	Strictly avoid any pollution of smaller streams as they serve for drinking water supply for downstream communities.	High plateau areas of 400 kV OHL	Visual inspection Inspection of complaints	No pollution No complaints by residents	Regularly during construction	HVEN PIC External auditor
Waste Management	CC will agree with municipal authorities about using services of communal service providers for waste disposal purposes.	Construction sites	Control of written agreement	Written agreement provided	In advance of construction	HVEN PIC External auditor
	Development of Waste Management Plan within HSE Management Plan		Control of Waste Management Plan	Waste Management Plan developed		
	Implementation of a Waste Management System		Control of Waste Management System	Waste Management System implemented		
	Store hazardous waste in adequate storage sites (lockable, roofed, ventilated, concreted and bunded floor) at new s/s Ayrum and s/s Ddmashen	s/s Ayrum and s/s Ddmashen	Visual inspection	All hazardous wastes adequately stored	Regularly during construction	
	Pack all hazardous wastes securely in sealed drums or other suitable containers and clearly identify them by labels			All hazardous wastes securely packed and labeled		
Training in waste handling	Train workers in handling and disposal of recyclable, sanitary, solid, liquid and hazardous waste	Construction sites	Inspection of training records	All workers trained accordingly		
Decommissioning of workers' camps	Disassemble light constructions	Workers' camps	Visual inspection	Locations of workers' camps are free of any waste	After construction works supported from construction camps	HVEN PIC External auditor
	Remove concrete lining and/or gravel/sand spread in vehicle servicing areas					

Activity / Impact	**What** (Is the parameter to be monitored?)	**Where** (Is the parameter to be monitored?)	**How** (Is the parameter to be monitored?)		**When** (Define the frequency / or continuous?)	**Who** (Is responsible for monitoring?)
			Method	**Indicator**		
Decommissioning of workers' camps and harmonizing areas with the landscape	Hand over re-usable elements of waste from disassembling of constructions for recycling	Workers' camps	Checking documents on hand-over of reusable waste	Documents on hand-over of recyclable waste are on file	After construction works supported from construction camps	HVEN PIC External auditor
	Dispose construction waste generated from decommissioning of workers' camps in locations agreed in written by local authorities		Checking waste disposal agreements	Documents on allowed disposal of waste are on file		
	Even out soil surface to quasi-natural condition and provide conditions for natural regeneration of local vegetation as relevant		Visual inspection	Earth surface is harmonized with the landscape		
Noise impacts on workers	For workers noise levels shall be kept below 80 dB (A), wherever possible. In case of exceeding this value, hearing protections must be provided to workers and warning signs must be installed	Construction sites	Instrumental measurement in case of particularly noisy activities	Noise level below 80 dB (A); if noise levels are higher: workers fitted with PPE and warning signs installed	Regularly during construction	HVEN PIC External auditor
Noise impacts on workers / public	Use low sound power mechanical equipment, whenever possible	Construction sites	Visual inspection and inspection of complaints	Low sound equipment used; no complaints from residents	Regularly during construction	HVEN PIC External auditor
	Regular maintenance and service of building machinery and other vehicles during construction works		Inspection of maintenance records	Equipment regularly maintained		
	Shut down or throttling down of noisy machinery to a minimum		Inspection of complaints	No complaints from residents		
Noise impacts on public	Optimization of transportation management to avoid needless truck drives	Residents living near construction sites	Inspection of complaints	No complaints from residents	Regularly during construction	HVEN PIC External auditor

Activity / Impact	**What** (Is the parameter to be monitored?)	**Where** (Is the parameter to be monitored?)	**How** (Is the parameter to be monitored?)		**When** (Define the frequency / or continuous?)	**Who** (Is responsible for monitoring?)
			Method	**Indicator**		
Noise impacts on public	Reduce vehicle speeds in populated areas	Residents living near construction sites	Inspection of complaints	No complaints from residents	Regularly during construction	HVEN PIC External auditor
	Allow truck movements only during daylight, but not between 7 pm and 6 am					
	For residents the noise levels may not exceed 55 dB (A) or result in a maximum increase in background levels of 3 dB (A) at the nearest receptor location off-site		Instrumental measurement in case of complaints	Noise level below 55 dB (A) or maximum increase less than 3 dB (A)		
	Notify nearby residents and businesses at least 24 hours in advance if particularly noisy activities are anticipated		Interviews	Residents informed at least 24 hours in advance		
	Conduct noise-generating activities near to occupied buildings only between 9 am and 4 pm		Inspection of complaints	No complaints from residents		
Limitation of exhaust gas pollution	Limitations of size, weight or axe loads of vehicles using particularly difficult roads	Construction sites	Visual inspection	Size, weight and axe load of vehicles limited	Regularly during construction	HVEN PIC External auditor
	Reduction of speed and limited movement of vehicles		Inspection of complaints	No complaints from residents		
	Optimize transportation management to avoid needless truck trips		Inspection of transportation management	No needless truck trips		
	Maintain vehicles and construction machinery properly, as recommended by suppliers		Inspection of maintenance records	Equipment regularly maintained		
	Avoid unnecessary idling of construction machines and vehicles		Visual inspection	No unnecessary idling		

Activity / Impact	**What** (Is the parameter to be monitored?)	**Where** (Is the parameter to be monitored?)	**How** (Is the parameter to be monitored?)		**When** (Define the frequency / or continuous?)	**Who** (Is responsible for monitoring?)
			Method	**Indicator**		
Limitation of dust	Cover truck beds with tarps during material transport	Construction sites	Inspection of complaints	No complaints from residents	Regularly during construction	HVEN PIC External auditor
	Use dust-suppressing water spray during civil works, where necessary					
	Store and handle material appropriately to limit dust (e.g. protect cement with tarpaulins)		Visual inspection	Appropriate storage		
Limitation of smoke and air pollution	Prohibit open burning of construction / waste material	Construction sites	Visual inspection	No open burning of those materials	Regularly during construction	HVEN PIC External auditor
SF_6 as greenhouse gas	Follow relevant guidelines for handling SF_6	Substation sites		No incidents		
Impacts on Historical and Cultural sites	Avoid any damage to cultural sites in line corridor and keep tower locations in an adequate distance	Construction sites	Visual inspection	No damages to cultural sites	Regularly during construction	HVEN PIC External auditor
	Avoid archaeological excavation site near Teghut village (Lori)					
	Implementation of Chance Find Procedure and training of the construction workers		Inspection of chance find reports and training records	Chance Find Procedure implemented; all workers trained		

Activity / Impact	**What** (Is the parameter to be monitored?)	**Where** (Is the parameter to be monitored?)	**How** (Is the parameter to be monitored?)		**When** (Define the frequency / or continuous?)	**Who** (Is responsible for monitoring?)
			Method	**Indicator**		
Impacts on Historical and Cultural sites	Report chance finds immediately to the Ministry of Culture of RA, Dep. Protection of Monuments and Historical Sites	Construction sites	Inspection of chance find reports	All chance finds reported to Ministry of Culture	In advance of construction	Local members of Agency of Protection of Historical and Cultural Monuments (Budget for monitoring: **10,000 USD**)
	Agree with representatives of Dep. Protection of Monuments and Historical Sites of RA about location of towers and new access roads (including proposed bypasses) in advance of construction		Inspection of agreements with Ministry of Culture	All locations of new towers and access roads agreed with Ministry of Culture		
	Shifting of tower locations have to be approved by Dep. Protection of Monuments and Historical Sites		Inspection of agreements with Ministry of Culture	Shifting of tower locations approved		
HSE Policy and HSE Management	Development of an HSE Policy for the construction phase, in advance of construction activities	Construction sites	Inspection of relevant documents	HSE Policy developed	In advance of construction works	HVEN PIC External auditor
	Development of an HSE Management Plan (including sub-plans: see Section 8.3) for the construction in advance of construction activities			HSE Management Plan developed		
	Installation of an HSE Management System (HSEMS) during the construction phase, including HSE Officer			HSE Management System implemented	During construction	
Employee Health and Safety at construction sites	Make sure that all workers have a health insurance	Construction sites	Inspection of workers' health documents	All workers have health insurance	Regularly during construction	HVEN PIC External auditor

Activity / Impact	**What** (Is the parameter to be monitored?)	**Where** (Is the parameter to be monitored?)	**How** (Is the parameter to be monitored?)		**When** (Define the frequency / or continuous?)	**Who** (Is responsible for monitoring?)
			Method	**Indicator**		
Employee Health and Safety at construction sites	Provide proper sanitation facilities with hand-washing facilities in adequate number, separately for men and women[15]	Construction sites	Visual inspection	Adequate number of sanitation facilities separately for men and women; and in proper condition	Regularly during construction	HVEN PIC External auditor
	Provide first aid kits and fire extinguishers at all Project sites and in all vehicles		Interviews Visual inspection	First aid kits and fire extinguishers provided		
	All work crews shall have at least one person (two is strongly preferred) trained in first aid		Inspection of training records	Work crews accordingly arranged		
	Provide HIV/AIDS protection equipment for workers		Interviews	Protection equipment provided		
	Awareness raising regarding STD should be provided to workforce			All workers informed		
	Provide workers with appropriate protective equipment (PPE) (dust, noise, etc.)		Visual inspection	All workers provided with PPE		
	Install warning signs “Danger of Electrocution” at towers, substations etc.			Warning signs installed		
	Consider possible occurrence of poisonous snakes during construction works.		Interviews Visual inspection	All workers aware of possible danger		
	Train workers in regard to work at heights, electrical and vehicular safety, handling of hazardous materials, PPE, hazard avoidance and reduction measures, use of first aid and rescue techniques, emergency response etc.		Inspection of training records	All workers trained accordingly		

Activity / Impact	**What** (Is the parameter to be monitored?)	**Where** (Is the parameter to be monitored?)	**How** (Is the parameter to be monitored?)		**When** (Define the frequency / or continuous?)	**Who** (Is responsible for monitoring?)
			Method	**Indicator**		
Employee Health and Safety at construction sites	Limit occupational exposure to EMF by use of shielding materials, and train workers accordingly	Construction sites	Interviews Inspection of training records	Shielding materials in place All workers trained accordingly	Regularly during construction	HVEN PIC External auditor
	If work crews are in remote areas, they shall be equipped with cellular phones or radios		Visual inspection	Work crews accordingly equipped		
Employee Health and Safety at accommodation	Accommodate workers in adjacent towns if possible	Workers' accommodation / Workers' camps	Visual inspection	Location of workers' accommodation in accordance with municipal authorities	Regularly during construction	HVEN PIC External auditor
	Construction camps to be located in accordance with relevant authorities					
	Workers' camps have to meet the requirements of IFC/EBRD guidance note[15]	Workers' camps		Requirements of the IFC/EBRD guidance note are met		
General Employee Health and Safety	Identify area emergency responders, hospitals, and clinics, and provide advance notice of Project activities	Area emergency responders	Interviews	Area emergency responders informed about Project activities	In advance of construction works	HVEN PIC External auditor
	Forbid alcohol and other drugs at construction sites/ workers' camps	Construction sites; workers' camps	Inspection of incident records	No workers found under influence of alcohol or other drugs	Regularly during construction	
	Set up mobile clinics for workers capable of treating all injuries and diseases occurring at the construction sites	Construction sites	Visual inspection	Mobile clinics set up		
	Assure transfer of injured workers to hospitals in the case of serious accidents		Inspection of accident records	Workers transferred to hospital in case of serious accidents		

Activity / Impact	**What** (Is the parameter to be monitored?)	**Where** (Is the parameter to be monitored?)	**How** (Is the parameter to be monitored?)		**When** (Define the frequency / or continuous?)	**Who** (Is responsible for monitoring?)
			Method	**Indicator**		
General Employee Health and Safety	Implement programs for medical screening, health and safety monitoring, and reporting	Construction sites	Inspection of records	H&S programs implemented	Regularly during construction	HVEN PIC External auditor
	Record work-hours as well as all accidents and incidents		Inspection of records	Recording implemented		
Notification of public in advance of construction works	Notify public on upcoming construction activities in adjacent villages and through media	Residents living near to construction sites	Interviews	Public informed about upcoming construction	In advance of construction works	HVEN PIC External auditor
	Public education/ outreach efforts providing information about hazard awareness, safety measures, reporting unsafe conditions and environmental impacts		Interviews and inspection of complaints	Public informed accordingly; no complaints	In advance of construction and regularly during construction	
	Awareness raising regarding STD should be provided to local communities					
Notification of public in advance of transporting heavy equipment	Inform population along public roads in advance in case of transporting heavy equipment	Residents along public roads	Inspection of complaints and accident records	No complaints from residents; no accidents	Regularly during construction	HVEN PIC External auditor
Public Health and Safety	Provide adequate security measures to prevent accidents and injury (e.g. speed limits on public roads, grounding objects)	Residents living near to construction sites	Inspection of complaints and accident records	No complaints from residents; no accidents	Regularly during construction	HVEN PIC External auditor
	Use warning signs at access points along main roads, and around work sites near villages or residences		Visual inspection	Warning signs erected		

Activity / Impact	**What** (Is the parameter to be monitored?)	**Where** (Is the parameter to be monitored?)	**How** (Is the parameter to be monitored?)		**When** (Define the frequency / or continuous?)	**Who** (Is responsible for monitoring?)
			Method	**Indicator**		
Public Health and Safety	Provide clear and adequate signage to identify work areas and hazardous equipment, before commencement of relevant construction	Residents living near to construction sites	Visual inspection	Work areas and hazardous equipment clearly signed	Regularly during construction	HVEN PIC External auditor
	Install warning signs at all towers and sensitize the community on dangers of electricity, and risks of electrocution		Visual inspection Interviews	Warning signs installed; communities informed		
	Provide adequate security to prevent public access to substations, work sites, hazardous materials and waste	Construction sites	Visual inspection Inspection of records	Security measures implemented No incident records		
	Establish worker code of conduct to help prevent friction or conflict with communities	Residents living near to construction sites	Inspection of complaints	Worker code of conduct established		
	No houses are allowed in corridor (wayleave) of the OHLs	OHL corridors	Visual inspection	No houses in corridors		
	Regular community liaison/stakeholder engagement activities should be undertaken during construction	Villages near to OHL corridors	Inspection of documents Interviews	Community liaison/stakeholder engagement activities performed		
Traffic Management in advance of construction	Arrange worker bus transport to minimize external traffic	Construction sites	Visual inspection	Worker bus transport arranged	In advance of construction	HVEN PIC External auditor
	Announce start and duration of works through media and signs to the public	Residents living near construction sites	Interviews	Public informed about construction works		

Activity / Impact	**What** (Is the parameter to be monitored?)	**Where** (Is the parameter to be monitored?)	**How** (Is the parameter to be monitored?)		**When** (Define the frequency / or continuous?)	**Who** (Is responsible for monitoring?)
			Method	**Indicator**		
Traffic Management in advance of construction	Establish rights-of-way, speed limits onsite vehicle inspection requirements, operating rules and procedures	Construction sites	Visual inspection	ROW, speed limits, inspection requirements, operating rules established	In advance of construction	HVEN PIC External auditor
	Collaborate with local communities and authorities to improve signage, visibility and overall safety of roads, particularly along stretches located near schools or other locations where children may be present	Local communities	Interviews	Improvement of overall safety of roads started		
	Collaborate with local communities on education about traffic and pedestrian safety			Education program about traffic and pedestrian safety established		
	Coordination with emergency responders	Emergency responders	Interviews	Coordination established		
Training of vehicle operators	Training and licensing industrial vehicle operators in safe operation of specialized vehicles, including safe loading/ unloading, load limits	Construction sites	Inspection of training records	All vehicle operators trained and licensed	Regularly during construction	HVEN PIC External auditor
Training of drivers	Licensing and training of drivers; improvement of driving skills	Construction sites	Inspection of licensing records	All drivers licensed and trained	Regularly during construction	HVEN PIC External auditor
Traffic Management during construction period	Keep speed limits in public roads	Residents near construction sites	Inspection of complaints	No complaints from residents	Regularly during construction	HVEN PIC External auditor

Activity / Impact	**What** (Is the parameter to be monitored?)	**Where** (Is the parameter to be monitored?)	**How** (Is the parameter to be monitored?)		**When** (Define the frequency / or continuous?)	**Who** (Is responsible for monitoring?)
			Method	**Indicator**		
Traffic Management during construction period	Maintain vehicles regularly and use manufacturer approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure	Construction sites	Inspection of maintenance records	Vehicles regularly maintained and approved parts used	Regularly during construction	HVEN PIC External auditor
	Allow traffic to pass through the work in progress where possible		Visual inspection Inspection of complaints and accident records	Traffic can pass through work sites		
	Erect signs that the traffic is aware from far, where the actual construction sites are located			Signs erected		
	Ensure all equipment is visible to the traffic through either illumination or suitable marking			Visibility of equipment ensured		
	Ensure that the work areas are lighted well			Work areas well lighted and sufficiently signed at night		
	Sign the actual construction site area sufficiently at night					
Interference with existing power lines	Keep minimum distance to existing power lines that ensures the width of the ROW of both parallel running lines	Construction sites	Visual inspection Inspection of planning documents	Adequate minimum distances realized	In advance of relevant construction	HVEN PIC External auditor
	Where crossing existing power lines adequate minimum distances between the conductors have to be ensured					
Power outage	HVEN shall develop an energy compensation plan in order to minimize possible power outage duration and ensure power supply to local power consumers.	HVEN office	Inspection of documents	Energy compensation plan developed No complaints	In advance of relevant construction	PIC External auditor

Activity / Impact	**What** (Is the parameter to be monitored?)	**Where** (Is the parameter to be monitored?)	**How** (Is the parameter to be monitored?)		**When** (Define the frequency / or continuous?)	**Who** (Is responsible for monitoring?)
			Method	**Indicator**		
Interference with quarry	Avoid crossing quarry northwest of Haghtanak by implementing recommended ROW	Construction sites	Visual inspection	Quarry not crossed No complaints	In advance and during construction	HVEN PIC External auditor
Crossing of Teghout CJSC property	Final line routing of 400 kV OHL crossing Teghut Mining Site has to be closely coordinated with Teghout CJSC	Construction sites at Teghut Mining Area	Visual inspection	Final line routing coordinated between HVEN and Teghout CJSC		
Land use	Limit construction of access roads and route carefully to minimize impacts on agricultural land	Construction sites	Inspection of complaints	No complaints from residents	In advance of relevant construction	HVEN PIC External auditor
	Locate laydown areas close to existing roads in non-productive areas to minimize interference with agricultural activities and to facilitate site clean-up and rehabilitation		Visual inspection Inspection of complaints	Laydown areas accordingly located	Regularly during construction	
	Minimize surface of and damage caused by workers' camps	Workers' camps		Damage as low as possible		
	Shift towers to avoid orchards, vineyards, gardens	Tower locations	Visual inspection	Tower locations shifted accordingly		
	Adjust construction works not to interfere with harvesting period in order to avoid damages to crops as far as possible	Construction sites	Inspection of complaints	Damage to crops as low as possible		
Grievance Redress Mechanism	Implement and communicate an accessible grievance mechanism for PAP to address complaints at the local level	Construction sites	Inspection of grievances	All grievances adequately treated	Regularly during construction	HVEN PIC External auditor

Activity / Impact	**What** (Is the parameter to be monitored?)	**Where** (Is the parameter to be monitored?)	**How** (Is the parameter to be monitored?)		**When** (Define the frequency / or continuous?)	**Who** (Is responsible for monitoring?)
			Method	**Indicator**		
Complaints during construction	Presence of an impartial person to receive complaints during the construction process and to forward complaints to HVEN	Construction sites	Interviews	Impartial person present	Regularly during construction	HVEN PIC External auditor
Employment	Develop and implement a non-discriminatory hiring and wage policy	Construction sites	Inspection of employment contracts	No complaints	Regularly during construction	HVEN PIC External auditor
	Prosecute offenses related to payment of wages by sub-contractors strictly					
	Prioritize employment of local people for construction works (offer job opportunities in nearby villages)		Inspection of complaints Interviews with employees	High percentage of local people employed		
	Improve recruitment of women for construction works			Percentage of women employed		
	Adhere to Core Labor Standards and IFC PS 2			Relevant standards are met		
Development of RAP	Develop and implement a RAP based on the Project related RPF	All affected sites	Inspection of RAP	RAP implemented	In advance of construction period	HVEN PIC External auditor
	Consultation with PAP about their development priorities in the framework of RAP development		Inspection of consultation reports	Development priorities of PAP considered		
	Develop and implement RAP implementation compliance report		Inspection of compliance report	RAP implemented accordingly	After implementation of RAP	

Activity / Impact	**What** (Is the parameter to be monitored?)	**Where** (Is the parameter to be monitored?)	**How** (Is the parameter to be monitored?)		**When** (Define the frequency / or continuous?)	**Who** (Is responsible for monitoring?)
			Method	**Indicator**		
Compensation payments	Legal experts will support PAP who are not registered land owners with legalization of land titles	All affected land owned by not registered land owners	Interviews with owners	All compensations paid according to the RAP	After relevant construction	HVEN PIC External auditor (for details and budget see RAP)
	Pay compensation to PAP for damages and loss of crops and for expropriation of land	All sites damaged or expropriated				
	Documentation of compensation payments	All affected sites	Inspection of documentation	Documentation established	Regularly during construction	
Gender aspects	Zero tolerance for sexual harassment at the work place or in workers' camps/ overnight locations	Construction sites and overnight locations	Inspection of complaints	No complaints from residents and from workers	Regularly during construction	HVEN PIC External auditor
	Make sure that women are included in public consultations and that gender equality is respected for compensation payments	Villages nearby to OHL corridors		Percentage of complaints adequately treated		
	Cash compensations shall be made in presence of male and female household members	Villages of compensated PAP	Interviews with PAP Inspection of complaints	Compensations paid accordingly	After relevant construction	
	Bank accounts shall be accessible both for male and female household members			Bank account accessible for male and female household members		

8.2.3 Monitoring measures during operation and maintenance phase

Table 8-26: Summary of Monitoring Measures during Operation and Maintenance

Activity / Impact	**What** (Is the parameter to be monitored?)	**Where** (Is the parameter to be monitored?)	**How** (Is the parameter to be monitored?)		**When** (Define the frequency / or continuous?)	**Who** (Is responsible for monitoring?)
			Method	**Indicator**		
Impacts on Flora and Fauna during maintenance and operation	Avoid complete clearing of the ROW during maintenance works	Maintenance sites	Visual inspection	ROW not completely cleared	Regularly during operation and maintenance	HVEN
	Cut down only mature and tall trees from the corridor while not tampering understory plants			Only mature and tall trees felled		
	Selective felling and pruning of trees adjacent to the corridor			Only selected trees felled		
	Avoid maintenance during breeding/ nesting season (March - June) in forested areas	Maintenance sites at forested areas		No maintenance in relevant areas during breeding season		
	Strict prohibition of herbicide use for maintaining the ROW. In exceptional case, if any of such application would be required, no extremely or highly hazardous pesticides (WHO classes I a and I b) may be utilized by any of the end-users. Moderately hazardous pesticides (WHO class II) are not to be used, unless the end-user has appropriate controls established with respect to the manufacture, procurement, or distribution and/or use of these chemicals. These chemicals should not be accessible to personnel without proper training, equipment, and facilities in which to handle, store, apply, and dispose of these products properly.	Maintenance sites		No herbicides used In exceptional cases, parameters are met		

Activity / Impact	**What** (Is the parameter to be monitored?)	**Where** (Is the parameter to be monitored?)	**How** (Is the parameter to be monitored?)		**When** (Define the frequency / or continuous?)	**Who** (Is responsible for monitoring?)
			Method	**Indicator**		
Impacts on Flora and Fauna during maintenance and operation	Prohibit plant-collecting and hunting in the vicinity of the ROW; do not allow access to the forest	Maintenance sites	Visual inspection	No incidents	Regularly during operation and maintenance	HVEN
	Use of berms at roads is recommended to limit vehicle access at forested areas	Forested areas		Berms constructed to limit vehicle access		
	Check proper adjustment of bird diverters during maintenance works	Maintenance sites at gorges, valleys and mountain meadows		Bird diverters properly adjusted		
Soil and Water Pollution from sanitation facilities	Provide proper sanitation facilities at substations and for maintenance workers	Substations and Maintenance sites	Visual inspection	Proper sanitation facilities provided	Regularly during operation and maintenance	HVEN
	Train substation staff and maintenance workers in appropriate sanitation practices		Inspection of training records	All s/s staff and workers trained accordingly		
Soil and Water Pollution from spills	Provide spill-control materials at substations and to drivers and maintenance workers, in order to clean up spills, if any	Substations and Maintenance sites	Inspection of equipment	Equipment provided	Regularly during operation and maintenance	HVEN
	Report and respond to spills promptly and train substation staff and maintenance workers in how to report	Substations and Maintenance sites	Inspection of spill reports and training records	Number of spill reports All s/s staff and workers trained accordingly		
	Remove contaminated soil if spills occur and handle as hazardous waste		Inspection of spill reports and storage areas	All contaminated materials adequately stored at s/s sites		
	Collect contaminated spill materials and manage as hazardous waste	Storage sites at s/s Ayrum and s/s Ddmashen				

Activity / Impact	**What** (Is the parameter to be monitored?)	**Where** (Is the parameter to be monitored?)	**How** (Is the parameter to be monitored?)		**When** (Define the frequency / or continuous?)	**Who** (Is responsible for monitoring?)
			Method	**Indicator**		
Soil and Water Pollution from waste	Train substation staff and maintenance workers in proper management of recyclable, sanitary, solid, liquid, and hazardous wastes	Substations and Maintenance sites	Inspection of training records	All s/s staff and workers trained accordingly	Regularly during operation and maintenance	HVEN
	Collect all type of wastes at s/s sites and during maintenance		Visual inspection	All waste adequately collected		
	Make arrangements for proper waste handling, treatment, disposal			Waste properly treated		
	Store all hazardous waste (if any) in adequate storage sites at s/s Ayrum and s/s Ddmashen			All hazardous waste adequately stored		
Noise impacts on workers	For workers noise levels shall be below 80 dB (A). In case of exceeding this value, provide hearing protections to workers and install warning signs	Substations and Maintenance sites	Instrumental measurement in case of particularly noisy activities	Noise level below 80 dB (A); if higher noise levels occur: workers fitted with PPE and warning signs installed	Regularly during operation and maintenance	HVEN
Noise impacts on workers/ public	Use low sound power mechanical equipment, whenever possible	Substations and Maintenance sites	Visual inspection and inspection of complaints	Low sound equipment used; no complaints from residents	Regularly during operation and maintenance	HVEN
Noise impacts on public	Reduce vehicle speeds (stick to recommended speeds) in populated areas	Residents living near s/s or maintenance sites	Inspection of complaints	No complaints from residents	Regularly during operation and maintenance	HVEN
	For residents noise levels may not exceed 55 dB (A) or result in a max. increase in background levels of 3 dB (A) at nearest receptor location off-site		Instrumental measurement in case of complaints	Noise level below 55 dB (A) or maximum increase less than 3 dB (A)		
	Notify residents and businesses at least 24 hours in advance of particularly noisy activities		Interviews	Residents informed in advance		

Activity / Impact	**What** (Is the parameter to be monitored?)	**Where** (Is the parameter to be monitored?)	**How** (Is the parameter to be monitored?)		**When** (Define the frequency / or continuous?)	**Who** (Is responsible for monitoring?)
			Method	**Indicator**		
Noise impacts on public	Conduct noise-generating activities near to occupied buildings only between 9 am and 4 pm	Residents living near s/s or maintenance sites	Inspection of complaints	No complaints from residents	Regularly during operation and maintenance	HVEN
Limitation of exhaust gas pollution	Maintain vehicles and engines as recommended by suppliers	Maintenance sites	Inspection of maintenance records	Equipment properly maintained	Regularly during maintenance	HVEN
	Avoid unnecessary idling of vehicles		Visual inspection	No unnecessary idling		
	Train maintenance workers accordingly		Inspection of training records	All workers trained accordingly		
SF_6 as greenhouse gas	Apply relevant international guidelines for handling SF_6	Substation sites	Visual inspection	No incidents	Regularly during operation	HVEN
	Train substation personnel in handling SF_6 parts correctly		Inspection of training records	Substation personnel trained accordingly		
Employee Health and Safety	Develop HSMP and implement HSMS for operation and maintenance	Substations and Maintenance sites	Visual inspection	HSMP developed and HSMS implemented	After construction works are finished	Development and implementation recommended for HVEN
Notification of public in advance of operation	Conduct Information/ Awareness Campaigns on the dangers of a high voltage line	Residents living near to OHLs	Interviews	Residents are informed	Before start of operation	HVEN
Public Health and Safety	Provide signage to identify work areas and hazardous equipment	Substations and Maintenance sites	Visual inspection	Proper signage established	Regularly during operation and maintenance	HVEN
	Keep speed limits on public roads during maintenance works	Villages near maintenance sites	Inspection of complaints	No complaints from residents		
	No houses are allowed in corridor (wayleave) of the OHLs	OHL corridors	Visual inspection	No houses in corridors		
	Regular community liaison/stakeholder engagement activities should be undertaken during operation	Villages near maintenance sites	Inspection of documents Interviews	Community liaison/stakeholder engagement activities performed		

Activity / Impact	**What** (Is the parameter to be monitored?)	**Where** (Is the parameter to be monitored?)	**How** (Is the parameter to be monitored?)		**When** (Define the frequency / or continuous?)	**Who** (Is responsible for monitoring?)
			Method	**Indicator**		
Land use	Land within the ROW can further be used for agricultural purposes Inform local residents before undertaking maintenance measures involving clearing of land in ROW or potential damage to crops	Residents near to OHLs using land within the ROW	Interviews	Local residents informed about maintenance works	In advance of relevant maintenance works	HVEN
Compensation payments	Pay compensations for damaged crops during maintenance	All sites damaged by maintenance measures	Inspection of compensation payments	All compensations paid according to the RAP	After relevant maintenance works	HVEN (for details and budget see RAP)

8.3 Implementation Arrangements and Reporting Needs

The responsible HVEN department for dealing with safety and health issues relevant for workers is the '*Safety Engineering and Reliability Service*' installed at the headquarters in Yerevan. This Service is running departments in regional branches. Among others, this Service performs annual tests of workers at the substation sites regarding health and safety issues. However, environmental aspects are not covered by this Service.

The Construction Contractor (CC) is obliged to implement the ESMP. Doing so, he shall set up a Health, Safety and Environmental Management Plan (HSEMP) and install a Health, Safety and Environmental Management System (HSEMS) during the entire construction period covering all construction sites and all construction activities. HSEMP shall include all necessary sub-plans (e.g. waste management plan, traffic management plan, OHS Plan, public health and safety plan, vegetation management plan, management of river crossings) and include method statements. The Contractor may also identify needs for additional plans/ measures not yet integrated into the ESMP and hence will have to set up additional plans.

The CC shall determine a person being responsible for all HSE issues at the construction site(s). This HSE officer shall prepare monthly reports of all HSE relevant incidents and accidents and send these reports to the Project Implementation Consultant (PIC).

PIC shall employ a local HSE officer. This HSE officer will monitor implementation of the mitigation measures given in the ESMP (including the tree cutting and replanting of trees), and prepare monthly reports which will be sent to the Project Management Unit (PMU) at HVEN and the external internationally experienced auditor. The costs for the local HSE officer will sum up to **50,000 USD**.

An external internationally experienced auditor shall perform quarterly supervision of the implementation of the ESMP and monitor the implementation of the mitigation measures. Based on his quarterly supervision and the monthly reports provided by the HSE officer of PIC, the external auditor will produce narrative analytical quarterly reports on environmental and social performance in the course of Caucasus Energy Network Project and furnish these reports to KfW Development Bank. The costs for this supervision will sum up to **100,000 USD**.

Additionally, an external internationally experienced forest specialist shall perform supervision of forest related mitigation measures. Once at the beginning of the Project, when trees have to be cut for supervision of Hayantar's replanting and maintenance concept, and one year later for supervision of implementation of this concept (including the monitoring by Forest State Monitoring Center SNCO), and of the replanting done by a NGO (e.g. Armenia Tree Project - ATP). The costs for this supervision will sum up to **40,000 USD**.

HVEN will have to develop an overarching Environmental, Health & Safety (EHS) Policy (if not already existing), which should be communicated to all levels of the organization. The EHS policy documents the organization's overall EHS aims and objectives in a policy statement, and identifies and registers environmental aspects and impacts and occupational health and safety risks as well as regulatory requirements.

HVEN will have to implement an Emergency Preparedness and Response Plan (EPRP) for engineering contingencies, collisions, natural hazards and other emergencies during construction and operation to include:

- the emergency response in the event of fire, accidents, earthquakes, floods
- procedure for staff and subcontractors to report any incidents and the investigation, remediation and preventive actions taken
- regular emergency response training
- emergency communication procedure including with local communities and authorities.

HVEN shall develop and implement a Stakeholder Engagement Plan (SEP, in line with EBRD PR 10) including appointment of a member of staff as a focal community liaison officer and implementation of stakeholder grievance mechanism. The SEP shall outline appropriate reporting methods to provide annual reports to affected communities concerning ongoing risks, impacts, and mitigation measures.

Figure 8-1 shows the relationship of the different parties in implementing the ESMP (including reporting, monitoring, supervision and auditing):

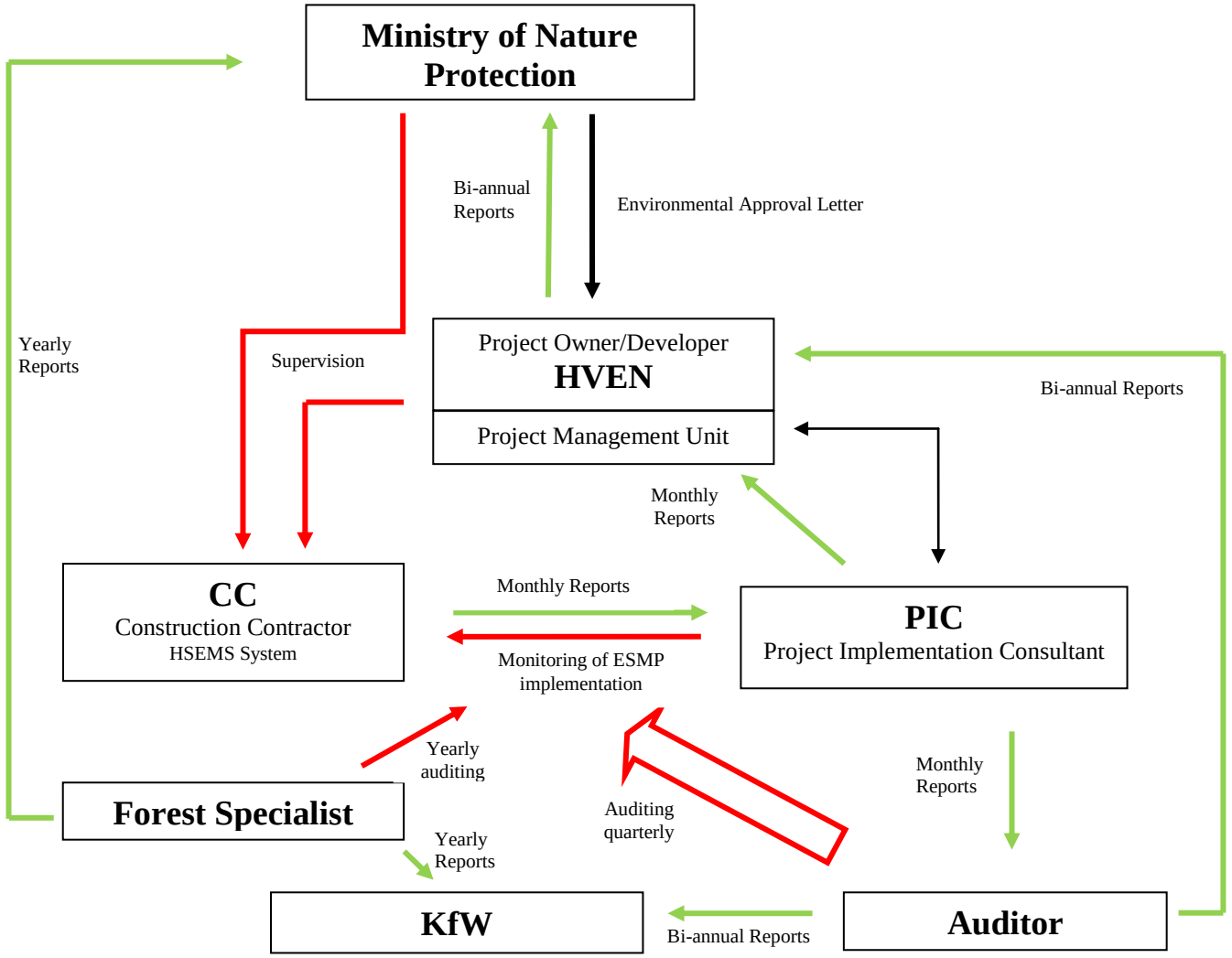


Figure 8-1: Relationship of the different parties in implementing the ESMP (monitoring, supervision, auditing red) and the reporting needs (green). The related RAP will be set up on a later stage by HVEN and implemented by the social department of HVEN.

8.4 Training of HVEN Staff

HVEN already employed a Social Specialist but there is no Environmental Specialist employed yet.

Training of a qualified environmental specialist is therefore required. Training will focus on the application of KfW and World Bank safeguard policy and monitoring procedures and shall contain the implementation of the mitigation and monitoring measures specifically to this Project (including rehabilitation of 220 kV OHL Lori and 110 kV OHLs Tumanyan-1 and -2). One main focus will be on waste and recycling management. Provision for training requirements to be performed by PIC/ owner's engineer is about **20,000 USD** (training on the job).

8.5 Disclosure, Consultation, and Participation

Fichtner's environmental, biodiversity and social specialists, held meetings at Yerevan and at Vanadzor with the representatives of HVEN, Ministry of Agriculture, Ministry of Nature Protection, Ministry of Culture, and conducted field trips to the proposed substation sites and OHL corridors (see Section 11.1 – Appendix I). Discussions on the environmental implications of the Project were held with NGOs WWF Armenia, Armenian Society for the Protection of Birds (ASPB), Ecolur, and Armenia Tree Project (ATP). The Ministry of Culture/ Agency for Security of Historical and Cultural Monuments was consulted on the procedures to protect historical and cultural sites.

Field visits to the proposed substation sites and OHL corridors of the different options were conducted and local residents interviewed on the spot. Preliminary Community Consultations were made by *Fichtner* Social and Environmental Team together with HVEN social specialist for the optimization of line routing in most of the following communities (some communities were not reached due to snow conditions and will have to be consulted by HVEN at a later stage and when line routing will be defined). For a list of meetings refer to Section 11.1 – Appendix I.

Table 8-27: Potentially affected communities and comments from preliminary community consultation

No.	Name	Marz	Comment
1	Ddmashen	Gegharkunik	s/s Ddmashen is located on territory of Gegharkunik Marz (land acquisition completed) Consultation was made, No objections, participants are satisfied with prior compensation process for land of substation
2	Zovaber	Kotayk	No separate consultation was made, degree of affectedness depends on option (to be defined)

No.	Name	Marz	Comment
3	Kakavadzor	Kotayk	No separate consultation as routing needs to be defined, village not directly affected, line not close to village
4	Fioletovo	Lori	Consultation with village head was made, No objections, line could pass either in the middle between Margahovit or more suitable below the village (East / Option 4a)
5	Margahovit	Lori	Consultation with village head, No objection, looking for jobs for community members in line construction, project is welcome, minimization of agriculture lands
6	Aghnidzor	Lori	Consultation with village head and residents, line crosses community lands used as pastures, some lands private used for haymaking No objections, wish for jobs
7	Atan	Lori	Consultation with village head and residents, line crosses community pasture lands, No objections, wish for jobs
8	Gomshavar	Tavush	Mountain Pastures in Tavush region are crossed on 3.5 km if border mapping is correct, could not be accessed due to snow condition
9	Teghut	Lori	Consultation with village head and residents in 2013, community has experienced Vallex expropriation process, wish for timely compensation, minimization of forest cutting
10	Shnogh	Lori	Consultation with village head and residents in 2013 and in 2016, community has experience with expropriation through Vallex Mining Project, suffering from impacts but benefit for jobs, however no general objection against project, but wish minimization of forest cutting and land take and fair compensation
11	Archis (depending on final line routing)	Tavush	(depending on Option for Teghut Mining Area), Minimization of agricultural land
12	Mets Ayrum	Lori	(depending on Option for Teghut Mining Area), Consultation with village head, Minimization of agricultural land , Minimization of line crossings with other OHLs
13	Chochkan	Lori	Consultation was made, wish for minimization of land take of agricultural land, timely compensation, involvement of the community during definition of tower positions together with CC, S/S should be renamed after Chochkan village (not Ayrum) otherwise objection against project
14	Haghtanak	Lori	Line routing to be defined, avoidance of agricultural land, avoidance of quarry after Ayrum s/s
15	Deghzavan	Lori	Georgian border area, after Ayrum s/s, no separate consultation was held, border area

The Final Draft version of the ESIA, including the ESMP, was disclosed to the public in English and Armenian versions for ten days to allow stakeholders to familiarize with it. According to national requirements the disclosure period is 7 days.

The document was not only posted on HVEN's website, but was also delivered in printed copies to the local administration offices and advertisements in local media about their availability and public consultation meeting were done. Printed copies were also provided to representative civil society organizations.

After disclosure of the documents, public consultation meeting on the ESIA was held on 23 September 2016 at Lori Region Administration in Vanadzor city. The consultation meeting concentrated on interpreting the ESIA report to the PAP and seeking their feedback and concerns, which were involved in the Final ESIA report. The Public Consultation meeting was successfully conducted with a good participation. Most of the affected communities were represented by their community leaders or their representatives. Representatives of NGOs also participated actively in the discussion.

Recommendations from the public consultation meeting were:

- There should be a tender process implemented regarding the recommended additional tree planting by an environmental NGO.
- Change the name of Ayrum substation and call it Chochkan substation, as it is located in Chochkan Community.

For further details of the Public Consultation meeting see Section 11.8 – Appendix VIII.

8.6 Grievance Redress Mechanism

In the course of the construction process, PAP may feel treated unjustly. This might happen for various reasons: the contractor does not adhere to sound construction principles, the damages to crops are not paid for, resettlement measures have not been implemented, people have been forgotten during land survey or simply misunderstandings have arisen and so forth. This may also be disagreement with procedures of consultation, notification or valuation.

When this happens people are encouraged to lodge their complaints. The grievance mechanism is implemented, so that people can get their problems solved and grievances redressed in a timely and effective manner without directly addressing the court. All APs will be notified about the presented Grievance Redress Mechanism (GRM) during Public Consultation meetings as well as through the disclosed project information leaflets, providing contact dates of the HVEN Grievance coordinator.

During consultation, survey and compensation PAP shall be notified orally or in a written form about their rights and the procedure of complaints introduction. Local NGOs e.g. via the local Aarhus Centre can inform communities about the possibility to raise complaints and how and where to address them. The grievance mechanism has to be locally implemented at the level of village institutions and local self-government as well as bundled on national level at HVEN.

Grievances can be addressed at the local community level (‘marzpet’), where the grievance is recorded and forwarded to HVEN grievance committee responsible. Grievances that are addressed to the Construction Contractor during the execution of civil works shall also be forwarded to HVEN grievance committee. Even if the constructor decides to settle the grievance on the spot, the documentation of the grievance settlement procedure needs to be documented at the HVEN grievance committee/ focal point. Also, all project related complaints can be directly addressed to HVEN grievance committee via phone, e-mail or grievance form. A project grievance hotline shall be made available by HVEN for direct complaints (at national level) and all received grievances shall be recorded in a grievance log-book.

The HVEN grievance committee then decides whether to settle directly, call for grievance committee meeting or go to court. The decision has to be taken within 15 days.

In case of major grievances, that cannot be directly settled, permanent and non-permanent members of the grievance committee will be called for a meeting.

In case of failure of the grievance redress system, the PAP can submit their case to the appropriate court of law.

The Committee will be composed of permanent and non-permanent members:

- permanent members: HVEN, the contractor and a lawyer
- non-permanent members: Appropriate marz representative, community representative and NGO representative.

Non-permanent members will be notified of the date and venue of the meeting 10 days before the meeting. Absence of non-permanent members cannot be the reason for the cancellation of the meeting. A lawyer can be represented by one of the permanent members.

The contractor is obliged to carry out the work in accordance with the contractual requirements that include:

- a person of staff responsible for grievance procedure who will provide technical assistance to HVEN in handling any grievances that may arise during RAP preparation and implementation
- preparation of regular monitoring reports on the status of RAP preparation and implementation, including details of any complaints that arose and how they were handled
- If vulnerable affected people are identified following census completion, then the contractor will appoint professional advocates (social workers/legal experts) to assist those people during the entire process, and to act as independent advocates for them should any grievances arise.
- arbitration of grievances with HVEN and PAP.

HVEN will carry out works that include:

- a person of staff responsible for grievance procedure coordination, hereby referred to as grievance coordinator (including first contact, periodical site visiting of mitigation measure to be implemented by contractor)
- a telephone line, e-mail address and contact name on project boards
- arbitration of grievances with contractor and PAP
- liaison with court.

However, PAP have the option to choose a different representative or directly liaison with HVEN staff, responsible for grievance redress. Vulnerable households will have the support of their individual social worker and legal support. Additionally, legal experts will support PAP who are not registered land owners with legalization of land titles.

NGOs, e.g. Aarhus Centre or local member organizations will monitor grievance redress negotiations, assist with grievance arbitration, raise public awareness. PAP need to be informed that in case of conflict with the community leader they can address NGO staff to follow up their complaint. NGOs will monitor relationship between PAP and community leader.

The aggrieved person (PAP) is encouraged to proceed in the following way:

a) Contact the contractor's designated grievance staff in the following way: in person via designated telephone number, via email, via regular mail. Alternatively, PAPs can contact their community leader, who would convey their grievance to the contractor's designated grievance staff.
b) Lodge complaint and provide information on the case. Each complaint will be registered and a tracking number will be assigned to it. Responses to all complaints should be provided within 15 days (or 25 days in cases where complaint resolution requires special efforts).
c) Agree with the contractor on mitigation measure.
d) Agree with the contractor on time limit for grievance settlement. Grievances have to be settled within two weeks, or otherwise specified in scheduled agreement.

e) Sign if the mitigation measure has been implemented as agreed
f) Seek redress from HVEN if not satisfied with above mentioned procedure though designated telephone numbers, in person, or via email or regular mail. HVEN should register all grievances and provide response within 15 days.
g) Involve appropriate NGOs
h) Seek redress from court if all else fails.

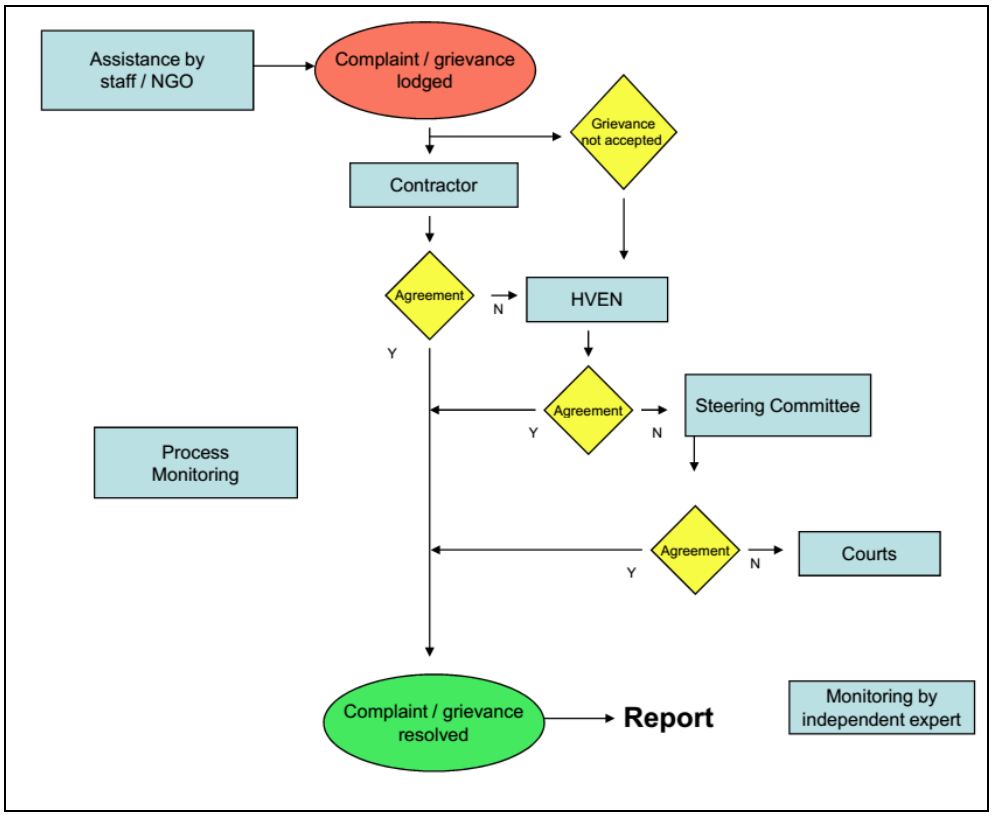


Figure 8-2: Grievance Mechanism Flow Chart

Nevertheless, the above mentioned grievance mechanism does not limit the citizen's right to submit the case straight to the court of law just in the first stage of grievance process. The grievance mechanism is designed to avoid lengthy court procedures.

The KfW Development Bank is not directly a part of the Grievance procedure but shall receive reports which complaints were received and how they have been followed up/ mitigated.

Special consideration has to be taken for PAP living in remote areas and vulnerable people as complaint mechanisms may be unusual and contact with legal procedures let alone courts of law may appear not very promising from their experience. This would prevent the most disadvantaged persons from addressing their grievance.

A close monitoring on village level by an independent social expert during the implementation of the project and a personal contact with PAP is therefore recommended.

Vulnerable PAP (all women headed households and all households below the poverty line) will be entitled to a legal aid/ social worker to support them with complaints procedures.

8.7 Costs of Implementation of ESMP

Most of the costs for mitigation of the impacts during the construction period of the Caucasus Energy Network Project are included in the regular construction costs.

Extra costs with respect to environmental mitigation are related to establishment of a Biodiveristy Action Plan, rehabilitation measures and monitoring at forested areas and installation of bird diverters. Further costs are foreseen for monitoring of construction works by a local HSE officer of PIC, for monitoring by local members of Agency of Protection of Historical and Cultural Monuments, for quarterly supervision of construction sites to be performed by an internationally experienced auditor, for supervision of replanting concept and implementation by an internationally experienced forest specialist, and for training of HVEN staff.

Considering a construction period of about 2 years, costs for implementation of the ESMP sum up to **1,243,000 USD** (see

Table 8-28).

These costs include the implementation of the RAP, but not the costs for preparing the detailed RAP study including asset survey. This will be done by a RAP consultant or HVEN's Social Specialist.

Table 8-28: Costs for mitigation measures, monitoring and training

	Phase	**Issue**	**Costs [USD]**
RAP implementation	Pre-construction	See Project related RPF (Chapter 8)	135,000
BAP establishment	Pre-construction	Preparation of Biodiversity Action Plan	30,000
Mitigation	Construction	Installation of bird flight diverters at ground wires, if the line crosses gorges*	135,000
Mitigation	Construction	Tree replanting and maintenance by Hayantar SNCO	300,000
Mitigation	Construction	Additional tree replanting and maintenance by a NGO	300,000
Mitigation	Construction	Awareness raising activities implemented by a NGO	10,000
Monitoring	Construction	Local HSE officer at PIC	50,000
Monitoring	Construction	Monitoring by local members of Agency of Protection of Historical and Cultural Monuments	10,000
Monitoring	Construction	Quarterly supervision of construction sites by external auditor	100,000
Monitoring	Construction	Supervision of replanting by internationally experienced forest specialist	40,000
Training	Construction	Training of HVEN staff	20,000
Sum			**1,130,000**
10 % contingencies			113,000
Total			**1,243,000**

* it is assumed that the CC has a line car for installation in operation

9. Conclusion

In summary, from the findings of this Environmental and Social Impact Assessment it can be concluded that the proposed Caucasus Energy Network Project, will have low to medium impacts, if all proposed mitigation measures are implemented. Medium impacts are related to line routing (passing remote areas in the mountains and forested areas), access roads, flora and fauna (by OHLs), and infrastructure (OHL crossing property of Teghout CJSC).

The Project can be constructed and operated without having significant adverse impacts on the social environment.

However, an impact on ecology will remain and cannot be mitigated to zero. This has to be accepted by the decision makers if the project shall be implemented.

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11. Appendices

11.1 Appendix I: Record of Meetings and Field Surveys

Table 11-1: Record of meetings

Date	Agency/ Institution/ Company	Place	Name of Person consulted Position	Reason for Visit
08.12.2015	HVEN	Yerevan	Aram Ananyan General Director Derenik Gevorgyan Deputy General Director on General Issues Simon Igitbashchyan Chief Engineer Armine Barseghyan Head of NMS	Kick-off meeting; possible technical measures and line routings
01.02.2016	Ministry of Agriculture (Forest Department – Hayantar SNCO)	Yerevan	Ruben Petrosyan Chief Forester	Forest areas crossed by the line corridor, compensation aspects
01.02.2016	Armenian Society for the Protection of Birds	Yerevan	Mamikon Ghasabyan Director Tsovinar Hovhannisyan Conservation Officer	Birds in the investigation area, migration paths in the investigation area, areas of specific concerns
01.02.2016	Ministry of Culture (Agency for Security of Historical and Cultural Monuments)	Yerevan	Armen Abroyan Director of the Agency Suren Shaqaryan Head of Monument and Historical Environment Security Department	Information about the Project, cultural and archaeological sites along the proposed line routing and general procedure how to manage cultural aspects in Armenia
01.02 2016	Ecolur NGO	Yerevan	Inga Zarafyan Informational NGO President	Fauna and Flora in the investigation area, areas of specific concerns
02.02.2016	Ministry of Agriculture (Forest State Monitoring Center SNCO)	Yerevan	Aram Gyulkhasyan Director Armen Ghurshudyan Deputy Director	Monitoring aspects of forest cutting and reforestation measures
02.02.2016	WWF Armenia	Yerevan	Karen Manvelyan Director	Possible crossing of OHL of Dilijan National Park and other Protected areas along the line routing

Date	Agency/ Institution/ Company	Place	Name of Person consulted Position	Reason for Visit
03.02.2016	Ministry of Nature Protection (Bioresources Management Agency)	Yerevan	Artashes Ziroyan Head of Agency Ashit Vardevanyan, Deputy Head of Agency Aram Aghasyan and other experts	Protected areas along the line corridor
02.02.2016	American University of Armenia (AUA Acopian Center for the Environment)	Yerevan	Alen Amirkhanian Director Dr Karen Aghababyan Research Assistant Professor	Maps of the region, Fauna and flora along the line corridor, areas of specific ecological concerns
04.02.2016	KfW Armenia	Yerevan	Zara Chatinyan Local Representative	To inform about the Project
04.02.2016	ASCE Group OJSC Armenian Steel Casting Enterprise	Charentsavan	Mikhail Harutyunyan President of Founding Council	Recycling of scrap metal
17.02.2016	Ddmashen community	Ddmashen	Avetis Averisyan Head of Community Samvel Sagkomanyan, Aiola Galstyan, Ana Mkrtchyan, S. Hovannisyan, Hovik Balabekyan, P. Zakaryan, Garik Haykapetyan, Karine Hayrapetyan, Arik Manukyan Community members Derenik Gevorgyan HVEN Deputy General Director on General Issues Lusine Zaqaryan HVEN Sociologist	Introducing project, environmental and social concerns
17.02.2016	Margahovit community	Margahovit	Samvel Ananyan Head of Community Ashot Aldinyan Deputy head of Comm. Garik Gevorgyan Director Northern Branch, HVEN Lusine Zaqaryan HVEN Sociologist	Introducing project, environmental and social concerns
17.02.2016	Fioletovo community	Fioletovo	Alexey Novikov Head of Community Garik Gevorgyan Director Northern Branch, HVEN Lusine Zaqaryan HVEN Sociologist	Introducing project, environmental and social concerns

Date	Agency/ Institution/ Company	Place	Name of Person consulted Position	Reason for Visit
18.02.2016	Atan community	Atan	Roland Hakobyan Head of Community Garik Gevorgyan Director Northern Branch, HVEN Lusine Zaqaryan HVEN Sociologist	Introducing project, environmental and social concerns
18.02.2016	Ahnidzor community	Ahnidzor	Vanik Karyan Head of Community Garik Gevorgyan Director Northern Branch, HVEN Lusine Zaqaryan HVEN Sociologist	Introducing project, environmental and social concerns
19.02.2016	Shnogh community	Shnogh	Hovik Sahakyan Head of Community Garik Gevorgyan Director Northern Branch, HVEN Lusine Zaqaryan HVEN Sociologist Armen Nalbandyan Chief Engineer Northern Branch, HVEN	Introducing project, environmental and social concerns
19.02.2016	Chochkan community	Chochkan	Arkady Tamazyan Head of Community Garik Gevorgyan Director Northern Branch, HVEN Lusine Zaqaryan HVEN Sociologist Armen Nalbandyan Chief Engineer Northern Branch, HVEN	Introducing project, environmental and social concerns
20.02.2016	Hayantar SNCO	Margahovit	Zhora Gasparyan Forest officer Gagik Barseghyan Forest guard	Environmental impacts of line routing crossing Margahovit State Sanctuary
22.02.2016	HVEN	Yerevan	Aram Ananyan General Director Derenik Gevorgyan Deputy General Director on General Issues Simon Igitbashchyan Chief Engineer Armine Barseghyan Head of NMS Lusine Zaqaryan HVEN Sociologist and other experts	Wrap-up meeting: Findings of field survey and meetings; HVEN comments

Date	Agency/ Institution/ Company	Place	Name of Person consulted Position	Reason for Visit
22.02.2016	Armenian Tree Project (ATP)	Yerevan	Lucineh Kassarjian ATP Country Director Arthur Harutyunyan Country Deputy Director	Introducing project, gathering information about replanting projects near to possible line corridors
18.04.2016	Debet/ Chkalov/ Yeghegnut communities	Debet	Ararat Kocharyan Head of Debet community Roman Sahakyan Head of Chkalov community Misha Hovhannisyan Head of Yeghegnut community	Introducing project, environmental and social concerns (Option 5)
18.04.2016	Dsegh community	Dsegh	Norik Kocharyan Head of Community	Introducing project, environmental and social concerns (Option 5)
18.04.2016	Armenian Society for the Protection of Birds (ASPB)	Nature Visitor Centre Dsegh	Mamikon Ghasabyan Director Tsovinar Hovhannisyan Conservation Officer	Introducing project, environmental concerns (Option 5), crossing of IBA Dsegh, threatened bird species
18.04.2016	Armenia Tree Project	Yerevan	Lucineh Kassarjian Country Director	Discussion of proposed line corridors (Option 4 versus Option 5) with respect of affected forest areas and possible compensation measures
18.04.2016	WWF Armenia	Yerevan	Karen Manvelyan Director	Discussion of proposed line corridors (Option 4 versus Option 5) with respect of protected areas
19.04.2016	Hayantar SNCO	Akhtala	Harutyun Amirjanyan Director of Lalvar Forestry Branch	Impacts of line routing (Option 5) crossing forested areas
19.04.2016	Alaverdi community (including villages Sanahin, Akner)	Alaverdi	Karen Paremuzyan Head of Community	Introducing project, environmental and social concerns (Option 5)
19.04.2016	Haghpat community	Haghpat	Vahram Karyan Head of Community	Introducing project, environmental and social concerns (Option 5)
20.04.2016	Mets Ayrum community	Mets Ayrum	Sahak Nazaryan Head of Community	Introducing project, environmental and social concerns

Date	Agency/ Institution/ Company	Place	Name of Person consulted Position	Reason for Visit
20.04.2016	Lermontovo community	Lermontovo	Edik Chakhalyan Head of Community	Introducing project, environmental and social concerns (Option 5)
20.04.2016	Armenia Tree Project	Yerevan	Jeanmarie Papelian Executive Director Lucineh Kassarjian Country Director and others	Discussion of proposed line corridors (Option 4 versus Option 5) with respect of affected forest areas and possible compensation measures
21.04.2016	HVEN	Yerevan	Aram Ananyan General Director Derenik Gevorgyan Deputy General Director on General Issues Simon Igitbashchyan Chief Engineer Armine Barseghyan Head of NMS and other experts	Wrap-up meeting: Findings of field survey and meetings (Option 5); HVEN comments

Table 11-2: Record of field surveys

Date	Agency/ Institution/ Company	Place	Name of Person consulted Position	Reason for Visit
09.12. 2015	HVEN	Field trip: Ddmashen and Ayrum substation sites	Derenik Gevorgyan Deputy General Director on General Issues Simon Igitbashchyan Chief Engineer	s/s locations; possible environmental and social impacts
17.02.2016	HVEN	Field trip: Ddmashen substation site and connecting lines	Derenik Gevorgyan HVEN Deputy General Director on General Issues Lusine Zaqaryan HVEN Sociologist	Possible environmental and social impacts of substation and connecting lines
17.02.2016	HVEN	Field trip: Margahovit	Garik Gevorgyan Director Northern Branch, HVEN Lusine Zaqaryan HVEN Sociologist	Possible line routing near to Gugark line crossing Margahovit State Sanctuary
17.02.2016	HVEN	Field trip: Gosh	Garik Gevorgyan Director Northern Branch, HVEN Lusine Zaqaryan HVEN Sociologist	Impacts of possible line routing in the Gosh valley
18.02.2016	HVEN	Field trip: Atan, Ahnidzor	Garik Gevorgyan Director Northern Branch, HVEN Lusine Zaqaryan HVEN Sociologist	Possible impacts of line routing above Atan and Ahnidzor
19.02.2016	HVEN	Field trip: Alaverdi	Garik Gevorgyan Director Northern Branch, HVEN Lusine Zaqaryan HVEN Sociologist Armen Nalbandyan Chief Engineer Northern Branch, HVEN	Line routing of Tumanyan-1 and -2 lines
19.02.2016	Vallex Mining Company	Field trip: Teghut Mining Complex	Hovhannes Aghabekyan Electricity Specialist Vallex Mining Group Garik Gevorgyan Director Northern Branch, HVEN Lusine Zaqaryan HVEN Sociologist Armen Nalbandyan Chief Engineer Northern Branch, HVEN	Line routing avoiding mining site (west and east option)

Date	Agency/ Institution/ Company	Place	Name of Person consulted Position	Reason for Visit
19.02.2016	HVEN	Field trip: Ayrum substation site and connecting lines	Garik Gevorgyan Director Northern Branch, HVEN Lusine Zaqaryan HVEN Sociologist Armen Nalbandyan Chief Engineer Northern Branch, HVEN	Possible environmental and social impacts of substation, connecting lines, and 400 kV line routing
20.02.2016		Field trip: 500 kV line north of Haghtanak	Field trip	Possible environmental and social impacts of 500 kV line routing
20.02.2016		Area north of Hovk village	Field trip	Social and environmental impacts of line routing
18.04.2016		Debet/ Chkalov/ Yeghegnut communities	Field trip	Social and environmental impacts of line routing (Option 5)
18.04.2016		Dsegh	Field trip to cultural sites near Dsegh: Qarasun Manjants monastery, Bardzrakash St. Grigor monastery, Sirun Khach cross-stone	Impacts on cultural sites of line routing (Option 5)
19.04.2016		Areas north of Tumanjan and south of Alaverdi	Field trip to steep rocky hills with forested valleys	Environmental impacts of line routing (Option 5)
19.04.2016		Alaverdi (Sanahin, Akner)	Field trip to forested areas crossed by line routing	Social and environmental impacts of line routing (Option 5)
19.04.206		Haghpat	Field trip to forested areas near Haghpat	Social and environmental impacts of line routing (Option 5)
20.04.2016		Akori	Field trip for overview on steep rocky hills with forested valleys	Environmental impacts of line routing (Option 5)
20.04. 2016		Odzun, Aygehat	Field trip for overview on steep rocky hills with forested valleys	Environmental impacts of line routing (Option 5)
20.04.2016		Fioletovo	Field trip	Social and environmental impacts of line routing (Option 5)

11.2 Appendix II: Photo Documentation for Analysis of Alignment Options

Red line: rough line corridor of 400 kV OHL

1.) Option 1

Option 1: Traverse of Dilijan National Park

Option 1: Dilijan National Park forest at planned traverse location

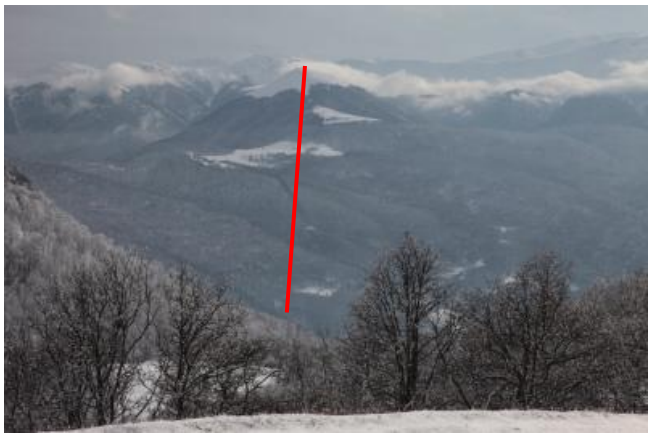
Option 1: Traverse between Teghut and Haghartsin villages and rock wall in background

2.) Option 2

Option 2: Existing 330 kV line above village Gosh

Option 2: 330 kV line traverse of Dilijan NP

Option 2: 330 kV line traverse of Dilijan NP (towards North)



Option 2: 330 kV traverse of Dilijan NP (looking South)

Option 2: Planned routing at the base of rock walls above village Hovk

3.) Option 3

Option 3: Traverse of Gosh Valley (upper part), 330 kV line in background on summit

Option 3: Traverse of Gosh Valley (lower part)

Option 3: Passage above Hovk

4.) Option 4/ 4a

Substation site Ddmashen

Option 4/ 4a/ 5: Passage between Ddmashen and Zovaber

Option 4: Corridor of existing Gugark-1OHL

Option 4: Passage of Margahovit State Sanctuary of existing Gugark-1 OHL

Option 4a: Traverse of Margahovit State Sanctuary (foreground village Fioletovo)

Option 4a: Traverse of Margahovit State Sanctuary

Option 4: Traverse of Fioletovo/ Margahovit (left ATP forest plantation)

Option 4/ 4a: Traverse above village Atan

5.) Option 5

Option 5: Crossing of valley leading to Debet (vulture breeding sites on cliffs in background)

Option 5: Traverse of steep hills without access roads northeast of Tumanjan

Option 5: Traverse of steep hills without access roads opposite of Aygeshat village

Option 5: Traverse of steep hills without access roads opposite of Akori village

Option 5: Traverse of forested hills above Sanahin

Option 5: Traverse of forested hills above Haghpat

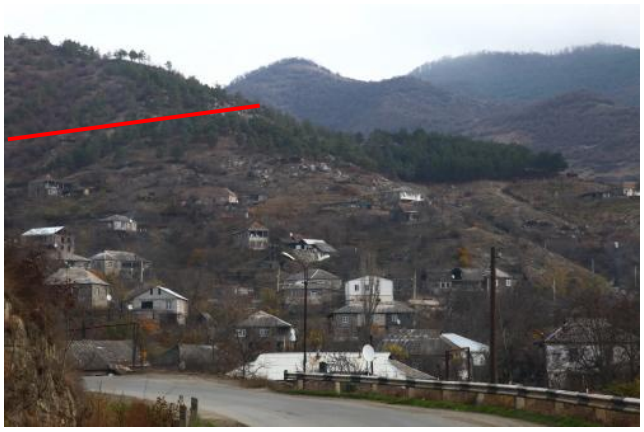
Option 5: Traverse of forested hills and valleys east of Neghots

6.) Options at Teghut Mining Area

Option Teghut West: Traverse of Teghut Vallex Mining Area

Option Teghut East: Traverse of Forest

Option Teghut East: above village Teghut



Option Teghut East: above village Shnogh

Option Teghut East: agriculture lands of village Archis

Option Teghut West: Canyon between Mets Ayrum and Chochkan

All options: Substation site Ayrum

11.3 Appendix III: Report on Higher and Lower Risk Areas for Migratory Soaring Birds along the Corridors of 400/ 500 kV OHLs of Caucasus Energy Network Project

Report on determination of higher and lower risk areas for migratory soaring birds in path identified by the

CAUCASUS ENERGY NETWORK

This report provides the deliverables as set forth in Appendix A of the April 29, 2016 contract signed between AUA and GefaÖ. The deliverables include:

1. A written report that demonstrates high-risk areas and lower-risk areas from point of view of vulnerability of soaring migrants: Raptors, Cranes, and Storks
2. Lists of the soaring migrant species of both: high-risk areas and lower-risk areas
3. Data visualized through GIS Maps
4. Records of all of the field visits conducted for the study

Material and methods

For the study the following sources of information have been reviewed and site visits made:

1. Adamian M. & D. Klem Jr. 1997. Handbook of the Birds of Armenia. American University of Armenia Corporation, 649 pp.
2. Dahl S.K. 1954. Fauna of the Armenian SSR. Academy of Scientific Press, Armenian SSR. Yerevan, Armenia. 416 pp.
3. Own unpublished data covering period from 2000 to 2015.
4. Two one-day excursions have been conducted – on 1st and 8th of May, 2016.

Results

The existing information allows concluding that the following migratory soaring birds listed in Table 1 can be expected to fly over the proposed line.

Table 1. List of soaring migratory birds (Raptors, Cranes, and Storks) which have been recorded along the proposed power line route.

Latin names	English names	Armenian names	Status in Red Book of Armenia	Status in IUCN Red List
CICONIIDAE				
Ciconia nigra	Black Stork	Սև արագիլ	VU	LC
Ciconia ciconia	White Stork	Սպիտակ արագիլ		LC
ACCIPITRIDAE				
Pernis apivorus	European Honey-buzzard	Կրետակեր		LC
Milvus migrans	Black Kite	Սև ցին		LC
Milvus milvus	Red Kite	Կարմիր ցին	EN	NT
Haliaeetus albicilla	White-tailed Eagle	Սպիտակապոչ արծիվ	EN	LC
Neophron percnopterus	Egyptian Vulture	Գիշանգղ	EN	EN
Circaetus gallicus	Short-toed Snake-eagle	Օձակեր արծիվ	VU	LC
Circus aeruginosus	Western Marsh-harrier	Ճահճային մկնաճուռակ		LC
Circus cyaneus	Northern Harrier	Դաշտային մկնաճուռակ		LC
Circus macrourus	Pallid Harrier	Տափաստանային մկնաճուռակ	NT	EN
Circus pygargus	Montagu's Harrier	Մարգագետնային մկնաճուռակ	VU	LC
Accipiter gentilis	Northern Goshawk	Ցախաքլորատրս	VU	LC
Accipiter nisus	Eurasian Sparrowhawk	Լորաճուռակ		LC
Accipiter brevipes	Levant Sparrowhawk	Եվրոպական ճնճղաճուռակ	VU	LC
Buteo buteo	Common Buzzard	Մեծ ճուռակ		LC
Buteo rufinus	Long-legged Buzzard	Տափաստանային ճուռակ		LC
Buteo lagopus	Rough-legged Buzzard	Թավշատոտճուռակ		LC
Aquila pomarina	Lesser Spotted Eagle	Փոքր ենթապտծիվ	VU	LC
Aquila clanga	Greater Spotted Eagle	Մեծ ենթապտծիվ	VU	LC
Aquila nipalensis	Steppe Eagle	Տափաստանային արծիվ	VU	LC
Aquila heliaca	Imperial Eagle	Գերեզմանապտծիվ	VU	VU

Latin names	English names	Armenian names	Status in Red Book of Armenia	Status in IUCN Red List
Aquila chrysaetos	Golden Eagle	Քարատրծիվ	VU	LC
Hieraaetus pennatus	Booted Eagle	Գաճաճ արծիվ	VU	LC
PANDIONIDAE				
Pandion haliaetus	Osprey	Ջրատրծիվ	VU	LC
FALCONIDAE				
Falco naumanni	Lesser Kestrel	Տափաստանայ ին հողմավար բազե	VU	LC
Falco tinnunculus	Common Kestrel	Սովորական հողմավար բազե		LC
Falco vespertinus	Red-footed Falcon	Կարմրատոտ բազե	VU	NT
Falco columbarius	Merlin	Աղավնաբազե	DD	LC
Falco subbuteo	Eurasian Hobby	Արտույտաբազե		LC
Falco cherrug	Saker Falcon	Բալոբան	EN	EN
Falco peregrinus	Peregrine Falcon	Սապսան	VU	LC
GRUIDAE				
Grus grus	Common Crane	Մոխրագույն կռունկ	VU	LC
Anthropoides virgo	Demoiselle Crane	Գեղանի կռունկ	EN	LC

In accordance to the provided map of the power line (see Fig 1), about 50% of the area lays above 2000 m a.s.l., about 20% between 1000 and 2000 m a.s.l., and about 30% below 1000 m a.s.l. Over 90% of the line is drawn over the grassland area (dry and wet mountain steppes and mountain meadows), while less than 10% passes some patches of deciduous forest.

Meanwhile, the dimensional map (see Fig 2) demonstrates that the line passes three mountain ridges. The collected data shows that usually migration takes place along the mountain ridges, most probably because wind updrafts are created there. Depending on weather, the elevation of the flight can range from 50 to 100 and more meters above the ground.

There are slight differences between space patterns of spring and autumn migrations (see Fig 3 and Fig 4). Based on those patterns the areas of higher risk can be determined (see Fig 5).

Fig. 1. Relief map of the proposed power line

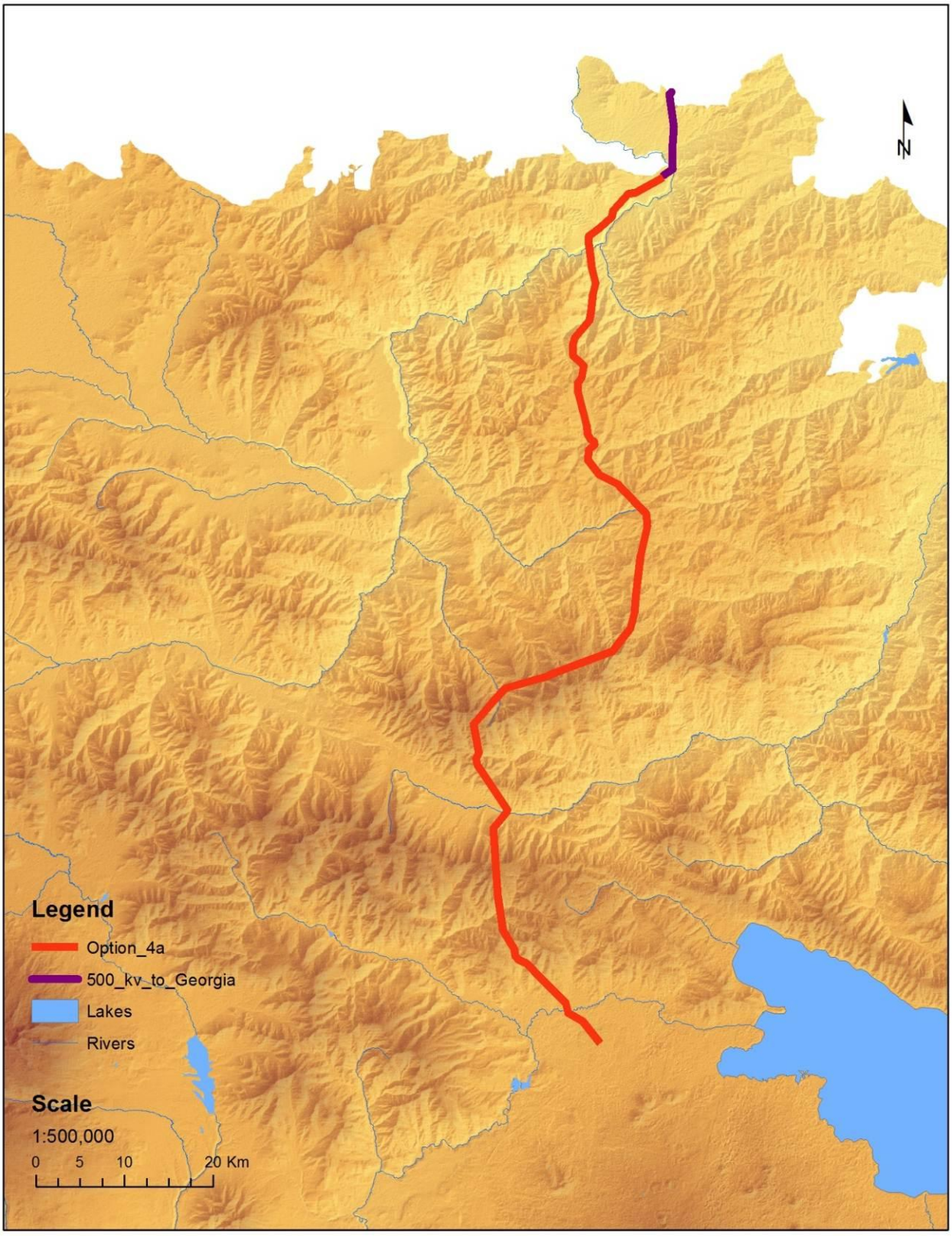


Fig. 2. Three-dimension map of the proposed power line

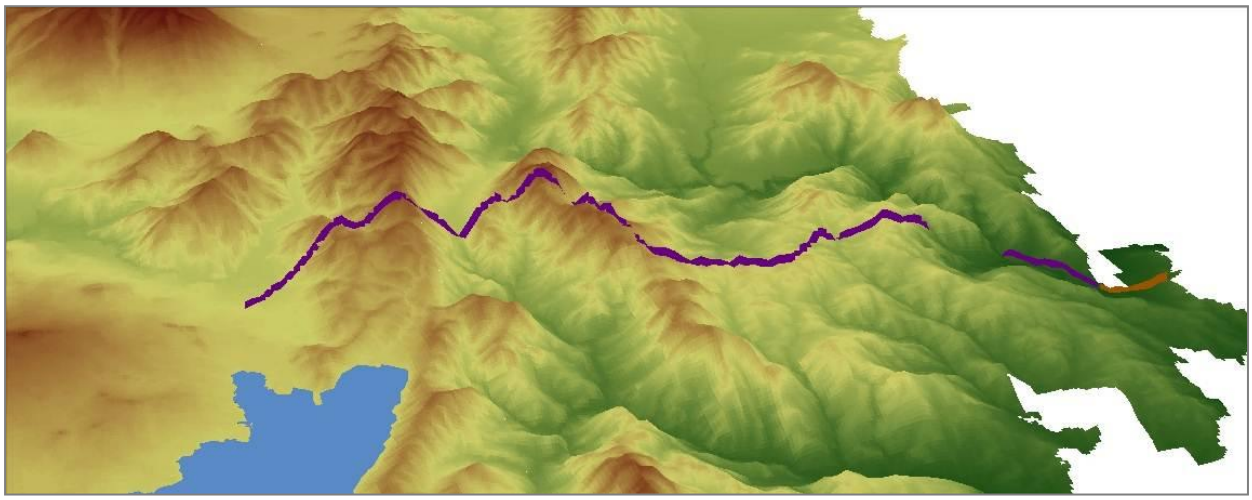


Fig. 3. Spring migration pattern at the area of the proposed power line

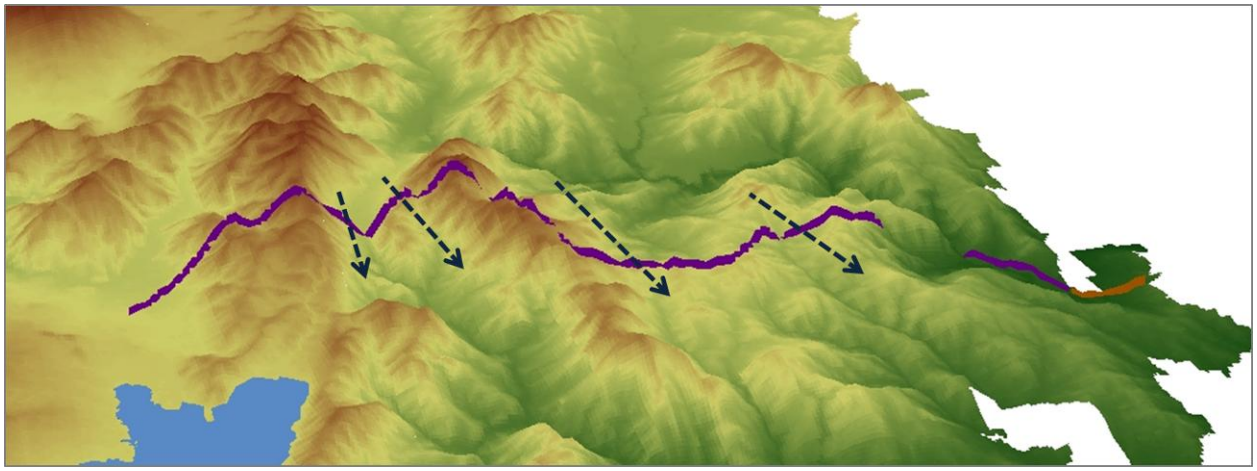


Fig. 4. Autumn migration pattern at the area of the proposed power line

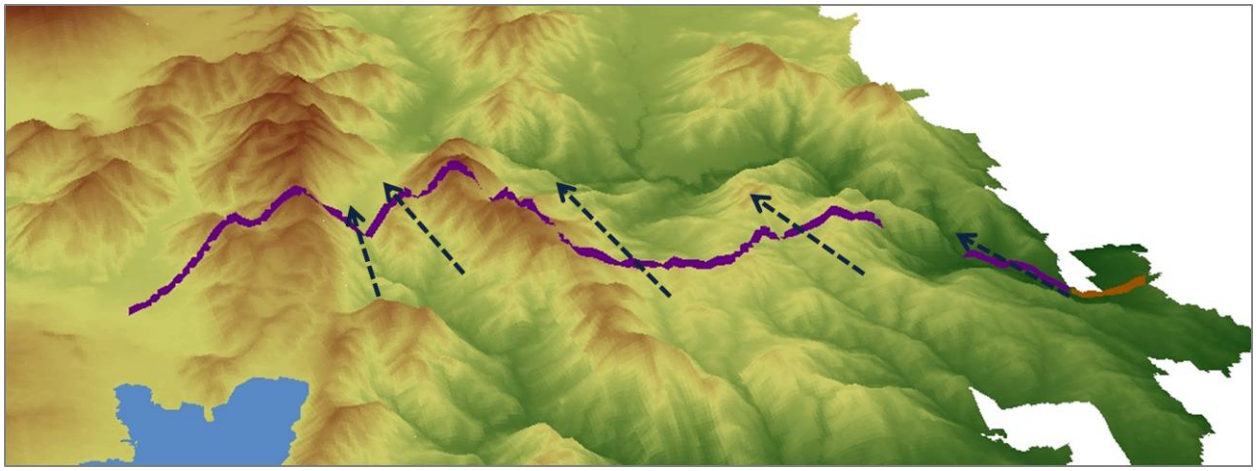
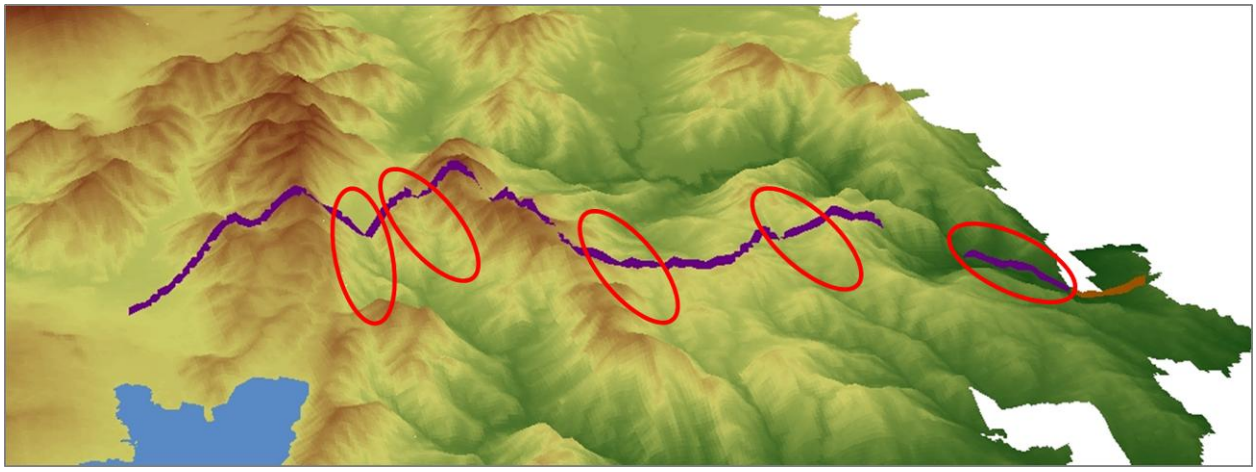


Fig. 5. Areas of higher risk along the proposed power line



The species composition along the entire power line is the same however the abundance of various species is different. Table 2 demonstrates tentative frequency of occurrence of various bird species. It is important to mention that accuracy of data (due to its scarcity) is still low; for higher accuracy of the data extensive longer-term monitoring of both fall and spring migration should be conducted.

Table 2. Frequency of occurrence of various bird species.

Latin names	English names	Occurrence on migration
CICONIIDAE		
Ciconia nigra	Black Stork	Regular
Ciconia ciconia	White Stork	Regular
ACCIPITRIDAE		
Pernis apivorus	European Honey-buzzard	Abundant
Milvus migrans	Black Kite	Occasional
Milvus milvus	Red Kite	Regular
Haliaeetus albicilla	White-tailed Eagle	Occasional
Neophron percnopterus	Egyptian Vulture	Regular
Circaetus gallicus	Short-toed Snake-eagle	Regular
Circus aeruginosus	Western Marsh-harrier	Regular
Circus cyaneus	Northern Harrier	Rare
Circus macrourus	Pallid Harrier	Rare
Circus pygargus	Montagu's Harrier	Regular
Accipiter gentilis	Northern Goshawk	Rare
Accipiter nisus	Eurasian Sparrowhawk	Regular
Accipiter brevipes	Levant Sparrowhawk	Regular
Buteo buteo	Common Buzzard	Abundant
Buteo rufinus	Long-legged Buzzard	Regular
Buteo lagopus	Rough-legged Buzzard	Occasional
Aquila pomarina	Lesser Spotted Eagle	Regular
Aquila clanga	Greater Spotted Eagle	Occasional

Latin names	English names	Occurrence on migration
Aquila nipalensis	Steppe Eagle	Regular
Aquila heliaca	Imperial Eagle	Rare
Aquila chrysaetos	Golden Eagle	Rare
Hieraaetus pennatus	Booted Eagle	Regular
PANDIONIDAE		
Pandion haliaetus	Osprey	Rare
FALCONIDAE		
Falco naumanni	Lesser Kestrel	Regular
Falco tinnunculus	Common Kestrel	Regular
Falco vespertinus	Red-footed Falcon	Rare
Falco columbarius	Merlin	Rare
Falco subbuteo	Eurasian Hobby	Regular
Falco cherrug	Saker Falcon	Occasional
Falco peregrinus	Peregrine Falcon	Rare
GRUIDAE		
Grus grus	Common Crane	Regular
Anthropoides virgo	Demoiselle Crane	Abundant

Conclusion

There are 34 migratory soaring species recorded along the proposed path of the power line. The high risk areas are related to the slopes of mountain ridges which are crossed by the power line; in such areas the flight of raptors in unfavorable weather conditions might be as low as 50 m, which significantly increases collision probability. Species composition of migratory soaring birds along entire power line is same, however some of the species occur rarely or occasionally (14 out of 34). The other 20 species occur regularly during spring and autumn migrations with a moderate to high number.

11.4 Appendix IV: Internationally Used Standards / Limit Values concerning Electric and Magnetic Fields (50 Hz) for the Public and at Working Places

Source	El. Field strength [kV/m]	Magn. Flux density [µT]
ICNIRP recommended 50/60 Hz		
Reference levels for exposure to time-varying electric and magnetic fields (unperturbed r.m.s. values)		
occupational exposure*	10	500
general public exposure	5	100
Limit values according to the European Directive 2004/40/EC		
exposure of workers*	10	500
Limit (r.m.s) value as per 26. BimSchVer 12/96		
general public up to 24 hours /day	5	100
Limit values as per VDE V 0848 Part 4/A3 at 50 Hz		
r.m.s. values for equivalent field strength in exposure range 1 for exposure times up to 1 h/d	30	4,240
r.m.s. values for equivalent field strength in exposure range 1 for exposure times up to 2 h/d	30	2,550
r.m.s. values for equivalent field strength in exposure range 1 for continuous exposure	21.32	1,360
r.m.s. values for equivalent field strength in exposure range 2	6.67	424

* exceedance of value requires specific actions
r.m.s. = root mean square (value)
Exposure range 1 includes monitored areas, e.g. operating zones, areas monitored by operators generally accessible areas, in which, owing to the operating mode or the length of stay, it is guaranteed that exposure only occurs for a short period of time
Exposure range 2 includes all areas in which not only short-term exposure can be expected, for example: areas containing residential and social buildings, individual residential sites, parks and facilities for sport, leisure and relaxation, operating zones where a field generation is not expected under normal conditions
(ICNIRP=International Commission on Non-Ionizing Radiation Protection, BImSchVer=German Bundesimmissionsschutzverordnung, VDE=Verband Deutscher Elektrotechniker e.V., Cenelec=European Committee for Electrotechnical Standardisation)

11.5 Appendix V: Sulfur Hexafluoride (SF_6)

SF_6 as Greenhouse Gas

Sulfur hexafluoride (SF_6) is used in GIS circuit breakers and within whole GIS substations. This gas is an effective gaseous dielectric that allows the safe transmission and distribution of electricity. SF_6 provides excellent insulation and arc quenching performance. SF_6 gas itself is an inert gas which has no influence on humans, animals or plants. However, as a result of the electric arc, extremely small traces of agents detrimental to health may be formed.

On the other hand, SF_6 is a very highly effective and persistent greenhouse gas (substances absorbing infrared). One ton of SF_6 corresponds to about 23,900 tons of CO_2. Once emitted into the atmosphere it lasts more than 3,000 years (!) until SF_6 is disintegrated by energy rich UV radiation.

Up to now, the effects of SF_6 in the atmosphere are minor compared to other industrial ozone-destroying substances. The total worldwide quantitative contribution to global warming of SF_6 is below 0.1 % with respect to the other man-made greenhouse gases (for the European Community it is guessed to be about 0.05 %). However, actually the SF_6 concentration in the atmosphere is increasing (an exponential increase in the late 90ties and a slight decrease since beginning of this century is reported) what requires consequently specific carefully handling with this substance.

General Sulfur Hexafluoride (SF_6) Guidelines

Some guidelines for proper handling of SF_6 are given below (there are other equivalent guidelines existing that can be used depending from which country the supplier is coming):

- DIN EN 60376 ‘Specification of technical grade sulfur hexafluoride (SF_6) for use in electrical equipment’
- DIN EN 60480 ‘Guidelines for the checking and treatment of sulfur hexafluoride (SF_6) taken from electrical equipment and specification for its re-use’
- IEC 62271-4: High-voltage switchgear and control gear. Handling procedures for sulphur hexafluoride (SF_6) and its mixtures.

The amount of SF_6 emitted during the operational phase by GIS stations will be absolutely minimized if:

- Best Available Technique (BAT) is used.
- The guidelines mentioned above are followed.
- The recommendations of the International Council on large Electric Systems (CIGRE: SF_6 Task Force: Handling and given Recycling of SF_6 Mixtures) are taken into consideration (www.cigre.org).

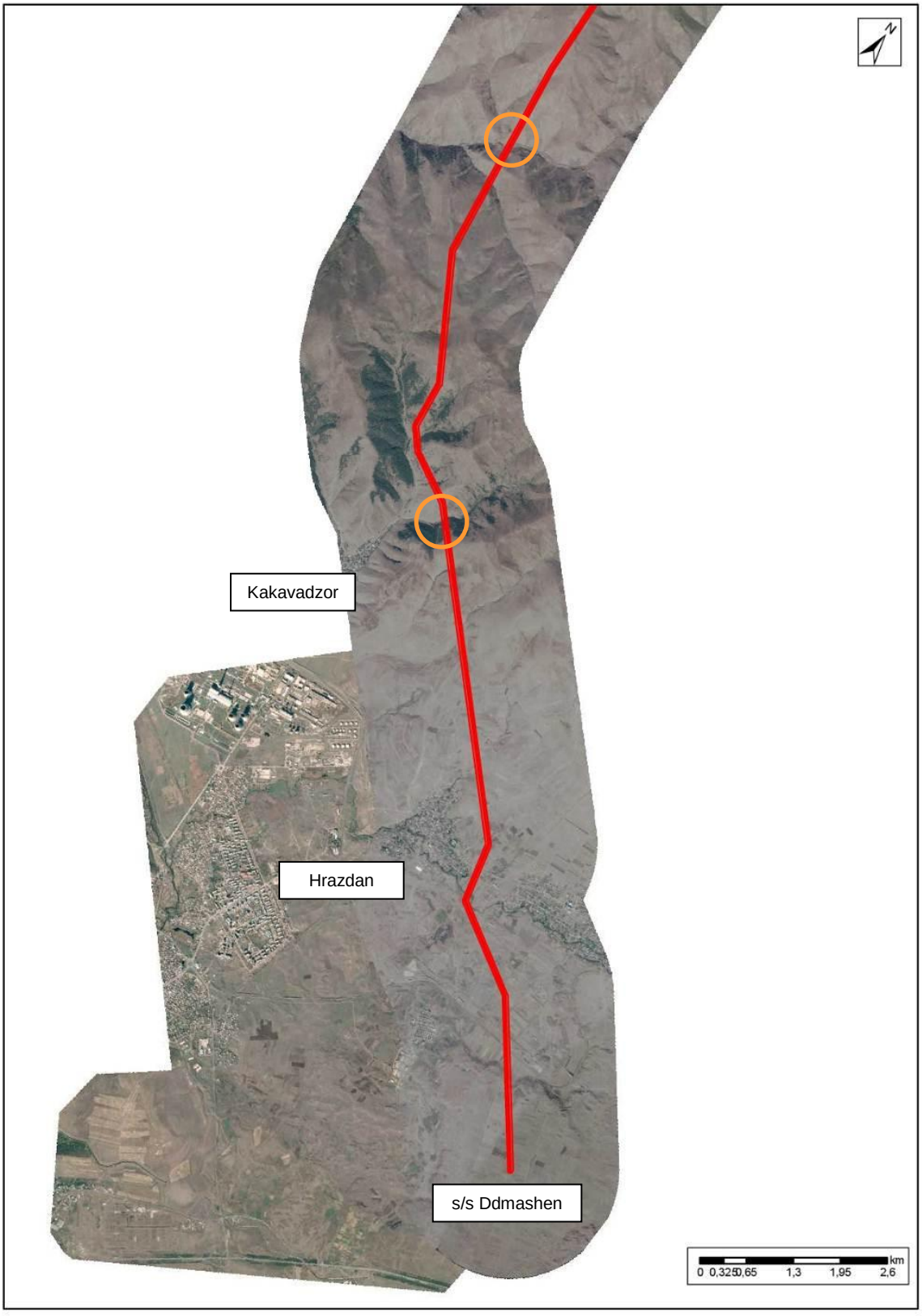
- ISO 14040 is followed.
- Detectors indicate immediately any leak from which SF_6 will be emitted.

A detailed description of handling and maintenance SF_6 circuit breakers is given in:

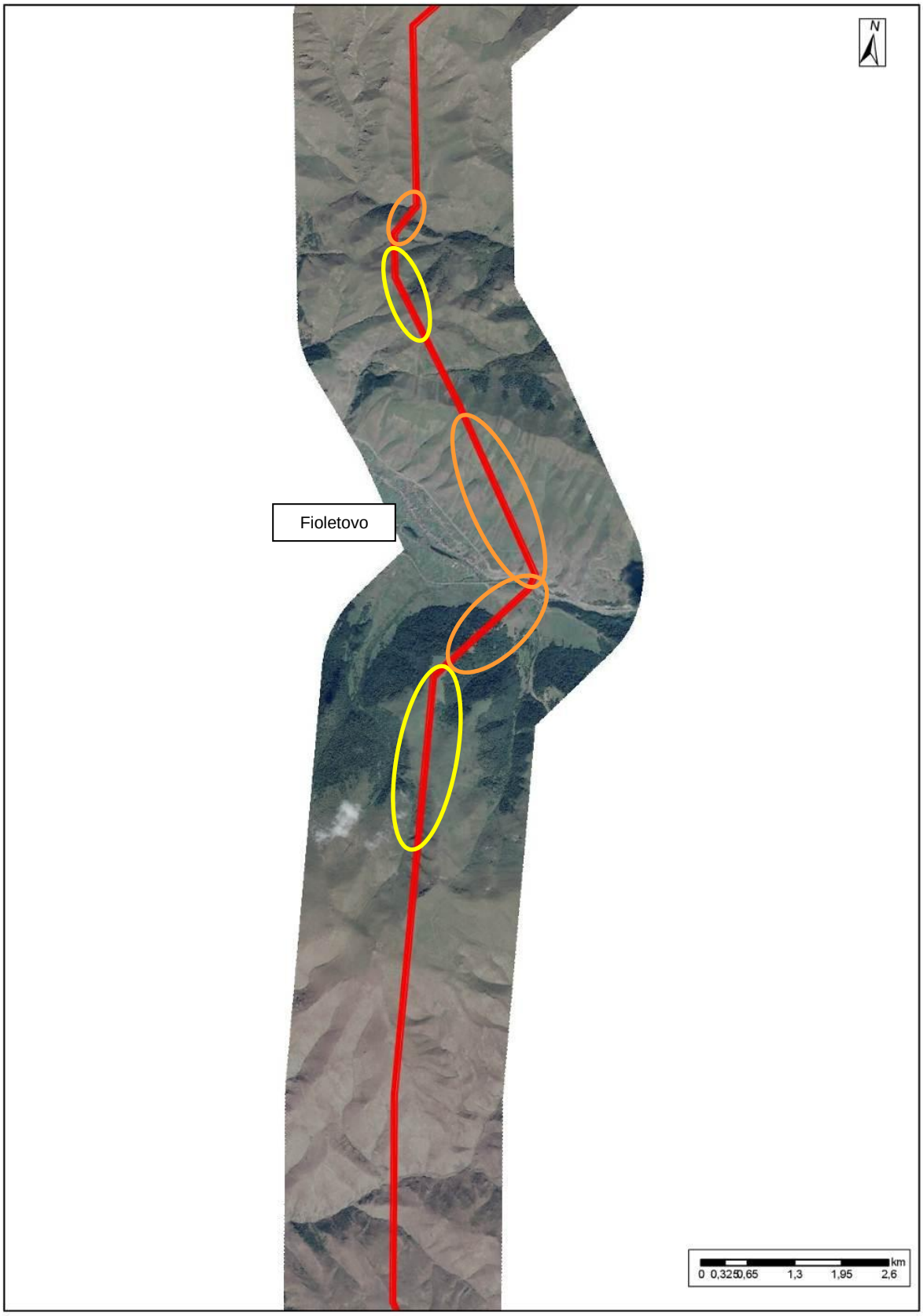
- Hydroelectric Research and Technical Services Group – United States Department of the Interior Bureau of Reclamation Denver, Colorado: Facilities Instructions, Standards and Techniques Vol. 3-16. Maintenance of Power Circuit Breakers.[1]

[1] http://www.usbr.gov/power/data/fist/fist3_16/fist3-16.pdf

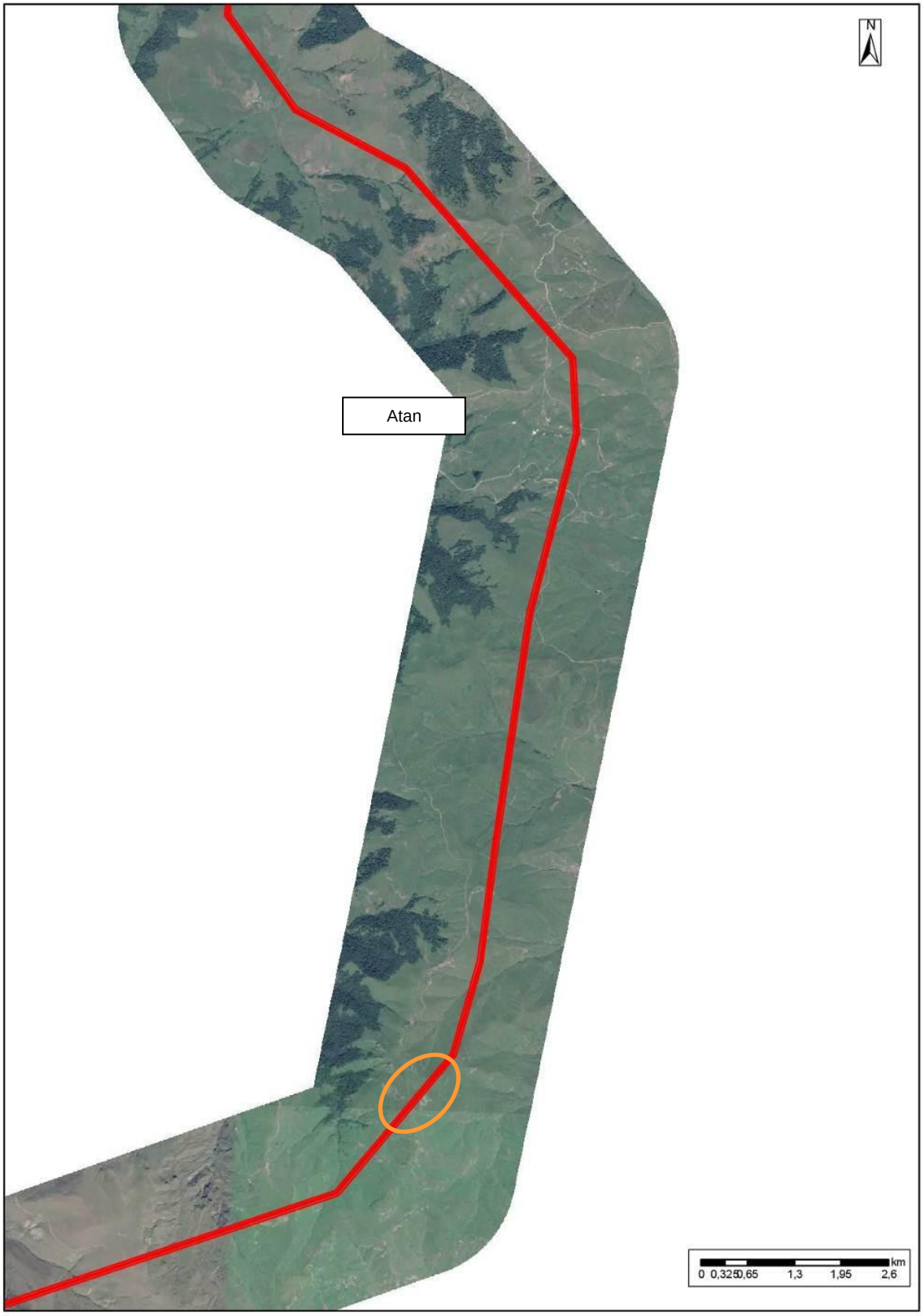
11.6 Appendix VI: Maps indicating location for installation of bird



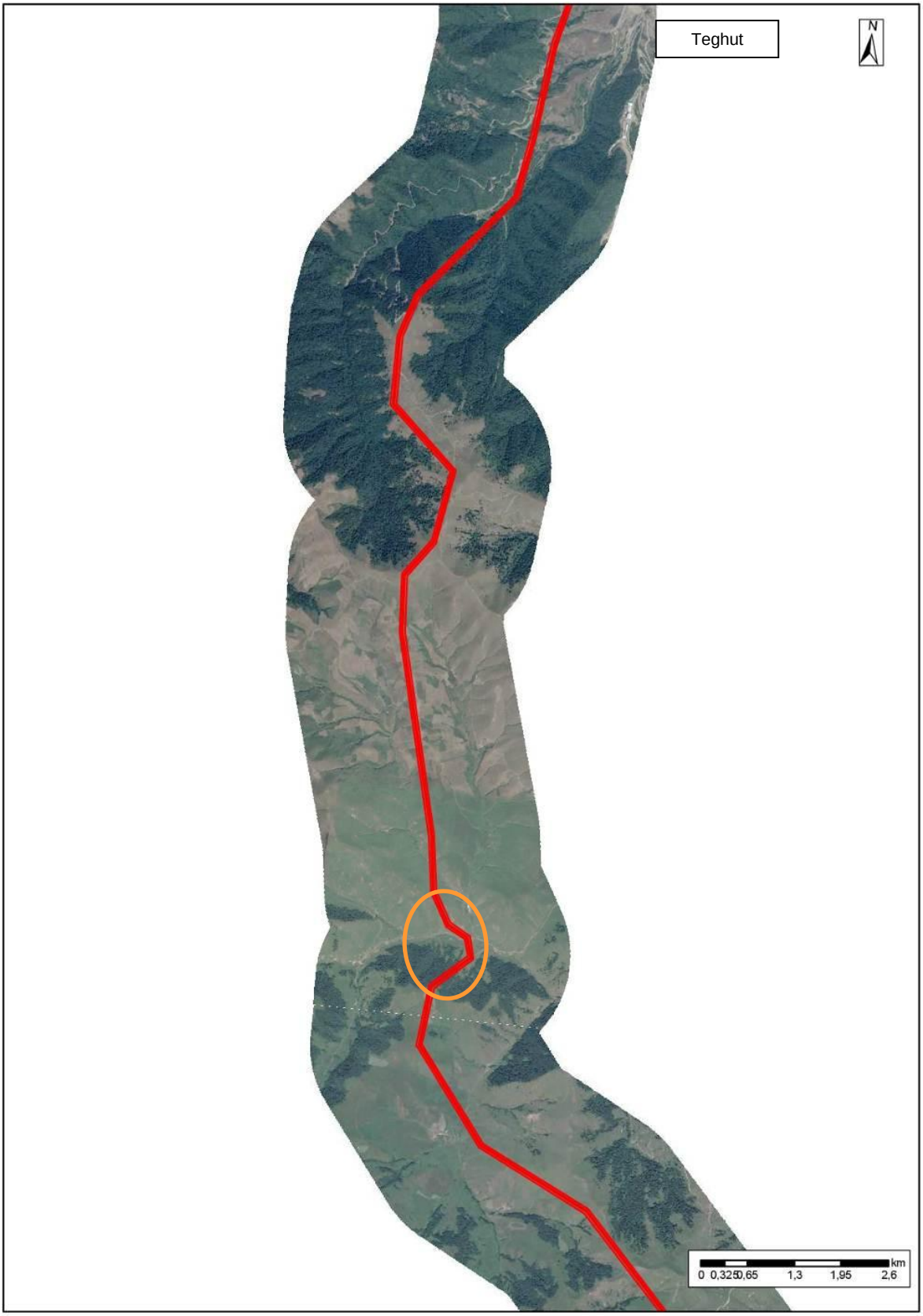
Map 11-1: Line sections of planned 400 kV OHL (Option 4a) where bird diverters shall be installed (orange circles: installation at the ground wire)



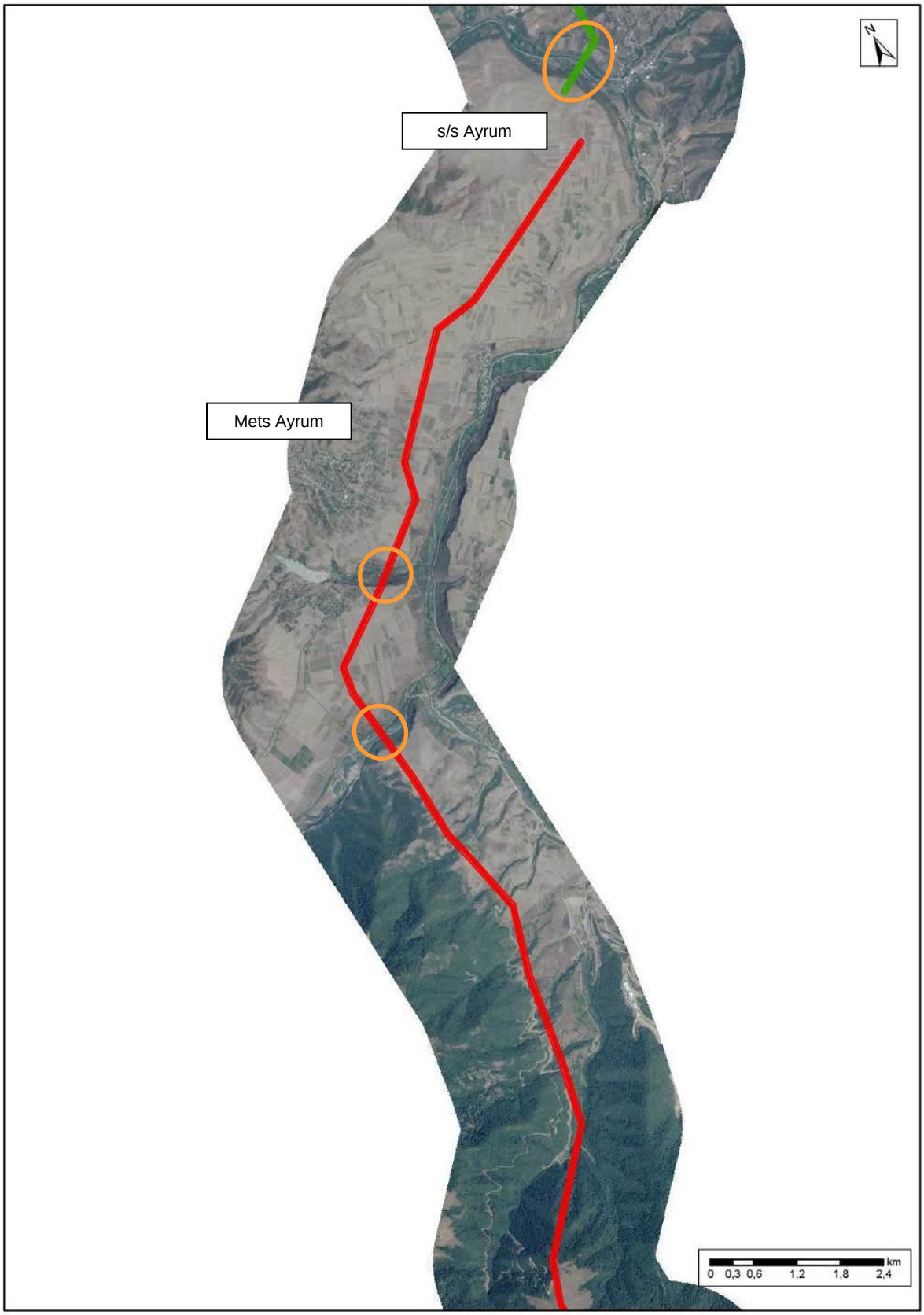
Map 11-2: Line sections of planned 400 kV OHL (Option 4a) where bird diverters shall be installed (orange circles: installation at the ground wire; yellow circles: installation at the lowest conductors)



Map 11-3: Line sections of planned 400 kV OHL (Option 4a) where bird diverters shall be installed (orange circles: installation at the ground wire)



Map 11-4: Line sections of planned 400 kV OHL (Option 4a) where bird diverters shall be installed (orange circles: installation at the ground wire)



Map 11-5: Line sections of planned 400 kV OHL (Option 4a) and 500 kV where bird diverters shall be installed (orange circles: installation at the ground wire)

11.7 Appendix VII: Contents of a Biodiversity Action Plan (BAP)

1 Introduction
1.1 Overview
1.2 Management area for this BAP
1.3 Purpose and objectives of the BAP
1.4 Company strategy, policy, standards and guidelines

Chapter 1 Note: This chapter defines the project site and boundaries as well as outlines the objectives for the BAP. A BAP should also align with the aims, objectives and priorities of regional and local action plans where they exist.

2 Biodiversity baseline data
2.1 Summary of baseline data
2.2 Data gaps
2.3 Identification of actions required

Chapter 2 Note: This chapter should include a summary of the baseline data collected and identify any data gaps that would be needed to determine suitable mitigation measures that would ensure protection of biodiversity values. This chapter should describe the species, habitats and ecosystems (occurrence and services) that need special management, taking into account international, national and local priorities.

3 Risk assessment
3.1 Habitat loss – Habitat types
3.2 Habitat loss – Species specific
3.3 Habitat degradation and fragmentation (including invasive species)
3.4 Hunting and poaching
3.5 Mortality
3.6 Fire

Chapter 3 Note: This chapter should summarize the key threats to biodiversity values that may occur as a result of project implementation. As the BAP may be used as a stand-alone document and be updated throughout the life of the construction and operational phases of the Project it is of utmost importance that these risks are listed within the BAP.

4 Stakeholder consultation and community engagement
4.1 Summary of stakeholder consultation
4.2 Data gaps
4.3 Identification of actions required

Chapter 4 Note: This chapter should describe the stakeholder consultation effort particularly in relation to the development of the BAP including local community, local and international experts, etc. Stakeholder engagement can help a company build trust, manage expectations, promote a partnership approach and allow companies to enjoy a better working environment, avoid conflict, foresee and prevent potential problems and improve their global business reputations. Actions identified should consider continuous open dialogues with 'community forests' stakeholders as they will play an integral role in the offset planning and implementation stage e.g. employment/ consultation for forest rehabilitation.

5 Management measures
5.1 Management program
5.2 Responsibilities
5.3 Biodiversity monitoring

Chapter 5 Note: This chapter should describe the management program (i.e. identified actions required) aimed at achieving the objectives of the BAP. This should include prioritization of actions with set targets including specific indicators, time frame and responsibilities against which monitoring of actions/progress can be undertaken. Continuous monitoring allows assessment of the effectiveness of each action and identify where changes to management are required.

6 Evaluation of the BAP

Chapter 6 Note: This chapter should describe the assessment of the efficacy of the BAP in achieving the identified objectives. This is essentially a process of verification and improvement of the BAP. A local but independent review panel should be constituted with the mandate to evaluate the approach used within the BAP and assess its implementation.

11.8 Appendix VIII: Public Consultation Meeting

The Draft ESIA and RPF Reports to the 'Caucasus Energy Network Project' have been disclosed on 13th September 2016. The documents were published on the HVEN website in both Armenian and English, and Armenian hard copies were submitted to all affected communities.

The Public Consultation meeting has been conducted at Lori Region Administration in Vanadzor city on 23 September 2016. Respective announcements were sent to local authorities via email and posted on the announcement desk of the municipalities ten days before the Public Consultation meeting. Local NGOs were informed via emails and directly contacted through Aarhus Center. Additionally an announcement of the Public Consultation Meeting was published in "Republic of Armenia" newspaper.

At the public consultation meeting, the Consultant held a non-technical introduction (with slides) presenting the results of the ESIA. This introduction was held with simple, non-technical words understandable also for not highly educated people. It was held in English and translated consecutively in Armenian language. All questions raised in Armenian were translated into English language; the answers to these questions were also translated consecutively into Armenian. The slides to the presentation were given in Armenian.

This introduction presented a project description, stated who did the investigation, and it gave information about the method of investigation and the method of assessment. Analysis of different line routing alternatives of 400 kV OHL was presented and the advantages of the preferred option were demonstrated. Environmental and social impacts of the Project were communicated and some examples were shown in detail, measures for mitigation and their monitoring were introduced, and recommendations were presented. The ESMP and Grievance Redress Mechanism were also introduced and the provisions of the Resettlement Policy Framework explained. After the introduction the discussion started. The questions raised and the corresponding answers of the meeting are given in the following.

Public Consultation Meeting at Vanadzor 23.09.2016

Questions / Concerns raised and Answers

Question / Concerns	Participant	Answers
Why has the NGO Armenia Tree Project (ATP) been chosen for additional replanting of trees? Would it not be better to have a tender process?	Gagik Amiryan, NGO Armenian Green Cross	In the ESIA replanting of trees by Hayantar SNCO is given as mitigation measure. Due to the high value of the remaining forests in Armenia, an additional tree planting is recommended. Wording in ESIA will adapted accordingly in order not to be fixed on NGO ATP.
What is the origin of transmitted energy, i.e. whether it is generated locally or only transmitted (via the territory of the country)?	Perch Bojukyan, Head of NGO Vanadzor Aarhus Center	There are transit OHLs which will connect energy systems of Iran, Georgia, Armenia and Russia.
Is it possible to use the old OHLs, constructed and operated in the Soviet time, which connected Soviet Caucasian republics?	Mamikon Ghasabyan, Director of NGO Armenian Society for the Protection of Birds (ASPB)	There are old OHLs that are still in operation, however, these are 220 kV lines, whereas, the envisaged new OHL is 400/500 kV, i.e. of higher capacity.
Would it be possible to use already existing OHLs in order to avoid crossing the forests?	Lucineh Kassarjian, Country Director of NGO Armenia Tree Project (ATP)	There are no existing OHLs along the selected route option from Ayrum to Ddmashen which could be used.
How was the area of agricultural land determined, which will be crossed by OHLs?	Sahak Nazaryan, Head of Mets Ayrum Community	Land use of the corridor has been roughly determined by interpretation of high resolution satellite pictures for overview purposes. However, during surveys for preparation of Resettlement Action Plans all affected areas will be considered individually.
Which are the basic principles that will be used for land acquisition?		It was clarified that Resettlement Action Plans will be developed for individual areas based on the Resettlement Policy Framework (RPF).
Will the ionized field degrade the areas adjacent area to OHLs?	Artak Demirchyan, Head of Nature Protection Division of the Lori Regional Administration	All steps to exclude or minimize potential impact of ionized field on humans, flora and fauna are considered during the route design and respective mitigation measures are given in the ESIA and Environmental and Social Management Plan (ESMP).

Question / Concerns	Participant	Answers
Change the name of Ayrum substation and call it Chochkan substation, as it is located in Chochkan community.	Zhora Andreasyan, Representative of Chochkan Community	The concern will be discussed.
Will land for construction of access roads be expropriated?	Sahak Nazaryan, Head of Mets Ayrum Community	Land for construction of permanent access roads (if any) will be expropriated and compensated according to Resettlement Policy Framework (RPF).

The Participants at Vanadzor Public Consultation Meeting

No.	Name	Institution
1	Armen Shahverdyan	Senior Specialist of Local Self-Governance Division of Lori Regional Administration
2	Mamikon Ghasabyan	Armenian Society for the Protection of Birds (NGO), Director
3	Zhora Andreasyan	Assistant to Head of Chochkan Community
4	Vanik Qaryan	Representative of Tumanyan Community
5	Roland Hakobyan	Representative of Atan Community
6	Ararat Abrahamyan	Representative of Fioletovo Community
7	Gagik Amiryan	Armenian Green Cross (NGO)
8	Garegin Gevorgyan	Director of Northern Branch of HVEN CJSC
9	Harutyun Aslanyan	Representative of Lori Regional Administration
10	Hovik Sahakyan	Head of Shnogh Community
11	Hasmik Darchinyan	Specialist of Nature Protection Division of Lori Regional Administration
12	Sahak Nazaryan	Head of Mets Ayrum Community
13	Perch Bojukyan	Head of Vanadzor Aarhus Center (NGO)
14	Karen Sardaryan	Chief Specialist of Margahovit Community
15	Artem Kharazyan	Project Administrator, Fichtner
16	Suren Zarabekyan	Deputy Head of Gugarq Forestry
17	Artur Gharajyan	Specialist of Gugarq Forestry
18	Lusine Zaqaryan	Sociologist of HVEN CJSC
19	Tigran Oganezov	Chief Environmentalist of HVEN CJSC
20	Hasmik Khachoyan	Environmentalist of HVEN CJSC
21	Lucineh Kassarjian	Armenia Tree Project (NGO), Country Director
22	Arthur Harutyunyan	Armenia Tree Project (NGO), Deputy Director
23	Detlev Paulsch	Environmental Expert of Fichtner
24	Raya Babayan	Specialist of HVEN CJSC
25	Artak Demirchyan	Head of Nature Protection Division of Lori Regional Administration
26	Armen Larabajyan	Representative of Lori Regional Branch of the Ministry of Nature Protection of RA
27	Samvel Kharatyan	Senior Specialist of Nature Protection Division of Lori Regional Administration

Conclusion

The Public Consultation meeting was successfully conducted with a good participation. Most of the affected communities were represented by their community leaders or their representatives. Representatives of NGOs also participated actively in the discussion.

Recommendations from the Public Consultation Meeting

- There should be a tender process implemented regarding the recommended additional tree planting by an environmental NGO
- Change the name of Ayrum substation and call it Chochkan substation, as it is located in Chochkan Community

Photos from Public Consultation Meeting at Vanadzor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FICHTNER
2. ՇՄՄՍԳ-ի և ՏՓԾ-ի նպատակները և հիմնական
բովանդակությունը (II)
• ՏՓԾ (Տարաբնակեցման քաղաքականության շրջանակ)
• Փոխհատուցման վճարումների համար շրջանակ և ավելի ուշ՝
ՏԿԾ (Տարաբնակեցման գործողությունների ծրագիր)
պատրաստում, պարզաբանելով տարաբնակեցման սկզբունքներն
ու կազմակերպչական կարգավորումները:
• Տարաբնակեցման գնահատ գծի նախընտրելի ծրագծի համար:
• Ամբողջ գծի և նեթակայանների գոտվելու վայրերի դաշտային
ուսումնասիրություն, ներառյալ հնարավոր ազդակիր
բնակչության ներկայացուցիչների հետ քննարկումներ և
հարցազրույցներ շահառուների հետ ազդակիր շրջաններում:
• Դաշտային ուսումնասիրությունը լրացվել է արբանեկանի
պատկերների մանրամասն վերլուծությամբ, ինչպես նաև
օդնկարային և ինստիտուցիոնալ շրջանակի վերլուծությամբ: