

*June 4, 2015*

# **High Voltage Electric Networks**

## **Electricity Supply Reliability Project**

### **Replacement of Lalvar and Noyemberyan 110 kV OTLs**



**Environmental and Social Impact Assessment**

**Final Draft Report**

Sarweystraße 3  
70191 Stuttgart • Germany  
Phone: + 49 711 8995-0  
Fax: + 49 711 8995-459  
[www.fichtner.de](http://www.fichtner.de)

**Please contact: Birgit Oellbrunner**  
**Extension: - 705**  
**E-mail: Birgit.Oellbrunner@Fichtner.de**

## Table of Contents

<b>1. Executive Summary</b>	<b>5</b>
1.1 Project Description	5
1.2 Objectives and Methodology of the ESIA	6
1.3 Legal and Regulatory Framework	7
1.4 Institutional Framework	8
1.5 Analysis of Alignment Alternatives	8
1.6 Baseline Conditions	9
1.7 Information, Disclosure, Consultation, and Participation	11
1.8 Impact Assessment	12
1.9 Environmental and Social Management Plan	12
1.10 Grievance Redress Mechanism	16
1.11 Costs of Implementation of the ESMP	16
<b>2. Project Description</b>	<b>18</b>
2.1 Project Context	18
2.2 Technical Design and Scope of Works for OTLs Replacement	18
2.3 Location of Lalvar and Noyemberyan OTLs	20
<b>3. Objectives and Methodology of the ESIA</b>	<b>22</b>
3.1 Scope and Objectives of the ESIA	22
3.2 Procedures and Methodology	22
<b>4. Legal and Regulatory Framework</b>	<b>24</b>
4.1 National Requirements	24
4.2 International Agreements	30
4.3 International Requirements	31
<b>5. Institutional Framework</b>	<b>32</b>
<b>6. Analysis of Alignment Alternatives</b>	<b>34</b>
6.1 Alternatives for Line Routing	34
6.2 Recommended bypasses	35
<b>7. Baseline Conditions</b>	<b>43</b>
7.1 General Environment and Ecology	43
7.1.1 Study Area	43
7.1.2 Topography	44

7.1.3	Meteorology and Climate	45
7.1.4	Geology and Seismicity	46
7.1.5	Soils	48
7.1.6	Water Resources	48
7.1.7	Flora and Fauna	49
7.1.8	Forests	50
7.1.9	Landscape	51
7.1.10	Protected Areas	52
7.1.11	Waste Management in Armenia	52
7.2	Socio-economic Conditions	53
7.2.1	Population in the Study Area	53
7.2.2	Historical and Cultural Sites	54
7.2.3	Gender Aspects	54
7.2.4	Land Use Pattern and Agriculture	55
7.2.5	Living Standards	57
<b>8.</b>	<b>Information, Disclosure, Consultation, and Participation</b>	<b>58</b>
<b>9.</b>	<b>Environmental and Social Impacts and their Management</b>	<b>60</b>
9.1	Environmental Impacts and their Mitigation during Design	60
9.1.1	Line routing	60
9.1.2	Access Roads	60
9.2	Environmental Impacts and their Mitigation during Construction	61
9.2.1	Landscape	61
9.2.2	Flora and Fauna	62
9.2.3	Soil Erosion	63
9.2.4	Soil and Water Resources	65
9.2.5	Solid Waste	66
9.2.6	Noise	67
9.2.7	Air Quality	67
9.3	Environmental Impacts and their Mitigation during Operation	67
9.3.1	Flora	67
9.3.2	Fauna	68
9.3.3	Noise	73
9.3.4	Climate Change	73
9.3.5	Electric and Magnetic Fields	73
9.4	Social Impacts and their Mitigation during Construction	74

9.4.1	Land Use and Land Acquisition	74
9.4.2	Involuntary Resettlement	76
9.4.3	Historical and Cultural Sites	77
9.4.4	Health and Safety	79
9.4.5	Infrastructure	80
9.4.6	Gender Aspects	81
9.4.7	Vulnerable People	81
9.4.8	Local Workforce	82
9.5	Social Impacts and their Mitigation during Operation	82
9.5.1	Land Use	82
9.5.2	Electricity Supply	82
9.6	Summary of Impacts	83
<b>10.</b>	<b>Environmental and Social Management Plan</b>	<b>85</b>
10.1	Mitigation Measures	86
10.1.1	Mitigation Measures for the Design and Pre-Construction Phase	86
10.1.2	Mitigation Measures for the Construction Phase	87
10.1.3	Mitigation Measures for the Operation and Maintenance Phase	97
10.2	Monitoring Measures	101
10.2.1	Monitoring Measures during Design and Pre-Construction Phase	101
10.2.2	Monitoring Measures during Construction Phase	103
10.2.3	Monitoring Measures during Operation and Maintenance Phase	103
10.3	Implementation Arrangements and Reporting Needs	123
10.4	Training of HVEN Staff	124
10.5	Grievance Redress Mechanism	124
10.6	Costs of Implementation of ESMP	127
<b>11.</b>	<b>References</b>	<b>129</b>
<b>12.</b>	<b>Appendices</b>	<b>130</b>
12.1	Appendix I: Record of Meetings and Field Visits	130
12.2	Appendix II: Impact Investigation List as presented to Tractebel Engineering	131
12.3	Appendix III: Internationally Used Standards / Limit Values concerning Electric and Magnetic Fields (50 Hz) for the Public and at Working Places	135

## Acronyms and Abbreviations

ACSR	Aluminum Conductor Steel Reinforced
AP	Angle Point
CC	Construction Contractor
CE	Consultant Engineer
dB	Decibel
EHS	Environmental, Health, and Safety
EIA	Environmental Impact Assessment
EMF	Electric and Magnetic Fields
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESRP AF	Electricity Supply Reliability Project - Additional Financing
ETNIP	Electricity Transmission Network Improvement Project
GDP	Gross Domestic Product
GPS	Global Positioning System
GRM	Grievance Redress Mechanism
HSEMS	Health, Safety, and Environment Management System
HSMP	Health and Safety Management Plan
HSMS	Health and Safety Management System
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
OP	Operational Policies
OPGW	Optical Fiber Ground Wire
OTL	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
SNCO	State Non-commercial Organization
ToR	Terms of Reference
USD	US Dollar
WB	World Bank

# 1. Executive Summary

## 1.1 Project Description

The World Bank is supporting the Government of Armenia with the strengthening of the power transmission network under the ongoing Electricity Supply Reliability Project (ESRP). Under ESRP, the High Voltage Electric Networks (HVEN), the power transmission company, is already replacing a 220 kV overhead transmission line from Hrazdan TPP substation to Shinuhayr substation. The replacement works are underway. There are savings under the ESRP, which the Government intends to use for replacement of 110 kV Noyemberyan Overhead Transmission Line (OTL) from the Alaverdi-2 220/110/35 kV substation to Noyemberyan 110/35 kV substation in Haghtanak village, and 110 kV Lalvar OTL from the same Alaverdi-2 substation to Noyemberyan substation with the T-branch to Sadakhlo substation in Georgia. Both OTLs run as two different OTL circuits through the same set of towers.

Those OTLs supply power to large electricity consumers in the North-Eastern part of Armenia. The above mentioned existing OTLs are around 50 years old and severely dilapidated, as confirmed by the results of a representative sample of metal tests. This jeopardizes the security and reliability of the power supply in the region.

All information concerning the conceptual design, including line routings, used in this ESIA report are provided by HVEN. The mitigation measures and the plan of monitoring of their implementation shall be reviewed and updated when the final technical design is produced. The detailed design will be prepared by the Design, Supply, and Installation Company to be hired by the State-owned company High Voltage Electricity Networks (HVEN).

The new 110 kV double circuit OTLs will run for approx. 25 km from the Alaverdi-2 220/110/35 kV substation in the northern central part of the Republic of Armenia (Lori Marz) to the 110/35 kV Noyemberyan substation in Haghtanak village in the north-east (Tavush Marz).

The new OTLs will include new double circuit towers and foundations, new aluminum conductor steel reinforced (ACSR) conductors, new optical fiber ground wire (OPGW), earthing at each tower site, new connections to the National Grid via the Alaverdi-2 substation, new connections to the Noyemberyan 110/35 kV distribution substation at Haghtanak and the T-connections from the new main OTL for Akhtala railway substation and Matur mining substation.

The new OTLs will be constructed in a new corridor (50 m width), with deviations from the existing corridor by around 50 m in some parts required in order to avoid settlements and sensitive natural receptors. The line routing features several wide over-spans of canyons. Most of the new tower locations have existing access tracks or roads. Land acquisition will be required in the locations where new towers will be placed, for constructing

extension to the Noyemberyan substation, and possibly for the construction of new access roads.

The existing 110 kV OTL shall be completely dismantled when the new line enters into operation. HVEN will be responsible for dismantling of the old OTLs and will finance the dismantling from its own funds.

According to HVEN, disconnecting of the existing lines from the grid will not be necessary during construction. Thus, no power outage will occur during construction works.

## 1.2 Objectives and Methodology of the ESIA

The proposed replacement of Lalvar and Noyemberyan OTLs 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 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 the ESIA of the replacement of Lalvar and Noyemberyan, OTLs, *Fichtner* set up the following multi-disciplinary team:

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

General overview about biophysical environment in the OTLs corridor was carried out through a desktop study, and a field survey was conducted by the environmental and social experts. This implied walk-through along the proposed corridor of the new OTLs, including some hotspots like the crossing of valleys, forested areas and villages affected by the new line corridor. No rare, endangered, endemic, or other animal and plant species of concern were found during the survey and none are indicated as being present by existing data.

Additional information was gained through consultations of representatives of governmental organizations and NGOs. Intensive consultations have also been conducted with members of the Historical and Cultural Monument Protection Agency of the Ministry of Culture and with members of the Ministry of Nature Protection. Additionally to the field survey, an evaluation of possible ecological and social impacts was performed by interpretation of satellite maps. A preliminary ESIA report was also used as an input for the present one. However, the line routing studied in the preliminary report significantly differed from the currently proposed



corridor as it ran parallel in quite some distance to the South from the chosen alignment.

An Impact Investigation List considering the most severe impacts was prepared and presented to HVEN, which is finalizing the technical feasibility study, in order to avoid some possible impacts at the planning stage.

### 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 World Bank OP 4.01, the Project falls into environmental Category B and also requires EIA and environmental management planning. 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 following safeguard policies of the WB are triggered for the proposed works:

- OP 4.01 - Environmental Assessment
- OP 4.04 - Natural Habitats
- OP 4.11 - Physical Cultural Resources
- OP 4.12 - Involuntary Resettlement

World Bank/IFC General EHS Guidelines and in particular Guidelines for Electric Power Transmission and Distribution, 2007 also apply.

## 1.4 Institutional Framework

HVEN is an implementing agency for ESRP and will be responsible for all operations under the Project, including its compliance with the national environmental and social legislation and the World Bank's safeguard policies. Government agencies that are likely to be involved into the Project implementation according to their mandates include the Ministry of Nature Protection and the Ministry of Culture.

## 1.5 Analysis of Alignment Alternatives

Four routing alternatives were considered based on their scope of environmental interference and involuntary resettlement:

Alternative 1: This proposed new route would be within 50 m on the north side of the existing 110 kV corridor from Alaverdi-2 substation, crossing the existing corridor in Haghpat area and runs within 50 m on the south side of the existing 110 kV corridor to Noyemberyan substation. **This route option has been chosen as the preferred option**, because it is economically viable and carries minimal environmental and social impacts. The crossing of the existing corridor from north to south before the route reaches the Akhtala area is essential because of the congestion that occurs due to the existing 35 kV, 110 kV, 220 kV and some 6 kV OTLs. There are existing access roads / tracks that will represent 80 % of the total, which are presently known to the maintenance personnel.

Alternative 2: This new route would be installed between the existing 110 kV and 220 kV OTLs from Alaverdi-2 substation crossing the corridor in Akhtala area and running then within 50 m on the south side of the existing corridor to Noyemberyan substation. Negative impacts of this route option would impact on the cost of design and construction and the practicality of maintenance. The crossing of the existing corridor is foreseen in the Akhtala area in this option and for this purpose there are some non-standard items to be envisaged in the design. This option will for a part of its route be immediately adjacent to the existing 110 kV OTL, which is no problem for the construction, but there would be an amount of dismantling of existing 110 kV tower structures before the new line could be put into service. Total shut downs are therefore a necessity for this option. Environmental and social impacts of this alternative are about the same as for Alternative 1. Thus, Alternative 2 is not preferred, due to non-environmental /social reasons.

Alternative 3: This new route would take a northerly direction from Alaverdi-2 substation crossing road M6 and Debed River, then continuing to Akhtala area. Then the route again crosses Debed River, road M6 and the existing 110 kV corridor. After that it continues within 50 m on the south side of the existing 110 kV corridor to Noyemberyan substation. This route option was carefully reviewed because it is a totally new route from Alaverdi-2 substation to Akhtala area. There are some major concerns with the new route: the route is approx. 4 km longer than Alternatives 1 and 2 and additional tree clearance as well as additional access road construction

is required. Similar to Alternative 2 there are non-standard items envisaged in the design because of the new route is in a mountainous area on the north side of the road M6 and the Debed River, and in the Akhtala area. The latter is unavoidable for both options 2 and 3 because this is a congested area with the 35 kV and 6 kV OTLs that are close to the south side of road M6 and with few locations for making a satisfactory crossing of the existing corridor.

Alternative 4 (No-Project Alternative): No replacement of the 110 kV OTLs Lalvar and Noyemberyan. This alternative would not result in any forest felling and resettlement activities, but is not feasible because the existing OTLs are old (around 50 years) and severely dilapidated. This jeopardizes the security and reliability of power supply in this region.

## 1.6 Baseline Conditions

Lalvar and Noyemberyan OTLs are located in the province Lori Marz (northern Armenia), a small part is situated in the province Tavush Marz (northeast Armenia).

Starting from Alaverdi-2 substation the 110 kV OTLs run across the grass-plain of Sanahin high above the river Debed. The OTLs cross two canyons, pass on the western edge of village Haghpat, cross further plains, cross several valleys and traverse the steep forested slopes on the southern side of Debed River Gorge, where a T-off to the Akhtala railway substation is planned. At the valley of Neghots they over-span the gorge - at the bottom of which the settlement is located - and continue along the forest slopes. The lines continue still on the southern river side but soon cross the road and Debed River to gain the northern river side and the grass plains of Pokr Ayrum (on top of the Debed Gorge). From there they follow the edge of the gorge on the fields and grass plains of Pokr Ayrum and Mets Ayrum where a T-off to the existing line heading to Matur mining Company is planned, over-span one more canyon and reach Noyemberyan substation shortly after crossing Debed River and the road at village Haghtanak.

The climate of Lori Marz is relatively humid. Annual precipitation is 500 - 800 mm. Summers are long, hot and sunny. With increasing altitude the winters become snowy, lasting from October until April at foothills and until May on the ridges. Prevailing wind is Southern, sometimes Northern and North-Western.

The region has a complex geological structure due to its location, which is in the northwestern part of Sevan-Amasia tectonic zone of Small Caucasus. Geological formations of different ages participate in the geological structure of the region. According to the RA CCII-02.02.2006 the area is included in the seismic zone I (one), where the expected maximum accelerations make 0.20 g (8 points).

The brown mountainous forest soils with a number of their subtypes are common in the investigation area. Bioclimatic features of those soils promote good growth of forest plants communities and formation of

phytomass. The common soils in the area are leached and carbonated types of the brown mountainous forest soils.

The main river in the study area is Debed River with its Dzoraget, Pambak, and Martsaget tributaries. The rivers are mainly fed by rains. High water season lasts from March until June, followed by a stable and low water dry period. Short and intensive floods are observed in September and October, depending on the amount of precipitation. Lori Marz is rich in mineral springs.

Armenia is remarkable for the diversity of its flora both in the South Caucasus and the Caucasus region in general. The ESIA area falls within the Forest Landscape Zone. 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. The study area and adjacent territories contain various animal species, mostly inhabiting forests, hardy shrub associations, abandoned gardens and bee yards.

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.

No protected areas will be affected by the new line corridor.

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. As recycling possibilities are becoming increasingly available in Armenia, HVEN will check out their existence and relevance for the needs of managing particular types of waste generated from the works on OTLs throughout the project implementation period.

Lori Marz has a population of 234,700 people for a territory of 3,799 km<sup>2</sup> and a population density of 61.8 persons per km<sup>2</sup>. Vanadzor is the capital and largest city of the province. Tavush Marz has a population of 128,300 people and a territory of 2,704 km<sup>2</sup> with a population density of 47 persons per km<sup>2</sup>. 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.

ESIA revealed two cases of cultural heritage sites being located in the ROW of the existing / the new 110 kV OTL corridor. Northeast of Haghpat village, between APs 12 and 13, a Khachkar stone is located in the corridor of the existing 110 kV line. Between APs 15 and 16 the ruin of a church and an adjacent graveyard are located in in the OTL corridor.

Within the study area, agriculture is mainly concentrated in the lower mountain slopes. 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).

According to studies of the living standards of the local households carried out by the national statistics service of Armenia, the percentage of people living below the official poverty level is greater in Lori Marz than the average for the Republic. The main cause of poverty in the rural communities is the lack of industrial businesses, underdeveloped infrastructure and a long distance from larger population.

## 1.7 Information, Disclosure, Consultation, and Participation

ESIA process involved dialogue of the ESIA team with various line agencies of the Government and professionals of the relevant fields with the purpose of sharing their experience and take advice. *Fichtner's* environmental and social specialists, together with the national environmental consultant, held meetings at Yerevan and at Vanadzor with the representatives of HVEN, Ministry of Nature Protection, Ministry of Culture, and conducted field trips to the proposed corridor of OTL Noyemberyan (see Section 12.1 – Appendix I). Discussions on the environmental implications of the Project were held with WWF Armenia, and ways for achieving greater public participation in the upcoming stakeholder consultations on the present draft ESIA report were discussed with Aarhus Center. The Ministry of Culture / Agency for Security of Historical and Cultural Monuments was consulted on the procedures to protect historical and cultural sites.

The draft ESIA report, including Environmental and Social Management Plan (ESMP), will be disclosed to the public in English and Armenian versions and sufficient time will be allowed for stakeholders to familiarize themselves with these documents. According to national requirements, the disclosure period is only 7 days, but disclosure of the documents for at least two weeks is recommended. Affected people shall have real access to the documents, which will therefore not only be posted on HVEN's website, but will also be delivered in printed copies to the local administration offices and advertisements in local media about their availability will be made. Printed copies will also be provided to representative civil society organizations.

Earliest after two weeks from disclosure of the documents, public consultations on the draft ESIA report will be held. Consultation meetings shall concentrate on interpreting the ESIA report to the PAP and seeking their feedback and concerns, which will then be involved in the revision of the Final Draft ESIA report. Public consultations will be held close to the implementation sites, so that the community can engage with the process and express their questions and concerns.

HVEN will ensure that all public consultations are gender sensitive and relevant NGOs will participate in the discussions. The Aarhus Center will help to identify relevant NGOs and ensure sharing of information / studies.

## 1.8 Impact Assessment

Main types of possible environmental impacts expected from replacement of Lalvar and Noyemberyan OTLs comprise the following:

- During construction works, impacts to flora and fauna at forested areas are unavoidable, including felling of mature trees within the ROW.
- Existing access roads will be used, as far as possible. If new access tracks will have to be constructed, impacts will arise especially at forested areas.
- Small amounts of construction waste will be generated. Considerable volume of waste will be generated from dismantling of the existing OTLs, which is not part of this Project.

Most important possible social impacts areas are as follows:

- Land acquisition for placement of towers, construction of new access roads (as required), and for construction of an extension to substation Noyemberyan.
- Physical relocation of a small number of houses / households may be necessary, depending on the final corridor design (considering proposed bypasses).
- Possible damages to crops and trees, during construction of access roads, construction of towers, conductor stringing, and ROW maintenance.

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 proposed replacement of OTL Noyemberyan 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. During the operational phase, the positive impacts are obvious and consist in a much more reliable power supply in Lori and Tavush Marz.

## 1.9 Environmental and Social Management Plan

The proposed replacement of Lalvar and Noyemberyan OTLs 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.

An (local) environmental specialist will be employed within HVEN, which is an implementing entity for ESRP. Together with the social specialist, already employed at HVEN, the environmental specialist will monitor the proper implementation of the ESMP through monthly supervision at the construction sites.

#### Design Phase

Detailed design shall be developed the way minimizing needs for land take and physical relocation. Minimal need for the construction of new access roads shall also be targeted.

Where the new lines run parallel to other existing lines (35 kV, 110 kV and 220 kV OTLs), a minimum distance has to be chosen, that cuts the width of the ROW of two parallel running lines. Where the existing lines are crossed by the new 110 kV OTLs, adequate precaution measures have to be taken and adequate minimum distances between the conductors have to be ensured.

#### 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. About 80 % of new tower locations have existing access tracks or roads. Especially in the area where the line corridor is crossing the forested hilly and mountainous terrain south of Debed River valley the existing access tracks will have to be refurbished (e.g. cutting of vegetation covering the tracks) and some new tracks may have to be constructed. Felling of mature trees will also be necessary within the ROW. However the expected type and volume of vegetation clearing in the Project area will not cause functional damage to ecosystems and will not threaten viability of any plant and/or animal populations of the area. While biodiversity offset is not required, a compensatory tree planting will be planned and implemented. Tree species characteristic of the OTL corridor will be planted in ratio of 2:1 (two trees planted for one tree removed) in the vicinity of the corridor (e.g. in degraded forest areas). Long span towers will 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.

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 of these camps and the existing 110 kV line will be dismantled by HVEN.

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. HVEN will be responsible for recycling or disposal of dismantled material like towers, cables, construction waste, etc. Scrap metal may be sold for recycling purposes to specialized companies (e.g. an Open Joint Stock Company ASCE Group, Charentsavan), which should pick up the scrap metal directly at the dismantling sites. Small amounts of hazardous waste like residual oil, fuel, paint or spill contaminated soil will be stored at substation Alaverdi-2, which contains adequate space and roofed, concreted and bonded facilities for storing of hazardous waste. 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 OTL 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 20 m on each side from the outer conductors of a 110 kV OTL as a buffer zone (GRA 2009). The World Bank uses WB/IFC Performance Standards 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:

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

<b>ICNIRP exposure limits for general public exposure to electric and magnetic fields</b>		
<b>Frequency</b>	<b>Electric Field (V/m)</b>	<b>Magnetic Field (<math>\mu</math>/T)</b>
50 Hz	5,000	100
60 Hz	4,150	83

The OTLs 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 OTLs 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.

Physical relocation of a small number of houses / households may be necessary, depending on the final corridor design. Considering the proposed bypasses, the number of houses to be relocated will be reduced or eliminated altogether.

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).

There are two cultural sites in the OTL corridor that were identified during field work. Northeast of Haghpat village, a Khachkar stone is located in the corridor of the existing 110 kV lines. Between APs 15 and 16, the ruin of a church and an adjacent graveyard are located in in the corridor of the proposed 110 kV OTLs. Works for the construction of the new OTLs and dismantling of the old one may be carried out without any damage to these cultural heritage. Reasonable distance from these cultural property must be respected once location of towers is specified in agreement with the Ministry of Culture. Although there are no physical cultural resources within the OTL 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. HVEN will develop and implement a Health and Safety Management Plan (HSMP) for its personnel engaged in maintenance of the OTLs during operational phase.

### **1.10 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. PAP 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.

### **1.11 Costs of Implementation of the ESMP**

Most of the costs for mitigation of the impacts during the replacement of 110 kV Lalvar and Noyemberyan OTLs are included in the regular construction costs. Extra costs of environmental impact mitigation are related to compensatory tree planting. Total cost of replanting will be known, once the number of trees to be extracted is known and the

compensatory planting plan is developed. Those costs will be included in the Project.

## 2. Project Description

### 2.1 Project Context

The World Bank is supporting the Government of Armenia with the strengthening of the power transmission network under the ongoing Electricity Supply Reliability Project (ESRP). Under ESRP, the High Voltage Electric Networks (HVEN), the power transmission company, is already replacing a 220 kV overhead transmission line from Hrazdan TPP substation to Shinuhayr substation. The replacement works are underway. There are savings under the ESRP, which the Government intends to use for replacement of:

- 110 kV OTL Noyemberyan from the Alaverdi-2 220/110/35 kV substation to Noyemberyan 110/35 kV substation in Haghtanak village
- 110 kV OTL Lalvar from the same Alaverdi-2 substation to Noyemberyan substation with the T-branch to Sadakhlo substation in Georgia

These lines supply power to large electricity consumers in the North-Eastern part of Armenia. The above mentioned existing OTLs are around 50 years old and severely dilapidated, as confirmed by the results of a representative sample of metal tests. This jeopardizes the security and reliability of the power supply in this region.

### 2.2 Technical Design and Scope of Works for OTLs Replacement

Replacement of Lalvar and Noyemberyan OTLs will strengthen and support the maintenance of a reliable power supply in northern Armenia by rehabilitating priority OTLs in the provinces Lori Marz and Tavush Marz.

The new 110 kV OTLs will run for approx. 25 km from the Alaverdi-2 220/110/35 kV substation (see Photo 2-1) in the northern central part of the Republic of Armenia to the 110/35 kV Noyemberyan substation (see Photo 2-2) in Haghtanak village in the north-east.

The new OTLs will include new double circuit towers and foundations, new ACSR (aluminum conductor steel reinforced) conductors, new OPGW (optical fiber ground wire), earthing at each tower site and new connections to the National Grid via the Alaverdi-2 substation, new connections to the Noyemberyan 110/35 kV distribution substation at Haghtanak and the T-connections from the new main OTL for Akhtala railway substation, and Matur mining substation.



**Photo 2-1:** Substation Alaverdi-2

The route of the new OTLs will be a line construction in a new corridor, separated from the old line by 50 m in most parts, but sometimes further deviations from the line will be required in order to avoid houses, forests etc. The line routing features several wide over-spans of canyons (between 400 m and 600 m width). The possibilities for construction are good with 80 % of new tower locations having existing access tracks or roads (Tractebel Engineering 2014).

According to HVEN, it will not be required to disconnect the existing lines from the grid during construction. Thus, no power outage will occur during construction works.

Technical regulations on safety zones for electric networks of Armenia define a distance of 20 m on each side from the outer conductors of a 110 kV OTL as a buffer zone (GRA 2009). This results in a corridor width of 40 m plus the clearance between the conductors (depending on the final design of the towers) for 110 kV OTLs Lalvar and Noyemberyan. Thus, a total corridor width of 50 m was taken as a basis for this ESIA.

In order to reduce the visual impact, the towers of the old 110 kV OTLs will be completely dismantled when the new line will be taken into operation. This shall also include removal of no longer used tower fundamentals. Compensatory tree planting is part of the proposed mitigation measures. Development and implementation of a compensatory tree planting plan will be included into the contract of works. Maintenance of plantations and re-planting of dead seedlings over the period of two years will be ensured by forest departments or other professional organization to be hired by HVEN with prior agreement of the World Bank / NGOs. The costs will be covered from the project proceeds.

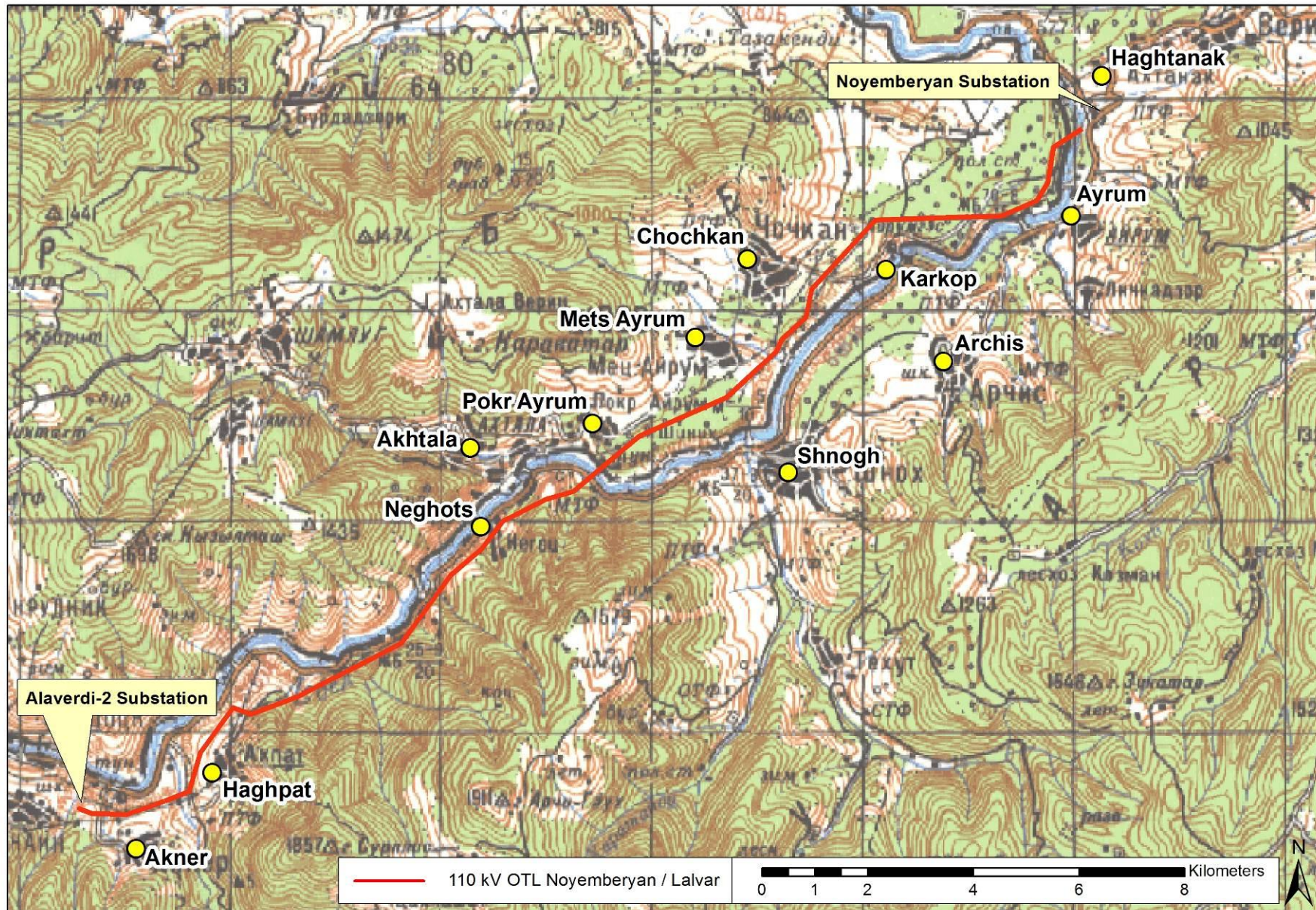
## 2.3 Location of Lalvar and Noyemberyan OTLs

The proposed 110 kV Lalvar and Noyemberyan OTLs with a length of approx. 25 km start at Alaverdi-2 substation (see Photo 2-1) (about 964 m a.s.l.) and ends at Noyemberyan substation (see Photo 2-2) in Haghtanak village (about 497 m a.s.l.).



**Photo 2-2:** Substation Noyemberyan at Haghtanak village

Starting from Alaverdi-2 substation the 110 kV OTLs run across the grass-plain of Sanahin high above the river Debed. They cross two canyons, pass on the western edge of village Haghat, cross further plains, cross several valleys and traverse the steep forested slopes on the southern side of Debed River Gorge, where a T-off to the Akhtala railway substation is planned. At the valley of Neghots they over-span the gorge - at the bottom of which the settlement is located - and continue along the forest slopes. The lines continue still on the southern river side but soon cross the road and Debed River to gain the northern river side and the grass plains of Pokr Ayrum (on top of the Debed Gorge). From there they follow the edge of the gorge on the fields and grass plains of Pokr Ayrum and Mets Ayrum where a T-off to the existing line heading to Matur mining Company is planned, over-span one more canyon and reach Noyemberyan substation shortly after crossing Debed River and the road at village Haghtanak (see Map 2-1).



Map 2-1: Location of proposed 110 kV Lalvar and Noyemberyan OTLs in provinces Lori and Tavush Marz

### 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 the replacement of the existing Lalvar and Noyemberyan 110 kV transmission lines from substation Alaverdi-2 to substation Noyemberyan (approx. 25 km).

The proposed replacement of OTLs Lalvar and Noyemberyan 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 high voltage power line shall be designed and planned, to avoid or mitigate negative impacts and to better capture anticipated environmental and social benefits.

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

Relating to HVEN the corridor for the new 110 kV OTLs will run in a distance of approx. 50 m to the existing 110 kV OTL. The impacts and the related mitigation measures of this new line corridor as well as some proposed bypasses of the OTLs are covered in this ESIA.

During the investigation, main focus was put on finding a line routing that is 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 Environmental and Ecological Expert;
- International Socio-Economic Expert;
- National Environmental and Legal Experts.

General overview about biophysical settings has been done as desktop study, and a field survey was conducted by the environmental and social experts in January 2015, visiting the substations and the proposed corridor



of the line including some hotspots like the crossing of valleys, forested areas and villages affected by the new line corridor. No rare, endangered, endemic, or other species of concern were found during the survey.

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 and with members of the Ministry of Nature Protection (see Section 12.1 – Appendix I).

Additionally to the field survey, an evaluation of possible ecological and social impacts was performed by interpretation of satellite images (date: 2010). A preliminary ESIA for the Project was also used as basis for the study. However, the line routing studied in the preliminary report significantly differed from the currently proposed corridor as it ran South in parallel from selected alignment.

An Impact Investigation List (see Section 12.2 – Appendix II) considering the most severe impacts was prepared and presented to the Belgian Company Tractebel Engineering GDF Suez which is undertaking the technical feasibility study, in order to avoid possible impacts already during planning.

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

<b>Extent of impact</b>	<b>Reason</b>
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 World Bank, 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. 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

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.
RA Law on Specially Protecting Areas of Nature	2006	<p>The current RA Law on Specially Protecting Areas of Nature was adopted on 27<sup>th</sup> November, 2006.</p> <p>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.</p> <p>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.</p> <p>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).</p>

Law/ Policy	Year	Main scopes
RA Land Code	2001	<p>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.</p> <p>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.</p>
RA Water Code	2002	<p>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.</p> <p>Vital principals of water resources management are:</p> <ul style="list-style-type: none"> <li>- Satisfaction of main vital needs of present and future generations</li> <li>- Maintenance and increase of the volume of the national water resources</li> <li>- Protection of water and related ecosystems and their biological diversity</li> <li>- Recognition of complete and coherent relationship of land, air, water and biological diversity</li> <li>- Regulation of water use through water use permission.</li> </ul>
RA Law on Protection of Atmospheric Air	1994	<p>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:</p> <ul style="list-style-type: none"> <li>- Maintenance of improvement of purity and quality of atmospheric air</li> <li>- Prevention and reduction of chemical, physical, biological and other influences over atmospheric air conditions</li> <li>- Regulation of public relationships within that sphere</li> <li>- Strengthening of legality within that sphere.</li> </ul>

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 Environmental Protection and Environmental Usage Fees	1998	<p>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.</p> <p>Types of environmental protection fees are payments:</p> <ul style="list-style-type: none"> <li>- against emission of hazardous substances at environment (air and water basin)</li> <li>- for industrial waste and household refuse disposal within adopted regulation</li> <li>- against environmentally harmful products.</li> </ul> <p>Types of environmental usage fees are payments:</p> <ul style="list-style-type: none"> <li>- for water use</li> <li>- for resources of extracted minerals,</li> <li>- for bio-resources use.</li> </ul>
RA Law on Flora	1999	Law on flora provides RA state policy regarding approved science-based protection, conservation, use and reproduction of natural flora.

Law/ Policy	Year	Main scopes
RA Law on Fauna	1999	<p>That law provides RA state policy regarding conservation, protection, reproduction and use of species of wild fauna.</p> <p>The subjects of that law are:</p> <ul style="list-style-type: none"> <li>- conservation, protection, natural reproduction of genetic and species diversity</li> <li>- prevention of infringement of comprehensiveness of animals' living environment</li> <li>- protection of comprehensiveness of animal species, their populations and relatives</li> <li>- protection of animals migration routes</li> <li>- regulation of relationships regarding using of objects of fauna.</li> </ul> <p>Responsibilities of different organizations, including government, ministries, state bodies, local self-governmental bodies are envisaged by that law.</p>
RA Law on Conservation and Use of Historical and Cultural Monuments and Historic Environment	1998	<p>The subjects of that law are:</p> <ul style="list-style-type: none"> <li>- provision of legal basis within domain of protection and use of monuments and</li> <li>- regulation of relationships, which are begotten within that activities.</li> <li>- The main issues of that law are:</li> <li>- envisaging of general provisions of the state policy within domain of protection and use of monuments</li> <li>- envisaging of regulation principals of recording, conservation, research, restoration, repair, restoration and use of monuments</li> <li>- 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</li> <li>- envisaging of special features of ownership rights to possess, use and dispose monuments, which are specific type of real estate.</li> </ul>
RA Law on Environmental Assessment and Expertise	21 June 2014	<p>That law regulates environmental impact assessment (through legal, economic and organizational principles) of proposed activities and concepts.</p>

The implementation of any activity in Armenia which may cause environmental impacts needs a positive conclusion of an EIA expertise. Environmental impacts of planned activity or principle 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. As the Law was revised in 2014, the experience of previous years is not applicable to the replacement of OTLs Lalvar and Noyemberyan.

According to World Bank OP 4.01, the Project falls into environmental Category B and requires ESIA. According to the national legislation of Armenia, the EIA is required, too. 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 3<sup>rd</sup> 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 3<sup>rd</sup> 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 the World Bank's environmental safeguard policy. The national law requires EIA, while the present draft report is about ESIA, through the Law on the Environmental Impact Assessment and Expertize does require coverage of social aspects of a proposed activity. World Bank's policy requires 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 agreed that at least two week 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

As the use of guidelines of the World Bank (WB) is required under the compact, relevant World Bank guidelines are given here. The following environmental and social requirements of the WB are triggered by the Project:

- OP 4.01 – Environmental Assessment
- OP 4.04 - Natural Habitats
- OP 4.11 - Physical Cultural Resources
- OP 4.12 - Involuntary Resettlement

World Bank/IFC General EHS Guidelines, and especially Guidelines for Electric Power Transmission and Distribution, 2007, also apply.

**Guidelines for Electric and Magnetic Fields** (ICNIRP Guidelines for Limiting Exposure to time-varying Electric, Magnetic, and Electromagnetic Fields, and EU Directive 2004/40/EC "on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields)" – see Section 12.3 – Appendix III), as well as **Guidelines for Waste Management** (EuropeAid 2010: Landfill Operations Guidance Manual), and **General Environmental Guidelines for Overhead Lines** (CIGRE 1998: High Voltage Overhead Lines – Environmental Concerns, Procedures, Impacts & Mitigation) were taken into consideration as a good practice.

## 5. Institutional Framework

HVEN is an implementing agency for ESRP and will be responsible for all operations under the Project, including its compliance with the national environmental and social legislation and World Bank's safeguard policies. With the recent employment of a Social Specialist at HVEN, the task to update the recommendations of the Resettlement Policy Framework and to prepare the (abbreviated) Resettlement Action Plan (RAP) (i.e. census, detailed inventory of losses, socio-economic survey, public consultation and disclosure) can be done by HVEN with some additional consultant support for RAP implementation. An Environmental Specialist will be employed within HVEN whose selection is underway. Both specialists together will carry out supervision of the implementation of the Environmental and Social Management Plan (ESMP).

The institutional structure of the Government of the RA is based on a multi-agency model. The major problems currently facing the system are the overlapping of functions and insufficiently defined competences of institutions as well as lack of coordination, consultation and information exchange between the institutions involved. There are several public institutions that are somehow involved in environmental and social issues of the Project. The roles, authorities and responsibilities of those organizations are briefly presented below.

### **Ministry of Nature Protection**

Ministry of Nature Protection elaborates and implements the policies of the RA in the areas of environmental protection and sustainable use of natural resources and is represented by the Minister and the staff of the Ministry. Within the system of the Ministry there are also State Non-Commercial Organizations and Institutions.

The main functions of the Ministry of Nature Protection of RA as applied to the replacement of Noyemberyan OTL are as follows:

- Decision about necessity of state environmental expertise
- Provision of impact category to the project
- Provision of Terms of Reference (ToR) for the EIA
- Organization of public hearings
- Final approval or rejection of the project and issue of environmental permit if project is approved

### **Ministry of Culture**

The Ministry of Culture is a republican body of executive power, developing the policy of the Government of Armenia in the sphere of culture. The purpose of the Ministry is to maintain and replenish the cultural heritage, promotion and development of contemporary art.

The main functions of the Ministry of Culture of RA as applied to the replacement of Noyemberyan OTL are as follows:

- Approval or rejection of new tower locations (e.g. bypasses) as provided by HVEN
- Decision about handling of chance finds
- Providing permission to resume construction works after chance finds

## 6. Analysis of Alignment Alternatives

### 6.1 Alternatives for Line Routing

Four Project alternatives have been considered by HVEN related to their scope of environmental interference and involuntary resettlement and 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.

Alternative 1: This proposed new route would be within 50 m on the north side of the existing 110 kV corridor from Alaverdi-2 substation, crossing the existing corridor in Haghat area and runs within 50 m on the south side of the existing 110 kV corridor to Noyemberyan substation. **This route option has been chosen as the preferred option**, because it is economically viable and carries minimal environmental and social impacts. The crossing of the existing corridor from north to south before the route reaches the Akhtala area is essential because of the congestion that occurs due to the existing 35 kV, 110 kV, 220 kV and some 6 kV OTLs. There are existing access roads / tracks that will represent 80 % of the total, which are presently known to the maintenance personnel.

Alternative 2: This new route would be installed between the existing 110 kV and 220 kV OTLs from Alaverdi-2 substation crossing the corridor in Akhtala area and running then within 50 m on the south side of the existing corridor to Noyemberyan substation. Negative impacts of this route option would impact on the cost of design and construction and the practicality of maintenance. The crossing of the existing corridor is foreseen in the Akhtala area in this option and for this purpose there are some non-standard items to be envisaged in the design. This option will for a part of its route be immediately adjacent to the existing 110 kV OTLs, which is no problem for the construction, but there would be an amount of dismantling of existing 110 kV tower structures before the new line could be put into service. Total shut downs are therefore a necessity for this option. Environmental and social impacts of this alternative are about the same as for Alternative 1. Thus, Alternative 2 is not preferred, due to non-environmental /social reasons.

Alternative 3: This new route would take a northerly direction from Alaverdi-2 substation crossing road M6 and Debed River, then continuing to Akhtala area. Then the route again crosses Debed River, road M6 and the existing 110 kV corridor. After that it continues within 50 m on the south side of the existing 110 kV corridor to Noyemberyan substation. This route option was carefully reviewed because it is a totally new route from Alaverdi-2 substation to Akhtala area. There are some major concerns with the new route: the route is approx. 4 km longer than Alternatives 1 and 2

and additional tree clearance as well as additional access road construction is required, as for the major part the line routing is far away from existing lines and no existing access tracks can be used. Similar to Alternative 2 there are non-standard items envisaged in the design because of the new route is in a mountainous area on the north side of the road M6 and the Debed River, and in the Akhtala area. The latter is unavoidable for both options 2 and 3 because this is a congested area with the 35 kV and 6 kV OTLs that are close to the south side of road M6 and with few locations for making a satisfactory crossing of the existing corridor.

Alternative 4 (No-Project Alternative): No replacement of the 110 kV OTLs Lalvar and Noyemberyan. This alternative would not result in any forest felling and resettlement activities, but is not feasible because the existing OTLs are old (around 50 years) and severely dilapidated. This jeopardizes the security and reliability of power supply in this region.

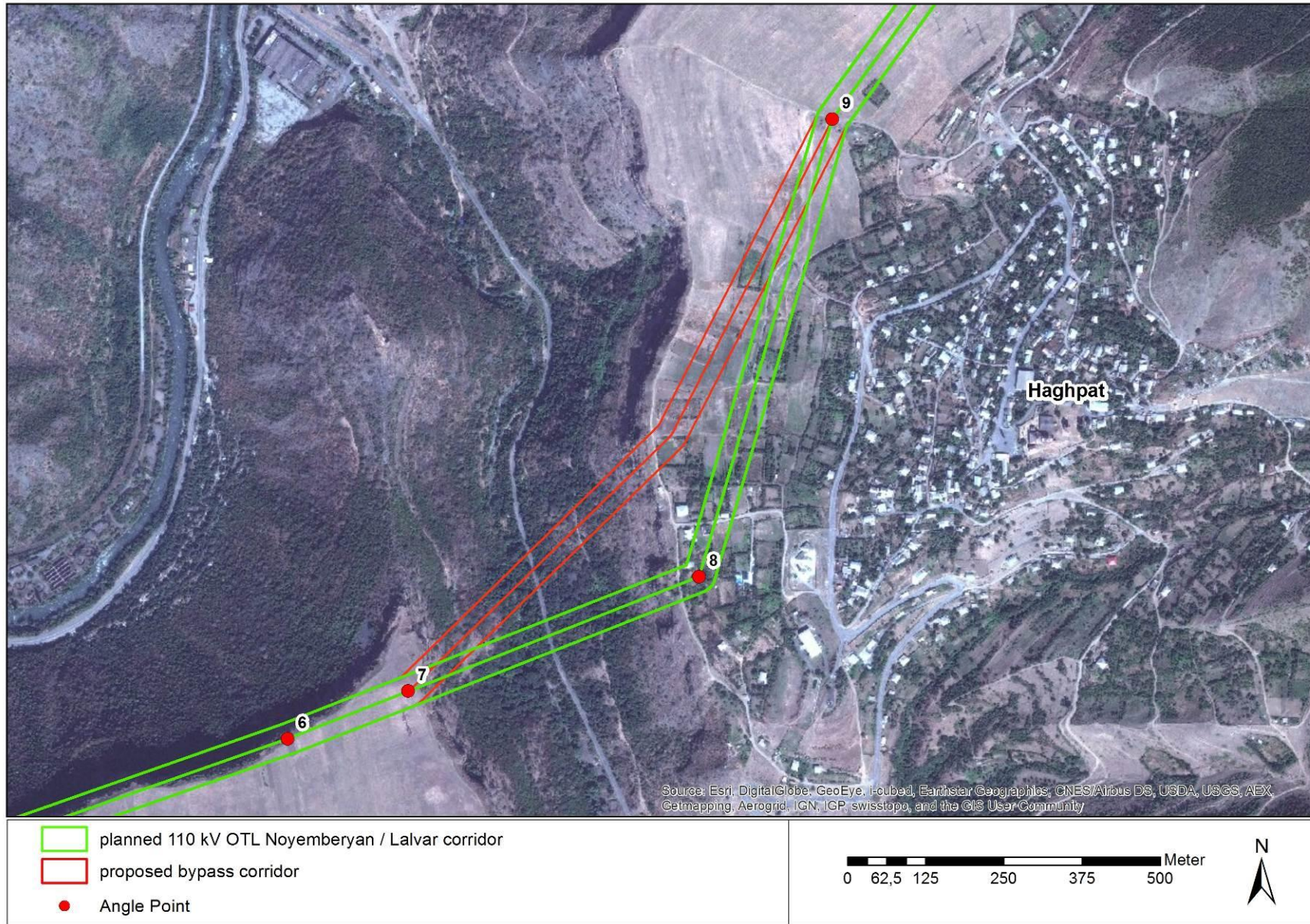
## 6.2 Recommended bypasses

Based on the line routing described in Alternative 1, some bypasses are proposed in order to avoid any physical relocation. These bypasses may have to be revised to find better options from a technical point of view:

- At Haghpat village three houses are located in the planned corridor of the 110 kV OTLs (see Photo 6-1). These can be avoided by a bypass located northwest of the proposed corridor (see Map 6-1).



**Photo 6-1:** Affected houses in Haghpat village, located in the planned corridor

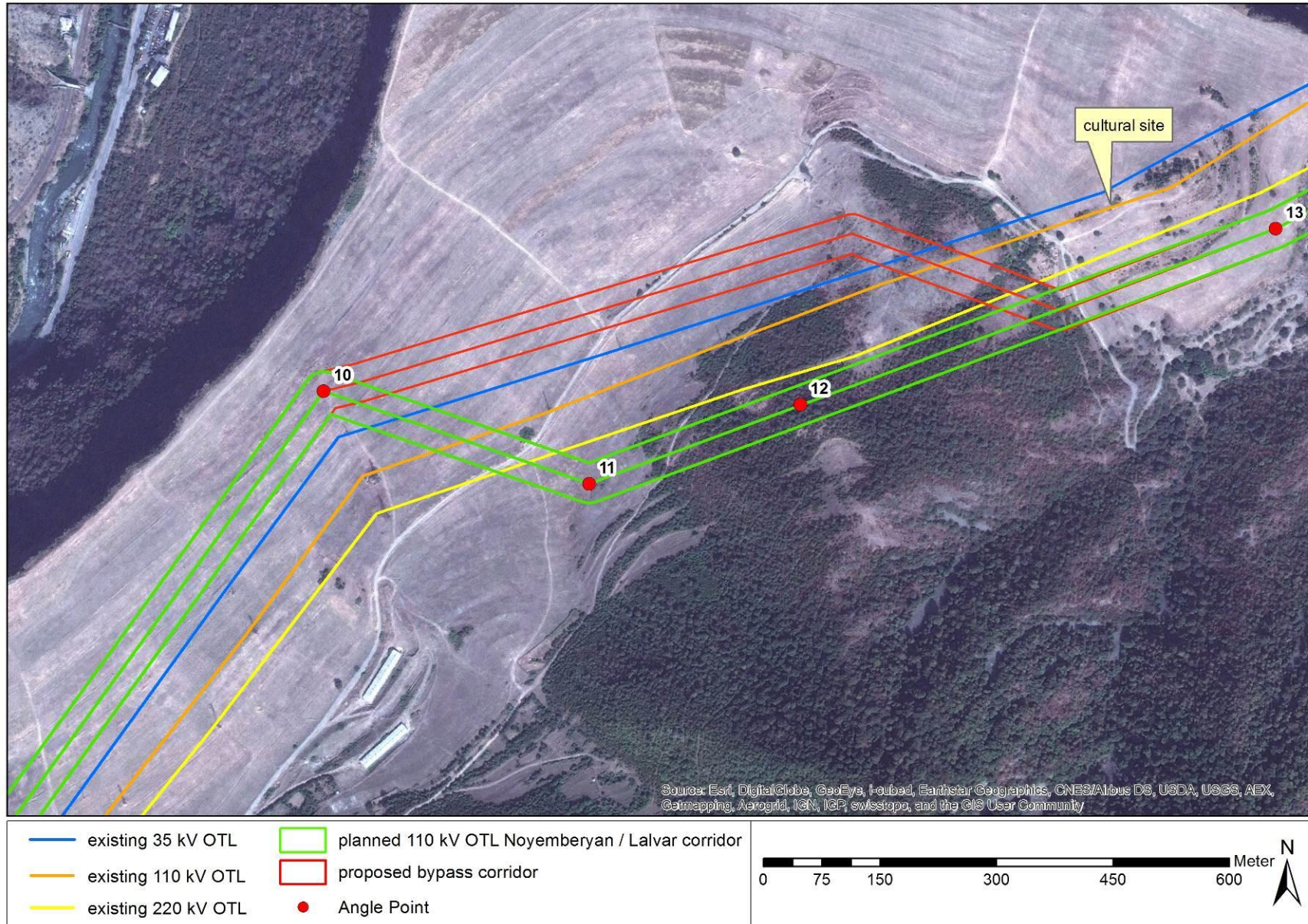


Map 6-1: Affected houses at Haghpat village located in the planned line corridor (green) and suggested bypass (red)

- Northeast of Haghpat village the proposed line corridor crosses the existing 35 / 110 / 220 kV lines; after that a forested hill is crossed. It is recommended to keep the line corridor longer on the pastures in the north and to cross the existing lines further east to avoid crossing the forest (see Map 6-2). During construction and dismantling of the old line the cultural site (Khachkar stone, see Photo 9-7), which is located in the corridor of the existing 110 kV line may not be damaged in any way.
- At Neghots village approx. 8 houses will be over-spanned by the planned line corridor (see Photo 6-2). A different line routing is recommended to avoid any physical relocation. One option is to relocate the corridor as near as technical feasible to the existing 220 kV line corridor (which is free of houses), another option would be to relocate the corridor further south (see Map 6-3).

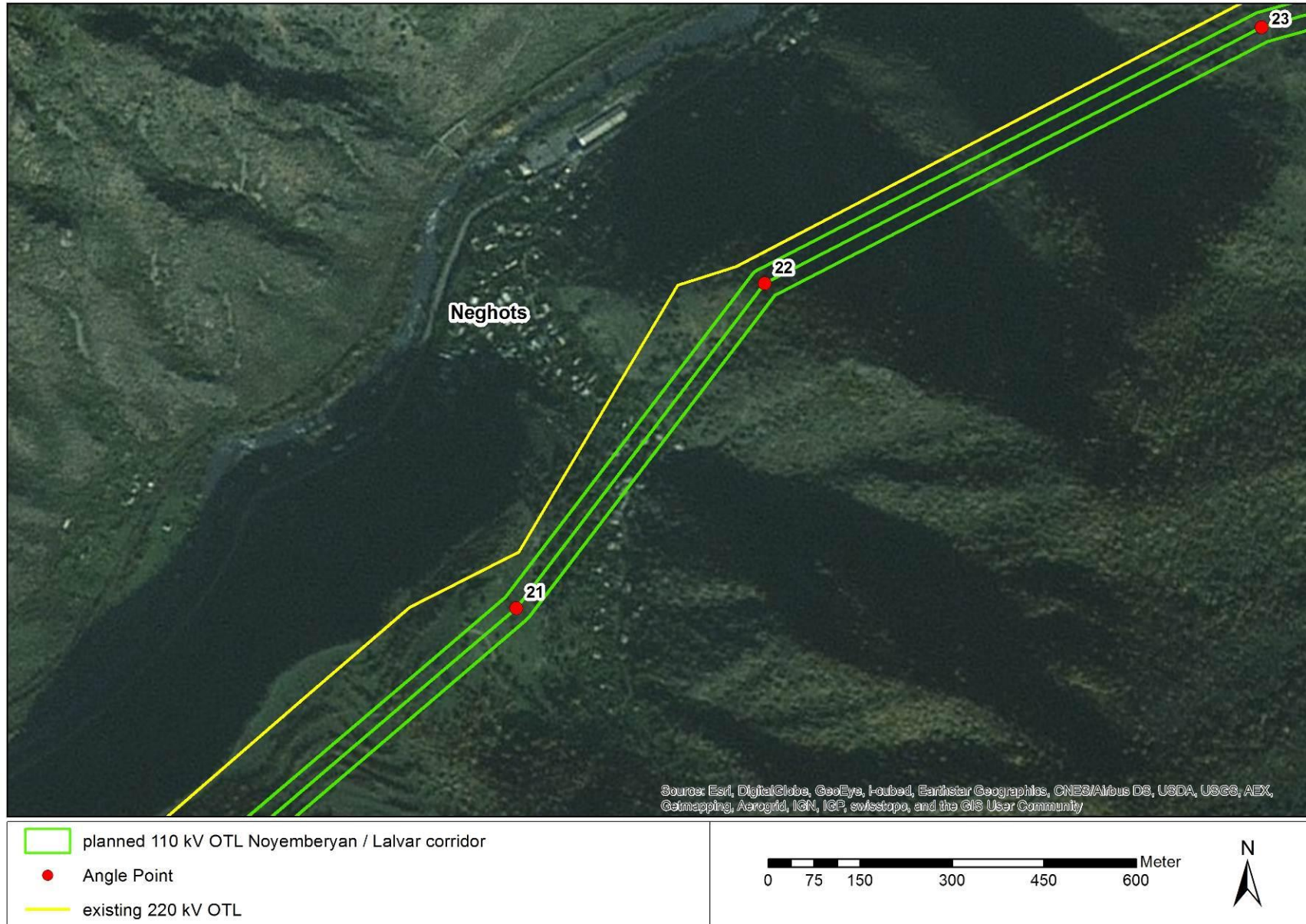


**Photo 6-2:** Some of the affected houses at Neghots village, located in the planned line corridor



Map 6-2: Planned corridor (green) crossing existing lines (blue, orange, yellow) and forested area (AP12), location of cultural site, and suggested bypass (red)





Map 6-3: Planned corridor (green) over-spanning houses at Neghots village and existing 220 kV OTL (yellow)

- South of Pokr Ayrum, before crossing the valley of Debed River, a farmhouse (see Photo 6-3), another building, and a fruit tree plantation are located in the planned line corridor. A bypass further west near to the existing 220 kV OTL is recommended to avoid any physical relocation (see Map 6-4).

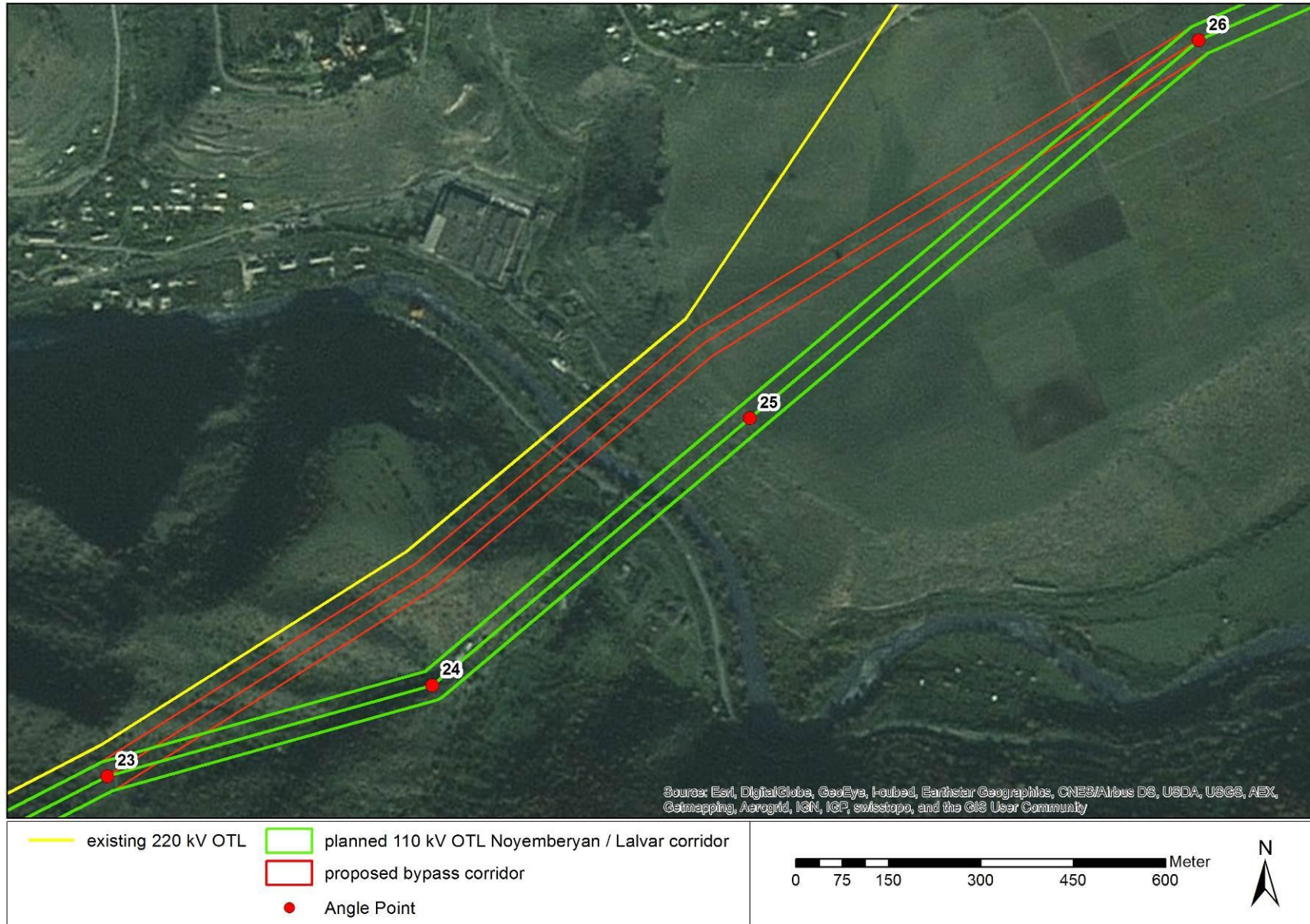


**Photo 6-3:** Farmhouse located in the planned line corridor

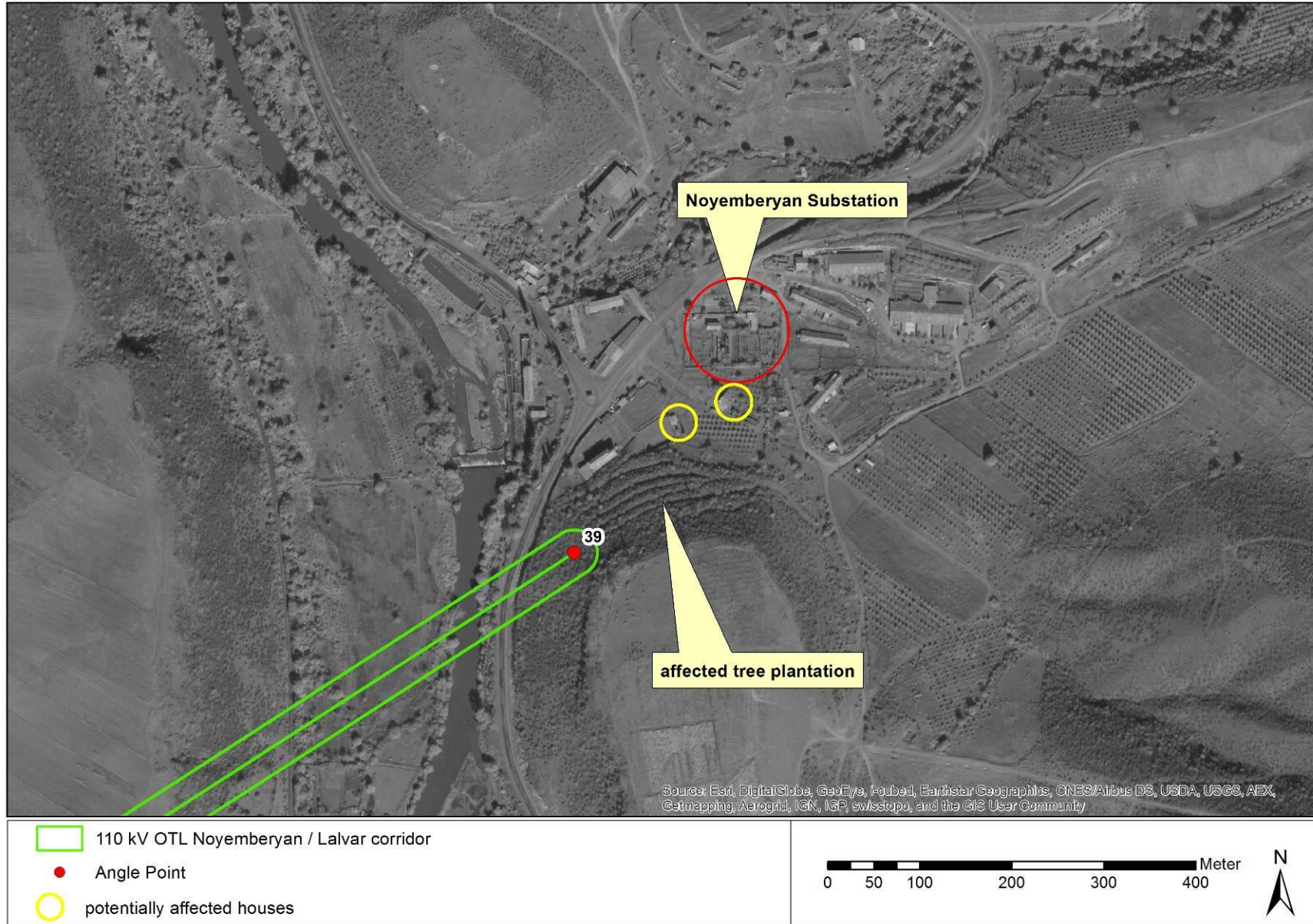
- At this project stage no design is available for infeeding of the line into Noyemberyan substation. A tree plantation and two houses (see Photo 6-4) are located in the probable line corridor (see Map 6-5). A line routing should be considered which avoids any physical relocation.



**Photo 6-4:** House located in probable corridor near Noyemberyan substation



Map 6-4: Affected buildings in the planned corridor (green), existing 220 kV OTL (yellow) and suggested bypass (red)



Map 6-5: Planned corridor (green) infeeding into Noyemberyan substation (not specified yet), probable crossing of tree plantation and potentially affected houses

## 7. 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 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 during January / February 2015, through a combination of desk studies and field surveys.

### 7.1 General Environment and Ecology

#### 7.1.1 Study Area

The transmission line considered in this Project is mainly located in the province Lori Marz (capital Vanadzor), which is situated in the north of the Republic of Armenia and is the third largest marz in the republic by its territory (3,799 km<sup>2</sup> - about 13 % of the total share of the country) and the second by its population number (234,700 people). Bounded on all sides by rugged mountains and cut by sheer gorges, Lori has the valleys of the Pambak, Debed and Dzoraget rivers.

A small part of the transmission line is located in Tavush Marz (capital Ijevan) which is located in the northeast of Armenia bordering Georgia and Azerbaijan. Tavush Marz has a surface of about 2,704 km<sup>2</sup> and a population of 128,300 people. The largest river of the marz is the Agstev River with Getik, Voskepar, and Sarnadzbur rivers as tributaries.

The proposed 110 kV Lalvar and Noyemberyan OTLs run from substation Alaverdi-2 (964 m a.s.l.) about a length of approx. 25 km to substation Noyemberyan in Haghtanak village (about 497 m a.s.l.) (see Section 2.3, Map 2-1).

Starting from Alaverdi-2 substation the 110 kV OTLs cross a valley about 100 – 150 m deep and about 500 m wide, run north of Akner village and cross another valley of similar depth and width before reaching Haghatpat village. Three houses are affected by the proposed line corridor in this village, so that a bypass is recommended (see Section 6.2). Northeast of Haghatpat the proposed line corridor crosses the existing 35 kV, 110 kV and 220 kV OTLs and a forested area. A bypass is recommended here in order to avoid the forest crossing. Between the villages of Haghatpat and Neghots the line corridor crosses hilly terrain, over-spanning several valleys. Between AP16 and AP18 the T-off for Akhtala Railway Station is planned. Line routing at Neghots village shall be adapted as about eight houses will be over-spanned if the proposed corridor will be established. Between Neghots and the crossing of Debed River valley a forested mountainous area will be crossed, again over-spanning small valleys. Before crossing the valley of Debed River south of Pokr Ayrum, the line corridor will over-span a fruit tree plantation and two farm buildings. A bypass shall be considered

here as well (see Section 6.2). North of Debed River the line corridor crosses agricultural land with a T-off near AP26 for connection to the existing line heading to Matur mining Company and crossing a steep valley of about 350 m width east of Mets Ayrum. Southwest of Haghtanak village Debed River valley is over-spanned again. Before entering the Noyemberyan substation a tree plantation will be over-spanned and some buildings may be affected by the still unclear infeeding of the line into the substation (see Map 2-1).

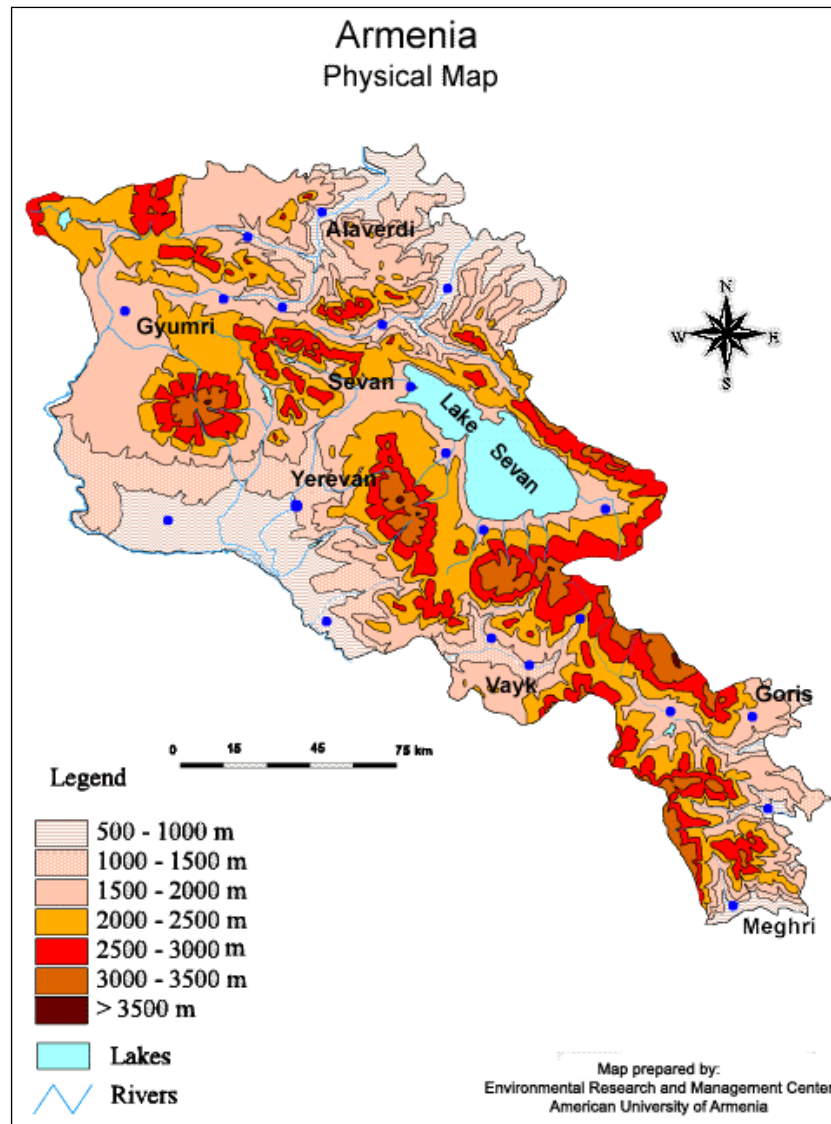
The proposed bypasses may have to be revised to find better options from a technical point of view.

### 7.1.2 Topography

The entire investigation area is located between 500 m and 1,490 m altitude. Mountain tops reach between 1,264 m and 1,911 m a.s.l. Major mountains around the study area are Mt. Surb-Lis (1,857 m), Mt. Archigluh (1,911 m), Mt. Sanglar (1,436m), Mt. Samerk (1,264m), Qarakatar (1,269 m).

Lori region, from the orographic point of view is located on the southern slope of Bazum ridge on the left banks of Pambak River. Bazum ridge belongs to the number of internal ridges of Small Caucasus Virahayots-Karabakh mountain system (shed, gradual fragmental zone). It has a length of 60 km and stretches from Sepasar plateau to Gayladzor canyon of Pambak River. The ridge has an average height above sea level of 2800 m and a maximum height of 2992 m (Urasar). Bazum's anticline corresponds to the geological structure. It is characterized by symmetric convex gradual slopes. The structural relief is characterized by the secondary anticlinal (Urasar's, Chqnagh's), dome (Maymekh's), synclinal or flexural (Gargar's), graben-synclinal (Dilijan's) structures.

Tavush Marz is extended on the external line of Small Caucasus mountain ranges (Virahayots, Gugarats and Miapor mountains) and is situated in the moderate damp region of the Republic of Armenia.



**Figure 7-1:** Physical Map of Republic of Armenia

### 7.1.3 Meteorology and Climate

The climate of the investigation area is relatively humid. Annual precipitation is 500 - 800 mm. Summers are long, hot and sunny. With increasing altitude the winters become snowy, lasting from October until April at foothills and until May on the ridges. The maximum height of snow cover for ten-day period is about 30 cm; the average number of days with lying snow is 52. Prevailing wind is Southern, sometimes Northern and North-Western. The annual average occurrence of 0-1 m/s winds is 24 %.

Meteorological data for Shnogh, situated in the northeast of Lori Marz, can be found in Table 7-1.

**Table 7-1:** Meteorological data for Shnogh

Shnogh	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Temperature average (°C)	0.7	1.9	5.1	11.0	15.7	19.2	22.7	22.5	18.0	12.3	7.1	2.7	<b>11.6</b>
Relative air humidity (%)	69	69	70	69	72	68	62	63	69	73	73	70	<b>69</b>
Average precipitation (mm)	20	25	40	54	79	87	49	39	37	42	31	16	<b>519</b>

#### 7.1.4 Geology and Seismicity

##### **Geological and tectonic description of the area**

In the geological structure of the studied area participate volcanogenic sedimentary rocks of middle White Jura age, represented by porfirits, tuff-sandstones, and rocks with clayey shale and other tuff-sediment and normal-sediment large facial and incurred major changes, which in the Debed River valley are covered with basalt lava flows of upper Pliocene- quaternary age. The volcanogenic sedimentary rocks have undergone hydrothermal, contact and metasomatic changes. The numerous diabases and iabase porfirit dykes are widely spread. The intrusive magmatism of the area is of clearly expressed alkaline type and is represented by a range of granodiorite rocks, among which are the intrusions of Lalvar mountain slopes.

The basalt lava flows are placed on the uneven surface of the above mentioned rocks of middle upper quaternary age with sharp stratigraphic disagreement, which originate from Lori plateau and descending along the Debed River valley, continue with a narrow uvula up to the depression of the Kur River. They are mainly represented by two flows: upper and lower, the characteristic feature of which is their separation. The column separation is characteristic for the upper flow, while cushion-ball separation – for the low flow. The capacity of basalts is not constant and averagely varies within 20-50 m range.

The area is mainly represented by cliffy rocks (andesites, porfirits, diorites), covered with surface dealluvial -prolluvial sediments of 4-6 m capacity.

The tectonic state of the studied area is defined by its location in Somkheti-Karabagh intrageoanticlinal zone. Lalvar synclinorium touches immediately to the studied area from the north-west side, stratified with Middle-Upper /White/ Jura and Eocene formations and Chatindagh anticlinorium – from the south-east side, among which the Middle-Upper /White/ Jura formations are revealed.

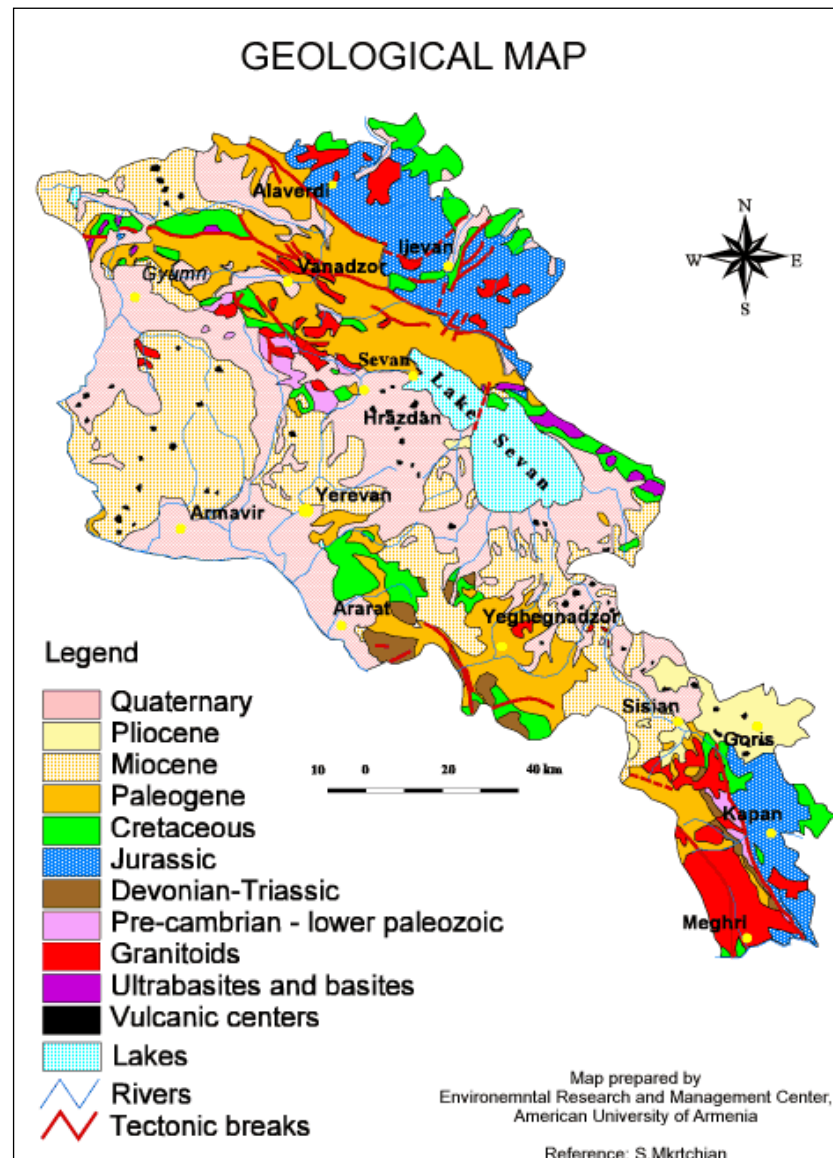


## Hydro-geological conditions of the area

From a hydro-geological point of view the studied route area is characterized by presence of splinter / riving / and splinter-porous waters, as well as by local extension of waters of dealluvial-prolluvial formations.

The main mass of splinter-empty and splinter-porous type waters belong to dolerite basalts, porfirits, their tuff-sandstones and similar rocks. Due to their cracked feature these rocks are easily dismissing surface (mainly melted and atmospheric) waters, which, by infiltration are accumulated in deep horizons, having ground flows in the direction of the Debed river, its streams, valleys and riverbed. The hydro-geological conditions are favorable for site development. The ground waters have not been discovered in the stated sites, in boreholes up to 6 m depth. Springs of limited quantity come out in separate parts of the Debed River. Waters of dealluvial-prolluvial formations are met in the slope foothills in the form of wellsprings.

The geological map of Armenia is given in Figure 7-2.



**Figure 7-2:** General geological map of Armenia

### **Seismic-tectonic conditions of the area**

The seismic–tectonic conditions of the area are favorable. During the assessment of the seismic–tectonic conditions of the area a high importance is given to the discovery of active fracture / faults / zones and to the determination of the initial value of seismic danger by estimation of ground conditions. There are no active tectonic fractures / faults in the area.

According to the RA CCII-02.02.2006 the area is included in the seismic zone I (one), where the expected maximum accelerations make 0.20 g (8 points).

#### **7.1.5 Soils**

The brown mountainous forest soils with a number of their subtypes are common in the investigation area. 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.

Distribution of soil types in Armenia is shown in Figure 7-3.

#### **7.1.6 Water Resources**

The Debed River flows parallel to the proposed corridor and will be crossed two times by the line. Debed River and its tributaries are mainly fed by rains. High water season lasts from March until June, followed by a stable and low water dry period. Short and intensive floods are observed in September and October, depending on the amount of precipitation

In general, the river is characterized by intensive and highly erosive floods. Surface waters are fresh, with mineralization between 238 and 599 mg/l. River waters are used by the local population for irrigation.

## DISTRIBUTION OF KEY SOIL TYPES IN ARMENIA



Figure 7-3: Distribution of soil types in Armenia

### 7.1.7 Flora and Fauna

The Project area is located at the northern part of the Ijevan Floristic Area of the Republic of Armenia and is dated to the Suicumbolistic Floristic Area of 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.

Mountain flora includes *Iris furcata*, *Anemone fasciculata*, *A. ramunculoides*, *Caltha popypetala*, *Veratium lobelianum*, *Palsatilla armena*, *Corydalis persica*, *Fritilaria caucasica*, *Betonica grandiflora*, *Prunus*

*spinosa*, *Sedum pilosum*, *Sempervivum transcaucasicum*, *Malus orientalis*, *Pyrus caucasicus*.

River gorges flora include *Iris lineolata*, *I. paradoxa*, *I. caucasica*, *Allium stamineum*, *Bellevalia paradoxa*, *B. longystila*, *Datura stramonium*, *Digitalis ferruginea*, *Muscari atropatana*, *M. sosnovskyi*, *Tulipa sosnovskyi*, *Punica granatum*, *Vinca sp.*, *Vitis sylvestris*, *Ficus carica* (wild).

The study area and adjacent territories carry various animal species, mostly inhabiting forests, hardy shrub associations, abandoned gardens and bee yards. Notable fauna include sylvan wildcat, reed wildcat, lynx, fox, royal stag, deer, Caucasian squirrel, porcupine, bear, wild bore and marten.

Armenia does not lie on one of the primary migration paths of birds. These paths bypass the country from east and west. Thus, The OTLs do not cross any Important Bird Area identified by Birdlife International.

### 7.1.8 Forests

The investigation area falls within the Forest Landscape Zone. In Armenia forests generally cover the mid-zone of mountains, occurring at altitudes between 500 m and 2,100 m in the north of the country. Armenian forests are predominantly broadleaved (97 %). The forest areas in Armenia are shown in Figure 7-4.

The forest cover of the proposed corridor comprises mainly the section from Haghpat to the crossing of Debed River south of Pokr Ayrum. About 5.5 km of forest is crossed by the proposed transmission line in this section and may require felling of trees in the forested area. This section of the proposed corridor is predominantly covered by hornbeam-oak forests, with the main species Georgian oak (*Quercus iberica*), accompanied by the common hornbeam (*Carpinus betulus*). These species are not threatened.

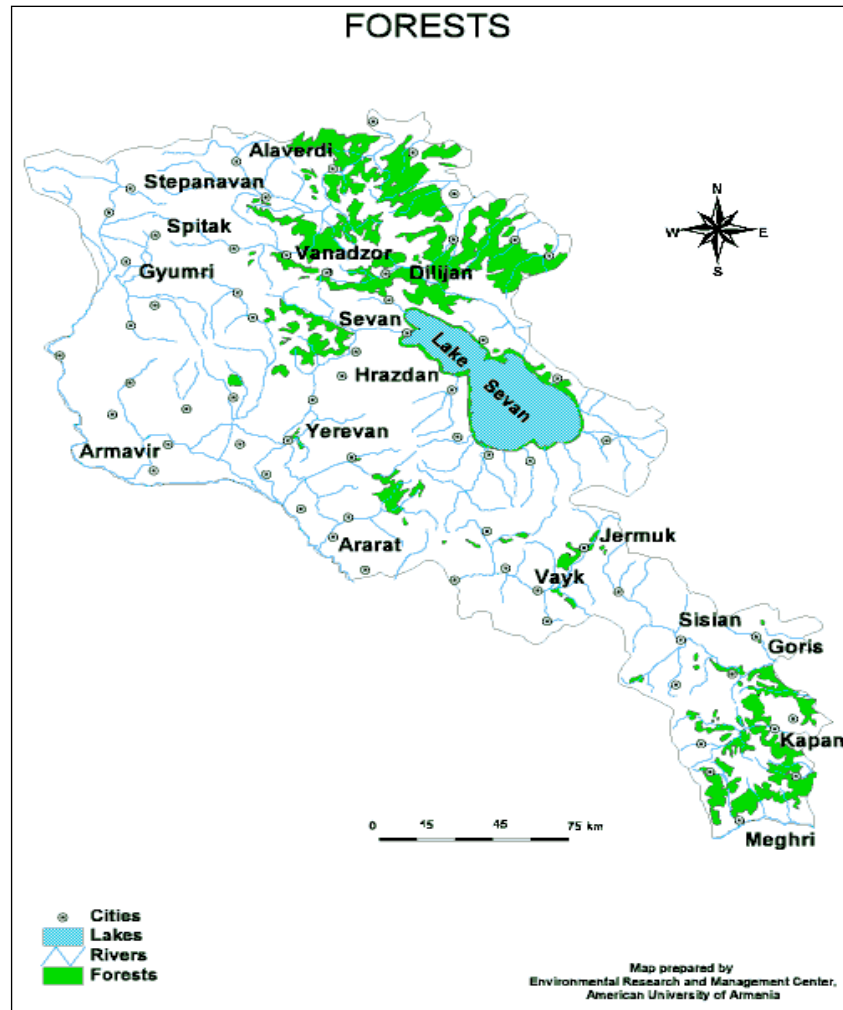
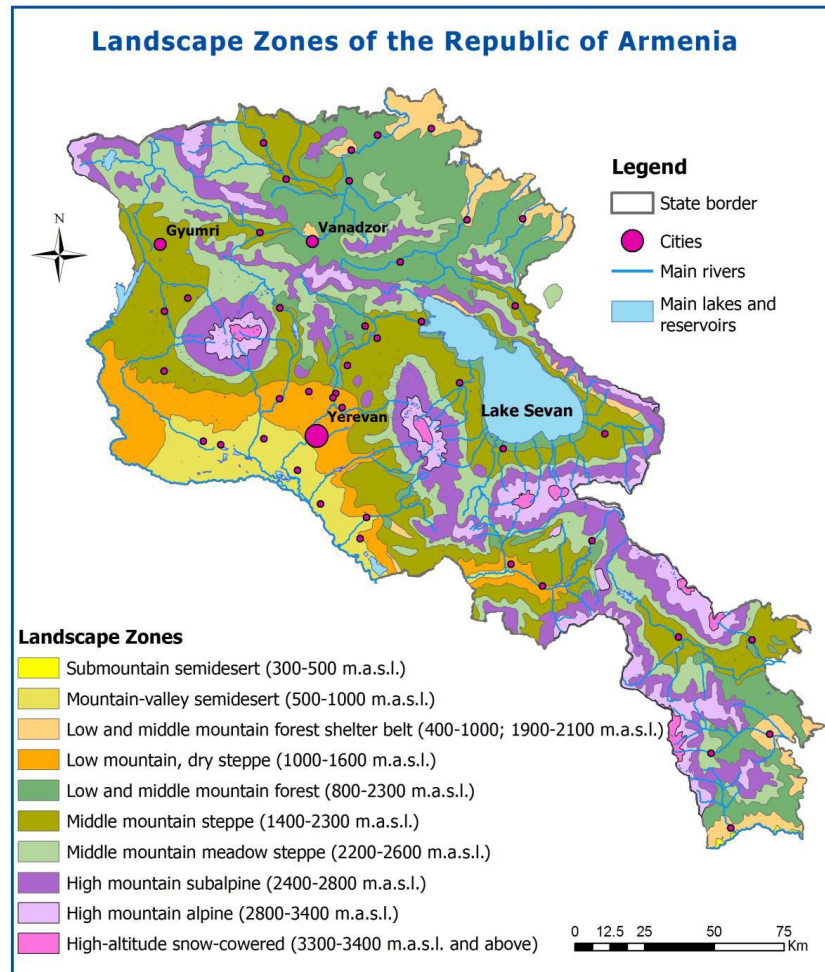


Figure 7-4: Forest cover in Armenia

### 7.1.9 Landscape

The investigation area falls within the Forest Landscape Zone (see Figure 7-5) and is strongly separated sculptured terrain with steep slopes and intervals of pastures and agricultural fields. The existing transmission lines are located on the mountain plateaus and river gorge / both sides of the road representing high visual impact. The Debed River gorge is marked by settlements. Debed River valley is very scenic and presence of the existing transmission lines represents a visual nuisance from a tourism perspective. Although not part of the Project, HVEN will dismantle the existing 110 kV OTLs and there will be no additional nuisance, as the number of towers remains more or less the same.



Source: Fifth National Report to the Convention on Biological Diversity, Republic of Armenia, Yerevan 2014

Figure 7-5: Landscape zones of Armenia

#### 7.1.10 Protected Areas

The proposed line routing of 110 kV OTLs Lalvar and Noyemberyan and its access roads will not cross or affect any of the protected areas of Lori and Tavush Marzes.

#### 7.1.11 Waste Management in Armenia

About 60 landfills (dump sites) can be found in the country. The waste management sector in Armenia is regulated by the RA Law on Waste and by 30 legal acts deriving from it, but there are very few capacities for recycling, neutralization, and elimination of hazardous waste, e.g. a landfill at Yerevan. Solid waste management is poorly organized in Armenia. Most of the solid waste is dumped in provisional dump sites and landfills without any segregation or recycling. Solid waste is generally not disposed of in accordance with internationally accepted practices. Waste is either burned or just dumped.

In order to change the situation Armenia is a party of the Basel Convention “On the Control of Transboundary Movements of Hazardous Wastes and their Disposal” since 1999 and the Government of the Republic of Armenia ratified in 2003 the Stockholm Convention “On Persistent Organic Pollutants”. A National Implementation Plan was developed based on Article 7 of the Stockholm Convention published in 2005. In 2004, the Law on Waste was entered into force which defines the state policy in the area of waste use, aimed at preventing the harmful impact of waste on the environment and human health, while maximizing its use as a secondary raw material.

However, the field work undertaken as part of the ESIA revealed that a recycling system for any waste is not available in Armenia at all. Valuable waste as used oil is either sold to private persons or exported to e.g. Iran for recycling purposes (e.g. steel/ iron). Enterprises like an Open Joint Stock Company *ASCE Group*, located at Charentsavan are currently contacted for possible recycling.

Consequently, the current situation concerning waste management also at the substations is bad. All wastes ever generated have been stored at the substation sites since decades. Thus, old equipment as old circuit breakers, ceramic parts and steel but also old batteries and old oil not suitable for further use are stored somewhere at the site. Sometimes they are stored securely, but steel parts and oil tanks are mostly exposed to rain and wind. All these old parts are still in the balance of HVEN. Therefore, HVEN will store all of the metal parts and other items mentioned above at the Alaverdi-2 and Vanadzor-1 substations, which have sufficient space. Construction Contractor will have to clarify with local authorities, where the different types of waste may be disposed of.

## 7.2 Socio-economic Conditions

### 7.2.1 Population in the Study Area

The area of the planned OTLs corridor passes through the marzes of Lori and Tavush. Some rural communities like Akner, Haghpat, Neghots, Pokr Ayrum and Mets Ayrum are situated in the vicinity of the proposed corridor.

Lori Marz has a population of 234,700 people for a territory of 3,799 km<sup>2</sup> and a population density of 62 persons per km<sup>2</sup>. Tavush Marz has a population of 128,300 people and a territory of 2,704 km<sup>2</sup> with a population density of 47 persons per km<sup>2</sup>.

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.

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.

Most agriculture is subsistence, 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 often migrated to the cities, primarily Yerevan or abroad, in search of more economic opportunities.

## 7.2.2 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.

According to the State Register of Cultural and Historical Immovable Monuments of Armenia (State Register), there are 2,460 historical-cultural monuments considered state property and are not subject to alienation in Lori Marz and 1,680 monuments in Tavush Marz, respectively (CE/EC 2010).

During field work undertaken as part of the ESIA, two cultural sites were identified, which were located in the ROW of the existing / the new 110 kV OTLs corridor:

- Northeast of Haghpat village between APs 12 and 13 a cultural site (Khachkar stone, see Photo 9-7), is located in the corridor of the existing 110 kV line.
- Between APs 15 and 16 the ruin of a church and an adjacent graveyard are located in in the corridor of the proposed 110 kV OTLs (see Photo 9-8).

No physical cultural property is located within the ROW and that is confirmed by the Ministry of Culture. 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.

## 7.2.3 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.

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.

#### 7.2.4 Land Use Pattern and Agriculture

Relating to the Statistical Yearbook of Armenia (2013)<sup>1</sup> 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 448,400 ha arable land, 33,400 ha perennial grass, 121,600 ha plough-land, and 392,700 ha others. Agricultural land of Armenia is shown in Figure 7-6.

According to data from State Cadaster Committee of RA private agricultural lands within the regions are less than 23 % of all agricultural lands, with pastures accounting for more than 70 % of the State agricultural lands. However, more than 59 % of arable lands are private land (see Table 7-2).

---

<sup>1</sup> <http://www.armstat.am/file/doc/99477353.pdf>

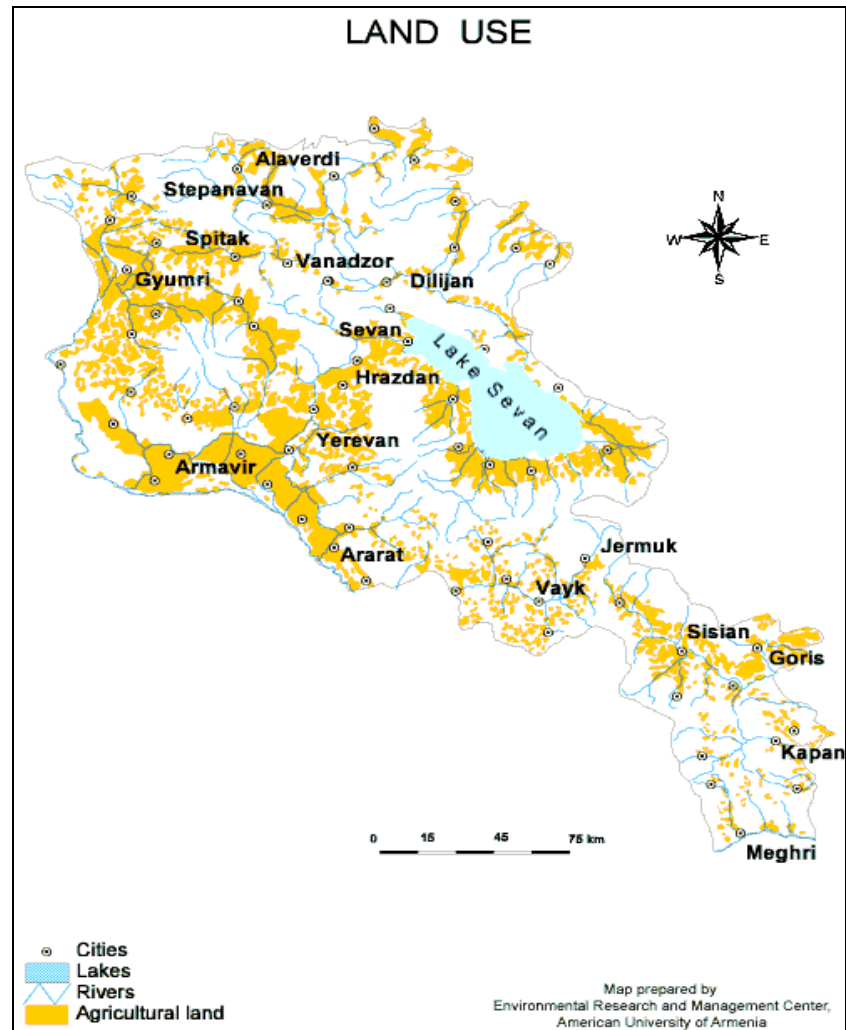


Figure 7-6: Agricultural land in Armenia

Table 7-2: Agricultural Land Inventory of RA, for Lori Marz, data from report of the State Cadaster Committee of the of Republic of Armenia 2013

Land Category	Lori	Tavush
<b>Total private agricultural land (ha)</b>	<b>49,404</b>	<b>24,454</b>
Arable (ha)	29,475	18,789
Orchard and Vineyard (ha)	296	1,424
Hayfield (ha)	16,300	4,081
Pasture (ha)	3241	28
Other (ha)	93	133
<b>Total State agricultural land (ha)</b>	<b>201,750</b>	<b>86,326</b>
Arable (ha)	12,600	6,817
Orchard and Vineyard (ha)	122	474
Hayfield (ha)	18,848	5,194
Pasture (ha)	142,480	63,167
Other (ha)	27,699	10,674

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, to more deep-rooted crops such as fruit trees (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. 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 transmission line replacement. About 47 % of the proposed line corridor are used for agriculture, pastures comprise about 16 %, tree plantations about 4 %, and about 23 % are forested areas (assessed on basis of satellite images from 2010).

### 7.2.5 Living Standards

According to the Program for the socio-economic development of the Lori Marz, the poverty level in Lori Marz is above and in Tavush Marz is below Armenia's average.

According to studies of the living standards of the local households carried out by the national statistics service of Armenia, the percentage of people living below the official poverty level is greater in Lori region than the average for the republic. The average is 35 % and in the Lori region it's 45.4 %. The severity of poverty in the Lori Marz is also above the republican average. 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 7-3:** Main poverty statistics for Lori and Tavush Marz, 2011

Marz (Region)	Extremely poor	% of people below poverty level	% of extremely poor in total poor	Percentage in total population
Lori	4.7 %	45.4 %	12.3 %	9.4 %
Tavush	2.0 %	26.7 %	3.4 %	4.5 %
<b>Armenia</b>	<b>3.7 %</b>	<b>35.0 %</b>	-	-

## 8. Information, Disclosure, Consultation, and Participation

*Fichtner's* environmental and social specialists, together with the national environmental consultant, held meetings at Yerevan and at Vanadzor with representatives of HVEN, Ministry of Nature Protection, Ministry of Culture, and conducted field trips to the proposed corridor of OTLs Lalvar and Noyemberyan (see Section 12.1 – Appendix I).

In Yerevan and Vanadzor possible environmental and social impacts as well as waste disposal possibilities at Armenia and Lori Marz were discussed. At Yerevan the NGOs WWF and Aarhus Center were consulted and informed about the upcoming works.

The Ministry of Culture/Agency for Security of Historical and Cultural Monuments at Yerevan was consulted and procedures to protect historical and cultural sites were discussed there.

The Final Draft version of the ESIA, including the ESMP, will be disclosed to the public in English and Armenian versions for sufficient time to allow stakeholders to familiarize with it. According to national requirements, the disclosure period is only 7 days, but disclosure of the documents for at least two weeks is recommended. The core of the affected people shall have real access to the documents, which will therefore not only be posted on HVEN's website, but will also be delivered in printed copies to the local administration offices and advertisements in local media about their availability will be made. Also HVEN will provide printed copies to representatives of civil society organizations. The list of civil society organizations will be discussed with the Aarhus Center, which keeps database of NGOs by the type of their activity, including CSOs at the grassroots level.

Earliest two weeks after disclosure of the documents, public consultations on the ESIA will be held. Consultation meetings shall concentrate on interpreting the ESIA report to the PAP and seeking their feedback and concerns, which will then be involved in the revision of the Final Draft ESIA report. The ESIA report as well as the Project Resettlement Policy Framework (RPF) will be discussed together in public consultation meetings.

HVEN will ensure that all public consultations are gender sensitive. This means that consultations have to include representation of the public (women, youth, and vulnerable groups) as well as ensure that gender-focused civil society organizations are invited.

Various NGOs, including the Aarhus Center (national and regional offices), will be invited to the public consultations. HVEN will identify relevant NGOs and ensure sharing of information / studies.

Public consultations will be held close to the implementation sites, so that the community can engage with the process and express their questions and concerns.

## 9. Environmental and Social Impacts and their Management

### 9.1 Environmental Impacts and their Mitigation during Design

#### 9.1.1 Line routing

The planned line will follow the already existing 110 kV OTL corridor in a distance of about 50 m. Due to the fact, that the routing of the proposed line crosses a number of buildings, there is a necessity for the creation of bypasses in order to avoid any physical relocation (see Section 6.2).

Areas of special concern for the line routing of Lalvar and Noyemberyan OTLs are:

- Houses in the west of Haghpat village (between APs 8 and 9)
- Houses to be over-spanned at Neghots village (between APs 21 and 22)
- Buildings to be over-spanned south of Pokr Ayrum before crossing the valley of Debed River (between APs 23 and 25)
- Houses near Noyemberyan substation
- Forested areas between Haghpat and the crossing of Debed River south of Pokr Ayrum (between APs 13 and 24). In these areas wide-span towers shall be installed at the hilltops, in order to over-span the forested hillsides and valleys, thus minimizing the cutting of trees.

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

#### 9.1.2 Access Roads

As the proposed line corridor of the new 110 kV OTLs will be near to the corridors of the existing 110 kV or 220 kV lines, the already existing access roads / tracks will be used. According to Tractebel Engineering (2014) about 80 % of new tower locations have existing access tracks or roads. Especially in the area between APs 13 and 24, where the line corridor is crossing the forested hilly to mountainous terrain south of Debed River valley the existing access tracks will have to be refurbished (e.g. cutting of vegetation covering the tracks) and some new tracks may have to be constructed (see Photo 9-1). Erosion prevention measures as roadside plantation with bushes and drainage systems will have to be implemented. Access roads that are not needed anymore after accomplishing construction will be rehabilitated and replanted.

Access tracks / roads will be designed to avoid 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).



**Photo 9-1:** Forested mountainous terrain (right side of picture) northeast of Haghpat

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

## 9.2 Environmental Impacts and their Mitigation during Construction

### 9.2.1 Landscape

In some parts of the OTL corridor, there is a high burden on the landscape caused by many other parallel lines crossing the country and by long distribution lines. Due to the character of the landscape the visibility of towers is often high.

The planned OTL corridor partly traverses Haghpat village which is an area of national importance for tourism (Haghpat Monastery). If the towers of the existing 110 kV OTLs will be effectively dismantled, the number of towers will be about the same as before, thus not increasing visual nuisance.

Debed River gorge is very scenic and the presence of existing transmission lines represents a visual nuisance from a tourism perspective. In order to reduce the visual impact of towers, HVEN will dismantle the old 110 kV OTLs as part of its core activity, which is not part of the Project. After replacement of the lines, the number of towers will then remain more or less

the same. The dismantling shall include also removal of no longer used tower fundamentals.

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

## 9.2.2 Flora and Fauna

Most of the land to be crossed consists of agricultural land, grazing land and hilly terrains. About 47 % of the proposed line corridor are used for agriculture, 23 % are forested areas (see Photo 9-2), pastures comprise about 16 %, shrub land about 8 %, and tree plantations about 4 % (assessed on basis of satellite images from 2010). The construction process will be carried out with due precaution in order to limit damages to flora and fauna. No protected areas will be affected by the proposed 110 kV OTLs corridor or any access roads.



**Photo 9-2:** Forested hill near AP15

About 80 % of the new tower locations can be accessed using existing access tracks or roads, which will be used as far as possible. However, in the area between APs 13 and 24, where the line corridor is crossing the forested hilly to mountainous terrain south of Debed River valley, the existing access tracks will have to be refurbished (e.g. cutting of vegetation covering the tracks).

Impacts to forested areas are unavoidable, as parts of the ROW have to be cleared of high trees which may lead to habitat alteration or loss. If the



proposed mitigation measures are implemented the impact is rated to be medium. Among others those measures include:

- Construction works at forested areas shall be avoided during breeding / nesting season (March - June).
- Long 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.
- Because no functional damage of forest ecosystem is expected, there is no need for biodiversity offset, however a compensatory tree planting plan will be developed and implemented as part of the Project. Tree species typical for the Project area will be planted at the ratio of 2:1 (two trees planted for one tree removed - according to national law) within the project area. Plantation maintenance and re-planting of dead seedlings will be done by forest departments or contracted to an NGO or a private company.
- Tower locations which have no existing access tracks shall be reached along the ROW in order to avoid unnecessary felling of trees.
- 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.

A total area of about 29 ha within the line corridor is forested and may be affected by felling of trees. If the forested hillsides and valleys will be over-spanned, the forest will not be fragmented in an ecologically significant way. The number of trees to be replanted and the 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.

Installation of bird flight diverters at the ground wires, where the power line over-spans valleys, and fitting towers with “bird guards” are recommended, in order to minimize risks of birds’ electrocution and collision (see Section 9.3.2).

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

### 9.2.3 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.

Especially when crossing the valley of Debed River and the steep side valleys (e.g. APs 3-4 Sanahin/Akner, APs 7-8 Akner/Haghpat, APs 21-22 Neghots, APs 28-29 Mets Ayrum) 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 (see Photo 9-3).



**Photo 9-3:** Steep valley to be over-spanned at Neghots village

Additional to the mitigation measures given in Section 10.1.2, preparation and implementation of specific erosion control plans is recommended, once the final technical design of the OTLs is available, as this final design will present information about location of towers and access roads, type of tower fundamentals and necessary earthworks for construction.

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

#### 9.2.4 Soil and Water Resources

There is a 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.

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<sup>2</sup> - 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.

<sup>2</sup> see IFC / EBRD Guidance Note on Workers' Accommodation (2009)

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

### 9.2.5 Solid 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. The generation of solid waste will be minimized by a proper waste management implemented by the construction contractor. Small amounts of Hazardous waste like oil, fuel, paint or spill contaminated soil will be stored at substation Alaverdi-2, which has sufficient space and required storage facilities (roofed, concreted and banded) as confirmed during the site visit. In order to reduce the visual impact, the towers of the old 110 kV OTLs shall be completely dismantled when the new line will be taken into operation. This shall also include removal of no longer used tower fundamentals. The Construction Contractor will agree with municipal authorities about using services of communal service providers for waste disposal purposes. Construction wastes include small amounts of packaging material, remaining metal parts, ceramics etc. While there are no standard sanitary landfills in the country, disposal of waste through official communal service providers will ensure that at least no free dumping and no open air burning of waste occurs. Scrap metal may be sold for recycling purposes to specialized companies (e.g. ASCE Group OJSC, Charentsavan), which should pick up the scrap metal directly at the dismantling sites.

Impact of/ on	Sensitivity	Extent of Impact on/ by	Duration of Impact	Direct/ Indirect
Solid Waste (generated by construction activities and by workers)	■ ■	■	Short term during construction	Indirect
Dismantling of old line	■ ■	■	Long Term	Direct

### 9.2.6 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 is 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 9-1). In order to keep nuisance from construction noise low, construction works near villages or houses shall be done between 9 am and 4 pm. Nuisance from noise may occur along the OTLs Lalvar and Noyemberyan in the villages Akner, Haghpat, Neghots, Pokr Ayrum, Mets Ayrum, Chochkan, and Haghtanak. 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

### 9.2.7 Air Quality

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
Air Quality	■	■	Short term during construction	Direct

## 9.3 Environmental Impacts and their Mitigation during Operation

### 9.3.1 Flora

Growing trees and shrubs within the ROW have to be cut from time to time to keep the minimum safety clearance of 7.5 m 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.

Most of the land within the ROW is agricultural land that can be cultivated with most of the original crops as before, except for the tower sites themselves.

The vegetation under new towers and along new access roads / tracks will partly be destroyed permanently. The vegetation within the ROW is cleared on a regularly basis during operation of the OTLs 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.

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

### 9.3.2 Fauna

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

Detailed information does not exist on birds' migration paths, but it is known that Armenia does not lie on one of the primary migration paths, which are located east and west of the country. Migrating birds fly in high altitude above 800 m. The planned OTLs do not cross any Important Bird Area identified by Birdlife International.

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 overflying the gorges (see Photo 9-4) 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.



**Photo 9-4:** Eurasian Griffon soaring above gorge west of Haghpat village

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 9-1) are installed at the conductors or the ground wire (VDE/FNN 2014).



**Figure 9-1:** 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 gorges. This will be the case between APs 3-4, APs 7-8, APs 13-14, APs 19-20, APs 21-22, APs 22-23, APs 24-25, APs 28-29, and APs 38-39 (see Map 9-1 and Map 9-2)

The bird diverters can be added to the ground wire during construction using line cars or line bicycles (see Figure 9-2).



**Figure 9-2:** Installation of bird diverters using a line car (left) or a line bicycle (right)

“Bird guards” are already foreseen in the functional preliminary tower design in order to minimize the risk of electrocution (Tractebel Engineering 2014): Stainless steel needle strips will extend sufficiently horizontally beyond the protected location and be applied to all surfaces a bird can sit on. Where needles are projecting from the cross-arm contours towards live parts, the tower clearance diagram will consider the height of the needles.

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).

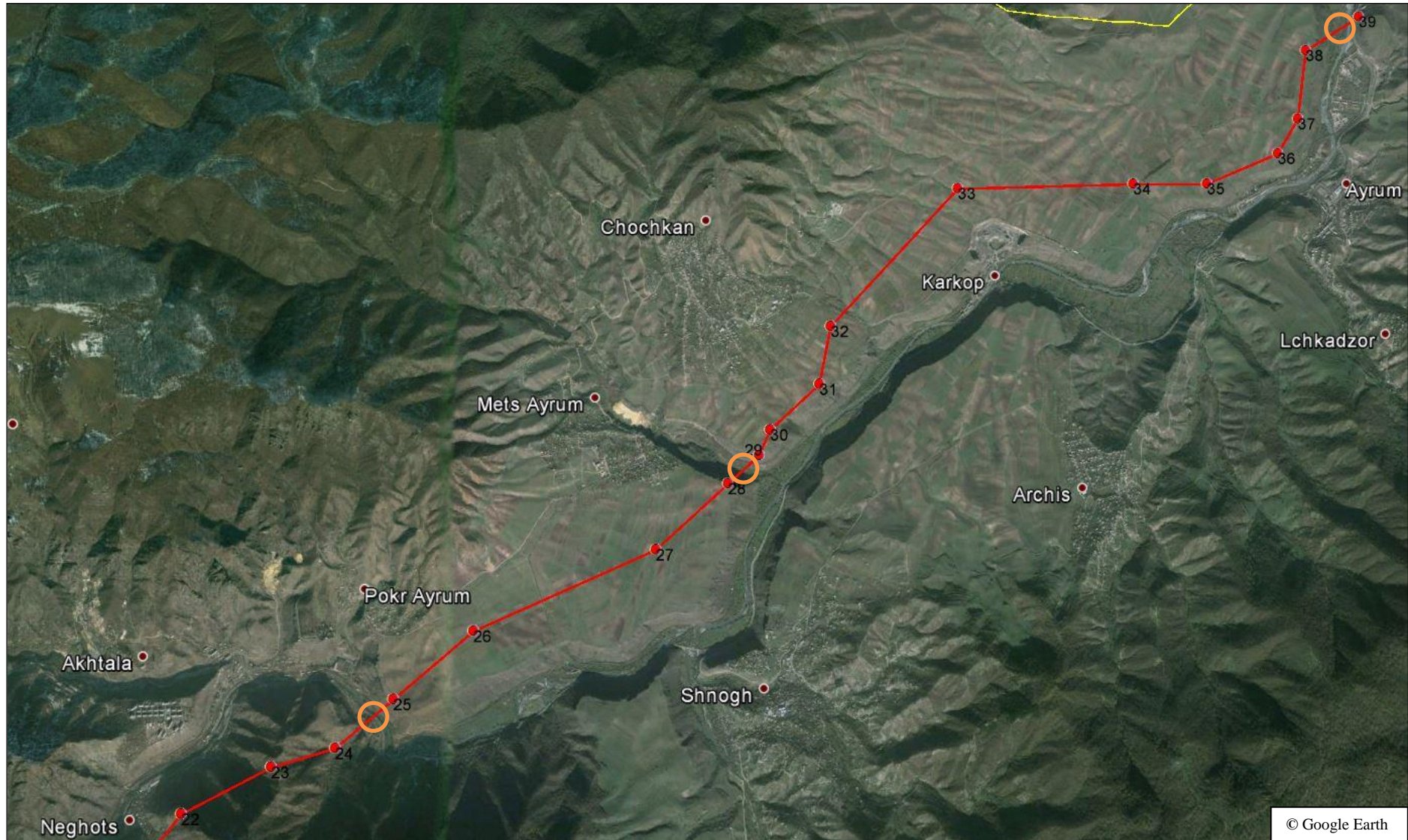
Construction and operation of OTLs will not cause loss or functional alternation of habitats that may affect viability of any plant or animal populations supported by these habitats. Main impact on wildlife will be confined to temporary disruption during construction works and no additional harm is likely at the operation stage.

<b>Impact of/ on</b>	<b>Sensitivity</b>	<b>Extent of Impact on/ by</b>	<b>Duration of Impact</b>	<b>Direct/ Indirect</b>
Fauna	■	■	Short term	Direct





Map 9-1: Line sections of planned 110 kV Lalvar and Noyemberyan OTLs crossing gorges, where bird diverters shall be installed (orange circles) - south-western part



**Map 9-2:** Line sections of planned 110 kV Lalvar and Noyemberyan OTLs crossing gorges, where bird diverters shall be installed (orange circles) - north-eastern part

### 9.3.3 Noise

The intensity of corona noise is influenced by weather conditions. Wet weather, fog or rain increases the noise level but these weather conditions do not dominate the weather in the study area. For population following limit values are valid (General WB/IFC EHS Guideline):

**Table 9-1:** 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 on the landscape through noise resulting from the operation of the OTL are assessed to be low. Noise emitted by conductors (corona effect) will be minimal. Specific mitigation measures are not necessary.

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

### 9.3.4 Climate Change

The replacement of the existing transmission line may have zero or even a positive impact on climate change as energy efficiency will be increased for the new line.

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

### 9.3.5 Electric and Magnetic Fields

Technical regulations on safety zones for electric networks of Armenia define a distance of 20 m for 110 kV OTLs from the outer conductors (GRA 2009) as a buffer zone. The World Bank uses WB/IFC Performance Standards 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 ( $\mu$ /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 ( $\mu$ /T)
50 Hz	5000	100
60 Hz	4150	83

The OTL 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 OTLs 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.

Impact of/ on	Sensitivity	Extent of Impact on/ by	Duration of Impact	Direct/ Indirect
<u>Electric and Magnetic Fields</u>				
• for the public	■	■	Long term	Indirect
• at the workplaces	■	■		

## 9.4 Social Impacts and their Mitigation during Construction

### 9.4.1 Land Use and Land Acquisition

With a length of approx. 25 km the planned transmission line is likely to affect land use. Some private land may need to be acquired for the tower locations, for new access roads, and about 200 – 300 m<sup>2</sup> will be needed near to Noyemberyan substation for construction of additional equipment. 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 PAP for impacts that cannot be avoided. As the line passes 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. Fields are fragmented and size is often very small. Agriculture will be possible in ROW after construction period.



**Photo 9-5:** Planned corridor crossing agricultural land northwest of Haghpat village

**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 or temporary, if the former land use can be continued after construction. The extent of permanent impact of access roads on private lands is therefore 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

#### 9.4.2 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 World Bank's Operational Policy OP 4.12 - Involuntary Resettlement provides safeguards to address and mitigate impoverishment risks related to involuntary resettlement under development projects. The main objectives of OP 4.12 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. Project affected persons 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, the World Bank policy requires 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 OTLs 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 (see proposed bypasses in Section 6.2).

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

### 9.4.3 Historical and Cultural Sites

According to information from Ministry of Culture - Agency for Security of Historical and Cultural Monuments there are no known historical or cultural sites located in the proposed line corridor (see Section 12.1 – Appendix I).

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 will not be mentioned here, as they won't be directly affected by the line construction.

The planned 110 kV OTL corridor traverses Haghpat village, where Haghpat Monastery, an area of national importance for tourism, is located. However, the monastery will not directly be affected as the line corridor will have a distance of more than 450 m (see Photo 9-6). In order to reduce the visual impact of towers the old 110 kV OTL towers shall be completely dismantled. This shall include removal of no longer used tower fundamentals. Thus, the number of towers will remain more or less the same.



**Photo 9-6:** Haghpat Monastery in a safe distance from the planned corridor (picture taken from the proposed corridor)

During field visits two cultural sites were identified, which were located in the ROW of the existing or the new 110 kV OTL:

- Northeast of Haghpat village between APs 12 and 13 a cultural site (Khachkar stone, see Photo 9-7), is located in the corridor of the existing

110 kV line. During construction and dismantling of the old line this cultural site may not be damaged in any way.



**Photo 9-7:** Khachkar stone within existing 110 kV OTL corridor northeast of Haghpat

- Between APs 15 and 16 the ruin of a church and an adjacent graveyard are located in in the corridor of the proposed 110 kV OTLs (see Photo 9-8). If a tower has to be located near to this cultural site, the Ministry of Culture will have to be consulted.



**Photo 9-8:** Church ruin and adjacent graveyard located in the proposed corridor

No other physical cultural property is located within the ROW and that is confirmed by the Ministry of Culture. 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 OTLs.

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)

#### 9.4.4 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 may result from various factors as electrocution during construction, sanitary situation during construction, e.g. contamination of water, sexually transmitted diseases (STD), especially HIV/AIDS due to contact of workers and population etc.

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<sup>2</sup>, 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.

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

#### 9.4.5 Infrastructure

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 110 kV OTLs run parallel to existing other lines (35 kV, 110 kV and 220 kV OTLs), 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 the existing lines are crossed by the new 110 kV OTLs adequate precaution measures have to be taken and adequate minimum distances between the conductors (> 4 m, according to Tractebel Engineering 2014) have to be ensured.

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

According to HVEN and Tractebel Engineering (2014), it will not be required to disconnect the existing lines from the grid during construction. Thus no power outage will occur during construction works.

### 9.4.6 Gender Aspects

The construction of the lines 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 is 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

### 9.4.7 Vulnerable People

In Lori Marz the incidence of poverty is about 45.4 % in Tavush Marz 26.7 %, including urban areas, where poverty incidence is expected to be lower. In remote areas and above 1500 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 OP 4.12 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 times 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

#### 9.4.8 Local Workforce

During the construction period local workforce will be employed for the construction of 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

### 9.5 Social Impacts and their Mitigation during Operation

#### 9.5.1 Land Use

An area of approx. 100 m<sup>2</sup> 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. The remaining land of the line corridors can be used as agricultural land or as pasture land without restriction. Maintenance works are not expected to have a major social impact. Minor impacts, as damages to crops during maintenance works will have to be compensated.

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

#### 9.5.2 Electricity Supply

Due to the dilapidated condition of the existing power lines, outages are likely in case of no Project intervention. An increased stability of the electricity supply, especially if a raising demand is expected, is a locally positive impact of the Project. An increased efficiency / reduction of transmission losses in the electricity network will be regionally positive.

Impact of/ on	Sensitivity	Extent of Impact on/ by	Duration of Impact	Direct/ Indirect
Electricity Supply	■■■	+ ++	Long term	Direct

## 9.6 Summary of Impacts

**Table 9-2:** 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 9-3:** 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	Direct by the physical presence of the line
Flora and Fauna	■ ■	■ ■	Long term	Direct
Soil Erosion	■ ■	■	Long term	Direct
<u>Soil</u>	■ ■	■	Short term during construction	Direct
<u>Water Resources</u>				
a) Groundwater	■	■		
b) Surface Water	■ ■	■		
Solid Waste (generated by construction activities and by workers)	■ ■	■	Short term during construction	Indirect
Dismantling of old Line		■	Long term	Direct
Noise	■	■	Short term during construction	Direct
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	■	■	Short term 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 9-4:** 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
Noise	■■	■	Long term	Indirect
Climate Change	■■■	○	Long term	Indirect
<u>Electric and Magnetic Fields</u> for the public	■	■	Long term	Indirect
at the workplaces	■	■		
Land use	■	■	Long term	Direct
Electricity Supply	■■■	+ ++	Long term	Direct

Extent of impact:

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

Extent of sensitivity

■■■	=	high
■■	=	medium
■	=	low

## 10. 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 replacement of OTLs Lalvar and Noyemberyan and will become integral part of civil works contract(s). 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.

In summary it can be concluded that the proposed replacement of 110 kV Lalvar and Noyemberyan OTLs **can be constructed and operated without having significant adverse impacts on the ecological and social environment**, if all mitigation measures proposed in the ESMP are implemented.

## 10.1 Mitigation Measures

### 10.1.1 Mitigation Measures for the Design and Pre-Construction Phase

**Table 10-1:** Summary of Mitigation Measures for Design and Pre-Construction Phase

<b>Mitigation measures to be applied during design and pre-construction phase</b>		
<b>Issue for Mitigation: Line routing, access roads</b>		
<b>Mitigation measures</b>	<b>Responsible Party</b>	<b>Budget for implementing (USD)</b>
Implementation of proposed bypasses of OTL corridor and / or shifting of tower locations to avoid any physical relocation (see Section 6.2)	Design Contractor  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 long span towers in order to bridge valleys, thus reducing number of felled trees in forested areas		
Consider bypasses in case of crossing cultural heritage sites, to be determined in consultation with Ministry of Culture		
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.		
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		
Inform PAPs prior to land survey that plantations / trees could be affected		
Inform PAPs prior to land survey on compensation mechanisms		
Pay compensation for all damages caused during the land survey in compliance with the project RPF		



## 10.1.2 Mitigation Measures for the Construction Phase

**Table 10-2:** Summary of Mitigation Measures during Construction Activities concerning Protection of Flora and Fauna

<b>Mitigation measures to be applied during construction phase</b>		
<b>Issue for Mitigation: Flora and Fauna</b>		
<b>Mitigation measures</b> (considering EHS-Guidelines: Electric Power Transmission and Distribution)	<b>Responsible Party</b>	<b>Budget for implementing (USD)</b>
Avoid construction during breeding / nesting season (March - June) in forested areas	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		
Use existing roads / tracks as far as possible; refurbish existing access roads / tracks at forested areas, if necessary		
Tower locations without access track shall be reached along the ROW if possible, to minimize felling of trees		
Careful design of new access roads (if any); avoid access roads crossing creeks and rivers		
Minimize introduction of foreign soil and avoid introduction of alien invasive plants to the power line corridor	Construction Contractor	45,000 for installation
Installation of clearly visible high contrast (i.e. black and white) moving bird flight diverters at the ground wires is recommended, where the line crosses gorges (see Section 9.3.2)		
Implementation of management plan for replanting of forest trees approved by Forest Department. including: area 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); ratio 2 new trees for 1 felled tree, according to national law	Construction Contractor	Costs for replanting to be determined after final survey of tower locations
Lead accurate record of all extracted trees	Forest Department	
Re-vegetate all disturbed areas and rehabilitate access roads, workers' camps, lay down and deposit areas with site specific and adaptive plant species (trees in ratio 2 new trees for 1 felled tree, according to national law)		

**Table 10-3:** Summary of Mitigation Measures during Construction Activities concerning Erosion Control

<b>Mitigation measures to be applied during construction phase</b>		
<b>Issue for Mitigation: Erosion</b>		
<b>Mitigation measures</b> (considering EHS-Guidelines: Construction and Decommissioning)	<b>Responsible Party</b>	<b>Budget for implementing (USD)</b>
Minimize removing topsoil at tower sites	Construction Contractor	Included in construction costs
Bring back topsoil to its original place, after having finished the erection of the tower		
Reseeding / replanting of native grass / shrub species at tower sites		
Careful selection of locations for new access roads (if necessary)		
Implement erosion prevention measures at access roads		
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 recommended		

**Table 10-4:** Summary of Mitigation Measures during Construction Activities concerning Soil and Water Pollution

<b>Mitigation measures to be applied during construction phase</b>		
<b>Issue for Mitigation: Soil and Water pollution</b>		
<b>Mitigation measures</b> (considering EHS-Guidelines: Water and Sanitation, Wastewater and Ambient Water Quality, Waste Management, Hazardous Material Management)	<b>Responsible Party</b>	<b>Budget for implementing (USD)</b>
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		
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		
Repair any damage to riparian areas, including riverbanks and riverbeds (if any), as soon as construction is complete		

**Table 10-5:** Summary of Mitigation Measures during Construction Activities concerning Waste Management

<b>Mitigation measures to be applied during construction phase</b>		
<b>Issue for Mitigation: Risks from Waste</b>		
<b>Mitigation measures</b> (considering EHS-Guidelines: Water and Sanitation, Wastewater and Ambient Water Quality, Waste Management, Hazardous Material Management)	<b>Responsible Party</b>	<b>Budget for implementing (USD)</b>
Collect all type of wastes including domestic and sanitary wastes. CC will have to clarify with local authorities, where these wastes may be disposed of. Waste disposal shall be done by communal services where the waste will be generated.	Construction Contractor Local authorities	Included in construction costs

<b>Mitigation measures to be applied during construction phase</b>		
<b>Issue for Mitigation: Risks from Waste</b>		
<b>Mitigation measures</b> (considering EHS-Guidelines: Water and Sanitation, Wastewater and Ambient Water Quality, Waste Management, Hazardous Material Management)	<b>Responsible Party</b>	<b>Budget for implementing (USD)</b>
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 at s/s Alaverdi-2		Costs for storage sites covered under ETNIP Project
Train workers in handling and disposal of recyclable, sanitary, solid, liquid and hazardous waste		Included in construction costs
Scrap metal from dismantling of existing 110 kV line (iron, steel, copper etc.) shall be reused or sold for recycling		No costs, as scrap metal will be sold
Only certified companies shall be contracted for waste recycling		

**Table 10-6:** Summary of Mitigation Measures during Construction Activities concerning Landscape and Visual Aspects

<b>Mitigation measures to be applied during construction phase</b>		
<b>Issue for Mitigation: Landscape and Visual Aspects</b>		
<b>Mitigation measures</b>	<b>Responsible Party</b>	<b>Budget for implementing (USD)</b>
Dismantling of workers' camps and harmonization of the areas with the landscape	Construction Contractor	No costs, as scrap metal will be sold for recycling
Complete dismantling of existing 110 kV OTLs (including removal of towers and fundamentals)		

**Table 10-7:** Summary of Mitigation Measures during Construction Activities concerning Noise

<b>Mitigation measures to be applied during construction phase</b>		
<b>Issue for Mitigation: Noise</b>		
<b>Mitigation measures</b> (considering EHS-Guideline: Noise Management)	<b>Responsible Party</b>	<b>Budget for implementing (USD)</b>
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 10-8:** Summary of Mitigation Measures during Construction Activities concerning Air Quality

<b>Mitigation measures to be applied during construction phase</b>		
<b>Issue for Mitigation: Risks for Air Quality</b>		
<b>Mitigation measures</b> (considering EHS-Guideline: Air Emissions and Ambient Air Quality)	<b>Responsible Party</b>	<b>Budget for implementing (USD)</b>
Limitations of size, weight or axle 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		

<b>Mitigation measures to be applied during construction phase</b>		
<b>Issue for Mitigation: Risks for Air Quality</b>		
<b>Mitigation measures</b> (considering EHS-Guideline: Air Emissions and Ambient Air Quality)	<b>Responsible Party</b>	<b>Budget for implementing (USD)</b>
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		

**Table 10-9:** Summary of Mitigation Measures during Construction Activities concerning Historical and Cultural Sites

<b>Mitigation measures to be applied during construction phase</b>		
<b>Issue for Mitigation: Risks for Historical and Cultural Sites</b>		
<b>Mitigation measures</b>	<b>Responsible Party</b>	<b>Budget for implementing (USD)</b>
Avoid any damage to cultural sites in line corridor and keep tower locations in an adequate distance (see Section 9.4.3)	Construction Contractor	Included in construction costs
Implementation of Chance Find Procedure (see Section 9.4.3) and training of the construction workers	HVEN	
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	Dep. Protection of Monuments and Historical Sites of RA	
Shifting of tower locations have to be approved by Dep. Protection of Monuments and Historical Sites of RA		

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

<b>Mitigation measures to be applied during construction phase</b>		
<b>Issue for Mitigation: Risks for Employee Health and Safety</b>		
<b>Mitigation measures</b>	<b>Responsible Party</b>	<b>Budget for implementing (USD)</b>
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 Waste Management Plan), in advance of construction activities		
Installation of an HSE Management System (HSEMS) during the construction phase		
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		
Provide HIV/AIDS protection equipment for workers		
Install warning signs “Danger of Electrocutation” at towers, substations etc.		
Accommodation of workers in adjacent towns 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 9.4.4)		
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		
Record work-hours as well as all accidents and incidents		

**Table 10-11:** Summary of Mitigation Measures during Construction Activities concerning Public Health and Safety

<b>Mitigation measures to be applied during construction phase</b>		
<b>Issue for Mitigation: Risks for Public Health and Safety</b>		
<b>Mitigation measures</b> (considering EHS-Guideline: Community Health and Safety)	<b>Responsible Party</b>	<b>Budget for implementing (USD)</b>
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		
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 50 m corridor (wayleave) of the overhead line		

**Table 10-12:** Summary of Mitigation Measures during Construction Activities concerning Traffic Management and Other Infrastructure

<b>Mitigation measures to be applied during construction phase</b>		
<b>Issue for Mitigation: Risks from / for Traffic and for Other Infrastructure</b>		
<b>Mitigation measures</b>	<b>Responsible Party</b>	<b>Budget for implementing (USD)</b>
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		



<b>Mitigation measures to be applied during construction phase</b>		
<b>Issue for Mitigation: Risks from / for Traffic and for Other Infrastructure</b>		
<b>Mitigation measures</b>	<b>Responsible Party</b>	<b>Budget for implementing (USD)</b>
Licensing and training of drivers; improvement of driving skills	Construction Contractor	Included in construction costs
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 to minimize external traffic in advance of construction period		
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 (35 / 110 / 220 kV OTLs) that ensures the width of the ROW of both parallel running lines		
Where crossing existing power lines adequate minimum distances between the conductors (> 4 m) have to be ensured		

**Table 10-13:** Summary of Mitigation Measures during Construction Activities concerning Social Impacts

<b>Mitigation measures to be applied during construction phase</b>		
<b>Issue for Mitigation: Social Impacts</b>		
<b>Mitigation measures</b>	<b>Responsible Party</b>	<b>Budget for implementing (USD)</b>
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		
Presence of an impartial person to receive complaints during the construction process		
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)		
Prosecute offenses related to payment of wages by sub-contractors strictly		
Prioritize employment of local people for construction works		
Improve recruitment of women for construction works		
Legal experts will support PAP who are not registered land owners with legalization of land titles		
Pay compensation to PAP for damages and loss of crops and for expropriation of land	Construction Contractor	Costs for compensation will be calculated in the referring RAP
Documentation of compensation payments	Construction Contractor	Included in construction costs
Develop and implement a RAP based on the Project related RPF (Consultation with PAP about their development priorities in the framework of RAP development)		Included in the construction cost
Zero tolerance for sexual harassment at the work place or in workers' camps / overnight locations	Construction Contractor	Included in construction costs
Strengthen district administrations on gender issues (i.e. receive complaints by women)		
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		

<b>Mitigation measures to be applied during construction phase</b>		
<b>Issue for Mitigation: Social Impacts</b>		
<b>Mitigation measures</b>	<b>Responsible Party</b>	<b>Budget for implementing (USD)</b>
Develop and implement a RAP implementation compliance report	Consultant	Included in the project budget

### 10.1.3 Mitigation Measures for the Operation and Maintenance Phase

**Table 10-14:** Summary of Mitigation Measures during Operation and Maintenance Activities concerning Protection of Flora and Fauna

<b>Mitigation measures to be applied during operation and maintenance</b>		
<b>Issue for Mitigation: Flora and Fauna</b>		
<b>Mitigation measures</b> (considering EHS-Guidelines: Electric Power Transmission and Distribution)	<b>Responsible Party</b>	<b>Budget for implementing (USD)</b>
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		
Implement Compensatory Tree Planting Plan using ratio of 2:1 and indicating areas for planting, age and species composition of seedlings, and maintenance requirements for a two year period		
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		
Check proper adjustment of bird diverters during maintenance works		

**Table 10-15:** Summary of Mitigation Measures during Operation and Maintenance Activities concerning Soil and Water Pollution

<b>Mitigation measures to be applied during operation and maintenance</b>		
<b>Issue for Mitigation: Soil and Water Pollution</b>		
<b>Mitigation measures</b> (considering EHS-Guidelines: Water and Sanitation, Wastewater and Ambient Water Quality, Waste Management, Hazardous Material Management)	<b>Responsible Party</b>	<b>Budget for implementing (USD)</b>
Provide proper sanitation facilities for maintenance workers	Operator (HVEN)	Included in operational costs
Train maintenance workers in appropriate sanitation practices		
Train maintenance workers in proper management of recyclable, sanitary, solid, liquid, and hazardous wastes		
Make arrangements for proper waste handling, treatment and disposal	Operator (HVEN)	Included in operational costs
Provide spill-control materials to drivers and maintenance workers, in order to clean up spills, if necessary		
Report and respond to spills promptly and train maintenance 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 10-16:** Summary of Mitigation Measures during Operation and Maintenance Activities concerning Noise

<b>Mitigation measures to be applied during operation and maintenance</b>		
<b>Issue for Mitigation: Noise</b>		
<b>Mitigation measures</b> (considering EHS-Guideline: Noise Management)	<b>Responsible Party</b>	<b>Budget for implementing (USD)</b>
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 10-17:** Summary of Mitigation Measures during Operation and Maintenance Activities concerning Air Quality

<b>Mitigation measures to be applied during operation and maintenance</b>		
<b>Issue for Mitigation: Risks for Air Quality</b>		
<b>Mitigation measures</b> (considering EHS-Guideline: Air Emissions and Ambient Air Quality)	<b>Responsible Party</b>	<b>Budget for implementing (USD)</b>
Maintain vehicles and engines properly, as recommended by suppliers	Operator (HVEN)	Included in operational costs
Avoid unnecessary idling of vehicles		
Train maintenance workers accordingly		

**Table 10-18:** Summary of Mitigation Measures during Operation and Maintenance Activities concerning Employee Health and Safety

<b>Mitigation measures to be applied during operation and maintenance</b>		
<b>Issue for Mitigation: Employee Health and Safety</b>		
<b>Mitigation measures</b>	<b>Responsible Party</b>	<b>Budget for implementing (USD)</b>
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 10-19:** Summary of Mitigation Measures during Operation and Maintenance Activities concerning Public Health and Safety

<b>Mitigation measures to be applied during operation and maintenance</b>		
<b>Issue for Mitigation: Public Health and Safety</b>		
<b>Mitigation measures</b> (considering EHS-Guideline: Community Health and Safety)	<b>Responsible Party</b>	<b>Budget for implementing (USD)</b>
Conduct Information / Awareness Campaigns on the dangers of a high voltage line (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 50 m corridor (wayleave) of the overhead line		

**Table 10-20:** Summary of Mitigation Measures during Operation and Maintenance Activities concerning Social Impacts

<b>Mitigation measures to be applied during operation and maintenance</b>		
<b>Issue for Mitigation: Social Impacts</b>		
<b>Mitigation measures</b>	<b>Responsible Party</b>	<b>Budget for implementing (USD)</b>
Land within the ROW can further be used for agricultural purposes	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		

## 10.2 Environmental and Social Monitoring

HVEN, in the capacity of an implementing agency for ESRP, will be responsible for monitoring environmental and social performance of contractor during physical works and ensure adherence to the ESMP. HVEN may undertake this task fully relying on its in-house capacity or supplement own capacity with external consultant services. HVEN must produce monthly environmental and social monitoring reports and include analytical information on environmental and social performance under the replacement of OTLs Lalvar and Noyemberyan into general ESRP progress reports on regular basis. HVEN will be responsible also for monitoring of environmental and social performance during operation and maintenance of the OTLs.

### 10.2.1 Monitoring Measures during Design and Pre-Construction Phase

**Table 10-21:** 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		
Impacts on Fauna	Pre-construction survey of birds and bats along the ROW	HVEN office	Inspection of pre-construction survey	Data about birds and bats along ROW compiled	In advance of construction	HVEN
Implementation of proposed bypasses to avoid any physical relocation	Bypasses designed and / or towers shifted to avoid over-spanning of buildings	Haghpat village	Visual inspection of planning documents	No buildings over-spanned	During Design Phase	HVEN
		Neghots village				
		South of Pokr Ayrum village				
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
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	HVEN
Over-spanning valleys	Use long span towers in order to bridge valleys	Location of towers	Visual inspection of planning documents	Long span towers used at valleys	During Design Phase	HVEN

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 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	HVEN
Impact on land use	Towers are not to be placed in orchards, vineyards, etc.	Location of towers	Visual inspection of planning documents	No towers located in orchards, vineyards	During Design Phase	HVEN
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	During Design Phase	HVEN
Historical and cultural sites	Inform Ministry of Culture about construction of towers or access roads, to avoid crossing of historical or cultural sites	Location of new towers and new access roads	Inspection of records	Ministry informed about construction of towers and access roads	During Design Phase	HVEN
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	HVEN  (for details and budget see RAP)
	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	



## 10.2.2 Monitoring Measures during Construction Phase

**Table 10-22:** 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  Visual inspection of planning documents	Lay down areas determined accordingly	Regularly during construction	HVEN
	Mark extent of the lay down areas and the routing of the access roads			Lay down areas and access roads marked		
	Use existing roads / tracks as far as possible; refurbish existing access roads / tracks at forested areas			Existing access roads used; refurbished if necessary		
	Careful design of new access roads (if any); avoid access roads crossing creeks and rivers			No creeks / rivers crossed by access roads		
	Reach tower locations without access tracks along ROW if possible			As few new access tracks as possible		
Impacts on Flora and Fauna from construction activities	Avoid construction during breeding / nesting season (March - June) in forested areas	Construction sites at forested areas	Visual inspection	No construction in relevant areas during breeding season	Regularly during construction	HVEN
	Prohibit plant-collecting and hunting; instruct workers not to disturb animals; do not allow access to the forest			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 gorges	Construction sites at gorges		Bird diverters installed in relevant 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		
Impacts on Flora and Fauna from construction activities	Avoid complete clearing of the ROW during construction works	Construction sites	Visual inspection	ROW not completely cleared	Regularly during construction	HVEN
	Protect large trees located adjacent to the construction sites with wooden barriers to prevent unintended destruction			Large trees protected accordingly		
	Protect root zones of large trees from excessive weight of machinery or excavated material			No foreign soil and alien invasive plants introduced		
	Minimize introduction of foreign soil and avoid introduction of alien invasive plants to the power line corridor					
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	Visual inspection	Log book in place with adequate entries	During tree planting and on monthly basis throughout Project live	HVEN NGO
	Compensatory Tree Planting Plan using 1:2 ratio, including identification of planting areas, number of trees to be planed, species, age of seedlings, and needs for maintenance over 2 years			Compensatory Tree Planting Plan in place with required information included		
	Compensatory Tree Planting Plan implemented			Plantations in place with required number of seedlings of required age and species composition		
Minimize erosion at tower locations	Minimize removing topsoil at tower sites	All tower locations	Visual inspection	Topsoil brought back to original place	Regularly during construction	HVEN
	Bring back topsoil to its original place, after erection of the tower					

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 tower locations	Reseeding / replanting of native species at new tower sites	All tower locations	Visual inspection	Reseeding / replanting at tower sites implemented	Regularly during construction	HVEN
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
	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	Regularly during construction	
	Preparation and implementation of specific erosion control plans (when final technical design is available) are recommended		Inspection of erosion control plans	Erosion control plan developed and implemented	In advance of construction	
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
	Implement erosion prevention measures at all access roads			Erosion prevention measures implemented		
	Implement drainage control measures (culverts, berms, etc.) on			Drainage control measures		

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		
	permanent access roads, if they are in steep or erosion-prone areas			implemented		
Minimize erosion at access roads	Rehabilitation of new access roads not needed anymore	Location of new access roads	Visual inspection	All access roads not needed anymore rehabilitated	After construction works	HVEN
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
	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
	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
	Train workers in appropriate sanitation practices		Inspection of training records	All workers trained accordingly		
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
	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		Inspection of	Spill-control		

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		
	drivers and workers, in order to clean up spills, if necessary		equipment	equipment provided		
Soil and Water Pollution from spills	Report and respond to spills promptly and train workers in how to report	Construction sites	Inspection of spill reports, and training records	Number of spill reports All workers trained accordingly	Regularly during construction	HVEN
	Remove soil contaminated by spills and handle as hazardous waste	Construction sites	Inspection of spill reports and storage areas	All contaminated materials adequately stored		
	Collect contaminated spill materials and manage as hazardous waste	Storage area at s/s Alaverdi-2				
Soil and Water Pollution from construction at riparian areas	Repair any damage to riparian areas, including riverbanks and riverbeds (if any), as soon as construction is complete	Riparian areas	Visual inspection	All damages repaired	After relevant construction	HVEN
Waste Management	CC clarifies with local authorities, where to dispose of wastes	Construction sites	Control of written agreement	Written agreement provided	In advance of construction	HVEN
	Development of Waste Management Plan within the 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 at s/s Alaverdi-2	s/s Alaverdi-2	Visual inspection	All hazardous wastes adequately stored	Regularly during construction	
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	Regularly during construction	HVEN
Waste recycling	Scrap metal from dismantling of existing 110 kV line shall be reused or sold for recycling	Construction sites	Visual inspection	Scrap metal reused or sold for recycling	Regularly during construction	HVEN

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		
	Only certified companies shall be contracted for waste recycling	HVEN office	Inspection of companies' certificate	Waste recycling only by certified companies	Regularly during construction	HVEN
Decommissioning of workers' camps and harmonizing areas with the landscape	Disassemble light constructions	Workers' camps	Visual inspection	Locations of workers' camps are free of any waste	After construction works supported from construction camps	HVEN
	Remove concrete lining and/or gravel/sand spread in vehicle servicing areas					
	Hand over re-usable elements of waste from disassembling of constructions for recycling		Checking documents on hand-over of reusable waste	Documents on hand-over of recyclable waste are on file		
	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		
Dismantling of old towers (including removal of foundations)	Demolish old towers, including their foundations	Locations of old towers	Visual inspection	Locations of removed old towers are free of any waste	After completion of works for the removal of old towers	HVEN
	Hand over metallic reusable elements of towers for recycling		Checking documents on hand-over of reusable waste	Documents on hand-over of scrap metal are on file		
	Dispose construction waste generated from dismantling of towers and their foundations in locations agreed in written by local authorities		Checking waste disposal agreements	Documents on allowed disposal of waste are on file		

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		
	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 higher than 80 dB (A): workers fitted with PPE and warning signs installed	Regularly during construction	HVEN
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
	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
	Reduce vehicle speeds in populated areas	Residents living near construction sites	Inspection of complaints	No complaints from residents	Regularly during construction	HVEN
	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		Instrumental measurement in case of complaints	Noise level below 55 dB (A) or maximum increase less than 3 dB (A)		

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		
	receptor location off-site					
	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		
Noise impacts on public	Conduct noise-generating activities near to occupied buildings only between 9 am and 4 pm	Residents living near construction sites	Inspection of complaints	No complaints from residents	Regularly during construction	HVEN
Limitation of exhaust gas pollution	Limitations of size, weight or axle loads of vehicles using particularly difficult roads	Construction sites	Visual inspection	Size, weight and axle load of vehicles limited	Regularly during construction	HVEN
	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		
Limitation of dust	Cover truck beds with tarps during material transport	Construction sites	Inspection of complaints	No complaints from residents	Regularly during construction	HVEN
	Use dust-suppressing water spray during civil works, where necessary		Inspection of complaints	No complaints from residents		
	Store and handle material appropriately to limit dust (e.g. protect cement with tarpaulins)		Visual inspection	Appropriate storage		
Limitation of smoke	Prohibit open burning of	Construction sites	Visual inspection	No open burning of	Regularly during	HVEN



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		
and air pollution	construction / waste material			those materials	construction	
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
Impacts on Historical and Cultural sites	Implementation of Chance Find Procedure and training of the construction workers	Construction sites	Inspection of chance find reports and training records	Chance Find Procedure implemented; all workers trained	Regularly during construction	HVEN
	Report chance finds immediately to the Ministry of Culture of RA, Dep. Protection of Monuments and Historical Sites		Inspection of chance find reports	All chance finds reported to Ministry of Culture	Regularly during construction	Local members of Agency of Protection of Historical and Cultural Monuments  (Budget for monitoring: <b>5,000 USD</b> )
	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	In advance of construction	
	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
	Development of an HSE Management Plan for the construction in advance of construction activities			HSE Management Plan developed		
	Installation of an HSE Management System (HSEMS) during the construction phase			HSE Management System implemented	During construction	

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	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
Employee Health and Safety at construction sites	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
	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		
	Provide workers with appropriate protective equipment (PPE) (dust, noise, etc.)		Visual inspection	All workers provided with PPE		
	Install warning signs "Danger of Electrocutation" at towers, substations etc.			Warning signs installed		
	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		
	Limit occupational exposure to EMF		Interviews	Shielding materials in		

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		
	by use of shielding materials, and train workers accordingly		Inspection of training records	place All workers trained accordingly		
Employee Health and Safety at construction sites	If work crews are in remote areas, they shall be equipped with cellular phones or radios	Construction sites	Visual inspection	Work crews accordingly equipped	Regularly during construction	HVEN
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
	construction camps to be located in accordance with relevant authorities					
	Workers' camps have to meet the requirements of IFC/EBRD guidance note <sup>2</sup>	Workers' camps	Visual inspection	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
	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		
	Implement programs for medical screening, health and safety monitoring, and reporting		Inspection of records	H&S programs 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		
	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
	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	
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
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
	Use warning signs at access points along main roads, and around work sites near villages or residences		Visual inspection	Warning sites erected		
	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		
	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		

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		
	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		
Public Health and Safety	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	Regularly during construction	HVEN
	No houses are allowed in 50 m corridor (wayleave) of the OTL	OTL corridor	Visual inspection	No houses in corridors		
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
	Announce start and duration of works through media and signs to the public	Residents living near construction sites	Interviews	Public informed about construction works		
	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		
	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		

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		
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
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
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
	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		
	Allow the traffic to pass through the work in progress where possible		Visual inspection	Traffic can pass through work sites		
	Erect signs that the traffic is aware from far, where the actual construction sites are located		Inspection of complaints and accident records	Signs erected		
	Ensure all equipment is visible to the traffic through either illumination or suitable marking		Visual inspection	Visibility of equipment ensured		
	Ensure that the work areas are lighted well		Inspection of complaints and accident records	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 (35 / 110 / 220 kV OTLs) that ensures the width of the ROW of both parallel running lines	Construction sites	Visual inspection	Adequate minimum distances realized	In advance of relevant construction	HVEN
	Where crossing existing power lines		Inspection of planning documents			

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		
	adequate minimum distances between the conductors (> 4 m) have to be ensured					
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
	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	Laydown areas accordingly located	Regularly during construction	
	Minimize surface of and damage caused by workers' camps	Workers' camps	Inspection of complaints	Damage as low as possible		
	Shift towers to avoid orchards, vineyards, gardens (in case new towers are needed)	Tower locations	Visual inspection	Tower locations shifted accordingly		
Complaints during construction	Presence of an impartial person to receive complaints during the construction process	Construction sites	Interviews	Impartial person present	Regularly during construction	HVEN
Employment	Develop and implement a non-discriminatory hiring and wage policy	Construction sites	Inspection of complaints	No complaints	Regularly during construction	HVEN
	Prosecute offenses related to payment of wages by sub-contractors strictly					
	Prioritize employment of local people for construction works		Visual inspection	Percentage of local people employed		
	Improve recruitment of women for construction works		Interviews	Percentage of women employed		

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 (for details and budget see RAP)
Compensation payments	Pay compensation to PAP for damages and loss of crops and for expropriation of land	All sites damaged or expropriated	Interviews with owners	All compensations paid according to the RAP	After relevant construction	HVEN (for details and budget see RAP)
	Documentation of compensation payments	All affected sites	Inspection of documentation	Documentation established	Regularly during construction	
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
	Consultation with PAP about their development priorities in the framework of RAP development		Inspection of consultation reports	Development priorities of PAP considered		
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
	Strengthen district administrations on gender issues (i.e. receive complaints by women)	District administrations		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	Compensations paid accordingly	After relevant construction	
	Bank accounts shall be accessible both for male and female household members		Inspection of complaints	Bank account accessible for male and female household members		
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



### 10.2.3 Monitoring during Operation and Maintenance Phase

**Table 10-23:** 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	Regular during 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		
	Implement Compensatory Tree Planting Plan using ratio of 1:2 and indicating areas for planting, age and species composition of seedlings, and maintenance requirements for a two year period			Compensatory Tree Planting Plan implemented		
	Avoid maintenance during breeding / nesting season (March - June) in forested areas	Maintenance sites at forested areas		No maintenance in relevant areas during breeding season		
	Prohibit plant-collecting and hunting in the vicinity of the ROW; do not allow access to the forest	Maintenance sites		No incidents		
	Use of berms at roads is recommended to limit vehicle access by trespassers at forested areas	Forested areas		Berms constructed to limit vehicle access		
	Strict prohibition of herbicide use for maintaining the ROW	Maintenance sites		No herbicides used		

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		
	Check proper adjustment of bird diverters during maintenance works	Maintenance sites at gorges		Bird diverters properly adjusted		
Soil and Water Pollution from sanitation facilities	Provide proper sanitation facilities for maintenance workers	Maintenance sites	Visual inspection	Proper sanitation facilities provided	Regularly during maintenance	HVEN
	Train maintenance workers in appropriate sanitation practices		Inspection of training records	All workers trained accordingly		
Soil and Water Pollution from spills	Provide spill-control materials to drivers and maintenance workers, in order to clean up spills, if any	Maintenance sites	Inspection of equipment	Equipment provided	Regularly during maintenance	HVEN
	Report and respond to spills promptly and train maintenance workers in how to report		Inspection of spill reports and training records	Number of spill reports All 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		
	Collect contaminated spill materials and manage as hazardous waste	Storage sites at s/s Alaverdi-2				
Soil and Water Pollution from waste	Train maintenance workers in proper management of recyclable, sanitary, solid, liquid, and hazardous wastes	Maintenance sites	Inspection of training records	All workers trained accordingly	Regularly during maintenance	HVEN
	Make arrangements for proper waste handling, treatment, disposal		Visual inspection	Waste properly treated		
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	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 maintenance	HVEN
Noise impacts on	Use low sound power mechanical	Maintenance sites	Visual inspection and	Low sound equipment	Regularly during	HVEN

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		
workers / public	equipment, whenever possible		inspection of complaints	used; no complaints from residents	maintenance	
Noise impacts on public	Reduce vehicle speeds (stick to recommended speeds) in populated areas	Residents living near construction sites	Inspection of complaints	No complaints from residents	Regularly during 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		
	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	Maintain vehicles and engines properly, 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		
Employee Health and Safety	Develop a Health and Safety Management Plan (HSMP) and implement an Health and Safety Management System (HSMS) for operation and maintenance	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 near to OTL	Interviews	Residents are informed	Before start of operation	HVEN

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 signage to identify work areas and hazardous equipment	Maintenance sites	Visual inspection	Proper signage established	Regularly during maintenance	HVEN
Public Health and Safety	Keep speed limits on public roads during maintenance works	Villages near maintenance sites	Inspection of complaints	No complaints from residents	Regularly during maintenance	HVEN
	No houses are allowed in 50 m corridor (wayleave) of the OTL	OTL corridor	Visual inspection	No houses in corridors		
Land use	Land within the ROW can further be used for agricultural purposes	Residents near to OTLs using land within the ROW	Interviews	Local residents informed about maintenance works	In advance of relevant maintenance works	HVEN
	Inform local residents before undertaking maintenance measures involving clearing of land in ROW or potential damage to crops	Residents near to OTLs using land within the ROW		Local residents informed about maintenance works		
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)

### 10.3 Implementation Arrangements and Reporting Needs

HVEN is an implementing entity for ESRP and will manage all aspects of its implementation, including application of environmental and social safeguard policies. 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.

An (local) Environmental Specialist will be employed within HVEN. Together with the Social Specialist already employed at HVEN the Environmental Specialist will carry out the overall supervision of the implementation of the Environmental and Social Management Plan (ESMP), reveal and report on incompliance with ESMP or issues that may arise in the course of construction works that had not been covered in the ESMP, develop a time-bound plan of corrective actions to address issues revealed / damage done and recommend it to the administration of HVEN, and follow up to track and oversee progress towards alleviation of problems.

In case of discrepancies the specialists shall implement proper actions to establish compliance with the ESMP. If this is not possible and if the discrepancy is considered to be severe, the person(s) in charge shall be empowered to stop the work immediately until compliance is achieved again.

The Environmental and Social Specialists will also be responsible for conception and implementation of all monitoring activities during the construction phase and provide training to relevant staff of the operator in order to ensure that all monitoring activities for both the construction and operation phases can be executed in an appropriate manner. The specialists shall perform formal monthly field monitoring checks of all active works sites and produce monthly monitoring reports, including photo documentation. Overall, this will require six months' work for monitoring and reporting per year.

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 the quarterly supervision and the monthly reports provided by the specialists of HVEN, the external auditor will produce narrative analytical quarterly reports on environmental and social performance in the course of replacement of OTLs Lalvar and Noyemberyan and furnish these reports to the World Bank. The costs for this supervision will sum up to **120,000 USD**.

The Construction Contractor shall determine persons being responsible for environmental and social performance at all construction site(s).

## 10.4 Training of HVEN Staff

HVEN already employed a Social Specialist but there is no Environmental Specialist employed yet and there is no prior experience of international requirements concerning rehabilitation of transmission lines.

Training of a qualified environmental specialist is therefore required. Training will focus on the application of World Bank safeguard policy and monitoring procedures and shall contain the implementation of the mitigation and monitoring measures specifically to this OTL Project. 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).

## 10.5 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 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 during periodical site visits in person or via designated telephone number or the community leader or NGO staff
- b) Lodge complaint and provide information on the case
- 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
- g) Involve appropriate NGOs
- h) Seek redress from court if all else fails.

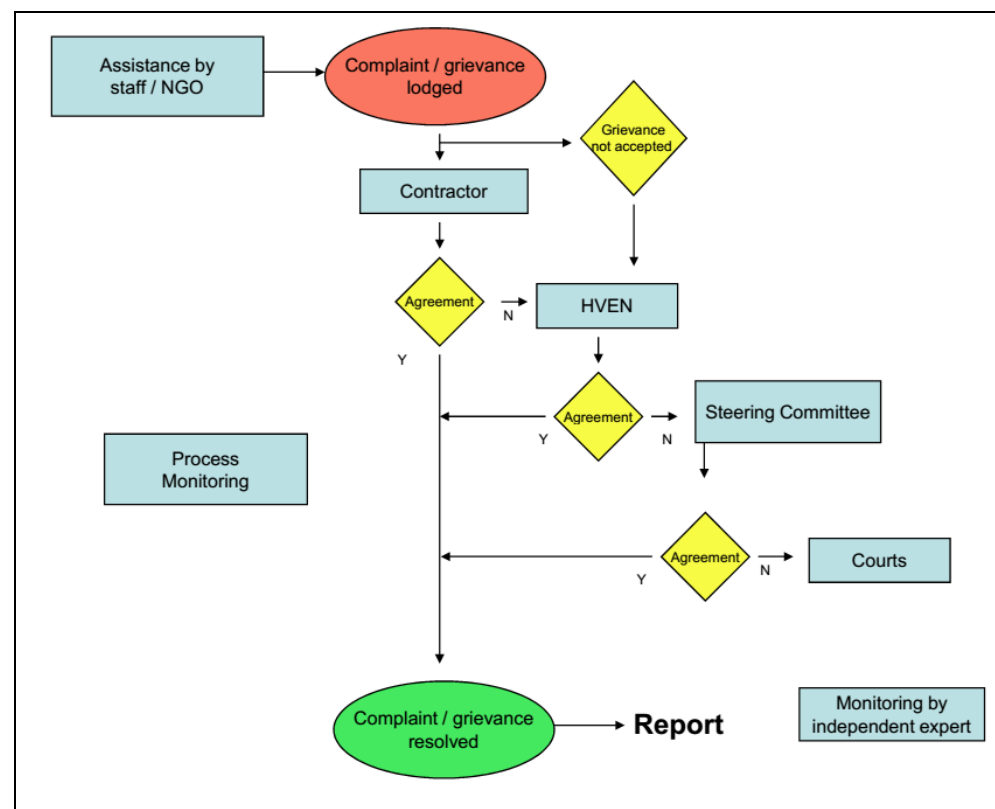


Figure 10-1: Grievance Mechanism Flow Chart



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 World 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.

## 10.6 Costs of Implementation of ESMP

Most of the costs for mitigation of the impacts during the construction period of the Replacement of 110 kV OTLs Lalvar and Noyemberyan Project are included in the regular construction costs.

Extra costs with respect to environmental mitigation are related to rehabilitation measures and monitoring at forested areas. Further costs are foreseen for monitoring of construction works 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, and for training of HVEN staff.

Costs for replanting measures of trees near to forested areas, where trees have been felled, will be determined after final survey of tower locations.

Considering a construction period of about 2 years, costs for implementation of the ESMP sum up to **237,600 USD** (see Table 10-24).

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 10-24:** Costs for mitigation measures, monitoring and training

	<b>Phase</b>	<b>Issue</b>	<b>Costs [USD]</b>
Mitigation	Pre-Construction	Survey of birds and bats along the ROW	20,000
Mitigation	Construction	Installation of bird flight diverters at ground wires, if the line crosses gorges*	45,000
Monitoring	Construction	Monitoring of rehabilitation measures at forested areas by NGO	6,000
Monitoring	Construction	Monitoring by local members of Agency of Protection of Historical and Cultural Monuments	5,000
Monitoring	Construction	Quarterly supervision of construction sites	120,000 (15,000 per mission)
Training	Construction	Training of HVEN staff	20,000
<b>Sum</b>			<b>216,000</b>
10 % contingencies			21,600
<b>Total</b>			<b>237,600</b>

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

## 11. References

- Council of Europe (CE), European Commission (EC) 2010: Heritage Assessment Report Armenia. Strasbourg, 2010.
- DG Consulting 2013: ESIA for construction of Batumi-Akhaltzikhe 220 kV power transmission line (World Bank financed project). Tbilisi, December 2013.
- EuropeAid 2010: Landfill Operations Guidance Manual. Waste Governance – ENPI East. Brussels, October 2010.
- EU Directive on Electromagnetic Fields 2004: Council Directive 2004/40/EC of 29 April 2004 on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields).
- Government of the Republic of Armenia (GRA) 2009: Decree No 363-n on "Approval of Technical Regulation on Safety Zones of Electric Networks". Yerevan.
- International Commission on Non-Ionizing Radiation Protection (ICNIRP) 1998: Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic, and Electromagnetic Fields (up to 300 GHz). Health Physics 74 (4): 494-522; 1998.
- International Finance Corporation (IFC) 2007: Environmental, Health and Safety (EHS) Guidelines. Available at: <http://www.ifc.org/ehsguidelines>
- Ledec et al 2011: Ledec, G.C., Rapp, K.W., Aiello, R.G.: Greening the wind. World Bank Publications.
- LLUR 2013: Landesamt für Landwirtschaft, Umwelt und ländliche Räume des Landes Schleswig-Holstein (LLUR): Empfehlungen zur Berücksichtigung der tierökologischen Belange beim Leitungsbau auf der Höchstspannungsebene (Recommendations for consideration of issues concerning animal ecology during construction of high voltage power lines). Flintbek, January 2013.
- Ministry of Nature Protection RA (MNP) (2014): Fifth National Report of the Republic of Armenia to the Convention on Biological Diversity. Yerevan. Available at: <http://www.cbd.int/doc/world/am/am-nr-05-en.pdf>
- Tractebel Engineering 2014: Feasibility Study & Project Implementation Support. Consultancy and Reconstruction Supervision of the Noyemberyan and Lalvar Overhead Transmission Lines. Determination of Optimal Preliminary Route for New OHTLs and Preparation of Functional Preliminary Design. October, 2014.
- VDE/FNN 2014: FNN-Hinweis: Vogelschutzmarkierung an Hoch- und Höchstspannungsfreileitungen. Berlin, December 2014.

## 12. Appendices

### 12.1 Appendix I: Record of Meetings and Field Visits

Date	Agency/ Institution/ Company	Place	Name of Person consulted Position	Reason for Visit
24 Sep 2014	HVEN	Yerevan	Aram Petrosyan Deputy Chief Engineer	Kick-off and possible technical measures
27 Sep 2014	Ministry of Nature Protection	Yerevan	Khachatur Khachatryan Head of Legal Department	EIA Process in Armenia
01.10.2014	ASCE Group OJSC	Charentsavan	Telefon call	Scrap metal recycling
02.10.2014	Ministry of Nature Protection State non-commercial organization	Yerevan	Henrik Grigoryan Deputy Director	Environmental permitting procedure in Armenia
02.10.2014	WWF Armenia	Yerevan	Karen Manvelyan Director	Protected and Forest Areas in the Project areas
02.10.2014	Ministry of Culture: Agency for Security of Historical and Cultural Monuments	Yerevan	Suren Shaqaryan Head of Monument and Historical Environment Security Department	Procedure to protect historical and cultural sites
13.01.2015	Aarhus Centers of Armenia	Yerevan	Silva Ayvazyan Coordinator of Yerevan Aarhus Center, Mary Chakryan PR Manager of Yerevan Aarhus Center	Mitigation and monitoring of Project impacts, involvement of NGOs in monitoring
15.01 – 16.01. 2015	HVEN, Energy Advisory	Field trip: OTLs Lalvar and Noyemberyan	Lusine Zakaryan HVEN Sociologist, Arsen Hayriyan Legal specialist	Line routing, possible environmental and social impacts
16.01.2015	Tractebel Engineering	Yerevan	Serge Lamborelle Section Manager International - Transmission and Distribution	Proposal for adaptation of line routing due to environmental and social impacts

## 12.2 Appendix II: Impact Investigation List as presented to Tractebel Engineering

No.	Tower No.	GPS Coordinates (UTM universal)	Place Name	Observations / Remarks	Potential Impact	Mitigation
			Substation Alaverdi-2			
1	AP 1-3		Sanahin	Line goes through fields, no houses or trees affected. Land belongs to community and the land use category is agricultural (pasture). The cadastral map should be acquired in order to identify the owner and category of the land and administrative territory.	Land Acquisition	Compensation if lands have building permission, land conversion as appropriate
2	AP 3-4	473634.00 m E; 4548588.00 m N	Sanahin-Akner	Crossing of the canyon. Width of the canyon is approximately 450-500 meter. AP3 is located in Sanahin and AP4 in Akner.	Collision risk for big birds	Installation of Bird Diverters
3	AP 4-7		Akner	Line routing on edge of Debed gorge to keep distance to 35 kV line.	Agricultural lands	
4	AP 7-8	475024.00 m E; 4548943.00 m N	Akner-Haghpat	Over-spanning of gorge between Akner and Haghpat, width approx. 500m	Collision risk for big birds	Installation of Bird Diverters
5	AP 8-9	475264.00 m E; 4548996.00 m N	Haghpat	Crossing of 3 houses in new ROW at edge of village	Land Acquisition or bypass on Debed Gorge side	Study if bypass on western side of village is possible
6	AP 9-10		Haghpat	Village Lands, Fields	Land Acquisition	Compensation if lands have building permission, land conversion as appropriate
7	AP 10-13	Forest: 476636.00 m E; 4550490.00 m N Cultural site: 477170.00 m E; 4550827.00 m N	Haghpat	Crossing of existing lines, crossing of forest area	Line crosses existing lines and forested hill, under existing lines cultural site (graveyard) is located	Line routing optimization, keep line longer on northern meadow to avoid forest area

No.	Tower No.	GPS Coordinates (UTM universal)	Place Name	Observations / Remarks	Potential Impact	Mitigation
8	AP 15-16	478438.34 m E; 4551364.79 m N	Haghpat	Church ruins in planned ROW	Cultural Heritage, not affected if over-spanned	Reconsider line routing in this area, shift tower foundation by a few meters not to affect church ruin
9	AP 13-20	e.g.:  478049.00 m E; 4551176.00 m N  478993.00 m E; 4551659.00 m N	Haghpat, Neghots	Line leads along forested slopes with valleys, towers put on outcrops to prevent cutting of trees, existing access roads to be rehabilitated and some extended	Cutting of trees, rehabilitation of old access roads in steep forest slopes. As per RA legislation ROW for 110 kV is 20 m from boundary conductor. The owner of the forest land is the Republic of Armenia.	Installation of towers on hillock tops and use of wide span towers to prevent cutting of trees. Trees that need to be cut shall be compensated and replanted in appropriate area. As per RA legislation the distance from the border of the road to any part of the tower should be as minimum the height of the tower.
10	AP 21-22	e.g.:  480957.74 m E; 4553787.34 m N  480909.25 m E; 4553743.32 m N	Neghots	Over-spanning of gorge at Neghots village, width approx. 500 m	Safety distance to houses to be respected, construction security aspects, according to law of RA no houses are allowed under lines	Different line routing to be enquired (probably further south). If over-spanning is not possible, resettlement requirements of approx. 7-8 houses
11	AP 16-18		Above Akhtala	T-Off to Railway station	Steep forested slope area	HVEN or Tractebel to provide T-off coordinates
12	AP 22-23	481645.00 m E; 4554340.00 m N	Above Akhtala	Traverse of steep forested slopes, distance between small ridges approx. 500 m, access road rehabilitation required	Cutting of trees for Access Road, rehabilitation of existing tracks	If new access tracks required, careful design of roads. Design of roads by Tractebel to be made available for EIA assessment
13	AP 24-25		Akhtala-Pokr Ayrum	Crossing of pasture lands and forest lands	Cutting of trees, land acquisition for tower Foundations	Replanting of trees, compensation for lands

No.	Tower No.	GPS Coordinates (UTM universal)	Place Name	Observations / Remarks	Potential Impact	Mitigation
14	AP 24-25	482745.94 m E; 4554826.44 m N	Akhtala-Pokr Ayrum	Crossing of barn and fruit tree plantation	Over-spanning or compensation for cut trees, 1 farmhouse half ruined half in operation	Line routing should be checked, if not possible resettlement of 1 farm and potentially another house
15	AP 24-25	482830.00 m E; 4554947.00 m N	Akhtala-Pokr Ayrum	Crossing of Debed Gorge, River, Railway and Road, Width approx. 500 m	Road Crossing, River Crossing, collision risk for big birds	Installation of Bird Diverters
16	AP 25-28		Pokr Ayrum, Mets Ayrum	Line goes through private fields. No houses or tress affected. The lands in the ROW (20 m) of existing line are community lands. Lands at a distance more than 20 m are private.	Land Acquisition	Compensation if lands have building permission, Land conversion as appropriate
17	AP 28-29	486227.00 m E; 4557229.00 m N	Mets Ayrum	Crossing of small canyon, width approx. 350 m.	Collision risk for big birds	Installation of Bird Diverters
18	AP 31-40		Mets Ayrum, Chochkan	Line goes through private fields. No houses or tress affected. The lands in the ROW (20 m) of existing line are community lands. Lands at a distance more than 20 m are private.	Land Acquisition	Compensation if lands have building permission, Land conversion as necessary
19	Near AP 26			T-Off to Mining Company	No major impact	
20	AP 29-38		Chochkan	T-branch to Sadakhlo substation goes through residential lands. From 10-20 houses are located in the corridor of 50 m. Lalvar and Noyemberyan lines go through private lands. No trees affected.	Land Acquisition	T-branch is no longer considered, only double circuit to Haghtanak (Noyemberyan S/S), Chochkan village not affected
21	AP 38-39	492026.00 m E; 4561459.00 m N	Substation Noyemberyan, village Haghtanak	Crossing of River Debed	Collision risk for big birds	Installation of Bird Diverters
22	AP 38-39		Substation Noyemberyan, village Haghtanak	Crossing of main road		

No.	Tower No.	GPS Coordinates (UTM universal)	Place Name	Observations / Remarks	Potential Impact	Mitigation
23	AP 39-40		Substation Noyemberyan, village Haghtanak	Crossing of Tree Plantation	Over-spanning or cutting of trees, land acquisition and compensation to be identified	Trees are bushes, that can be over-spanned, no design available for infeeding of line into S/S
24	AP 39-40	492270.27 m E; 4561666.92 m N	Substation Noyemberyan, village Haghtanak	1 small house/shed in ROW	House to be bypassed or resettled	no design available for infeeding of line into S/S
				Entrance into Substation Noyemberyan		



### 12.3 Appendix III: 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 [ $\mu$ T]
<u>ICNIRP recommended 50/60 Hz</u> 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
<u>Limit values according to the European Directive 2004/40/EC</u>		
exposure of workers*	10	500
<u>Limit (r.m.s) value as per 26. BImSchVer 12/96</u>		
general public up to 24 hours /day	5	100
<u>Limit values as per VDE V 0848 Part 4/A3 at 50 Hz</u>		
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-Ionising Radiation Protection, BImSchVer=German Bundesimmissionsschutzverordnung, VDE=Verband Deutscher Elektrotechniker e.V., Cenelec=European Committee for Electrotechnical Standardisation)